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Frames of spatial reference in Dhivehi language and cognition

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Abstract

Frames of spatial reference (or 'FoRs') are ways of representing the location, orientation, or path of one object with respect to another. Egocentric frames of reference relate one object to another by making use of the speaker's location or viewpoint (e.g., 'The man is to the left of the tree'). Intrinsic FoRs make use of an object's own geometry (e.g., 'The man is in front of the house'). Geocentric FoRs make use of features of the wider environment such as landmarks or cardinal directions (e.g., 'The man is towards the beach from the tree', 'The man is north of the tree', etc.). This thesis investigates FoRs in Dhivehi, an Indo-Aryan language spoken throughout the Maldives. Data on both linguistic and non-linguistic representations of space was collected, using a range of established and newly developed methods that required participants to describe or memorize various spatial distinctions. The data was gathered during two field trips to the Maldives, in September 2013 to April 2014 and January 2015 to April 2015. The main field site was Laamu Atoll, though additional data was collected from the capital, Malé, and the second largest urban centre, Addu.

The results show that FoR choice in Dhivehi is not determined by the physical environment, and that non-linguistic FoR choice is not fully determined by the choice of FoRs in language, though a correlation exists between linguistic and non-linguistic FoR choice. The results also show that linguistic FoR choice varies significantly according to a range of demographic factors including occupation, location, age, gender, level of education and bilingualism. A preference for cardinal directions among fishermen and certain demographic groups associated with fishing (e.g., men) contrasts with a preference for egocentric FoRs among other groups such as indoor workers and women. Some strategies such as the intrinsic FoR and landmarks are used across the whole community. The variation between groups is explained primarily in terms of the diverse ways in which people interact with the topographic environment, with possible additional effects of education and exposure to the English language. The findings have implications for our understanding of the relationship between language, cognition, and the environment. In particular, they suggest that environmental interaction mediates the relationship between spatial language and cognition.

In addition, this thesis describes the linguistic expression of FoRs in Dhivehi, and shows that despite being spoken in an atoll-based environment, Dhivehi does not have a grammaticized 'lagoonward-oceanward' axis like the atoll-based languages of the Pacific.

However, other aspects of the topographic environment, such as a distinction between the beach and the inland area, are represented differently in Dhivehi grammar and are also invoked more frequently. This suggests that while topography does not determine a language's system of spatial reference in a predictable way, we can perhaps expect that topography will be represented in one way or another.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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Many Maldivians were extremely helpful to me during the course of the project. I believe it is a credit to the Maldivian people that so many Maldivians take an interest in matters pertaining to their language, even when so few outsiders do. It was a privilege to be able to work with some of these Maldivians, and I very much hope that this thesis is of interest to them. In Malé, I was always treated like a distinguished guest by members of the Dhivehi Language Academy (formerly the National Centre for Linguistic and Historical Research). The Academy organized my research visa and put me in touch with the Laamu Atoll Council as well as staff and students of linguistics at the Maldives National University. It was also valuable to discuss my research with members of the Academy during my short visits to the capital. In particular I wish to thank Ashraf Ali, Rafia Abdul Qadir, Naseema Mohamed, Mohamed Waheed Nadwi, Naseema Ahmed, Mohamed Nazim, Iyaz Naseem, and Shizna Fathimath. In Malé I also had some valuable conversations with Nazim Sattar, a lecturer at the Maldives National University. I am also grateful for the kindness shown to me by Leesha Wisam and Wisham Abdallah, who despite busy schedules always found time to keep me company when I was in Malé.

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Lists of symbols and abbreviations

In main text

/ /	Phonemic representation
[ ]	Phonetic representation
FIBO	Front = Inside, Back = Outside
FoR	Frame of reference
GCE	General Certificate of Education
L.	Laamu Atoll or Laamu dialect
LRFB	Left/right/front/back
M.	Malé/standard dialect
MPI	Max Planck Institute
NP	Noun phrase
NSEW	North/south/east/west
PSPV	Picture Series for Positional Verbs
RA	Relative-to-absolute
S.	Seenu (Addu) Atoll
SAP	Speech-act participant
TRPS	Topological Relations Picture Series
V	Vowel

In interlinearized examples

=	Clitic boundary
-	Morpheme boundary
~	Morpheme boundary in cases of reduplication
.	Morpheme break shown in English but not Dhivehi (or vice versa)
*	Ungrammatical form
?	Marginal/uncertain form (when question mark appears before an example)
1	First-person/egophoric
3	Third-person/alterphoric
ABL	Ablative/instrumental case
ADVZ	Adverbializer
COM	Comitative/sociative case
COMP	Complementizer

CONJ	Co-ordinating particle
COP	Copula
CVB	Converb
DAT	Dative case
DEM1	Speaker-proximal demonstrative
DEM2	Addressee-proximal demonstrative
DEM3	Distal demonstrative
EMPH	Emphatic particle
FILL	Filler
FOC	Focus marker
FUT	Future tense
GEN	Genitive case
IMP	Imperative
INDF	Indefinite
INF	Infinitive
LOC	Locative case
PL	Plural
PRES	Present tense
PRF	Perfect aspect
PROG	Progressive aspect
PST	Past tense
PTCP	Participle
REDUP	Reduplicated morpheme
SUC	Successive particle
TEMP	Temporal subordinator
UNSP	Unspecified

In file names (tasks and locations)

MT	Man and Tree
O	Other
PSPV	Picture Series for Positional Verbs
RD	Route Description
TRPS	Topological Relations Picture Series

VAR	Verbal Animals-in-a-row
VAT	Virtual Atoll Task
LD	L. (Laamu) Dhanbidhoo
LF	L. Fonadhoo
LG	L. Gaadhoo
LH	L. Hithadhoo
LI	L. Isdhoo
LK	L. Kunahandhoo
LKa	L. Kalaidhoo
LMb	L. Maabaidhoo
LMm	L. Maamendhoo
LMn	L. Mundoo
LMv	L. Maavah
Ma	Malé
Me	Melbourne (Australia)
SH	Seenu (Addu) Hithadhoo

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1 Introduction

1.1 Language, cognition and space

Does the language we speak affect the way we think? The idea that it does may be traced back at least as far as Humboldt (1988 [1836]), but is most strongly associated with the work of Edward Sapir and his student, Benjamin Lee Whorf (e.g., Sapir 1921; Whorf 1956). This notion of 'linguistic relativity' (also called the 'Sapir-Whorf hypothesis' or 'Whorfianism') became increasingly unpopular with the rise of Universal Grammar and nativism (e.g., Chomsky 1965; Fodor 1975; Pinker 1994), which stressed the innateness and universality of many linguistic structures and concepts. But as relativists such as Lucy (1992a) point out, nativists have tended to exaggerate Whorf's views, misrepresenting his position as a kind of 'linguistic determinism' according to which our thinking is tightly constrained and predetermined by the language we speak.

A possible mechanism by which language could influence thought without determining it is Slobin's (1996) notion of "thinking for speaking". To speak any language, we must attend to certain distinctions (such as tense, number, etc.) that are habitually or even obligatorily encoded. But precisely which distinctions are made depends on the particular language we speak, and we must pay attention to the relevant things in the world around us in order to make those distinctions when speaking. Speakers of different languages might therefore habitually notice and remember different aspects of objects, events, and relationships in the world around them, and even conceptualize them differently, in line with the structures and patterns in their language.

Empirical evidence for linguistic relativity has been identified in several domains including agency and liability (Fausey & Boroditsky 2010; 2011; Fausey et al. 2010), colour (e.g., Brown & Lenneberg 1954; Davidoff, Davies & Roberson 1999; Roberson, Davies & Davidoff 2000), grammatical gender (e.g., Boroditsky, Schmidt & Phillips 2003; Sera, Berge & Pintado 1994; Sera et al. 2002), grammatical number (e.g., Athanasopoulos & Kasai 2008; Imai & Gentner 1997; Imai & Mazuka 2003; Lucy 1992b; Lucy & Gaskins 2003), motion (e.g., Kersten et al. 2010; Slobin 1996; 2003), space (e.g., Levinson 2003; Majid et al. 2004; Pederson et al. 1998), and time (e.g., Bergen & Chan Lau 2012; Boroditsky 2001; Boroditsky & Gaby 2010; Fuhrman et al. 2011). However, some other studies have failed to find such evidence, and the debate between nativists and relativists is ongoing (for some recent reviews of this debate, see Athanasopoulos, Bylund & Casasanto 2016; Wolff & Holmes 2011).

This thesis is concerned with the domain of space in particular. Of course, the linguistics of space is a broad subject, encompassing a range of topics such as deixis, motion verbs, topological relations, case marking, adpositions, and postural verbs. Although I will address many of these topics in Chapter 4, this thesis will mostly focus on frames of spatial reference. Frames of reference (or 'FoRs') are systems for representing the location, orientation, or path of one object (or person) with respect to another. Different FoRs rely on different conceptual 'anchors' – entities from which sets of directions are derived – and/or differ in how the relevant directions are derived from the anchor. For example, cardinal directions like 'east' are anchored in features of the wider world (e.g., the sunrise), and so may be classified as 'geocentric' FoRs. In contrast, terms for 'left', 'right', 'front' and 'back' (or 'LRFB' terms) involve an 'egocentric' FoR when they are anchored on the speaker or the speaker's viewpoint – 'in front of the tree' means at the side of the tree nearest to the speaker. However, the same terms involve an 'intrinsic' FoR when anchored on the reference point itself – 'in front of the car' can mean near the car's front side, regardless of the speaker's position. This three-way division of FoRs is sufficient for now, though Chapter 2 will introduce additional distinctions.

Frames of reference are important to consider because of their primacy in human language and cognition. Expressing spatial relationships – mentioning the locations of objects or people, or saying which way they are facing or where they are going – is one of the most fundamental communicative tasks we perform every day. But in order to do this, we must also have an underlying mental representation of space, and this mental representation is essential for our very survival. Finding resources, avoiding dangers, and interacting with other people are all basic activities that rely on an ability to perceive and remember various relationships in space. Given the evolutionary importance of spatial cognition, we might expect all humans to share the same basic conceptualization of space, and consequently to use the same frame(s) of reference in language. In English and many other languages, FoRs are typically egocentric, being anchored on the speaker's body or viewpoint (e.g., *The fork is to the left of the plate*). An egocentric system seems natural because of its basis in the human body, and indeed such a system is often assumed to be universal (e.g., Levelt 1989:49–50; Miller & Johnson-Laird 1976:381, 394).

However, evidence from many languages and cultures shows that egocentric FoRs are not always predominant, and some types of egocentric reference are not even universally available. Many languages make little or no use of words translating to ‘in front’, ‘behind’, ‘left’, or ‘right’. In Guugu Yimithirr (Pama-Nyungan, Queensland), it is not possible to say that ‘the boy is in front of the tree’, only that he is, for example, to the ‘east’ of it (Levinson 2003:118). While English also has cardinal direction terms, the contexts in which English speakers use such terms is fairly limited, in contrast to Guugu Yimithirr where cardinal directions are the dominant spatial strategy even in small-scale space. There are also languages which anchor their FoRs in features of the environment such as rivers, coastlines or hillside slopes (e.g., Levinson & Wilkins 2006a; Palmer 2015). Thus, depending on the language, the boy might most naturally be described as being ‘upriver’, ‘seaward’ or ‘uphill’ of the tree, rather than ‘in front’ or ‘east’ of it.

Interestingly, the diversity in FoRs appears to correspond with diversity in spatial cognitive styles across cultures, as evidenced by patterns of gesture, memory, and inferential reasoning. For example, an analysis of Guugu Yimithirr speakers’ pointing gestures suggests that speakers remember events geocentrically rather than egocentrically (Haviland 1993; 1998). And since the 1990s, members of the Max Planck Institute (or ‘MPI’) for Psycholinguistics in Nijmegen and collaborators have conducted various tests of spatial memory and inference in a range of populations. The results show a correlation between spatial language and cognition, leading to the view that language helps to shape non-linguistic spatial thinking (Levinson 2003; Majid et al. 2004; Pederson et al. 1998). Not everybody shares this view, however, and the MPI’s results have been interpreted in different ways, as I will discuss in Chapter 3.

Of particular importance to this thesis is Palmer’s (2015) view that FoRs in language and FoRs in cognition are correlated not simply because the former influences the latter, but because both are ultimately shaped by the environment. Palmer proposes a ‘Topographic Correspondence Hypothesis’ which predicts that FoRs are sensitive to the topographic environment in which speakers live, and so languages spoken in similar environments are predicted to display the same or similar FoRs. One of the main purposes of this thesis is to help evaluate Palmer’s hypothesis by using Dhivehi as a case study. Dhivehi is an Indo-Aryan language spoken throughout the Maldives, an Indian Ocean nation made up entirely of atolls (see §1.2). This thesis forms part of a larger comparative project on spatial reference in atoll-based languages, with Marshallese (Oceanic; Schlossberg Forthcoming) and Dhivehi being the main languages of comparison.[1] Atolls were specifically targeted for this project because of their highly distinctive topography and due to their threatened ecological status, and Dhivehi was selected because it is the only atoll-based language that is not from the Austronesian language family (see Palmer 2015:220).[2] The selection of a language from a different language family and region was necessary to rule out the possibility that any similarities observed might be due to genetic inheritance or language contact.

1.2 Dhivehi and the Maldives

1.2.1 Dhivehi

Dhivehi (or 'Maldivian') is an Indo-Aryan language with more than 340,500 speakers (Lewis, Simons & Fennig 2014). It is spoken primarily in the Maldives, where it is the national language, though there are also small numbers of speakers in India, Sri Lanka, and other countries. A dialect of the language (sometimes known as Mahl) is spoken in Minicoy, an island belonging to the Indian union territory of Lakshadweep. Despite the increasing encroachment of English, Dhivehi continues to enjoy a dominant status in the Maldives, where it is the main language of communication in mass media, government, and home life.

Dhivehi has attracted little scholarly attention, partly because of former government policies that restricted access to the country until the late 20th century. Thus, although the first word lists date back to the 17th century (Pyrard 1619) and the first grammatical sketches to the early 20th century (Geiger 1919), comprehensive dictionaries and grammatical descriptions were not produced until the last few decades. At present, the best Dhivehi-English dictionary is Reynolds (2003), and the most comprehensive grammar is Gnanadesikan (2017). Other grammatical descriptions include Wijesundera et al. (1988), Cain (2000) (also re-worked into a sketch grammar, see Cain & Gair 2000), and Fritz (2002). Rosegger (2008) is an unpublished learner's guide. There are also a number of

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[1] Australian Research Council Discovery Project G1100293: 'Thinking and talking about atolls: the role of environment in shaping language and our understanding of physical space' (Chief Investigators: Bill Palmer and Alice Gaby).

[2] Some other languages are spoken on atolls, such as Malayalam (Dravidian) in Lakshadweep, India, but Dhivehi is the only non-Austronesian language that is both indigenous to an atoll environment and primarily spoken on atolls (unlike Malayalam, for example, which is spoken mostly on the mainland of India).

Dhivehi-medium works on the language, housed in various educational and research institutions in the Maldives. Most of these are prescriptive in nature (e.g., Ahmad 1970; Saudiq 2012).

Since it first began to diverge from Sinhala in the 3^{rd}-1^{st} centuries BCE, Dhivehi remained in contact with Sinhala as well as with Dravidian languages (see Cain 2000). In later periods, it also came into contact with Arabic, Persian, Urdu, Portuguese, and more recently English. Typologically, Dhivehi has much in common with Sinhala and Dravidian languages of the region. For example, Dhivehi does not distinguish between aspirated and unaspirated stops, though pre-nasalization is phonemic like in Sinhala. It is predominantly an SOV language and noun phrases are always head-final. Clauses are combined using clause chaining rather than coordination, and so a sentence in Dhivehi contains a maximum of one finite clause along with any number of subordinate nonfinite clauses. Null arguments are common, especially in spoken language. In terms of morphology, Dhivehi has lost much of the complexity found in Sanskrit and the Prakrits from which it descends. Gender is not a grammatical category in the standard dialect (even in pronouns), and number is not obligatorily marked except on nouns denoting humans. The grammatical relations of subject and object are not morphologically distinguished (both take an unmarked 'direct' case), though the standard dialect does have dative, locative, genitive, ablative/instrumental, vocative, and comitative/sociative cases. Person is marked only in some tenses/aspects/moods, though there are different accounts of the person-marking system, and there is evidence that the distribution across persons and clause types resembles egophoricity (or 'conjunct-disjunct' marking) more closely than a true person-marking system (see Lum Forthcoming). An important morphological feature in Dhivehi verbs is the alternation between active/volitional stem forms and inactive/intransitive/involitive stem forms (which Cain & Gair 2000 refer to as IN-morphology). This alternation interacts with a number of distinct syntactic constructions in the language. IN-verbs are used in many intransitive clauses, passive (or at least, 'inactive') clauses, as well as clauses where the agent is acting involuntarily, among other contexts (see Cain 1995; Cain & Gair 2000:56–60; Gnanadesikan 2017:248–257).

Dhivehi has its own script, Thaana (ތާނަ), which dates back to the 17^{th} century and is influenced by Arabic. Thaana is typologically an alphabet, but is also similar to abugidas in some ways (see Gnanadesikan 2017:26–42). It is written from right to left, though there is also a Romanized version (known locally as 'Latin') running left to right, which is mostly used for typing when a Thaana keyboard is unavailable, such as on mobile phones. The Maldives has an extremely high literacy rate, at over 99% (The World Factbook 2017).

There are two main groups of Dhivehi dialects (see Figure 1.1 below): a northern group spanning from Minicoy all the way to Laamu Atoll, and a southern group comprising the dialects of Huvadhu, Fuvahmulah, and Addu. The standard dialect is based on the language of Malé, the capital, and is part of the northern group. It is used throughout the country in mass media and in official contexts, and is understood all across the archipelago. Atolls close to Malé use this dialect with only some slight variants, while more distant atolls (such as Minicoy and Laamu) have dialects that are more diverse but still belong to the northern group.[3] The dialects in the southern group are the most conservative and show similarities with older varieties of Sinhala (Fritz 2002).

Since my main field site was Laamu Atoll (see §1.2.4.1), most of the linguistic data presented in this thesis is in the Laamu dialect (*haddummatī bas*). Although this dialect is part of the northern group, it is the southernmost dialect in that group, as shown in Figure 1.1. It shows a number of differences to the standard dialect and shares some features with dialects of the southern group. For the benefit of readers familiar with the standard dialect, I will briefly summarize some of the key features of the Laamu dialect here. Phonologically, word-final *u* in Malé often corresponds with *a* in Laamu (e.g., M. *magu*, L. *maga* 'street'), and word-final *i* and *ī* often correspond with *u* and *ū* respectively (e.g., M. *mati*, L. *matu* 'top'; M. *danī*, L. *danū* 'going').[4] Word-final *Vs* in Malé is often *VhV* in Laamu (e.g., M. gas, L. *gaha* 'tree'; M. *gos*, L. *goho* 'having gone'). In morphology, the Laamu dialect lacks separate genitive and locative cases, and both functions are handled by an oblique case which is more marginal in the Malé dialect (see Gnanadesikan 2017:61). Thus Malé *gahu-ge* 'tree.GEN' and *gahu-ga* 'tree.LOC' are both simply *gahu* in Laamu, though some Laamu speakers sometimes use the Malé forms as well.[5] There are also distinctive future

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[3] The northern dialect group is probably not as homogeneous as some have claimed (e.g., Fritz 2002:13). According to my consultants from Malé and Laamu, Malé speakers can barely understand the Laamu dialect if at all. Some northern islands such as Naifaru (in Lhaviyani Atoll) are also reported to have distinct dialects. Nonetheless, the northern dialect group is still more homogeneous than the southern group.
[4] Note that the system of transliteration used in this thesis mostly follows Gnanadesikan (2017), though I follow Cain and Gair (2000) in using superscripts to transliterate pre-nasalized stops, which better reflects their status as single segments.
[5] For clarity, I will gloss words in the Laamu oblique case as GEN or LOC according to their function, even though formally there is no difference.

tense suffixes: the first-person/egophoric suffix is *-nam̊* in Malé but *-m̊* in Laamu, while the third-person/alterphoric suffix is *-ne* in Malé but *-ḷa* in Laamu (see Lum Forthcoming). In addition, there are many lexical differences between the Laamu and Malé dialects (e.g., M. *annanī*, L. *umanū* ‘coming’), especially in pronouns (e.g., M. *kalē*, L. *i*^{m}*ba* ‘you.SG’). Some pronouns even differ from island to island in Laamu (e.g., Fonadhoo *afen̊*, Gaadhoo *afagehin̊*, Maamendhoo *ahin̊*, Maavah *afaimen̊*, Mundoo/Maabaidhoo *ahagun̊*, other islands *aharun̊* ‘we’).

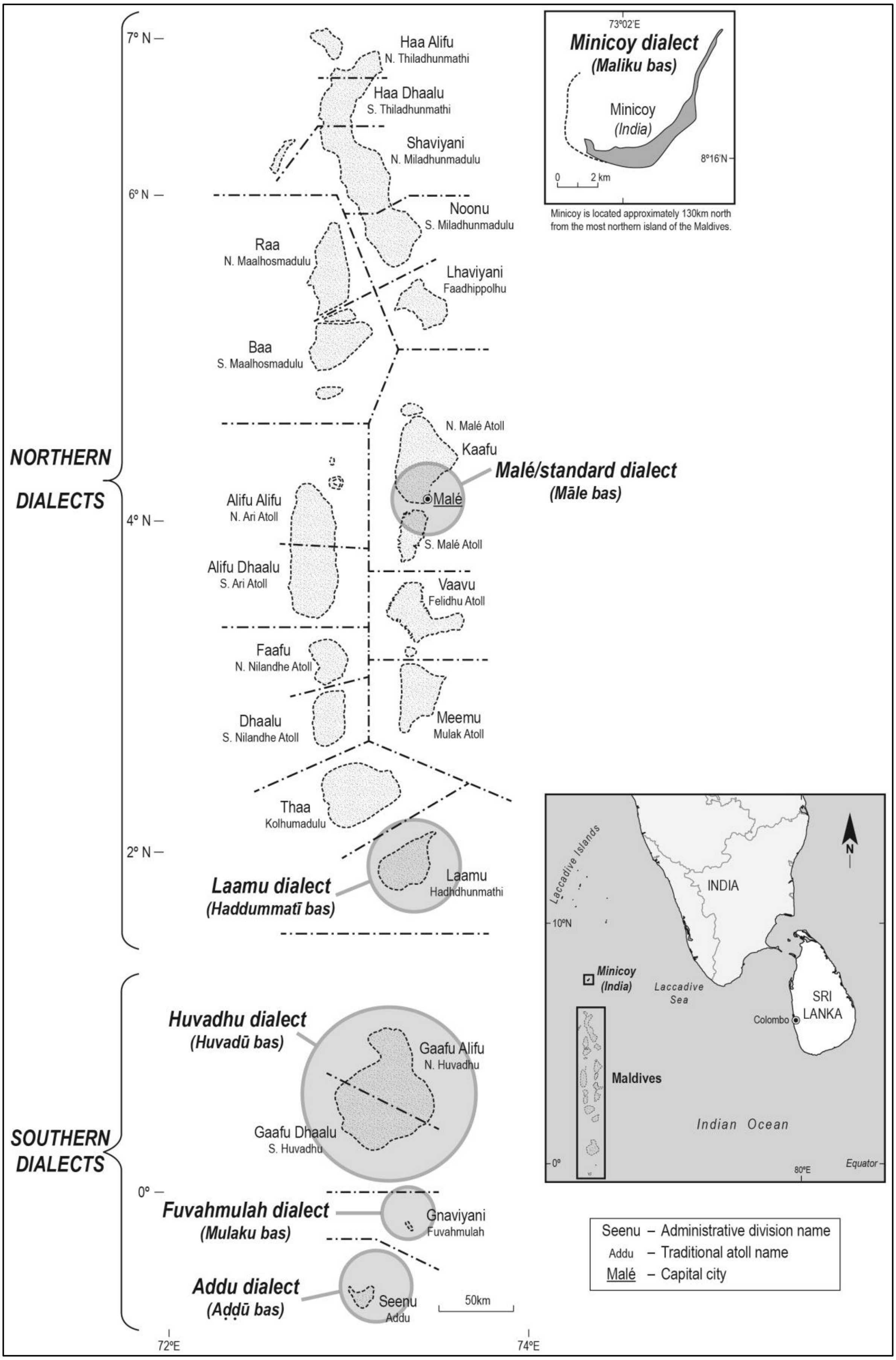


Figure 1.1: Map of the Maldives and Dhivehi dialects

1.2.2 Maldivians and their history

Ethnically, Maldivians are a South Asian people, though little is known of their early history. It is not clear whether the Maldives and Sri Lanka were settled at around the same time by Indo-Aryan speakers from northern India, or whether the Maldives was settled from Sri Lanka some time later (and if so, whether Dravidians were in the islands first). Estimates as to the date of settlement range from the 6th century BCE to the 5th century CE, though a date in the earlier part of this timespan seems more likely (see Cain & Gair 2000:1–3). It is likely that the earliest inhabitants continued to trade with peoples in Sri Lanka and India, given that Maldivian islands contain very few resources and hardly any crops can be grown on them. During the medieval period, Maldivians came into contact with Arab and Persian traders and missionaries, and the Maldivian population was converted from Buddhism to Sunni Islam in the 12th century. Today, Islam remains the official religion of the Maldives and is practiced by nearly the entire population, though many cultural beliefs and practices are rooted in Dravidian and pre-Islamic traditions (Maloney 1980; Romero-Frías 2003). The Maldives was briefly colonized by the Portuguese (from 1558 to 1573), but was never again dominated by Western powers. In the 1940s, the British established a military base in Addu Atoll with the permission of the Maldivian government, though their lease ended in 1976. Many Adduans learned English during this period (see §1.2.4.3).

1.2.3 Topography of the Maldives

As mentioned in §1.1, a goal of this thesis is to use Dhivehi as a test case for Palmer's (2015) Topographic Correspondence Hypothesis, and so it is necessary to first describe the main features of the environment in which Dhivehi is spoken. The Maldives is an archipelago of nearly 1,200 coral islands (of which about 200 are inhabited) to the southwest of India and Sri Lanka (see Figure 1.1 in §1.2.1). The islands are grouped into 26 natural atolls.[6] An atoll is a ring of narrow islands and coral reefs around a large, central lagoon.[7] Atoll islands are extremely low-lying. The Maldives is the world's lowest country – the average elevation is 1.8m and the highest point is 2.4m (The World Factbook 2017).

[6] The English word *atoll* derives from the Dhivehi *atoḷu* (Oxford English Dictionary Online 2014), a word referring to an administrative division. Administrative divisions in the Maldives correspond fairly well with natural atolls, though some large natural atolls are split into more than one administrative atoll, and some small natural atolls are grouped into more than one administrative atoll (see also §1.2.4). Without further specification, in this thesis I use the term 'atoll' to refer to natural atolls.

[7] Note that the term 'lagoon' may also refer to a shallow pool of water near or around an island (*vilu*) rather than the large body of water inside an atoll (*eterevari*). In this thesis I use the term in the latter sense.

Since the islands are so flat, and are usually only a few hundred metres wide, it is possible to see both the lagoon and the ocean from most points on land, provided one's view is not blocked by buildings or jungle. The two sides of the island are topographically quite different (see §1.2.4 for some photos of atoll islands). The ocean side generally has a band of shallow fringe reef between the beach and the open waters; this area is too shallow for boats. It is relatively exposed to the wind and ocean currents, which wash up shells, pebbles and other debris. This side of the island may also be slightly elevated (Woodroffe 2008). In contrast, the lagoon side is typically calmer, more protected, and characterized by sandier beaches and paler, clearer waters where boats may anchor.

The distinction between the ocean and lagoon sides is also culturally salient in many atoll communities. Tokelauans, for example, consider the ocean side to be dangerous and outside social control (Hoëm 1993). Among Maldivians, stories of evil spirits and monsters coming ashore from the ocean are common in folklore (Romero-Frías 2012). The two sides of the island also play different roles in everyday life. Boats anchor near the lagoon shore, and if only one side of the island is inhabited it is usually that side. Cowrie shells, once used as a currency in the Maldives, are collected from the fringe reef on the ocean side, as are certain shellfish. Traditionally, men and women went to opposite sides of the island for toileting – men to the lagoon side and women to the ocean side.

1.2.4 Field sites

The data presented in this thesis was mostly collected from three locations in the Maldives, during fieldwork in September 2013 to April 2014 and January 2015 to April 2015.[8] The primary field site was Laamu Atoll, though some data was also gathered in Malé and Addu. These locations are shown in Figure 1.2 below. Note that Maldivian atolls have traditional names (often referring to natural atolls – see Footnote 6) as well as administrative names which follow letters of the Thaana alphabet (Haa, Shaviyani, etc.). 'Laamu' is the name of the administrative division corresponding to the natural atoll 'Hadhdhunmathi', though the administrative name is now the more common of the two. In contrast, 'Seenu' is the name of the administrative division corresponding to the natural atoll traditionally called 'Addu', though in this case the traditional name is still the main one used. I therefore use the names

[8] Some additional data was collected from a Dhivehi speaker living in Melbourne, Australia, in August 2015 (see §4.5).

‘Laamu’ and ‘Addu’ following popular usage. Malé is a city geographically located within North Malé Atoll, but is administered separately.

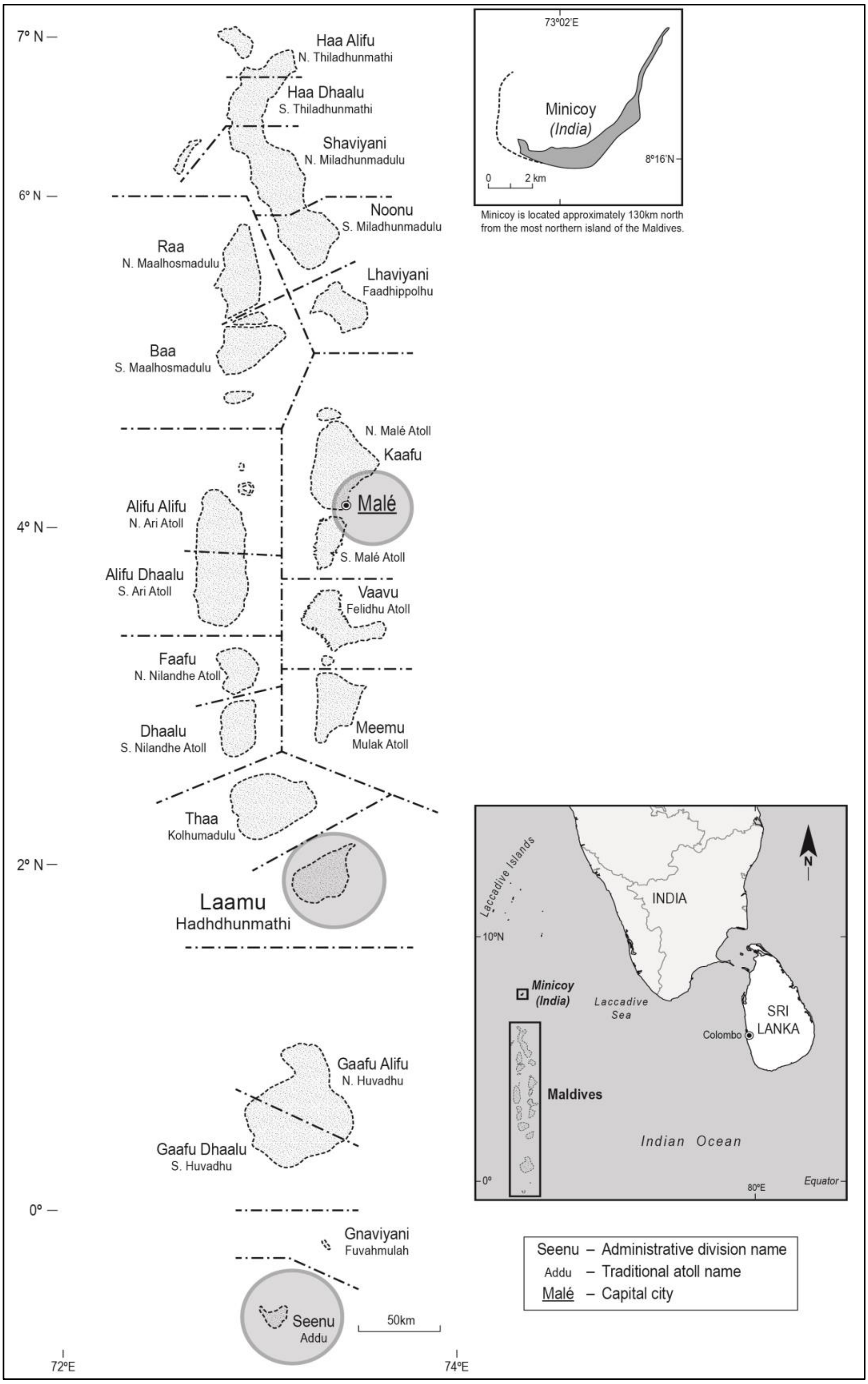


Figure 1.2: Map of the Maldives showing three field sites

1.2.4.1 *Laamu Atoll*

The main field site for the study was Laamu Atoll, about 250km south of Malé (see Figure 1.2 in the previous section). This atoll was selected for several reasons. In size and shape it is similar to Jaluit Atoll in the Marshall Islands, the field site for a concurrent study in the broader comparative project on FoRs in atoll-based languages (cf. §1.1; Palmer 2015; Schlossberg Forthcoming). Like Jaluit, but unlike many of the atolls in the northern and central Maldives, Laamu contains very few islands inside its central lagoon. Instead, its islands are mostly on the fringe reef surrounding the lagoon. Laamu also contains some very long islands, like atolls in the Marshalls Islands; Gan, in the east of the atoll, is the Maldives' longest island with a length of approximately 7.2km. A map of Laamu Atoll is shown in Figure 1.3 below:

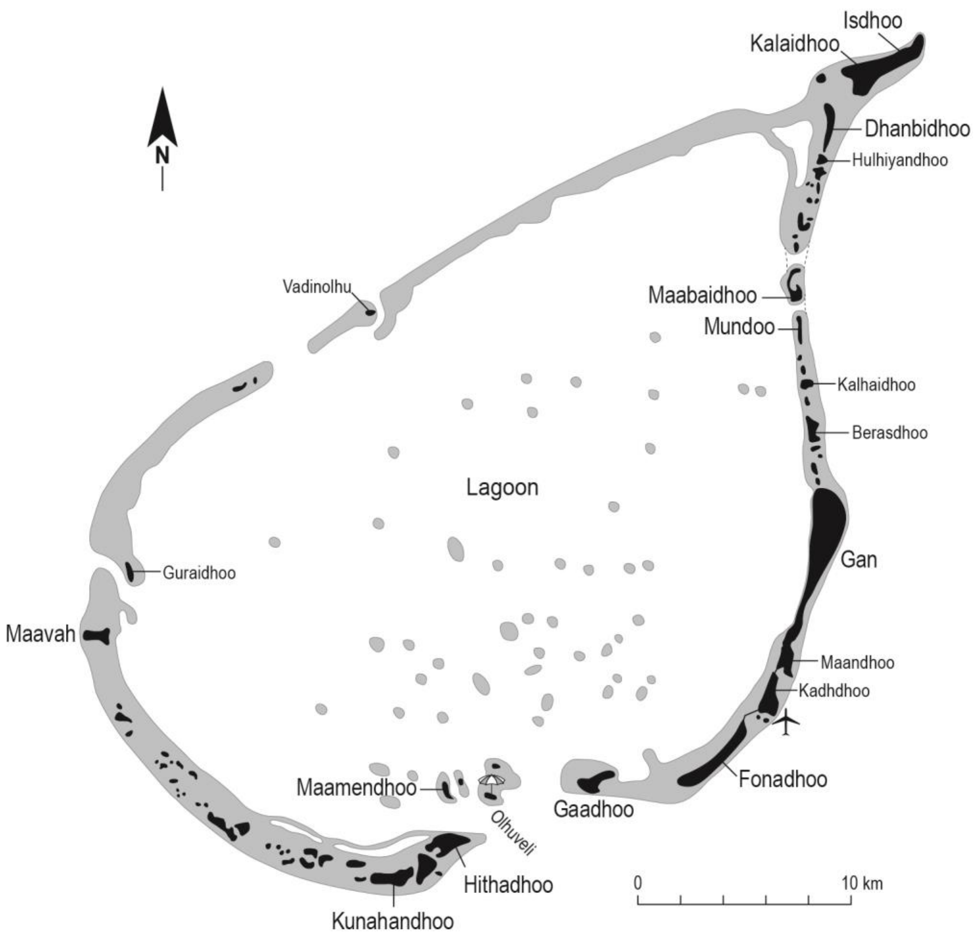


Figure 1.3: Map of Laamu Atoll

Laamu was also chosen because of its distance from the capital. Many residents of Laamu have never travelled to Malé, whereas many residents of atolls close to Malé actually work in the capital and return home on weekends. Although Laamu has had a domestic airport on the island of Kadhdhoo since the late 1980s, and mechanized boats since the late 1970s, before that a journey to Malé would reportedly take two to three months sailing. The physical distance is also reflected linguistically, with Laamu having a distinct dialect of Dhivehi (§1.2.1). Due to its relative isolation and the lack of islands inside the central lagoon (which are favoured by resort developers), Laamu is also relatively untouched by tourism. While atolls closer to Malé are peppered with resorts and guesthouses, at the time of the study Laamu contained only one resort on the otherwise uninhabited island of Olhuveli, as well as a few small guesthouses in Gan.[9] Some tourists also visit the atoll on 'safari boat' tours, and foreigners occasionally visit for other purposes such as development projects. In late 2015 the uninhabited island of Berasdhoo was used as a filming location for a major Hollywood film.

As of the 2014 census (National Bureau of Statistics 2014), the entire atoll has a population of 11,858 spread across 11 inhabited islands, one resort island, and one industrial island (Maandhoo, now contiguous with Gan following a land reclamation project, has a fish canning factory).[10] Fonadhoo, the atoll capital, has a population of 2,203, though the most populated island is Gan with 3,543 residents. Dhanbidhoo, from which much of the Laamu data was collected, has a population of 569.

In terms of area, some of Laamu's islands are quite large by Maldivian standards. Gan, the biggest island in the country (as well as the longest), is approximately 6km^2, and Fonadhoo is 1.68km^2. Because reclaimed land now links Gan with Maandhoo, and causeways link Maandhoo with Kadhdhoo and Kadhdhoo with Fonadhoo, it is possible to travel overland all the way from Gan to Fonadhoo along the Laamu Link Road, making the southeastern islands of Laamu the largest contiguous chain of islands in the Maldives. However, other inhabited islands in Laamu are much smaller and accessible only by water. Dhanbidhoo, for example, is only 0.52km^2 while Maamendhoo is just 0.21km^2. Like islands in other atolls, all islands in Laamu are quite narrow: Gan, the widest, is less than 1.5km at its widest point, while Fonadhoo is about 450m wide, Dhanbidhoo less than 300m wide, and Mundoo only about 200m wide.

[9] A new resort is due to open in Vadinolhu (currently uninhabited) in 2018.

[10] The figure of 11 inhabited islands includes Gaadhoo, which became uninhabited in early 2016 due to a government decision to move the population of that island to nearby Fonadhoo, where there is better infrastructure. The figure also counts Isdhoo and Kalaidhoo as just one island, though in 2014 the two communities (which are located on the same geographic island) split into two administrative areas that are often referred to as separate 'islands' in both Dhivehi and English (the Dhivehi word *rḁṣ̊* means both 'island' and 'town', and Maldivians who speak English tend to use the English word *island* in the same way). Another island, Kalhaidhoo (not to be confused with Kalaidhoo), was abandoned after the 2004 Indian Ocean tsunami.

Inhabited islands in Laamu are not as highly urbanized as Malé (see §1.2.4.2), though they are still more developed than villages in many other countries. Housing is not spread evenly across the available land on most islands; instead, there are densely inhabited areas adjacent to areas of thick jungle. While there is some farmland on certain islands, such as Isdhoo, farms are quite small and are usually bounded by jungle and buildings. As such, there is actually very little open space on the islands, except for soccer fields. Most buildings are single-storey and have their own courtyards, typically walled off for privacy. Coconut palms and verandas provide shade here and there, though as most buildings are single-storey and are spaced further apart, at street level the sun is more noticeable in Laamu than in Malé. Streets in Laamu are made of white coral sand, except for the newly paved Laamu Link Road, which was not completed until after the current study. Streets are arranged in a rough grid, the orientation of which varies somewhat from island to island, but typically follows the shore with cross-cutting roads at 90 degrees. On narrower islands, including Fonadhoo and Dhanbidhoo, the grid covers the entire width of the island, while on wider islands, towns are typically located on the lagoon side and extend into the island's interior.[11] Most streets are quite narrow, though many islands also have some large thoroughfares that are far wider than necessitated by local traffic, which mostly consists of motorcycles.[12] Although Fonadhoo is the atoll capital, its level of urbanization is no greater than that on other inhabited islands (in fact, some smaller islands like Maamendhoo are more crowded). Aerial photos of Fonadhoo and Gan are shown in Figure 1.4 to Figure 1.6 below. As the photos show, the size and density of buildings is similar in inhabited areas, though Gan has larger uninhabited areas outside its towns. A typical street in Fonadhoo is shown in Figure 1.7.

Two islands in Laamu were selected as primary field sites within the atoll. These were Fonadhoo, the atoll capital, and Dhanbidhoo, a smaller fishing community in the northeast

[11] An exception is the town of Isdhoo, part of the geographic island of the same name. This island, which juts out into the ocean at the northeastern corner of the atoll (see Figure 1.3), is unusual in that most of it is surrounded by fringe reef, with only a narrow opening to the lagoon at the southwestern end, where the town of Kalaidhoo is located. The town of Isdhoo, however, fronts onto a portion of reef near the northeastern tip, with a small artificial harbour providing access to the sea. Another exception is the town (or ward) of Mathimadhu in Gan, which spreads from the interior of the island to the ocean side. A local legend says that the residents of Mathimadhu once lived on the lagoon side of the island but relocated to evade government tax collectors, whose ships would arrive at the lagoon side.

[12] This pattern of urbanization dates to the early 1950s, when it was introduced by Mohamed Ameen, the first president of the Maldives. According to Romero-Frías (2003), the broad avenues were intended to provide space for military parades that could act as a deterrent against possible insurrection. Prior to the 1950s, Maldivian villages were simple clusters of houses that were not walled in or arranged in grids, and paths were narrow, winding and shaded (see Bell 2004 [1883]; Romero-Frías 2003).

of the atoll. Residents of Fonadhoo mostly work at the nearby airport or fish canning factory, in administrative jobs, or in their own homes. In Dhanbidhoo, a large proportion of the community work as fishermen (see Chapter 5). Smaller amounts of data were collected from the other inhabited islands in Laamu during shorter visits.

Figure 1.4: Fonadhoo, looking southwest (lagoon to the right)
(Photo: Mohamed Areeh, reproduced with permission)

Figure 1.5: Fonadhoo, looking north (lagoon to the left). The causeway and the airport at Kadhdhoo can be seen in the top right corner.
(Photo: Mohamed Areeh, reproduced with permission)

Figure 1.6: Gan, looking southeast (lagoon to the right)
(Photo: Unique Laamu Facebook page, reproduced with permission)

Figure 1.7: A street in Fonadhoo
(Photograph taken by the author)

1.2.4.2 *Malé*

A small amount of data was also collected from Malé, the capital of the Maldives, in order to investigate the possible effects of urbanization on the use of frames of reference. Malé is a concrete jungle – according to the 2014 census (National Bureau of Statistics 2014), the island has a population of 127,079 and a population density of 65,201/km^2, making it one of the most densely populated islands in the world. Buildings and paved streets cover practically the entire island (see Figure 1.8), except for a few soccer fields, cemeteries, and small parks. Many buildings have around eight floors, and together with a number of large, shady trees throughout the city, these block visual access to the path of the sun.

Streets in Malé are arranged in a rough grid, though some run diagonally. Most are quite narrow and allow only one-way traffic, except for some major thoroughfares. However, due to a lack of space, even the widest Malé streets are narrower than the broad avenues found on many outer islands (such as those in Laamu). Many streets have no footpaths, or only very narrow ones. There is heavy traffic, mostly consisting of motorcycles, at all hours of day. A typical Malé street is shown in Figure 1.9.

Figure 1.8: Malé as seen from the southwest
(Photo: Shahee Ilyas, 'Malé, capital of Maldives', from
https://commons.wikimedia.org/wiki/File:Male-total.jpg#
under a CC-BY-SA-3.0 license)

Figure 1.9: A street in Malé
(Photograph taken by the author)

A series of land reclamation projects have gradually expanded the size of Malé. These expansions, along with the construction of an artificial harbour along the south side of Malé, have made the distinction between the lagoon and ocean sides of the island far more subtle than in most atoll islands. As can be seen on the right-hand side of Figure 1.8, ocean waves meet the breakwaters just to the south of the island – formerly an area with exposed fringe reef. In any case, the distinction between lagoon and ocean sides is meaningless for most residents of the city, who spend most of their time indoors, and whose view of the water is usually blocked by buildings. In fact, most Malé speakers are unfamiliar with many of the topographic terms used in the outer atolls for referring to different sides of an island (see §4.6.4.1 for those used in Laamu).

It is worth noting that Maldivians refer to Malé as a city rather than an island, both in English and in Dhivehi. In many contexts, ‘the islands’ refers only to islands other than Malé, as does the term *rājje-tere*, which literally means ‘inside the country’. This reflects Malé’s official status as a city (*siṭī*) rather than an island/village (*raṣ̊*). This status as a city is shared only with Addu, the second largest urban centre (see §1.2.4.3). However, the ‘city’ of Malé includes not only Malé Island itself, but also the nearby islands of Vilingili, Hulhulé (an airport island), and the artificial island of Hulhumalé, which was reclaimed from the reef in order to provide more space for housing.

Many of Malé's inhabitants are recent arrivals from other atolls, having migrated for work, education, family or lifestyle reasons. Typically, residents are more highly educated and more fluent in English than Maldivians on outlying islands. This is a result of several factors, including a longer history of English-medium schooling and better teachers in Malé (Sobir et al. 2014:69–74), the availability of tertiary education, and contact with tourists and other visitors. Many residents have also lived abroad at some stage for work or study, most commonly in the United Kingdom, Pakistan, India, Sri Lanka, Malaysia, Singapore, Australia or New Zealand. Unlike in many of the atolls, the fishing industry is only a relatively small source of employment in Malé, and there is no available land for agriculture. Instead, most residents work in services, retail, administration, tourism, education, and other white-collar industries.

1.2.4.3 Addu

The island of Hithadhoo in Addu Atoll served as a third field site, and was selected for its intermediate level of urbanization as well as its typical atoll topography. Administratively, Addu is now regarded as a city, though until recently it was classified as an atoll with the administrative name 'Seenu'.[13] As of the 2014 census, Addu has a population of 19,712, of whom 10,575 live in Hithadhoo, which is also the largest island in terms of area, at 5.4km^2. As on many Maldivian islands, urban sprawl takes up the majority of available land on Hithadhoo, covering the entire width of the island and most of its length. In contrast to Malé, however, most buildings are only one or two stories high. There is more space between buildings and many have small courtyards like in Laamu. Roads are generally made of coral sand, though the Addu Link Road, which connects the western chain of islands (including Hithadhoo), is paved. As is the case in Laamu and other atolls, in Addu there are obvious visual differences between the lagoon and ocean sides of islands – the lagoon side is calmer and paler, and waves break on the ocean side. An aerial photo of Addu is shown in Figure 1.10, and a typical street in Figure 1.11.

From 1941-1975, part of Addu was used as a military base by the British, who employed many local men. Due to this period of contact, many middle-aged and older men speak English as well as Dhivehi. Younger Adduans are also bilingual due to English-medium

[13] To indicate that a particular island is in Addu, the abbreviation 'S.' is often used – for example, 'S. Gan' (or 'Seenu Gan') refers to an island in Addu, whereas 'L. Gan' refers to the island of the same name in Laamu; similarly, 'S. Hithadhoo' is in Addu while 'L. Hithadhoo' is in Laamu.

schooling. English is often used in conversation even when no foreigners are present, which is also the case among the young generation in Malé, but is unusual in Laamu and other atolls. Although there are not as many opportunities for tertiary education and training as in Malé, there is a campus of the Maldives National University in S. Hithadhoo, and some Adduans travel abroad for tertiary education. Economically, no single industry is dominant in Addu. As a proportion of the workforce in each location, there are more fishermen in Addu than Malé, though not as many as in Laamu where fishing is the major industry. The inclusion of Addu in this study allows for certain factors to be teased apart (see Chapter 5) – its population is more like Malé's in terms of bilingualism, education, and employment, but in terms of topography and urbanization it is more similar to Laamu.

Figure 1.10: Addu Atoll from the northwest, with Hithadhoo in the foreground
(Photo: Violet Dhonbe, reproduced with permission)

Figure 1.11: A street in Hithadhoo, Addu Atoll
(Photo: Lafwa Thaufeeq, reproduced with permission)

1.3 About this thesis

1.3.1 Aims and research questions

The primary goal of this thesis is to analyze frames of reference (FoRs) in Dhivehi. In particular, I hope to answer the following questions:

- Which FoRs are linguistically available in Dhivehi, and how are they expressed grammatically?
- How do FoRs relate to spatial language more generally in Dhivehi?
- Which FoRs are predominantly used in Dhivehi?
- To what extent do FoRs in Dhivehi differ according to location, context, and demographic variables such as age and gender? What explains this variation?
- What can FoR use in Dhivehi tell us about the relationship between language, cognition, and the environment? Is there supporting evidence for Palmer’s (2015) Topographic Correspondence Hypothesis, or for competing hypotheses in the literature on FoRs?

An additional aim is to investigate FoRs in Dhivehi cognition. This will involve addressing the following questions:

- Which FoRs do speakers of Dhivehi use in solving *non-linguistic* spatial tasks?

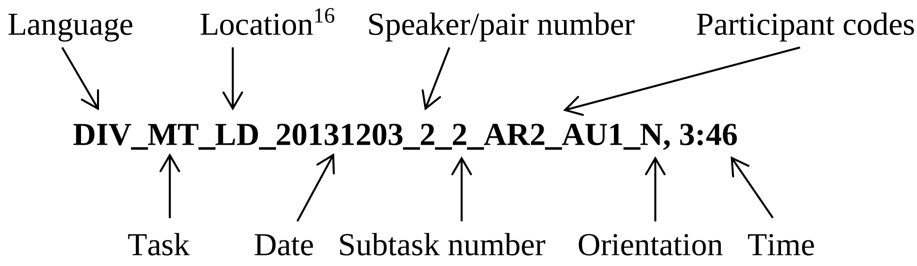
- To what extent does non-linguistic FoR use vary according to location, context, and demographic variables? What explains this variation?
- What do the patterns of non-linguistic FoR use suggest about the relationship between language, cognition, and the environment? Do they support the linguistic relativity hypothesis?

More specific aims and research questions will be provided at the beginning of each chapter.

1.3.2 Data

Data was collected with the approval of local authorities as well as the Monash University Human Research Ethics Committee (MUHREC).[14] Different kinds of data were collected in order to answer the different research questions presented in §1.3.1. Details of methodology and coding are provided in each of the relevant chapters. Many of the data collection techniques follow those used in previous research on FoRs, especially methodologies developed by the Max Planck Institute for Psycholinguistics in Nijmegen (e.g., Brown & Levinson 1993; Levinson et al. 1992; Senft 2007; Wilkins 1993). Most of the linguistic data was in the form of video and audio recordings of Dhivehi speakers telling stories or describing certain stimuli to other speakers. This data will be archived in the Pacific and Regional Archive for Digital Sources in Endangered Cultures (PARADISEC).[15] Excerpts from these recordings are presented in this thesis, in the form of interlinearized examples featuring a transliterated utterance, a linguistic gloss, and a free translation. The system of transliteration adopted mostly follows that used by Gnanadesikan (2017) (cf. §1.2.1, Footnote 4), and the abbreviations used in glosses are listed on page 8 of this thesis. A file name is also provided for each interlinearized example. File names contain basic metadata about the text in which the utterance occurred, as shown in the following annotated file name:

[14] Project number CF13/1726 - 2013000896.
[15] See www.paradisec.org.au.



This particular file name indicates that the text was in Dhivehi (as opposed to Marshallese, the other language in the broader cross-linguistic project), the task was the 'Man and Tree' game and was played in Laamu Dhanbidhoo, the date was 2013-12-03, the speakers were the second pair that day to perform this task and were playing their second Man and Tree game, the speakers were participants AR2 and AU1 (with the former playing as 'director' and describing the stimuli) and they were facing north, and the relevant utterance began at three minutes and 46 seconds into the recording.

1.3.3 Thesis outline

This thesis is divided into seven chapters and two appendices. Chapter 2 introduces Levinson's (1996; 2003) classification of frames of reference as well as some issues with this influential typology. I discuss some alternative typologies and argue for a fine-grained classification based on the rotational properties of different FoRs, following recent work by the 'MesoSpace' research group (e.g., Bohnemeyer & O'Meara 2012; Bohnemeyer & Tucker 2013; O'Meara & Pérez Báez 2011).

Chapter 3 discusses some of the main positions and developments in the debate on the relationship between frames of reference, cognition, and the environment. I summarize the evidence for linguistic relativity presented by Levinson and colleagues (e.g., Levinson 2003; Majid et al. 2004; Pederson et al. 1998) and address the well-known dispute between Li and Gleitman (2002) and Levinson et al. (2002), before considering some more recent research (e.g., Haun et al. 2011; Li et al. 2011). I also discuss various hypotheses on the role of the environment, especially Palmer's (2015) Topographic Correspondence Hypothesis.

[16] The abbreviations for tasks and locations in file names are listed in the abbreviations list at the start of this thesis.

Chapter 4 is a Dhivehi ‘grammar of space’, i.e., a description of spatial reference in Dhivehi, inspired by the ‘grammars of space’ in Levinson and Wilkins (2006a). The chapter covers deixis, topological relations, positional/postural verbs, motion events, and most importantly frames of reference. I show how Dhivehi has the linguistic resources to express various FoRs, describing the relevant lexical items and syntactic constructions in the language. While terms for topographic features like the lagoon and ocean exist, they behave grammatically like ordinary landmarks; in contrast, some other geocentric terms like cardinal direction terms and the nouns *atiri* ‘beach’ and *eggamu* ‘inland’ may participate in a specialized ‘locative dative’ construction, a construction in which some non-geocentric spatial terms may also participate. I also discuss the existence in Dhivehi of some unusual FoR subtypes, including a system of sidereal compass directions and an unusual use of ‘front’ and ‘back’ terms for the inner and outer sides of objects in circular configurations.

Chapter 5 presents quantitative data on FoR use in Dhivehi, especially from the ‘Man and Tree’ game. I discuss how a range of FoRs are used by individual speakers and across the community, but also show that much of the variation is based on the occupation, age and gender of the speakers, as well as which island they are from and whether they are bilingual. For example, the use of cardinal directions is strongly associated with fishermen who spend much of their time on the open waters, while speakers who work indoors use egocentric FoRs at higher rates. Additional data from various other tasks and narratives is also presented. I argue that FoR choice in Dhivehi is influenced by the nature and degree of speakers’ interactions with the surrounding environment, rather than the environment itself.

Chapter 6 considers FoRs in Dhivehi cognition, drawing upon the results of three non-linguistic spatial memory tasks. In the ‘Animals-in-a-row’ task, many participants employed a ‘monodirectional’ rebuilding strategy, though others employed geocentric or egocentric strategies. I argue that a monodirectional strategy that is also faithful to array-internal characteristics of the stimulus is best analyzed as an intrinsic solution to the task, even though it may superficially look like a mixed strategy. I also present statistical results showing a weak correlation between linguistic and non-linguistic coding, results which are compatible with linguistic relativity. However, the results from the three non-linguistic tasks together point to a degree of task specificity and individual preference.

Chapter 7 concludes by summarizing the main findings and discussing their significance to our understanding of the relationship between language, cognition, and the environment. In particular, I underscore the key finding that in the Dhivehi context, speakers' interactions with their environment are at least as important as the environment itself when it comes to FoR choice. Questions for further research are also considered.

Two appendices contain some additional information and data. Appendix I presents the Dhivehi instructions (read aloud to participants) for each of the tasks discussed in Chapters 5 and 6, along with English translations. Appendix II provides fully glossed and translated examples of a complete 'Man and Tree' game and a complete 'Route Description' game.

2 Classifying frames of reference

2.1 Introduction

Frames of reference (FoRs) are an important concept in the literature on spatial language and cognition. As Levinson (2003:24) observes, the term 'frame of reference' and its modern interpretation originate in Gestalt theories of perception in the 1920s. Since then, the concept has evolved somewhat differently in different disciplines (for an overview, see Levinson 2003:25-34). In the recent linguistics literature, FoRs are ways of coding *angular* relations in space, i.e., relations which invoke a direction or angle between objects (Levinson 2003:2). Thus, descriptions like *The cow is* ***in front of*** *the horse* or *Bass Strait is* ***south*** *of Victoria* involve FoRs, whereas non-angular descriptions like *The money is here/at home/near the table* are not generally regarded as involving FoRs.[17] Additionally, FoRs are generally taken to exclude topological relations such as INSIDE or THROUGH which relate more to notions of contact, containment, support, attachment and the like (see §4.3 for further discussion of topological relations); however, some topological relations such as ON, OVER, and UNDER do invoke angular distinctions along the vertical axis and so may be considered to employ FoRs (e.g., Bohnemeyer 2011:898; Levinson 2003:65–66).

Following Talmy (1983), most writers use the term 'figure' to refer to the item to be located, and the term 'ground' to refer to the reference object with respect to which the figure is located. For example, in *The cow is in front of the horse*, the figure is *the cow* while the ground is *the horse*.[18] Although some writers have preferred other terms like 'located object' and 'referent object' (Levelt 1984) or 'referent' and 'relatum' (Palmer 2002; 2003; 2004; 2015), in this thesis I will use 'figure' and 'ground' because they are well established in the literature. Applying this terminology, we can characterize a frame of reference as a strategy for encoding the location, orientation or path of the figure with respect to the ground, or as a coordinate system for expressing the spatial relationship between figure and ground (cf. Terrill & Burenhult 2008:93).

Within linguistics, frames of reference have in recent years been explored by a number of researchers and research groups, most notably Levinson and his colleagues in the Language

[17] An exception is Palmer (2003), who proposes an 'unoriented' FoR that encompasses such non-angular descriptions.

[18] Note that this technical use of 'ground' should not be confused with the ordinary word *ground* in English – in *The ground is under my foot*, the figure is *the ground* and the ground is *my foot*.

and Cognition Department[19] at the Max Planck Institute (MPI) for Psycholinguistics in Nijmegen. MPI researchers and their collaborators at other institutions have published widely on FoRs. While some publications describe FoRs in particular languages (e.g., Levinson & Wilkins 2006a; Senft 2001) and others address theoretical or definitional issues to do with FoRs (e.g., Pederson 2003), the focus has been to demonstrate that the preference and use of certain FoRs in different languages co-varies with the FoRs used in non-linguistic spatial tasks, suggesting a Whorfian effect of language upon thought (e.g, Brown & Levinson 1993; Haun et al. 2011; Levinson 1996; 2003; Levinson et al. 2002; Majid et al. 2004; Pederson et al. 1998). However, various aspects of this research program have proven controversial. Some have doubted that FoRs in language have any effect on spatial cognition (e.g., Li & Gleitman 2002; Li et al. 2011), while others have taken issue with definitional or classificatory aspects of certain FoRs (e.g., Danziger 2010; Palmer 2003; 2004; 2015). Another point of contention is the extent to which FoRs interact with various aspects of the physical environment (e.g., Li & Gleitman 2002; Palmer 2002; 2004; 2015).

In this chapter I address a number of theoretical issues relating to the classification of FoRs, leaving to Chapter 3 the empirical questions surrounding FoRs and their relationship with spatial cognition and the environment. In §2.2 I introduce Levinson's (1996; 2003) influential division of FoRs into 'intrinsic', 'relative' and 'absolute'. I then discuss some of the issues with Levinson's framework and outline some key areas where other classifications have diverged. In particular, Danziger's (2010) distinction between 'direct' and 'object-centered' intrinsic FoRs is explored in §2.3, and the distinction between landmark references and the absolute FoR is addressed in §2.4. After considering how these issues are handled by different typologies, I argue that FoRs are best classified in terms of their rotational properties, and in §2.5 I sketch out a revised typology that sorts FoRs in this way. With some minor differences, the typology resembles the classification favoured by the 'Spatial language and cognition in Mesoamerica' (or 'MesoSpace') research group (e.g., Bohnemeyer & O'Meara 2012; Bohnemeyer & Tucker 2013; O'Meara & Pérez Báez 2011), and makes use of Bohnemeyer and O'Meara's (2012) distinction between 'head-anchored' and 'angular-anchored' FoRs. The revised typology distinguishes between four major FoRs ('relative', 'intrinsic', 'landmark-based' and 'absolute'), each of which has

[19] Formerly the Cognitive Anthropology Research Group.

various subtypes and cross-cuts other distinctions made in the literature, such as the distinction between egocentric and geocentric FoRs.

2.2 Levinson's three frames of reference

Levinson and colleagues distinguish between three frames of reference (Levinson 1996; 2003; Majid et al. 2004; Pederson et al. 1998): the intrinsic FoR, as in *The man is in front of the house*; the relative FoR, as in *The man is to the left of the house (from my perspective)*; and the absolute FoR, as in *The man is north of the house.* Levinson's typology has been highly influential, with many subsequent studies adopting his three-way division along with his definitions for each FoR (e.g., Arka 2006; Blake 2007). Levinson's definitions for each FoR are provided below, along with some of his observations on the subtypes and properties of each FoR.

2.2.1 The intrinsic frame of reference

According to Levinson (1996:140–142; 2003:41–43), the intrinsic FoR is a binary relation between figure and ground. The figure is located by projecting a search domain off the ground on the basis of a perceived asymmetry in the ground. In (1), for example, *the man* is the figure (F) and *the house* is the ground (G):

(1) *The man is in front of the house.*

Here, the man is located by projecting a search domain off the house on the basis of a perceived asymmetry in the house itself – in this case, the house is considered to have its own 'front' side. The search domain extends from the origin of the coordinate system at the centre of the ground (in this case, the centre of the house) through an anchor point (the house's front facet) and outwards for some distance. Thus, in the intrinsic FoR, the origin (X) and ground (G) coincide, as illustrated in Figure 2.1 below:[20]

[20] Figures from Levinson (2003) are reproduced with the permission of Cambridge University Press.

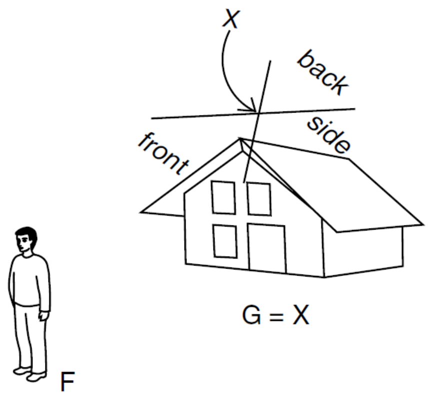


Figure 2.1: Intrinsic FoR: *The man is in front of the house*
(adapted from Levinson 2003:40)

As Levinson (2003:41-42) notes, there is a degree of cross-linguistic variation in how facets are assigned to ground objects. English and many other languages label as 'front' the side we attend to or face (e.g., of a computer or house), or else the side that lies in the canonical direction of motion (e.g., of a vehicle). In some languages, however, facets are labelled by shape rather than function (see Levinson 1994 for Tzeltal). Cross-linguistically, it is common for human or animal body parts to provide a prototype for the names of intrinsic facets, as in the English word *back*.

Whichever way the asymmetry of the ground is perceived and labelled, an important point is that the intrinsic FoR operates on the basis of this asymmetry. This means that the intrinsic FoR has a unique set of rotational and logical properties (Levinson 2003:50-53). Rotating the house in Figure 2.1 while keeping the man fixed would render the proposition false, but rotating the entire figure-ground array would not. Rotating the speaker's (or hearer's) viewpoint would also not affect the truth value of the proposition. Further, the intrinsic FoR lacks the logical properties of transitivity and converseness:

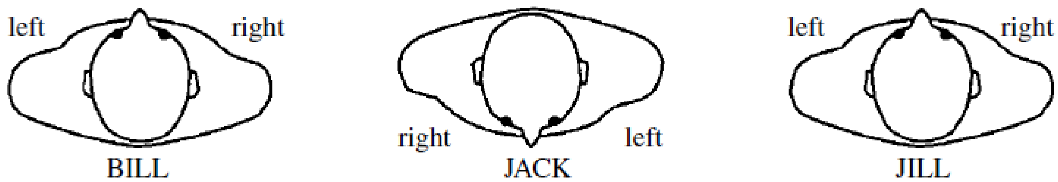


Figure 2.2: Logical inadequacies of the intrinsic FoR (adapted from Levinson 2003:51)

In Figure 2.2 above, Jill is to Jack's left, Bill is to Jill's left, but Bill isn't to Jack's left, and so intrinsic leftness is not a transitive relation (in contrast to, say, tallness, where if Jill is taller than Jack, and Bill is taller than Jill, then Bill must be taller than Jack). Nor is leftness a converse relation – Jill is at Jack's left, but Jack isn't at Jill's right (again contrast tallness, where if Jill is taller than Jack, Jack must be shorter than Jill).

2.2.2 The relative frame of reference

In the relative FoR (Levinson 1996:142–145; 2003:43–50), the spatial relationship between figure and ground is expressed by presupposing an external viewpoint (V). Since this is a third component in addition to the figure and ground, Levinson describes the relative FoR as a ternary relation. The relative FoR operates by projecting a search domain off the ground on the basis of an asymmetry assigned to the ground by the viewpoint, which functions as the origin (X) of the primary coordinate system. This is demonstrated in Figure 2.3 below:

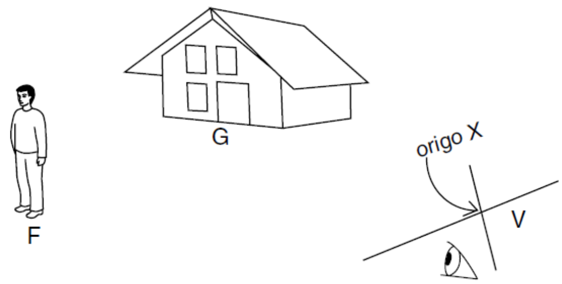


Figure 2.3: Relative FoR: *The man is to the left of the house* (adapted from Levinson 2003:40)

In this example, a search domain is projected off a facet of the house (G) in order to locate the man (F). The relevant facet of the house is labelled ('left') according to the viewpoint. Note that the viewpoint is generally that of the speaker, but could belong to the hearer (e.g., *The man is to the left of the house from your perspective*) or some other observer (e.g., *The man is to the left of the house from John's perspective*).

More specifically, in the relative FoR, the intrinsic left/right/front/back coordinates (C_1 in Figure 2.4 below) of the viewer (V) are mapped onto the ground (G) in order to generate a *secondary* set of coordinates (C_2) with the ground as the origin (X_2). A search domain is then extended off a facet of the ground designated by these secondary coordinates in order to locate the figure. The way in which coordinates are mapped from viewpoint to ground differs across languages, and sometimes even within a language. These different systems of mapping constitute different subtypes of the relative FoR. English and many other languages prefer a 'reflectional' relative FoR in which the coordinates of the viewpoint are reflected across the frontal transverse plane when mapped onto the ground, as in Figure 2.4 below:

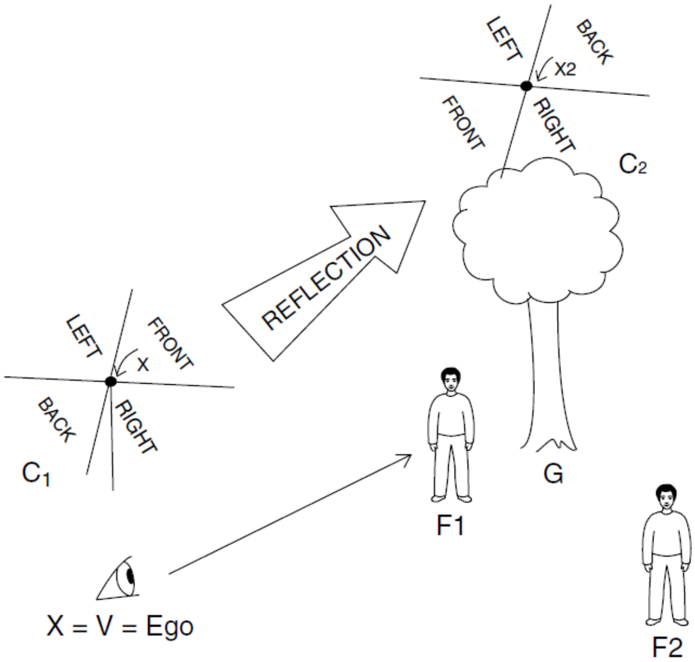


Figure 2.4: Reflectional relative FoR: *The man* (F1) *is in front of the tree*; *The man* (F2) *is to the right of the tree* (adapted from Levinson 2003: 86)

In this case, the coordinates of the viewpoint (V) are mapped onto the tree (G), but undergo a process of reflection along the way. Thus, the 'back' of the tree is the side further from V, and the 'front' is the side closer to V, while the 'left' and 'right' of the tree remain aligned with the viewer's left and right sides.

Other languages map the coordinates from V to G differently. Marquesan (Austronesian, French Polynesia; Cablitz 2006), rural Hausa (Afro-Asiatic, western Africa; Hill 1982), Tongan (Austronesian, Tonga; Bennardo 2000) and Yélî Dnye (isolate, Papua New Guinea; Levinson 2006) employ a system of 'translation' in which the coordinates of V are projected forward onto G without any reflection or rotation. This 'translational' subtype of the relative FoR is illustrated in Figure 2.5 below. The description *The man is in front of the tree* now locates the man on the *far* side of the tree, as represented by F1, while the description *The man is to the right of the tree* locates the other man (F2) in the same place as in Figure 2.4 above.

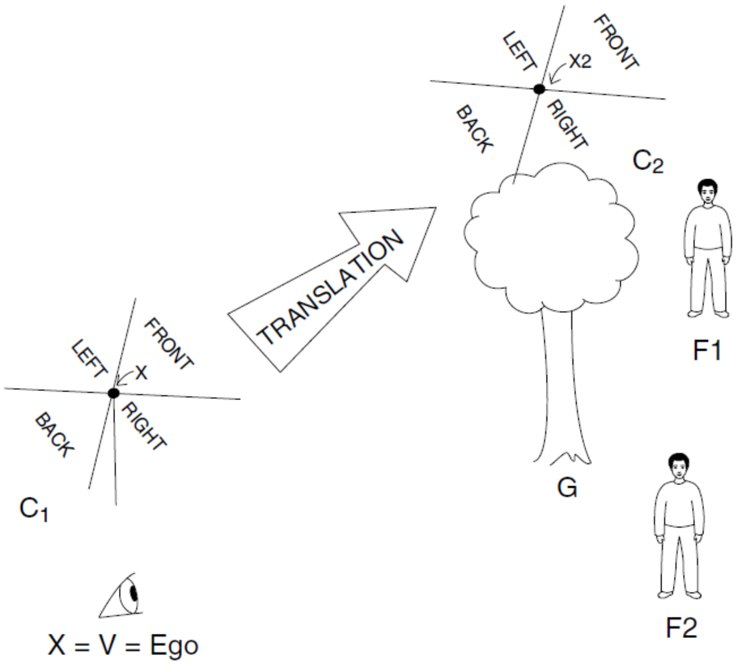


Figure 2.5: Translational relative FoR: *The man* (F1) *is in front of the tree*; *The man* (F2) *is to the right of the tree* (adapted from Levinson 2003:88)

Finally, at least one dialect of Tamil employs a rotational system in which the coordinates of V are rotated 180 degrees when mapped onto G (Pederson 2006), as shown in Figure 2.6 below:

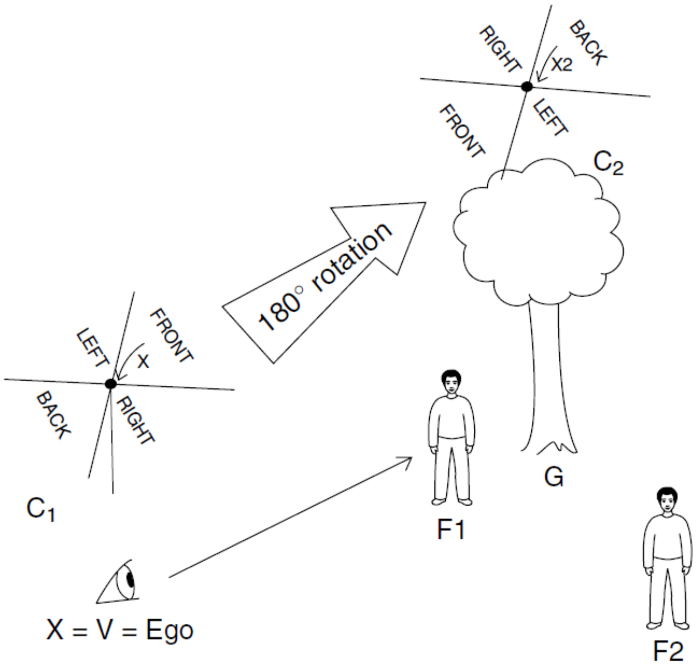


Figure 2.6: Rotational relative FoR : *The man* (F1) *is in front of the tree; The man* (F2) *is to the left of the tree*
(adapted from Levinson 2003:87)

In this rotational subtype of the relative FoR, the man at F1 is on the near side of the tree when he is *in front* of it, just as he is in the reflectional relative system. However, the man at F2 is *to the left* of the tree in the rotational system but *to the right* of the tree in both the reflectional and translational systems.

All subtypes of the relative FoR share a particular set of rotational and logical properties that are distinct from the properties of the intrinsic FoR. Under rotation of the ground, a description in the relative FoR remains true – if the tree in Figure 2.4 is rotated by itself, for example, it remains the case that the man is in front of the tree (assuming, for the purpose of illustration, a reflectional subtype of the relative FoR). But under rotation of the figure-ground array (while keeping the viewpoint constant) or under rotation of the viewpoint around the array (while keeping the figure and ground fixed), the description becomes false. Further, if the viewpoint is held constant, the relative FoR has the properties of transitivity and converseness: if A is left of B, and B is left of C, then A is left of C; and if A is left of B, then B is right of A (cf. Levelt 1984).

2.2.3 The absolute frame of reference

Levinson (1996:145–147; 2003:47–50) defines the absolute frame of reference as a binary relation between figure and ground in which a search domain is projected off the ground on the basis of a conceptual ‘slope’ consisting of fixed bearings which are arbitrary and abstract. Cardinal directions like ‘north’ are good examples of such bearings, as illustrated in Figure 2.7 below:

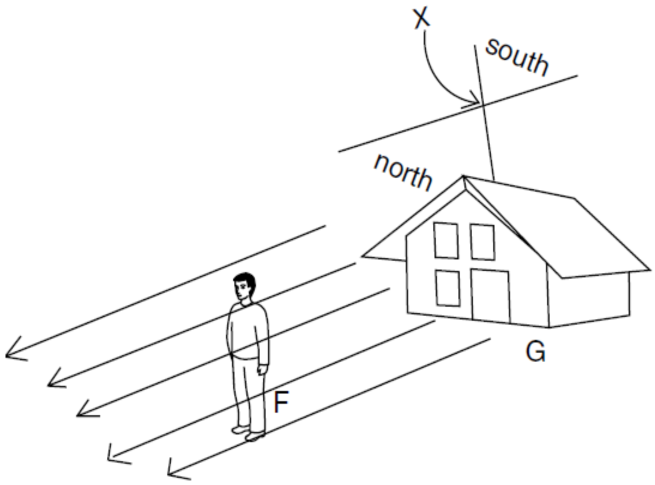


Figure 2.7: Absolute FoR: The man is north of the house (adapted from Levinson 2003:40)

In Figure 2.7, the absolute FoR operates by imposing an asymmetry on the house based on large-scale cardinal bearings – one side of the house is further north than the others. More technically, the origin X of the coordinate system is centred on G (the house), and the system of directional terms is anchored to the slope (in this case, the system of cardinal bearings across the landscape). A search domain is projected off G in the direction of the fixed bearing in order to locate F.

As with other FoRs, there is considerable cross-linguistic diversity within the absolute FoR. Some languages allow search domains to be projected off the ground along an arc of roughly 90 degrees, while in other languages the arc may be far narrower or wider depending on the bearing (see Levinson 2003:50). The origins of absolute bearings are also diverse, and directional systems in languages may be motivated by a range of environmental features including the sun, stars, winds, elevation, rivers, coastlines, mountains, and so forth.

Spatial descriptions in the absolute FoR maintain their truth value under rotation of the viewpoint or ground, but not under rotation of the figure-ground array. In Figure 2.7 above, for example, the man is north of the house regardless of the orientation (or position) of any observers, and regardless of the orientation of the house, but he is no longer to the north of the house if the entire scene is rotated. As with the relative FoR, descriptions in the absolute FoR have the properties of transitivity and converseness: if the man is north of the house and the ball is north of the man, then the ball is necessarily north of the house (transitivity); and if the man is north of the house, the house is necessarily south of the man (converseness). Table 2.1 below compares these properties to those of the intrinsic and relative FoRs:

Table 2.1: Logical and rotational properties of FoRs compared

	Intrinsic	**Relative**	**Absolute**
Transitivity	No	Yes (if viewpoint held constant)	Yes
Converseness	No	Yes (if viewpoint held constant)	Yes
Constancy under rotation of viewpoint around the array	Yes	No	Yes
Constancy under rotation of ground	No	Yes	Yes
Constancy under rotation of figure-ground array	Yes	No	No

2.3 Intersection of the intrinsic and relative FoRs

2.3.1 The problem: speaker as ground and anchor

The previous section gave a sketch of Levinson's (1996; 2003) three frames of reference. However, there is some disagreement in the literature as to the precise boundaries between different FoRs. In this section I consider the boundary between the intrinsic and relative FoRs. The basic problem is that the intrinsic and relative FoRs appear to overlap in cases where the speaker/viewer *is* the ground, as in (2) below:

(2) *The ball is in front of me.*

The issue is that like the relative FoR, the proposition in (2) is anchored on the speaker/viewer (that is, 'front' is derived from the speaker's body), but like the intrinsic FoR, the ground is the anchor in what is a simple binary relation between figure and ground. In the literature on FoRs, examples of this kind have variously been classified as intrinsic, as relative, or as a separate FoR altogether. I will argue that an intrinsic analysis is essentially correct, but that the use of a more specific label like Danziger's (2010) 'direct FoR' can be useful when it comes to comparing FoRs across frameworks that classify such examples in different ways.

Under Levinson's (1996; 2003) classification, as well as in some other classifications (e.g., Dasen & Mishra 2010:58), examples like (2) fall under the intrinsic frame because of their conceptual structure (see Levinson 2003:34–38). The relation between figure and ground is *binary*, and the figure is located by projecting a search domain from an intrinsic facet of a ground object. For Levinson, the fact that the ground happens to be the speaker changes nothing, since the same conceptual structure would apply if the ground were a separate person or object – it is just that the speaker has chosen to make herself the ground in this instance.[21] Furthermore, in (2) there is no transposition (or 'mapping') of coordinates from the viewpoint to the ground like in the relative FoR; instead, the description invokes a facet perceived to be inherent to the ground object, and would be falsified if the ground were to be rotated around its own vertical axis.

2.3.2 Are binary egocentric FoRs relative?

Prior to Levinson's work, no distinction was typically made between examples like (2) and examples in which the anchor is a viewpoint separate to the ground (such as those presented in §2.2). Thus, the Levinsonian relative FoR (a ternary FoR) and the speaker-as-ground subtype of the intrinsic FoR (a binary FoR) were grouped under a single 'deictic' or 'egocentric' FoR (e.g., Levelt 1989:48–52).[22] This grouping is still maintained by some

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[21] Note that, contrary to what is suggested in some of the literature (e.g., Bennardo 2009; Danziger 2010), the choice to use oneself as ground is not necessarily significant from a psychological perspective – (2) might be used simply because the ball is closer to the speaker than to any other salient object, or because the ball's position with respect to the speaker is especially relevant in the discourse.

[22] See Levinson (2003:25–38) for a review of the 'deictic' vs. 'intrinsic' and 'egocentric vs. allocentric' distinctions in the literature.

scholars such as Bennardo (1996; 2000; 2004; 2009), who confusingly takes up Levinson's 'relative FoR' label but uses it in the same way as the older 'deictic' or 'egocentric' label. Bennardo is aware of Levinson's classification, but rejects Levinson's view that examples like (2) are intrinsic, instead arguing that they fall under a 'conflated' (Bennardo 1996) or 'basic' (Bennardo 2000; 2004; 2009) subtype of the relative FoR. For example, Bennardo (2009:57) writes:

> [B]oth the research on the visual system… and that on the developmental sequence… point towards the primacy of a stage in which viewer V and ground G are conflated on ego. As a matter of fact it is exactly the capacity to assign independent sets of coordinates to objects that marks one of the milestones of cognitive development… Consequently, unlike Levinson, I define a relative FoR as anchored on ego.

Thus, Bennardo's position is based largely on the importance of the ego in psychology, and particularly in developmental psychology. The fact that the 'basic' relative appears to be conceptually prior to the projective relative is taken as evidence that the former is a type of intrinsic rather than relative FoR.[23] Similarly, it is largely for developmental reasons that Shusterman and Li (2016a; 2016b) group binary and ternary egocentric FoRs under a single 'egocentric object-based' FoR. However, there are a number of problems with this kind of argument, some of which I outline below.

Firstly, the literature on the acquisition of FoRs also shows that the intrinsic FoR is acquired earlier than (projective) relative uses of 'front' and 'back', and much earlier than relative 'left' and 'right' (Johnston & Slobin 1979; Levinson 2003:308; Tanz 1980). If the developmental sequence is to be taken as a guide to FoR divisions, then presumably one must also say that sagittal (i.e., front-back) relative terms and transverse (i.e., left-right) relative terms belong to different FoRs, and that both are distinct from the 'basic' relative. Bennardo does not do this, and indeed there is probably no one who would wish to classify FoRs in this way, since such an approach completely overlooks how each FoR operates. Instead, it is more plausible to suppose that certain FoRs are acquired in several stages, and that a child may begin to use a FoR in certain contexts (e.g., along a sagittal axis, and/or with a person – especially the ego – as ground) before extending it to other contexts. It is no surprise that young children first use themselves as grounds before they start to use other objects or people as grounds. This may merely show that they learn about the asymmetries

[23] See Bennardo (2009:57) for references to the relevant literature on the visual system and developmental sequence.

of their own bodies before those of others, and/or that in the earliest stages, children are most interested in objects in their immediate vicinity, which they can describe in relation to their own bodies rather than to other entities. It does not show that the conceptual structure of the 'basic' relative FoR is necessarily different to that of the intrinsic FoR.

Secondly, a distinction between projective and non-projective uses of left/right/front/back terms is well motivated by the evidence from language typology. The intrinsic FoR (including the speaker-as-ground subtype) appears to exist in all languages, but the (projective) relative FoR is absent or highly limited in many languages (Levinson 2003; Majid et al. 2004; Pederson et al. 1998).

Thirdly, Bennardo's approach has a strange consequence when we consider cases in which the speaker is the anchor and ground, but refers to himself in the third person, as in (3) below:[24]

(3) *The ball is in front of John.*

Just as in the intrinsic FoR, the proposition in (3) is true from John's viewpoint as well as from anyone else's, and would be equally true if it were uttered word for word by another speaker. But under Bennardo's classification, the analysis of (3) must depend on who the speaker is – if John is the speaker, then (3) is a 'basic relative' FoR description, but if the speaker is anyone else, it is an intrinsic FoR description. This is an unappealing way to classify FoRs because it means that even if the scene and spatial description are held constant, and the description does not rely on any particular viewpoint, two different FoR analyses are possible depending on who the speaker is.

The use of a deictic ground in (2) (in the previous section) is in fact a distraction from the true conceptual structure of the spatial description, which is more easily seen when we consider the variant in (3). I have touched upon the nature of this conceptual structure already, but it is worth reiterating as it is critical to the difference between the intrinsic and

[24] While it is true that such cases may be relatively unusual, I consider them to be common enough to warrant discussion. In English, speaking about oneself in the third person is reasonably normal in child-directed speech (e.g., *Mummy has to go now*) as well as in certain other contexts. In any case, the phenomenon is not so unusual in some languages, including Dhivehi, where names and kin terms are often used in lieu of first and second person pronouns (Gnanadesikan 2017:70, 88–89).

relative FoRs: in (2) as in (3), although the viewpoint and the ground both coincide with the anchor, the anchor is most plausibly the speaker *qua* ground rather than the speaker *qua* viewer. The latter possibility is implausible because it would assume that the speaker 'maps' his own intrinsic left/right/front/back coordinates onto himself with no process of reflection, translation, or rotation. The resulting coordinate system would overlay the very same entity (the speaker's body) from which the coordinates were derived in the first place. This operation is needlessly complex, and it is unlikely to be the one used by speakers when they make descriptions like (2).

The conceptual structure of such descriptions is therefore no different to ordinary intrinsic FoR examples; it is just that since the ground is a speech act participant, it may be labelled in a deictic way, i.e., with a personal pronoun. But crucially, the *relationship* between figure and ground is not deictic as it is in the relative FoR, and the underlying proposition is viewpoint-independent (from any viewpoint, the ball still lies in a search domain extending out from John's own 'front', even if he refers to himself deictically). It is an unhelpful distraction that the pronoun *me* is deictic and can thereby designate different people depending on who is speaking, since for (2) to be true of a particular scene in which the ball is in front of John, it is essential that *me* picks out John in particular, and not just anyone who utters the description.

It is also worth observing at this point that the ground can be deictic not just in the intrinsic FoR but in other FoRs too, as in *The ball is north of me* and *The ball is to the left of me from where you are standing* (cf. Levinson 2003:50–51; Palmer 2002:111).[25] But when the speaker is the ground in an intrinsic FoR description, it necessarily follows that the speaker is also the anchor, since in the intrinsic FoR, the anchor is the ground by definition. Hence, the fact that the speaker is the anchor in (2) is merely an epiphenomenon, and a distraction from the true conceptual structure which aligns with the intrinsic FoR in every other respect.

[25] The figure can also be deictic in any FoR: 'I am in front of the truck' (intrinsic), 'I am north of the truck' (absolute), 'I am in front of the truck from your point of view' (relative).

2.3.3 Danziger's (2010) 'direct' FoR

A different approach to classifying binary egocentric FoRs has been developed by Danziger (2010), who proposes a distinct 'direct FoR' to accommodate such examples. Danziger argues that the addition of the direct FoR makes Levinson's typology logically complete, allowing FoRs to be classified firstly according to whether they are 'allocentric' (anchor is not the speaker or hearer) or 'egocentric' (anchor is the speaker or hearer), and secondly according to whether they are 'ternary' (anchor is separate from the ground) or 'binary' (anchor is the ground or part of it). Danziger's four-frame typology is summarized in Table 2.2 below:[26]

Table 2.2: Danziger's (2010) classification of FoRs

	Allocentric Anchor is not speaker/hearer	**Egocentric** Anchor is speaker/hearer
Ternary Anchor is not ground	**Absolute** *The milk is to the east of the kettle;* *The milk is to the east of you.*	**Relative** *The milk is to the right of the kettle; The milk is to the right of you.* (from the speaker's perspective)
Binary Anchor is (part of) ground	**Object-Centered**[27] *The milk is at the spout of the kettle.*	**Direct** *The milk is in front of me.* (i.e., at the speaker's own front)

One difference between Danziger's typology and Levinson's is that Danziger assumes the absolute FoR is ternary, while Levinson (2003:47–50) characterizes it as binary (see §2.2.3). While Danziger does not provide a justification for this aspect of her typology, there are good reasons for viewing the absolute FoR as ternary, as I will discuss in §2.4.3.1 (see also Palmer 2003; 2004; 2015).

A more problematic development is the dichotomy between allocentric and egocentric FoRs, which Danziger defines in terms of whether or not the anchor is a "speech-situation participant" (i.e., the speaker or hearer). Although such a distinction is often made in the brain sciences and in developmental studies (for an overview, see Levinson 2003:28-29),

[26] This table is adapted from the one in Danziger (2010:172).

[27] Note that Danziger's 'object-centered' FoR is different to the 'object-centric'/'object-based' category recently proposed by Shusterman and Li (2016a; 2016b). Danziger's category includes *only* binary, allocentric references, whereas Shusterman and Li's similarly named category covers all FoRs anchored to movable objects/people. Shusterman and Li's 'object-centric' category is broad and includes examples of both binary and ternary references and both egocentric and allocentric references.

Levinson's typology cross-cuts this division. For Levinson (2003:54), the relative FoR is "prototypically" egocentric, but is not necessarily so, since the relative FoR is anchored on a viewpoint which may or may not belong to anyone in the speech situation. Similarly, Levinson's intrinsic FoR is "typically, but not definitionally, non-egocentric" (Levinson 2003:54). Danziger's four-frame typology is premised on the assumption that FoRs can be sorted according to whether or not the anchor is egocentric, and this leads her to split the intrinsic FoR into 'direct' and 'object-centered' frames; however, she does not extend the approach to the relative FoR, in which the anchor can also be either egocentric (e.g., *The milk is to the right of the kettle from my perspective*) or allocentric (e.g., *The milk is to the right of the kettle from Jill's perspective*). Ordinarily, it might be plausible to think of allocentric relative examples as a special case of the relative FoR, involving a kind of deictic projection from the ego to an external observer. But it is not clear that this option should be available in Danziger's framework, since it is inconsistent with the approach she takes to the intrinsic FoR: she does not treat the direct FoR as a special, egocentric type of the intrinsic FoR, but classifies it as a separate frame entirely. For the sake of consistency, *neither* the allocentric relative case nor the egocentric intrinsic (i.e., direct FoR) case should be considered separate FoRs, or else *both* should be counted as separate FoRs, bringing the total number of FoRs up to five. Given Danziger's closed framework of egocentric vs. allocentric and binary vs. ternary, however, there would appear to be no place for a fifth FoR in her typology.

Danziger (2010:175–179) argues that the four-frame typology is both more complete than Levinson's in terms of the different permutations of rotation sensitivities, and more useful when applied to pointing gestures. Here, I will focus on the question of rotation sensitivities in particular.[28] Table 2.3 below shows the rotation sensitivities of Danziger's four frames of reference:[29]

[28] It is beyond the scope of this chapter to explore how gestures might be analyzed in terms of FoRs. However, it is worth mentioning that like direct FoR descriptions, Danziger's 'direct' pointing gestures could simply be analyzed as 'intrinsic' under Levinson's framework. Since Danziger does not demonstrate what exactly she considers to be the difference between 'direct' and 'object-centered' gestures, it is not clear what advantage her framework offers in this domain. In any case, the kinds of gestures Danziger refers to (such as pointing and saying *The milk is right over there!*) can also be accounted for by Bohnemeyer and O'Meara's (2012) notion of head-anchored FoRs (see §2.4.4).

[29] This table is adapted from the one in Danziger (2010:176).

Table 2.3: Rotation sensitivities of Danziger's (2010) FoRs

Description	**A. Still felicitous under rotation of speaker/hearer?**	**B. Still felicitous under rotation of ground?**	**C. Still felicitous under rotation of figure-ground array?**	**Frame of reference**
1. *milk east of kettle*	Yes	Yes	No	Absolute
2. *milk to right of kettle* (from speaker's perspective)	No	Yes	No	Relative
3. *milk at spout of kettle*	Yes	No	Yes	Object-Centered
4. *milk in front of me* (i.e. "at my front")	No	No	Yes	Direct

Comparing the permutations in rotation sensitivities across the three-frame and four-frame typologies, Danziger claims that the four-frame version is more complete because it includes the possibility for a 'No' in Column A with a 'No' in Column B of Table 2.3.[30] However, as I have already suggested when discussing Bennardo's (2009) 'basic relative' FoR, the fact that the speaker is the anchor in example (2) or in Row 4 of Table 2.3 is merely epiphenomenal, since the speaker is necessarily the anchor in any intrinsic description that has the speaker as ground. Therefore, the resulting rotation sensitivity in Row 4 of Column A is equally epiphenomenal, and does not really indicate a different FoR. The problem emerges because the intrinsic FoR is viewpoint-independent, i.e., it operates without any viewpoint in its conceptual structure. Some intrinsic descriptions (namely, 'direct FoR' descriptions) may appear to feature a viewpoint, but as we have seen, this viewpoint is not actually involved in how the FoR operates (and so a descriptor like 'front' could equally be used by other observers of the scene). To avoid this confusion, it may make more sense to apply the rotation tests in the following sequence: first the rotation of the ground; if 'No', then intrinsic, but if 'Yes', then test for rotation of the viewer. This is represented in Figure 2.8 below:

[30] Note that due to the nature of the rotation tests in Columns B and C of Table 2.3, the values in those columns must always be opposite to one another. This is because a FoR must either be anchored in the ground (in which case the FoR is sensitive to rotation of the ground) or else anchored in something external to the figure-ground array (in which case the FoR is sensitive to the rotation of the array). Hence, the inclusion of Column C does not actually help to distinguish FoRs any further, though it does still illustrate an interesting rotational property.

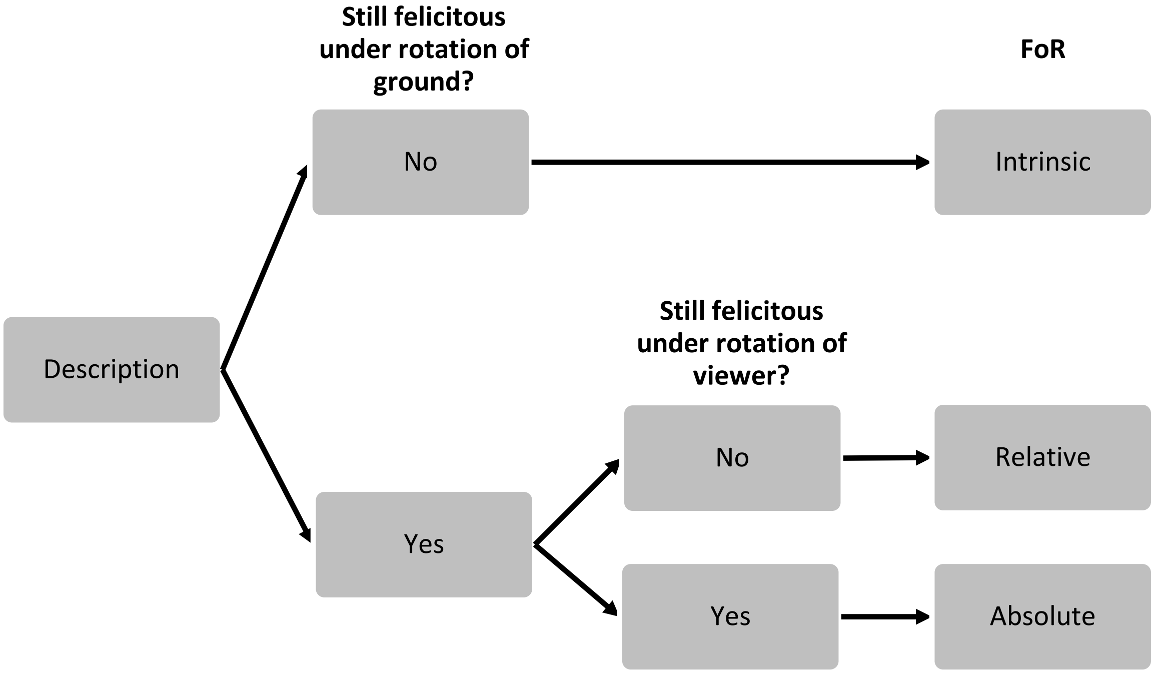

Figure 2.8: Possible decision tree for diagnosing FoRs

The decision tree in Figure 2.8 is a tentative one – in later parts of this chapter I will consider additional rotation tests that may be necessary to make further distinctions.[31] However, the diagram illustrates the relationships between two important rotation tests and the FoRs proposed by Levinson (2003), without presenting the tests in such a way that a 'direct' FoR emerges epiphenomenally.

Whether or not the direct FoR is a truly independent FoR, Danziger's distinction between 'direct' and 'object-centered' FoRs has been adopted by a number of other researchers, especially those in the 'MesoSpace' research program (e.g., Bohnemeyer & Tucker 2013; Eggleston 2012; O'Meara & Pérez Báez 2011). Even if the direct FoR is really a subtype of the intrinsic FoR, the terminology is valuable because it facilitates comparisons across different frameworks (cf. Polian & Bohnemeyer 2011:877), and avoids vagueness as to whether the ground in a particular intrinsic FoR description is the speaker's body or another entity. This vagueness has caused some confusion in the literature. For example, Danziger (2010:176) suggests that the notion of a direct FoR could explain Li et al.'s (2005) finding that Tzeltal speakers, who lack a relative FoR, still sometimes adopt apparently 'egocentric'

[31] It should also be stressed that Figure 2.8 is only intended to represent a possible tree for *diagnosing* FoRs, and is not supposed to represent the types of calculations speakers perform when using a FoR.

solutions in non-linguistic rotation tasks.[32] Thus, in the remainder of this chapter and thesis I sometimes refer to 'direct' and 'object-centered' FoRs, even though I consider both to be subtypes of the intrinsic FoR.

2.4 Intersection of the intrinsic and absolute FoRs

2.4.1 The problem of landmarks

Another controversy in the literature on FoRs relates to the classification of 'landmark' references like *The man is mountainward of the tree* or *The ball is toward the door from the chair*. Here a 'landmark' refers to a reference point outside the figure-ground array, such as a salient environmental feature, town, building, object or person. On the one hand, Levinson and his colleagues have generally regarded landmark references as intrinsic, or as an intermediate case between the intrinsic and absolute FoRs (e.g., Levinson 2003:49, 81; Levinson et al. 2002:173; Pederson 2003:290–291). On the other hand, Oceanicists in particular have tended to classify at least certain kinds of landmark references as absolute (e.g., Bennardo 2000:515–518; François 2004; Palmer 2015:194–199; Senft 2001:539–540), and even Levinson's group has sometimes categorized landmark references this way too (e.g., Levinson 2003:66; Levinson 2006:187; Pederson et al. 1998:572). More recently, the MesoSpace team have found it preferable to treat 'landmark-based' descriptions as a distinct FoR category (e.g., Bohnemeyer 2011:897–898; Bohnemeyer & Tucker 2013:641). I will suggest that the more fine-grained division offered by the MesoSpace group is preferable in that it allows for a clearer comparison of multiple frameworks, and avoids vagueness as to which types of spatial descriptions are being referred to.

2.4.2 The case for an intrinsic analysis of landmark references

One reason for treating landmark references as examples of the intrinsic FoR relates to how landmark references operate. This point is articulated well by Pederson (2003:290):

> Of course, locating by directional reference to perceptual landmarks is akin to locating by projecting from the intrinsic features of a ground object. In both cases there is a direction determined from the ground on the basis of perceptually available features. The

[32] In the tasks in question, Tzeltal speakers distinguished the rights and lefts of their own bodies, a finding which Li et al. (2005) claimed to demonstrate a mismatch between Tzeltal language (which lacks a relative FoR) and cognition. However, the participants were not required to *project* their right and left sides onto a separate ground object, as the relative FoR demands, and so Li et al.'s conclusion is not justified. This is discussed further in Chapter 3.

difference being that in one case the features belong to the ground and in the other case they do not.

Operationally, in a landmark reference the search domain is projected from the ground towards the landmark, and so the figure is located in the space in between the ground and the landmark. This is not so different from the canonical intrinsic FoR (see §2.2.1), in which the search domain extends from the centre of the ground, through a named intrinsic facet (e.g., the 'front') of the ground, and out into space. As Pederson observes, the main difference is that in the canonical case the anchoring point is a physical part of the ground, but in landmark references the anchor is external.

Additionally, Levinson in particular has argued that landmark references are distinct from the absolute FoR in that they do not possess the same abstract properties as directions like 'north'. Levinson (2003:90) writes:

> Conceptually cardinal directions are very abstract notions. A notion like 'north' or 'west' (in its relevant everyday conception) cannot be thought of as a proximate place or landmark… because then if we moved sideways the bearing would change. Rather, it defines an infinite sequence of parallel lines – a conceptual 'slope' – across the environment. Nor does it matter what defines the slope, just so long as everybody in the speech community agrees: these are cultural conventions not 'natural' directions, whatever basis there may be in the environment.

Although it is not always explicit in his writing, it is presumably the case that Levinson (along with his MPI colleagues) wanted to distinguish the absolute FoR from landmarks because his research program involved testing for correlations between FoRs in language and FoRs in cognition. After all, there is a vast cognitive difference between the use of cardinal directions in some languages, which often involves 'dead reckoning' and the need to keep track of one's bearings even with a paucity of environmental cues (see Levinson 2003), and the use of ad hoc local landmarks, which are perceptually available, concrete, and do not create the same demands on spatial awareness and memory. Since the MPI sought to explore cognitive diversity in spatial cognition as well as in language, it would have been problematic to lump together landmarks and cardinal directions, as this would have obscured their findings.

2.4.3 The case for an absolute analysis of (some) landmark references

The problem for the intrinsic analysis is that in fact, landmark references do share many important properties with the absolute FoR, and are quite distinct from the intrinsic FoR in a number of ways. In particular, the use of a landmark invokes something external to the figure-ground array (and which is not a viewpoint), and thus rotating the ground falsifies a canonical intrinsic description but not a landmark description (cf. Bohnemeyer & O'Meara 2012:244). In fact, under the basic rotation tests, landmark-based descriptions pattern exactly like the absolute FoR (see §2.4.4). Landmark-based descriptions are also ternary (featuring a figure, ground, and separate anchor), whereas intrinsic descriptions are binary.

For these reasons, a number of researchers have classified landmark references as examples of the absolute FoR. This is especially true of Oceanicists, perhaps because of the importance of landmarks like the sea in the directional systems of Oceanic languages (see François 2004). Bennardo (2000:515–518) distinguishes between a number of subtypes of the absolute FoR in Tongan, including cardinal directions, a 'landward-seaward' axis, a 'town-inland' axis, a 'below-inland' axis, and a 'radial' subtype in which the axis points towards or away from a particular point of reference such as a building or person. Senft (2001:539–540) and François (2004) also treat such examples as absolute, though François mostly uses the term 'geocentric' rather than 'absolute'. Palmer (2003; 2015) considers only some kinds of these cases to be absolute, but has a unique definition of the absolute FoR. Since Palmer's (2015) classification is one of the most recent in the literature and since it offers a unique perspective, I will discuss it in some detail in the following subsections.

2.4.3.1 Palmer's criticisms of the Levinsonian absolute FoR

Palmer (2003; 2015) raises a number of objections to Levinson's definition of the absolute FoR. Palmer rejects Levinson's claim that the absolute FoR necessarily involves arbitrary, abstract and fixed bearings, as well as the notion that the absolute FoR is a binary relation. On the matter of arbitrariness and abstractness, Palmer (2003:5–7; 2015:190–191) observes that absolute systems cross-linguistically are anchored in features of the surrounding environment, and so are not truly arbitrary or abstract. For example, Palmer (2003:5) writes:

> A claim that the actual vectors are arbitrary seems difficult to sustain. Languages have absolute directional axes that correspond to the path of a river, coastline, direction of an overall fall of land, or path of the sun. No languages have directional axis [sic] that run at 45 degrees to these external phenomena. Instead, axes correspond to these, or cross them at roughly right angles. This is because these features in the external world are the orienting features for the axes.

To an extent, Palmer's argument may appear not to be problematic for Levinson's definition of the absolute FoR, in that most of Palmer's examples of non-arbitrary 'absolute' systems are what Levinson would presumably consider landmark systems rather than absolute systems anyway, the relevant directions being anchored to particular locations (such as mountains or coastlines) rather than to a conceptual slope containing "an infinite sequence of parallel lines" (Levinson 2003:90). Still, as Palmer (2015:191) points out, even apparently abstract cardinal systems are probably based on the path of the sun or other environmental cues, a point which is also conceded at times by Levinson (e.g., Levinson & Wilkins 2006a:22). Absolute directions based on such cues may become fixed and abstracted away from the actual location of the environmental features in question (which might fluctuate with seasonal variation), but for Palmer this is not in itself a reason for excluding geocentric systems that are less abstract.

As for fixedness, Palmer (2003:8–9; 2015:186–190) argues that Levinson's stipulation privileges Western-style cardinal directions over other kinds of geocentric directions. To illustrate this, Palmer discusses Lichtenberk's (1983) analysis of the landward-seaward and clockwise-anticlockwise axes in Manam (Oceanic, Papua New Guinea), a language spoken on a round volcanic island. When circumnavigating the island, the Manam directional terms expressing 'landward' appear to be unfixed from the perspective of Western cardinal directions. At the north of the island they point south, at the east they point west, and so on. However, within the conceptual framework of the Manam directional system, these directional terms always point the same way – landward. Indeed, from the point of view of a Manam speaker, it is the English cardinal directions that are not fixed (see also Terrill & Burenhult 2008:123). On the north coast, the English term *north* points 'seaward', on the south coast it points 'landward', on the east coast it points 'anticlockwise' and on the west coast it points 'clockwise'. As Palmer (2015:188) observes:

> From the perspective of the Manam conceptual system, it is English cardinal directions such as *north* that are not fixed…Manam directions can only be seen as not fixed if we privilege the English cardinal system over all others.

Further, Palmer (2015:188–189) argues that the Manam directions are operationally identical to the English cardinal system. When used to express the location of a figure with respect to a ground (e.g., 'the boy is north of the house' or 'the boy is seaward of the house'), both systems assign an asymmetry to the scene in order to project a search domain off the ground. But neither relies on the viewpoint of the speaker (or any other observer), and neither relies on an intrinsic asymmetry in the ground. Furthermore, the two systems share the same basic logical and rotational properties (cf. §2.4.4). Palmer proposes that if the English cardinal system is to be regarded as operating in the absolute FoR, then it follows that the Manam system should be viewed in the same way.

Palmer (2003:10–11; 2015:186) also objects to Levinson's characterization of the absolute FoR as a binary relation. Since the absolute FoR relies on information external to the figure-ground array, Palmer argues that it is in fact a ternary relation with the conceptual 'slope' functioning as the third component. Just as the significance of the viewpoint to the relative FoR makes the relative FoR a ternary relation, so the significance of the slope to the absolute FoR makes the absolute FoR ternary. In fact, Levinson occasionally appears to acknowledge that the absolute FoR is ternary anyway (e.g., Levinson & Wilkins 2006a:542), and some of his former colleagues also classify the absolute FoR in this way (e.g., Danziger 2010:170, cf. §2.3.3), as do some other scholars (e.g., Blythe et al. 2016:135).

What implications does all of this have for the notion of an absolute FoR? Levinson's definition can fairly easily be amended to account for the fact the absolute FoR is a ternary relation, and to account for the fact that absolute systems are not truly arbitrary. Letting go of the notions of abstractness and fixedness is more problematic, however. Without these criteria, the door is open to a vast range of spatial references invoking ad hoc local landmarks, which are seemingly very different to the kinds of large-scale, conventionalized spatial references usually considered archetypal of the absolute FoR. Palmer (2015:195–209) therefore attempts to distinguish between landmarks and the absolute FoR on the basis of grammatical and operational criteria, a proposal I will address in §2.4.3.2. For now, however, I will consider Levinson's notions of abstractness and fixedness in light of Palmer's criticisms. As I have already suggested, it may be that Levinson considers these notions to be defining features of the absolute FoR because he is primarily interested in the cognitive differences between each FoR, and there is a unique cognitive burden on speakers of languages with absolute bearings that are abstracted away from salient, accessible features in the local environment, and generalized to apply across larger, possibly infinite expanses of space. For example, speakers of Guugu Yimithirr, who mostly use cardinal directions in spatial descriptions (Levinson 1997), or speakers of Tzeltal who mostly use an uphill-downhill directional axis that is abstracted away from local fluctuations in elevation

(Brown 2006; Brown & Levinson 1993), must keep track of their absolute bearings at all times and employ 'dead-reckoning' in order to make spatial descriptions. But this is not necessary for a speaker who invokes a salient local landmark – if landmarks are visible or otherwise accessible to speakers, memory of a system of *abstract* bearings is not required when making a landmark reference. Of course, this cognitive difference is a generalization and lies on a scale – a speaker might actually be watching the sun rise as she uses 'east' (typically considered absolute), while it is also possible to use landmark references like 'towards the school from my house' simply from memory of the school's location and without any visual access to the school. Still, abstractness may be a useful criterion by which to distinguish the absolute FoR from landmark references, given that landmarks are typically more accessible. On the other hand, landmark references and abstracted absolute systems share many important operational, logical and rotational properties that are distinct from the intrinsic FoR, as mentioned earlier in this section.

Regarding fixedness, Levinson may well be able to avoid charges of anglocentrism in that his descriptions and examples of the absolute FoR are largely based not on English or other familiar European languages but on the Mayan language Tzeltal and the Australian language Guugu Yimithirr (Levinson 2003). But even without any anglocentric bias, it is possible that Levinson's conception of the absolute FoR is somewhat skewed towards the patterns displayed by a few example languages. As Palmer (2015:188) points out, landward-seaward and other such directional systems that are sometimes dismissed as 'landmarks' are only not fixed if we are already thinking in terms of compass directions, and from the Manam perspective it is in fact compass directions that are not fixed.

However, regardless of whether one adopts a Manam, English, or Tzeltal perspective, there are still some objective geometric differences between Levinsonian absolute systems and 'landmark' systems like a landward-seaward axis, and it is likely that it is these geometric differences Levinson has in mind when he refers to absolute bearings as 'fixed'. For one thing, the possible vectors denoted by an absolute bearing such as 'east' do not cross paths (i.e., they constitute "an infinite sequence of parallel lines" according to Levinson 2003:90), whereas 'landmark' bearings converge on a focal point (such as a mountain, or the centre of an island) or spread radially from it. For another thing, Levinsonian absolute directions are *unbounded* in that they do not have any clearly defined start or end point, whereas landmark bearings necessarily begin or terminate at a defined landmark. As such, a system of landmark bearings is far less portable. For example, a landward-seaward system may function on an island or near a coast, but becomes difficult or impossible to use when further out to sea or further inland on a landmass, where other directional systems must take over – see Palmer (2007:102) for an example from Marshallese.

One could reasonably ask whether, on this view, all absolute systems might in fact be landmark-based systems, although with more distant and intangible 'landmarks' such as the location of the sunrise on the horizon. A suitably distant landmark may for all intents and purposes be equivalent to an absolute bearing, since speakers would never find themselves on the other side of the landmark, and all vectors pointing towards a very distant landmark would be almost precisely parallel. While I do not consider this analysis to be completely implausible, I do not adopt it here for two main reasons. Firstly, it remains true that in some directional systems but not others, bearings are *abstracted away* from the actual locations of environmental features, such that 'east' for example stays constant despite seasonal fluctuation in the location of the sunrise. Thus, absolute systems are motivated by environmental features, but their bearings do not consistently point towards those features.[33] The fact that speakers often explain absolute bearings in terms of salient environmental cues does not detract from this, since those cues may well be mnemonic devices for absolute bearings rather than definitional to the system. For example, a Melburnian might point along Flinders Street when asked which way *east* is, even though the street is about 20 degrees off the east-west axis. This does not mean that in such a context, *east* actually means 'that way along Flinders Street', it is just that the city's grid can serve as a mnemonic for approximating cardinal directions which exist independently (and indeed the speaker may well concede that the direction in which he is pointing is only roughly east, and would probably defer to a compass if available).[34] Secondly, some absolute systems are abstracted away from asymmetries in the 'lay of the land', rather than from particular landmarks. These include many uphill-downhill and upriver-downriver systems. Because systems of this kind are anchored on an asymmetry in the topography,

[33] On this view, if a language has a directional term that does in fact point consistently to the location of the sunrise, rather than a generalized direction that averages out seasonal variation, then this would qualify as a landmark reference and may be better glossed as 'sunriseward' rather than 'east(ward)'.

[34] Mnemonics also exist for other coordinate systems, such as relative 'left' and 'right'. To remember which way is *left*, many English-speaking children and some adults hold up their thumbs and pointer fingers at right angles so that an 'L'-shape is visible on the left but not right hand. Of course, this is never taken as evidence that *left* in English is actually defined on that basis, and similarly a mnemonic for an absolute system should not be confused for the actual foundation of the system.

such as an incline or a direction of water flow, and not on the *locations* of particular features in the surrounding environment, it is possible to distinguish them from landmark-based systems.

It is thus not entirely clear that Levinson's distinction between landmark references and the absolute FoR should be completely abandoned, even if one does not wish to classify landmark references as a subtype of the intrinsic FoR. This raises the possibility of an additional FoR for landmark references, a possibility I return to in §2.4.4. For now, however, I turn to Palmer's (2015) own method for distinguishing between landmark references and the absolute FoR.

2.4.3.2 Palmer's (2015) criteria for the absolute FoR

Given what he sees as a lack of a principled distinction between landmark systems and the Levinsonian absolute FoR, but still wanting to exclude *ad hoc* landmarks from the absolute FoR, Palmer (2015:195–209) proposes grammatical and operational criteria for distinguishing the two. In English, for example, noun phrases can refer to landmarks, and these can be embedded in a prepositional phrase expressing a goal, source or location, as in (4a) below. Although Palmer does not address it specifically, it is also worth noting that nouns like *beach* can also modify general nouns like *side* or *end* to pick out a particular facet of a ground object, as in (4b):

(4) a. *The girl is* ***towards the beach*** *from the tree.*

b. *The girl is* ***on the beach side*** *of the tree.*

In principle, just about any concrete noun in English could be used in these constructions. But English also possesses directional adverbs like *north*, as in (5) below, as well as the derivational suffix *-ward(s)* which converts ordinary nouns into directional adverbs, as in (6) below:

(5) *The girl is* ***north*** *of the tree.*

(6) *The girl is* ***beachward*** *of the tree.*

Palmer's position is that the examples in (4) are in landmark constructions while (5) and (6) are in the absolute FoR. This is because the former do not involve a "grammaticized coordinate system imposing an asymmetry on the scene" (Palmer 2015:196), whereas the latter do. Even though *beachward* in (6) is not arbitrary, abstract or fixed in terms of compass directions, according to Palmer's definition it qualifies as an example of the absolute FoR because of its grammatical and operational structure. Like *north*, *beachward* is a directional adverb, and so it has special grammatical behaviour that the ordinary noun *beach* in (4) lacks. Operationally, (6) is similar to (5) in that both are ternary relations in which a search domain is projected off the ground (*the tree*) in order to locate the figure (*the girl*) by invoking external features that impart an asymmetry to the scene – one side of the tree is further *north/beachward*. Hence, if (5) is to be regarded as an example of the absolute FoR, then it would appear that (6) should too.

As Palmer (2015:197) observes, cardinal directions like *north* and *east* can also occur in English as nouns. In such cases, they function as landmarks according to the definition of 'landmark' adopted by Palmer. Compare (7) and (8) below:

(7) *The birds flew towards* ***the north***.

(8) *The birds flew towards* ***the tower***.

If *the tower* in (8) is to be considered a landmark, then *the north* in (7) must also be a landmark according to Palmer's definition. Drawing upon data from Terrill and Burenhult (2008) and Wassmann and Dasen (1998) respectively, Palmer (2015:198–201) discusses directional terms in Lavukaleve (Papuan, Solomon Islands) and Balinese (Austronesian, Bali) as further evidence for this point. Both languages have specialized, grammatically distinctive sets of directional verbs for their absolute axes, but also possess locational nouns for referring to the relevant directions as landmarks (e.g., 'the north', 'the mountain', etc.). While just about any concrete noun can be used as a landmark, only a restricted set are 'grammaticized' as directional verbs in an absolute FoR. Palmer therefore proposes that cross-linguistically, grammaticization should be regarded as a definitional requirement for the absolute FoR.

Palmer's (2015) definition of the absolute FoR is vulnerable to a number of objections, however. Firstly, it is possible to question how tidy the distinction between ad hoc landmark references and the absolute FoR really is. Although Palmer (2015:195) suggests that the absolute FoR is distinct from landmark references *both* grammatically and operationally, the operational distinction is not entirely clear. His discussion of operational requirements focuses on demonstrating that examples like *landward* behave in identical (or highly similar) ways to the absolute FoR, and he also aims to show that such examples are operationally distinct from the intrinsic and relative FoRs. While this point is well argued, it only shows that examples like *landward* can be analyzed as being in the absolute FoR – it does not show that 'landmark' references like those in (4), (7) and (8) are operationally distinct from the absolute FoR. This is problematic because, at least at face value, landmark references do behave in very similar ways to the absolute FoR. This becomes apparent if we consider the operational behaviour of (4a) versus (6), repeated below. Recall that Palmer's definition classifies the former as a landmark reference, and the latter as absolute FoR:

(4') a. *The girl is* ***towards the beach*** *from the tree.*

(6') *The girl is* ***beachward*** *of the tree.*

Let us examine how each of these spatial references operates. Both references locate *the girl* with respect to *the tree,* and so in both cases *the girl* is the figure and *the tree* is the ground. Again in both cases, the search domain is not projected on the basis of an asymmetry perceived to be inherent to the ground object (as in the intrinsic FoR), and nor is it projected on the basis of a viewpoint (as in the relative FoR). Instead, the direction in which the search domain is projected from the ground is determined by information external to the figure-ground array. In both examples, this is the location of the beach. As this component is external to the figure-ground array, the descriptions in (4a) and (6) are ternary relations. If Palmer considers examples like (6) to be operationally identical to the absolute FoR, then it is unclear why he excludes examples like (4a), except on the basis of grammatical criteria alone.

A similar point can be made regarding the logical and rotational properties of landmark references versus the absolute FoR. In the literature, FoRs are often discussed in terms of their logical and rotational properties, which are commonly held to be important in distinguishing between the three FoRs (cf. §2.2, §2.3). Palmer (2015:204–209) also addresses these properties, as part of his argument that examples like *landward* and *beachward* pattern with the absolute rather than the intrinsic or relative FoRs. But Palmer does not account for the fact that *towards the beach* also shares the same logical and rotational properties, being operationally identical to *beachward*. Hence, if possessing a certain set of logical and rotational properties is evidence for membership in the absolute FoR, and (6) is analyzed as being in the absolute FoR, then (4a) can also be analyzed as being in the absolute FoR.

In any case, there are reasons to doubt whether special grammatical behaviour should be regarded as criterial to the absolute FoR, and it is not clear whether the requirement is in fact theoretically well founded. The existing literature defines FoRs as semantic notions, not grammatical ones. When determining which FoR a particular spatial reference belongs to, or if it belongs to any FoR at all, what is paramount is how the reference operates with respect to the figure, ground, search domain, viewpoint, slope, and so forth. These are not grammatical concepts. While it is true that the adverbs *north* and *beachward* are grammatically distinct from most landmarks in English (which are typically expressed as nouns), this does not necessarily reflect the operation of those terms with respect to figure-ground arrays, as demonstrated in the earlier comparison of *beachward* and *towards the beach.*

Secondly, it could be argued that Palmer's definition excludes too many examples that would normally be considered instances of the absolute FoR. Although cardinal directions are generally regarded as canonical examples of the absolute FoR, some languages may possess systems of cardinal directions that are not grammaticized, or that can be used in ungrammaticized ways. English, as we have already seen, is one such language, but since English also has adverbial cardinals, Palmer's approach is to treat the corresponding set of nouns as a kind of landmark system. There are some reasons to doubt whether this approach can succeed (as discussed above, the two sets of terms operate in much the same way), but there is also a more obvious problem – what if a language possesses *only* an ungrammaticized set of cardinals, without a corresponding grammaticized set? Or what if a language has a grammaticized set, but in practice speakers mostly use the terms in ungrammaticized ways (such as the use of English *north* in (7) above)? According to Palmer's definition, such uses of cardinal terms would not qualify as absolute FoR (or indeed as any FoR), which seems counterintuitive.

A further potential issue with Palmer's definition is that for consistency, his grammatical criteria should equally be applied to the intrinsic and relative FoRs as well. There is nothing inherent to the absolute FoR that calls for special grammatical behaviour as a definitional feature, and so Palmer's argument could be interpreted as a call for FoRs in general to be distinguished from non-FoR descriptions on the basis of grammatical criteria. But again, this leaves us with the question of how to analyze ungrammaticized expressions of the intrinsic or relative FoRs? Thus, for example, *at the front side of the building* might not qualify as a FoR description because *front* here appears not to display any special grammatical behaviour, since one could replace *front* with any semantically appropriate modifier (e.g., *at the near/sunny/fancy/grey side of the building*), in contrast to *in front of the building*. I will therefore refrain from incorporating grammatical considerations when defining FoRs. While such an approach may exclude references to some ad hoc landmarks from the absolute FoR, it is on the whole too stringent, and excludes many spatial descriptions that should be analyzed as belonging to a FoR or to the absolute FoR in particular. However, this is not to deny that a consideration of the grammatical properties of FoR terms is still a valuable language-specific or even cross-linguistic exercise that may lead to important discoveries about the expression of FoRs in languages. For this reason I address the grammatical behaviour of Dhivehi FoR terms in §4.6, though I will not actually treat grammatical properties as criterial to FoR membership.

2.4.4 A 'landmark-based' FoR?

Thus far, I have discussed how landmark references share some properties with both the intrinsic and absolute FoRs, and how attempts to employ grammatical criteria are problematic. I now turn to the possibility that landmark references might represent a distinct FoR type. This is an analysis that has become more popular in some of the recent FoR literature (e.g., Dasen & Mishra 2010:57–58), and especially among the MesoSpace group (e.g., Bohnemeyer 2011:898; Bohnemeyer 2012a; Bohnemeyer & O'Meara 2012:218–225; Bohnemeyer & Tucker 2013:641; Eggleston 2012:5–7; Polian & Bohnemeyer 2011:873–875).

In their discussion of FoR categories, Bohnemeyer and O'Meara (2012:219, original emphasis) introduce a distinction between 'head-anchored' and 'angular-anchored' FoRs:

> Both egocentric and geocentric FoRs can be either *angular-anchored*, in which case their axes are derived through transposition or abstraction from axes or gradients of the anchor, or *head-anchored*, in which case their axes point towards the anchor.

Levinsonian absolute, relative and (canonical) intrinsic FoR descriptions are necessarily angular-anchored, because they rely on the axes or gradients of their respective anchors (e.g., a north/south/east/west conceptual slope or the left/right/front/back axes of the viewer or ground). Landmark-based descriptions like those in (9) and (10) below are head-anchored (cf. Bohnemeyer & O'Meara 2012:215), because they rely on the anchor's location but not on its internal geometry. The anchor here is the 'head' (or sometimes the 'tail') of a vector that begins or ends at the ground.[35]

(9) *The ball is toward the door from the chair.*

(10) *The ball is seaward from the chair.*

As Bohnemeyer and O'Meara (2012:220) observe, what is significant about head-anchored descriptions is that the orientation of the anchor does not matter – (9) and (10) require us to know the location of the door and the sea respectively, but not their orientation. This results in unique truth conditions and rotational properties, but only if we go beyond the basic rotation tests previously considered in the literature (see §2.2 and §2.3). Bohnemeyer and O'Meara (2012:243–245) implement two new tests, the *lateral movement of the anchor* to a different location, and the *rotation of the anchor* around its own vertical axis.[36] For example, moving the door laterally in (9) falsifies the proposition but rotating it does not. Although the sea in (10) is a much larger landmark, if it could be picked up and moved far enough, the proposition would be falsified, while the proposition would remain felicitous if the sea were to be rotated. In contrast, the same properties are not shared by the angular-anchored descriptions in (11) and (12) below:

(11) *The ball is to the left of the chair.*

(12) *The ball is north of the chair.*

Under an intrinsic interpretation of (11), moving the chair laterally does not falsify the proposition,[37] but rotating it does. Under a relative interpretation, in which the viewer is the

[35] An example of a 'tail-anchored' vector is *The man is facing away from the door*.
[36] Here, 'lateral' movement means movement perpendicular to the line between the ground and the figure.
[37] This is true at least if we adopt a fairly broad interpretation of 'left' here so that it refers to an entire region of space on one side of the chair, rather than a small area in close proximity to the chair's left side. While this may seem somewhat artificial, the point is that at least some movements of the anchor are possible without falsifying the description, whereas in head-anchored FoRs even small movements of the anchor can falsify the

anchor, moving the viewer does not falsify the proposition, but rotating the viewer around her own vertical axis does.[38] Similarly, the lateral movement of the entire north/south/east/west (NSEW) slope in (12) does not falsify the proposition, whereas rotating the slope underneath the array (such that *north* points to what was formerly *east*, for example) does falsify the proposition.[39] These truth conditions are the exact opposite of those for the head-anchored descriptions in (9) and (10), and this difference gives us a solid basis for categorizing landmark-based references as a unique FoR.

The MesoSpace researchers also typically distinguish between ‘landmark-based’ FoRs and ‘geomorphic’ FoRs (e.g., Bohnemeyer & O’Meara 2012:218–220, 244). A geomorphic FoR is anchored on an environmental ‘slope’ such as a hillside or river, but the directional axis (e.g., ‘uphill-downhill’ or ‘upriver-downriver’) has not been abstracted away from the local topography to apply across the entirety of space as in the absolute FoR. An example is (13) below, in which *uphill* is a direction with respect to the slope of a particular hill, rather than a true absolute direction like ‘uphill’ in Tzeltal (Brown 2006; Brown & Levinson 1993).

(13) *The ball is uphill from the chair.*

Although in a sense the hill here could be regarded as a landmark, Bohnemeyer and O’Meara (2012:219) note that in this example, the axis does not point towards the hill, but is “transposed or abstracted from the slope of it”. In their terminology, (13) therefore constitutes an angular-anchored rather than head-anchored FoR. As such, it has two key rotational properties in common with other angular-anchored FoRs: sensitivity to rotation but not movement of the anchor (see Bohnemeyer & O’Meara 2012:244). Geomorphic and absolute FoRs also share the primary rotational properties discussed earlier in this chapter: constancy under rotation of the viewer and constancy under rotation of the ground (but not of the figure-ground array). On the basis of rotational/movement properties alone then, it

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proposition (though as we have seen, for larger landmarks, larger movements may be necessary). Given these complications, the *rotation of anchor* test may be more reliable.

[38] Note that this *rotation of anchor* test, when applied to a viewer anchor, is different to the test considered in §2.2 and 2.3, which the viewpoint rotated (or perhaps more accurately, ‘orbited’) *around* the array.

[39] If it is difficult to conceive of a conceptual slope such as a NSEW system being moved or rotated, it is also possible to apply the same tests in a different but equivalent way: for movement, pick up the entire figure-ground array and move it laterally to another location; for rotation, pick up the entire figure-ground array and rotate it around its central point.

would appear that geomorphic descriptions are really just a subtype of the absolute FoR. Still, MesoSpace researchers (e.g., Bohnemeyer & O'Meara 2012:219; Bohnemeyer & Tucker 2013:640–641) observe that Levinson's typology treats geomorphic descriptions as intrinsic, and so the category is useful when comparing different classificatory frameworks.

There is also one other kind of spatial description that should be considered when discussing landmark references. This is the scenario in which the speaker (or hearer) acts as the landmark, as in (14) below:

(14) a. *The ball is toward me from the chair.*
b. *The ball is on my side of the chair.*
c. *The ball is on the near side of the chair.*
d. *The ball is on this side of the chair.*[40]

What is interesting about such examples is that they could arguably fit into any of the three main FoRs. Since they are anchored on a landmark of sorts, one could classify them as intrinsic under Levinson's (2003) approach, or as absolute under some other approaches (e.g., Bennardo 2000:517–518). But one could also regard them as relative, because the anchor is the speaker/viewer. This is reminiscent of the confusion between the direct and object-centered FoRs discussed in §2.3 – although once again we have two kinds of spatial reference that operate in much the same way, in one case the anchor happens to be the speaker/viewer and in another case it is not. Whether or not we wish to separate the examples in (14) from other landmark-based references will depend largely on how much significance we attach to the fact that the speaker is the anchor. It should be noted that unlike in the relative or direct FoRs, in (14) the speaker/viewer/anchor's LRFB (left/right/front/back) coordinates are not involved in any way, but only his location, and so the descriptions in (14) have different rotational properties to those FoRs (e.g., rotating the speaker/viewer/anchor around his own vertical axis does not falsify the proposition). The anchor is egocentric, however, and so those wishing to maintain an egocentric-allocentric division may prefer to separate the examples in (14) from other landmark-based references.

[40] Where *this side* refers to the side nearest the speaker, rather than a side being pointed to.

Generally, the MesoSpace solution is to classify these examples as instances of the direct FoR (e.g., Bohnemeyer 2011:898; Bohnemeyer & O'Meara 2012:220; Eggleston 2012:7), because they are egocentric but require no transposition of coordinates from anchor to ground.[41] However, this is questionable for several reasons. First, the examples in (14) operate quite differently to the direct FoR, as I have already discussed, and have some different rotational properties. Second, the examples in (14) involve ternary relations, whereas the direct FoR is binary (see also Romero-Méndez 2011:930–933 for discussion of this issue).

Instead, I regard the examples in (14) along with the earlier landmark references in (9) and (10) as belonging to a distinct 'landmark-based' FoR, which, like the intrinsic FoR, has egocentric and allocentric subtypes (which we might call 'SAP-landmark' and 'object-landmark').[42] Of course, further subdivisions within the 'object-landmark' category might well be made on the basis of whether the landmark is conventionalized or ad hoc, large or small, distant or close, natural or artificial, fixed or movable, culturally significant or insignificant, visually accessible or inaccessible, and so on. These factors may prove to be important in terms of their place in spatial cognition, though most if not all are clines rather than true dichotomies, and none have an effect on the rotational properties of the landmark-based frame.[43]

As for the SAP-landmark category, besides the canonical examples given in (14), one might wonder whether the 'relative' uses of 'front' and 'back' terms in English (and many other languages) might actually treat the speaker/viewer as a kind of landmark, with 'front' picking out the side closer to the speaker/viewer, and 'back' picking out side further away. Some recent studies have shown that when facing *away* from an array with a 'non-oriented' ground object (i.e., a ground object without an intrinsic front), speakers of English, German, Mandarin Chinese and Tongan mostly consider the 'front' of the ground object to be the side nearer to them, while the 'back' is the side further away (Beller, Bohlen, et al.

[41] Danziger (2010) herself does not extend the direct FoR category to include such examples though, and nor do some MesoSpace publications (Pérez Báez 2011; Polian & Bohnemeyer 2011; Romero-Méndez 2011).

[42] Polian and Bohnemeyer (2011) draw a similar distinction between "SAP" and "general" landmarks.

[43] It is partly for this reason that I do not adopt Shusterman and Li's (2016a; 2016b) recent distinction between "object-based" and "environment-based" FoRs, a distinction based on whether the anchor is a fixed or movable entity. While such an approach is meant to capture the difference between environmental and non-environmental anchors, it does not attend to the fact that a FoR anchored on a fixed entity like a house may have the same rotational properties as a FoR anchored on a movable object like a car. It also overlooks the fact that at the time of making an utterance that invokes a FoR, the anchor may well be perfectly stationary (and so more similar to a fixed entity), even if it is technically a movable object.

2015; Beller, Singmann, et al. 2015). However, the same participants mostly used a 'backward projection' for 'left' and 'right' terms, such that the left and right of a ground object to their rear were perceived to be aligned with their own left and right sides. This means that although 'left' and 'right' are sensitive to the orientation of the viewer/anchor in these languages (and therefore qualify as relative FoR terms), 'front' and 'back' are not sensitive to the viewer/anchor's orientation (i.e., if the ball is 'in front' of the box when facing the array, it is still 'in front' of the box even if one turns the other way). The implication is that 'front' and 'back' could in fact be analyzed as SAP-landmark terms, while 'left' and 'right' are relative terms (of course, all four terms can also be used in the intrinsic FoR).

However, Beller, Bohlen et al. (2015) and Beller, Singmann, et al. (2015) suggest that a 'backward projection' is used in such cases, with LRFB coordinates being projected backwards from the viewer onto the ground. This process is still an example of the relative FoR, albeit the translational rather than reflectional subtype (cf. §2.2.2). The use of a different subtype of relative FoR for arrays in front of vs. behind a viewer muddies the waters when it comes to applying the rotation of anchor test, because as soon as the viewer is rotated, the description in question is interpreted as invoking a slightly different frame. The result may therefore be misleading, since the test does not truly reflect the rotational properties of just one frame.

Another possibility is that 'left' and 'right' are applied translationally (both forwards and backwards onto ground objects), but 'front' and 'back' in some languages are projected by reflection onto the ground object, with a "turn hypothesis" accounting for the use of 'front' and 'back' when the array is to our rear (i.e., when thinking about objects behind us, we imagine turning to face them when assigning fronts and backs – see Beller, Bohlen et al. 2015 and Beller, Singmann, et al. 2015). That a turn hypothesis should be correct for 'front' and 'back' but not for 'left' and 'right' is perhaps explainable in terms of the fact that the semantics of only the former terms includes notions of access, visibility, interaction and so forth – the 'front' of an object is typically the side we can see and interact with. Either way, it is obvious that non-intrinsic uses of LRFB terms are extended from intrinsic ones (cf. §2.2.2), as evidenced by the fact that the same terms are used in both frames. If non-intrinsic 'front' and 'back' terms are landmark terms rather than relative terms, it is less clear how they could have developed from intrinsic uses. All this suggests that non-intrinsic ‘front’ and ‘back’ are best seen as examples of the relative FoR rather than landmark-based after all (notwithstanding the results of one rotation test), and that the SAP-landmark subtype of the landmark-based FoR is probably restricted to examples of the kind in (14). The properties of the landmark-based FoR are summarized and compared with those of other FoRs in the following section.

2.5 A revised classification of FoRs

2.5.1 A fine-grained typology

Drawing together the various considerations from the previous sections, I will now put forward a revised classification of FoRs that will form the basis for the analysis of Dhivehi FoRs later in this thesis. This classification is similar to the one found in most of the MesoSpace literature (e.g., Bohnemeyer 2011:897–898; Bohnemeyer & Tucker 2013:641) in that it is more fine-grained than some previous typologies, and also in that it makes use of Bohnemeyer and O’Meara’s (2012) distinction between head-anchored and angular-anchored FoRs. However, there are also some minor differences between the MesoSpace typology and my own. In particular, I consider ‘SAP-landmark’ references to be a subtype of the landmark-based FoR rather than of the direct FoR, following the reasoning in §2.4.4, and in keeping with some MesoSpace publications (Pérez Báez 2011; Polian & Bohnemeyer 2011; Romero-Méndez 2011). Also, I do not consider the direct or geomorphic frames to be FoRs in their own right, though I concede that including them at least as subtypes helps to make for easier comparisons with other frameworks, and makes the typology more accessible for readers of various theoretical persuasions. To this end, I list major FoR types as well as subtypes in Table 2.4 below, and show how they correspond with some alternative FoR classifications found in the literature.[44]

[44] Note that this comparison is not exhaustive, and is unable to include some typologies that make use of very different criteria, since a much larger range of example sentences would be necessary to illustrate such typologies. For example, all the classifications shown in Table 2.4 would analyze the final example as absolute even if it were expressed slightly differently (e.g., *The ball is at the north side of the chair*). However, in Palmer’s (2015) classification, which relies on grammatical criteria (see §2.4.3.2), variants of any of the bottom four descriptions could potentially be either landmark-based or absolute, depending on grammatical details. In Shusterman and Li’s (2016a; 2016b) typology, movability of the anchor is criterial – for example, they would treat the fifth example as “environment-based” because the anchor is fixed, whereas they would classify *The ball is toward the chair from the door* as “object-based” (because now *the chair* is the anchor, and chairs can be moved).

Table 2.4: Revised classification of FoRs

<table>
<tr><th>Major FoR type</th><th>Subtypes</th><th>Anchor</th><th>Head- or angular-anchored</th><th>Example</th><th>Levinson (2003)</th><th>Bennardo (2000; 2009)</th><th>Danziger (2010)</th><th>MesoSpace</th></tr>
<tr><td>Relative</td><td>Reflectional; Translational; Rotational</td><td>Viewpoint</td><td>Angular-anchored</td><td>The ball is in front of the chair. (from the viewer's perspective)</td><td>Relative</td><td rowspan="2">Relative</td><td>Relative</td><td>Relative</td></tr>
<tr><td rowspan="2">Intrinsic</td><td>Direct</td><td>Ground (=SAP/viewer)</td><td>Angular-anchored</td><td>The ball is in front of me.</td><td rowspan="5">Intrinsic</td><td>Direct</td><td>Direct</td></tr>
<tr><td>Object-centered</td><td>Ground (≠SAP/viewer)</td><td>Angular-anchored</td><td>The ball is in front of the chair. (with respect to the chair's own front)</td><td>Intrinsic</td><td>Object-centered</td><td>Object-centered</td></tr>
<tr><td rowspan="2">Landmark-based</td><td>SAP-landmark</td><td>Landmark (=SAP)</td><td>Head-anchored</td><td>The ball is toward me from the chair.</td><td rowspan="4">Absolute</td><td>n.s.*</td><td>Direct</td></tr>
<tr><td>Object-landmark</td><td>Landmark (≠SAP)</td><td>Head-anchored</td><td>The ball is toward the door from the chair.</td><td>n.s.</td><td>Lmrk.</td></tr>
<tr><td rowspan="2">Absolute</td><td>Geomorphic</td><td>Slope (locally-restricted)</td><td>Angular-anchored</td><td>The ball is uphill from the chair.</td><td>n.s.</td><td>Geomorphic</td></tr>
<tr><td>Abstracted</td><td>Slope (across all of space)</td><td>Angular-anchored</td><td>The ball is north of the chair.</td><td>Absolute</td><td>Absolute</td><td>Absolute</td></tr>
</table>

*n.s.: not specified

The major groupings of FoRs in Table 2.4 are motivated by rotational properties that reflect different operational behaviours and conceptual structures. Certain subtypes (direct vs. object-centered intrinsic and SAP- vs. object-landmarks) may also be differentiated according to some rotational properties, but only epiphenomenally, as a result of the combination of other factors which affect the outcome of the relevant rotation tests. Recall that Levinson (2003:52–53) considers three rotation tests for distinguishing the absolute, intrinsic and relative FoRs, and that Bohnemeyer and O'Meara (2012:243–245) add two further tests for separating angular-anchored from head-anchored FoRs. This gives us the following set of rotation (and movement) tests:

(a) Constancy under rotation of the viewer (around the array)
(b) Constancy under rotation of the ground
(c) Constancy under rotation of the figure-ground array
(d) Constancy under rotation of the anchor (around its vertical own axis)
(e) Constancy under lateral movement of the anchor (within certain limits)

However, test (c) is redundant if we already have test (b) – it gives precisely opposite results to (b) and so does not help to distinguish FoR types any further. This is because a FoR must be anchored either on the ground, in which case it is sensitive to the rotation of the ground, or else it is anchored on something external to the figure-ground array, in which case it is not sensitive to the rotation of the ground (cf. Footnote 30 in §2.3.3). In addition, test (e) is redundant because a FoR must be either angular-anchored or head-anchored. If it is head-anchored, then the location but not the orientation of the anchor is important, and so the description will be constant under rotation of the anchor, but not movement of the anchor. If it is angular-anchored, the description is constant under movement but not rotation of the anchor (cf. §2.4.4), and so test (e) always produces exactly opposite results to (d). Therefore, to distinguish between FoRs, it is sufficient to consider only tests (a), (b) and (d), the combination of which yields eight different permutations, represented in Table 2.5 below:

Table 2.5: Rotational properties of FoRs

Constancy under:			FoR diagnosis
Rotation of viewer (i.e., anchor ≠ viewer's LRFB)?	**Rotation of ground (i.e., anchor ≠ ground)?**	**Rotation of anchor (i.e., head-anchored)?**	
Yes	Yes	Yes	Landmark-based
Yes	Yes	No	Absolute
Yes	No	Yes	n/a
Yes	No	No	Object-centered intrinsic
No	Yes	Yes	n/a
No	Yes	No[45]	Relative
No	No	Yes	n/a
No	No	No	Direct intrinsic

Of the eight permutations in Table 2.5, three are logically impossible. Two of these are permutations in which the description does not hold under rotation of the ground ('No' in the second column), but does hold under rotation of the anchor ('Yes' in the third column). Such a scenario is logically impossible because if the description does not hold under rotation of the ground, then the ground must be the anchor for the description. In such a case rotating the ground entails rotating the anchor, and so a 'No' in the second column entails a 'No' in the third column as well (though a 'Yes' in the second column does not entail a 'Yes' in the third column, as shown by the existence of the absolute and relative FoRs). The other logically impossible permutation is a description which does not hold under rotation of the viewer, but does hold under rotation of the anchor (i.e., 'No' in the first column and 'Yes' in the third column). This is logically impossible because if the description does not remain constant under rotation of the viewer around the array, then the viewer must be the anchor for the FoR, and so rotating the viewer/anchor around its own vertical axis would falsify the description. This means that a 'No' in the first column entails a 'No' in the third column. Thus, any 'No' in one or both of the first two columns entails a 'No' in the third column as well, and so the permutation 'No, No, Yes' is logically impossible on two counts.

[45] This is with the exception of 'front' and 'back' terms in some languages, which may operate differently when the viewer is facing towards vs. away from the array (see §2.4.4).

All other permutations are logically possible and represented in at least some languages (e.g., English – see Table 2.4), and each corresponds to a distinct FoR (or FoR subtype, if we take into account epiphenomenal results). The classification is motivated by these differences in rotational properties, which reflect differences in the ways FoRs operate and thereby reflect different conceptual structures. Previous classifications attend to only some of the relevant rotational properties, or else fail to invoke them consistently when categorizing FoRs. For example, Levinson's (2003) intrinsic FoR encompasses the direct, object-centered, and landmark categories, even though they have different rotational profiles. The MesoSpace typology is much more fine-grained, but generally groups SAP-landmarks with the direct FoR, again despite some rotational differences. The MesoSpace typology also incorporates a 'geomorphic' frame that is superfluous under the proposed classification, since its rotational properties are identical to the absolute frame.

It is also possible to group FoRs into supercategories according to one rotational property at a time. Considering only the rotation of the viewer, for example, we can observe the dichotomy between 'egocentric' (direct intrinsic, relative, and SAP-landmark) FoRs and 'allocentric' (object-centered intrinsic, absolute, and object-landmark) FoRs that has been important in much of the literature (e.g., Danziger 2010; Levelt 1989:48–52; Li & Gleitman 2002).[46] Looking only at the rotation of the ground, we get a dichotomy between binary (intrinsic) FoRs and ternary ones (absolute, relative, and landmark-based). And taking into account only the rotation of the anchor, we see the split between head-anchored (landmark-based) and angular-anchored (absolute, relative, intrinsic) FoRs as demonstrated by Bohnemeyer and O'Meara (2012). Other supercategories emerge if two parameters are considered at once. For example, the subset of ternary FoRs that are also allocentric may be described as 'geocentric' (i.e., absolute FoR and object-landmark references), a term which is useful when the distinction between angular-anchored and head-anchored FoRs is not relevant (e.g., if focusing on the identity of the anchor rather than how the FoR operates). These various supercategories are shown in Table 2.6 below:

[46] For simplicity I treat the relative FoR as 'egocentric' here, since the viewpoint in a relative FoR description is prototypically egocentric. However, unlike some others (e.g., Bennardo 2009; Danziger 2010), I do not regard the relative FoR as essentially or necessarily egocentric (see §2.3.3 for discussion).

Table 2.6: FoR dichotomies

		Binary	**Ternary**	
		Angular-anchored		**Head-anchored**
Egocentric	**Non-geocentric**	Direct intrinsic	Relative	SAP-landmark
Allocentric		Object-centered intrinsic		
	Geocentric		Absolute	Object-landmark

2.5.2 Orientation and motion descriptions

Much of the literature on FoRs focuses on locative descriptions, and tacitly assumes that orientation and motion descriptions can be straightforwardly sorted into the same FoRs. However, while it may be intuitive to classify ‘The man is facing north’ as absolute or ‘The ball rolled from right to left’ as relative, orientation or motion descriptions in the intrinsic FoR are somewhat more limited. For orientation, we might think of examples like ‘The man is looking (to his) left’, where a facing direction is described in terms of the figure’s own LRFB coordinates. However, such cases are limited because figures generally face ‘forward’ with respect to their own geometry, and also because it is usually more relevant or informative to describe the figure’s orientation with respect to something external (e.g., ‘The man is looking at the tree’). For motion, there are examples like ‘The man is walking backwards’, but contexts that call for such descriptions are limited for similar reasons. Therefore, although the intrinsic FoR is widely used in locative descriptions in many languages, its use in orientation and motion descriptions is more restricted. For some purposes, such as describing the orientation of the toy man in the ‘Man and Tree’ game (see §5.2), the intrinsic FoR is completely inadequate as a strategy, since in all photos the man would simply be facing ‘forwards’.[47]

However, under Levinson’s typology, which counts landmark-based references as intrinsic, descriptions like ‘The man is facing the tree’ are also classified as intrinsic (e.g., Levinson 2006:186–187). This inevitably follows from the classification of landmark references as intrinsic, but has also been justified on the basis of informational equivalence: if the man is facing the tree, then the tree is in front of the man, and vice versa (cf. Terrill &

[47] Of course, the use of intrinsic FoR in locative descriptions can serve to entail certain facts about the orientation of the toy man – for example, ‘The tree is in front of the man’ entails that the man is facing the tree, provided the description is used in an intrinsic rather than relative way.

Burenhult 2008:99). In contrast, Bennardo (2000:516) categorizes a very similar example ('He faces Nia') as absolute, in keeping with his classification of landmark references as belonging to the absolute FoR. MesoSpace researchers have treated such examples simply as landmark-based, or as belonging to the direct FoR if the figure is facing a speech-act participant (e.g., Bohnemeyer 2011:898).

Terrill and Burenhult (2008) propose that not only is there a kind of informational equivalence between the propositions 'The man is facing the tree' and 'The tree is in front of the man', but that the two belong to a single 'orientational' supercategory that cross-cuts Levinson's typology. In their framework, all 'facing descriptions' as well as intrinsic locative descriptions can be considered 'orientational', since they orient either the figure or the ground with respect to something external. Meanwhile, 'locational' descriptions include relative and absolute FoR descriptions, but never intrinsic ones. Terrill and Burenhult argue that this explains why many languages, including Jahai (Mon-Khmer, Malay Peninsula) and Lavukaleve (Papuan isolate, Solomon Islands), appeal to array-internal cues to describe 'standing information' but array-external ones to describe 'facing information'. Instead of using a mixed strategy, speakers of such languages in fact have a unified 'orientational' strategy that acts as the organizing principle behind their spatial descriptions.

However, as Bohnemeyer and O'Meara (2012:245–246) point out, Jahai and Lavukaleve are both languages that favour the intrinsic FoR in locative descriptions and disprefer or lack the absolute and relative FoRs. But the intrinsic FoR is not well suited to orientation descriptions, which explains the choice of other strategies – and especially head-anchored, landmark-based strategies – in such contexts.[48] Bohnemeyer and O'Meara present data from Seri and Yucatec, two indigenous languages of Mexico, which demonstrate a similar pattern. Thus there is no need to posit an 'orientational' super-strategy as Terrill and Burenhult do – the lack of intrinsic FoR in orientation descriptions simply reflects the nature of locative vs. orientation descriptions, rather than anything significant about FoR typology. It does, however, highlight the need to consider locative and orientation descriptions separately when presenting data on FoRs in particular languages, since the

[48] Bohnemeyer and O'Meara (2012:246) actually claim that the intrinsic FoR is "impossible" for orientation descriptions, which is not quite true – as I have pointed out, there are examples like 'The man is looking (to his) left' in which (a part of) the figure is in fact oriented with respect to itself. Nonetheless, their point that the intrinsic FoR is not available for orientation descriptions in the 'Man and Tree' task is valid.

same FoR strategies are not always equally available for both kinds of descriptions. Even in languages like English which prefer the relative FoR in both contexts, there can be a marked difference: in Bohnemeyer and O'Meara's (2012:238) pilot data collected with the 'Ball and Chair' photo-photo matching task, the relative FoR was used in 52.1% of locative descriptions but in 71.9% of orientation descriptions, presumably because the intrinsic FoR (which was sometimes used in locative descriptions) was unavailable in orientation descriptions, and the relative FoR was able to fill the gap.

Table 2.7 below illustrates how each FoR is represented in descriptions of orientation and motion (in English), according to the typology outlined in the previous section. Along with the classification of locative descriptions in the previous section, this will form the basis for the analysis of FoRs in Dhivehi presented in Chapters 4 and 5.

Table 2.7: FoRs in orientation and motion descriptions

<table>
<tr><th>Major FoR type</th><th>Subtypes</th><th>Example of orientation description</th><th>Example of motion description</th></tr>
<tr><td>Relative</td><td>Reflectional;
Translational;
Rotational</td><td>The man is facing left.
(from the speaker's/viewer's perspective)</td><td>The ball is rolling from right to left.
(from the speaker's/viewer's perspective)</td></tr>
<tr><td rowspan="2">Intrinsic</td><td>Direct</td><td>I am facing left.
(i.e., to my own left)</td><td>I am walking backwards.
(i.e., away from where I am facing)</td></tr>
<tr><td>Object-centered</td><td>The man is facing left.
(i.e., to his own left)</td><td>The man is walking backwards.
(i.e., away from where he is facing)</td></tr>
<tr><td rowspan="2">Landmark-based</td><td>SAP-landmark</td><td>The man is facing me.</td><td>The ball is rolling towards me.</td></tr>
<tr><td>Object-landmark</td><td>The man is facing the tree.</td><td>The ball is rolling towards the tree.</td></tr>
<tr><td rowspan="2">Absolute</td><td>Geomorphic</td><td>The man is facing downhill.</td><td>The ball is rolling downhill.</td></tr>
<tr><td>Abstracted</td><td>The man is facing north.</td><td>The ball is rolling north.</td></tr>
</table>

3 Frames of reference, cognition, and the environment

3.1 Outline

The question of how to define and classify frames of reference (FoRs), discussed in the previous chapter, is by no means the only disputed aspect of spatial frames of reference. The nature of the relationship between linguistic FoRs, spatial cognition, and the environment has been hotly debated over the last few decades, with most scholars falling into one of two main camps. ‘Universalists’ claim that all FoRs are equally available to all groups of humans at the cognitive level, and that any apparent cross-cultural differences in spatial cognitive behaviour result from superficial environmental factors rather than deep-rooted linguistic or cultural ones (Abarbanell & Li 2009; Gleitman & Papafragou 2005; Li & Abarbanell 2018; Li, Abarbanell & Papafragou 2005; Li et al. 2011; Li & Gleitman 2002; Pinker 2007; inter alia). In the opposing camp, ‘relativists’ or ‘neo-Whorfians’ claim that FoRs in cognition vary cross-culturally, and in particular that the relative FoR (as defined in §2.2.2) is far from universally available. According to neo-Whorfians, this variation is best explained not in terms of environmental differences but in terms of cross-linguistic variation in FoR use, with a Whorfian effect of language upon thought (Brown & Levinson 1993; Haun et al. 2011; Levinson 1996; Levinson 2003; Levinson et al. 2002; Majid et al. 2004; Mishra, Dasen & Niraula 2003; Pederson et al. 1998; Wassmann & Dasen 1998; inter alia). More recently, however, some scholars have proposed that while spatial language and thought are indeed correlated, some aspects of the environment still play a causal role in certain parts of this relationship (e.g., Dasen & Mishra 2010; Palmer 2015; Shapero 2017).

In this chapter I outline some of the main developments in this debate. In §3.2 I begin by summarizing the key findings of the research program on spatial language and cognition carried out by the Max Planck Institute (MPI) for Psycholinguistics during the 1990s and early 2000s. The MPI researchers found that the absolute FoR is widely used cross-linguistically, and that there is a correlation between FoRs in language and FoRs in spatial cognition, with speakers of geocentric-dominant languages tending to conceptualize spatial relations in a geocentric way even in non-linguistic tasks (e.g., Levinson 1996; Levinson 2003; Majid et al. 2004; Pederson et al. 1998). In §3.3 I address Li and Gleitman’s (2002) opposing view that the presence of salient landmarks affects the performance of participants in non-linguistic spatial experiments. Li and Gleitman reject the MPI's findings on the grounds that the MPI experiments were conducted in different environments (indoors vs. outdoors) for different populations. Following Levinson et al. (2002), I show how Li and Gleitman's position is based on a conflation of the intrinsic and absolute/geocentric FoRs, as well as a number of methodological flaws. I then discuss some more recent contributions to this debate from both sides (e.g., Haun et al. 2011; Li et al. 2011). In §3.4, I turn to a different kind of position that has emerged in the recent FoR literature: the view that the topographic environment plays a role in shaping representations of space in both language and cognition. This position is best articulated by Palmer (2015), whose 'Topographic Correspondence Hypothesis' proposes a systematic correlation between local topography and systems of absolute spatial reference in languages. According to this hypothesis, the topographic environment plays an important role in shaping cognitive representations of space, which are in turn reflected in spatial language. Finally, §3.5 concludes the chapter and discusses how Dhivehi represents a useful case study for many of the competing claims and hypotheses in the literature.

3.2 The case for linguistic relativity

As Levinson (2003:6–16) observes, Western thought going back to Aristotle (and especially since Kant), has generally considered human spatial cognition to be relative, egocentric, and anthropocentric in character (see also Levinson & Brown 1994). On this view, humans are assumed to think about space in relation to their own bodies, with "ego at the centre of the universe" (Miller & Johnson-Laird 1976:395). Further, it has been assumed that all languages reflect this notion of space, and that children acquire egocentric FoRs before geocentric ones (Clark 1973; Miller & Johnson-Laird 1976; Piaget & Inhelder 1956). For example, English has such terms as *in front*, *behind*, *left* and *right*, which use the body as an anchor from which to project a set of axes and thereby a whole coordinate system onto other entities (i.e., a relative FoR, cf. §2.2.2).

3.2.1 The MPI's linguistic findings

Recent findings in linguistics and linguistic anthropology have challenged the universality of egocentric spatial language, and have cast serious doubt on the notion that human spatial cognition is innately (and universally) egocentric. During the 1990s and early 2000s, an extensive cross-linguistic project was undertaken by Levinson and his team from the Language and Cognition Department (formerly the Cognitive Anthropology Research Group) at the Max Planck Institute (MPI) for Psycholinguistics in Nijmegen. The MPI researchers collected data from a diverse set of languages (of various genetic, areal, and typological affiliations) spoken in a broad range of communities around the world, including preliterate hunter-gatherer groups as well as agricultural groups and industrialized societies.[49]

The MPI used a suite of experimental methodologies each of which was designed either to elicit spatial language or to test non-linguistic spatial behaviour and memory (Brown & Levinson 1993; Levinson 2003; Levinson et al. 1992; Levinson & Wilkins 2006b; Pederson et al. 1998; Senft 2007). For example, in the 'Men and Tree' game (Levinson et al. 1992), two speakers sit side by side but separated by a screen.[50] Each speaker has an identical set of photographs laid out in front of her – the photographs show a toy man and toy tree in various configurations (e.g., man to the left or right of the tree, man facing towards or away from the viewer, etc.). The aim of the game is for one speaker, the 'director', to describe the photos one by one so that the 'matcher' can identify the corresponding photo from her own set. Since the dividing screen blocks visual contact between the speakers, the task is effective at prompting descriptions rich in spatial frames of reference (e.g., 'The man is to the left of the tree'). The use of the same methodology in different populations allows for meaningful comparisons to be made between languages or groups (though see Senft 2007 and Chapter 5 of this thesis for some limitations and shortcomings).

The results of this cross-linguistic investigation challenged the traditional view of spatial language as essentially egocentric. In many of the languages investigated, speakers described the photos not in egocentric terms but in geocentric terms (e.g., 'The man is north of the tree', 'The tree is on the inland side', etc.) or in intrinsic terms (e.g., 'The tree is at the man's front') (Levinson & Wilkins 2006c:541–550; Pederson et al. 1998:560–574). In fact, of the languages investigated, only Dutch, English and Japanese use an egocentric relative FoR as a predominant system, and in many languages (e.g, Arrernte, Guugu

[49] For lists of the languages and communities studied by the MPI, see Majid et al. (2004:112), Pederson et al. (1998:560) and Senft (2001:535).
[50] A version of this game will be described more fully in Chapter 5.

Yimithirr, Jaminjung, Longgu, Mopan, Tzeltal) the relative FoR was used only marginally or not at all – in many languages of the latter category, the terms for 'left hand' and 'right hand' apparently refer only to body parts and never to regions extended from these body parts (Pederson et al. 1998:571). Speakers of these languages favour geocentric reference even in small-scale space.[51] Mopan appears to rely on the intrinsic FoR only, and speakers are seemingly 'blind' to the difference between photos showing a 'mirror image' of each other, i.e., distinguishable only by a ternary FoR (Danziger 1999; Danziger 2001). Other languages use a mixture of FoRs in small-scale space (e.g., Kgalagadi, Totonac, Yucatec; Pederson et al. 1998:572), and in Tamil, rural speakers use a geocentric cardinal system while urban speakers use an egocentric relative system (Pederson 1993). Many of these findings are consistent with data obtained from narratives and conversations in many languages (see, e.g., Haviland 1998 for the use of cardinal directions in Guugu Yimithirr discourse).

3.2.2 The MPI's non-linguistic findings

Meanwhile, the MPI's non-linguistic cognitive experiments revealed a correlation between FoRs used in language and FoRs used in non-linguistic spatial reasoning and memory (Brown & Levinson 1993; Levinson 1996; Levinson 2003; Majid et al. 2004; Pederson 1995; Pederson et al. 1998; Senft 2001). The experiments, some of which will be described more fully in Chapter 6, involved asking participants to memorize some spatial array (such as a line of toy animals), wait a short time, and then turn 180 degrees to recreate the spatial array or choose the matching option at another table. This is then repeated for a given number of trials with each participant. Participants presumably complete such tasks according to the FoR they have used to mentally encode the spatial information at the stimulus table, and so different 'non-linguistic FoRs' may be distinguished due to the 180 degree rotation between the two tables. For example, if the participant remembers that the animals were facing left on the stimulus table, then he will place the animals facing left on the test table, even though they are now facing the opposite way in absolute or geocentric terms (e.g., if the animals were facing north on the stimulus table, they now face south on

[51] Note that geocentric strategies such as cardinal directions are available in familiar European languages such as English, and are often used for large-scale spatial relations (e.g., *England is north of France*). However, the use of these strategies sounds decidedly odd when applied to small-scale relations in English (and probably most other European languages too).

the test table); conversely, if the participant remembers that the animals were facing north on the stimulus table, he places them facing north on the test table, even though they are now the ‘wrong’ way in relative or egocentric terms (e.g., leftwards on the stimulus table but rightwards on the test table).[52] Participants can therefore preserve either the relative/egocentric coordinates or the absolute/geocentric coordinates of the array, but not both at once.

Intriguingly, the MPI’s results showed that performance on these non-linguistic spatial tasks was far from being universally egocentric. In fact, participants from many communities tended to solve the tasks using a geocentric FoR. For example, in a sample of 27 Tenejapan participants (speaking Tzeltal, a Mayan language in Mexico), 20 participants (74%) oriented the toy animals in a consistently geocentric way, and only two participants (7%) in a consistently egocentric way (Brown & Levinson 1993:15). Other groups showing a predominantly geocentric pattern on non-linguistic tasks included speakers of Arrernte (Pama-Nyungan, Australia), Belhare (Tibeto-Burman, Nepal), Guugu Yimithirr (Pama-Nyungan, Australia), Hai||om (Khoisan, Namibia), Kilivila (Oceanic, Papua New Guinea) and Longgu (Oceanic, Solomon Islands), as well as rural speakers of Tamil (Dravidian, India) (Levinson 2003; Pederson 1995; Pederson et al. 1998; Senft 2001). Moreover, groups that used predominantly geocentric language in description tasks were found to use predominantly geocentric encoding in the non-linguistic tasks, while groups using egocentric language (speakers of Dutch, English, or Japanese) were found to use mostly egocentric encoding in the same non-linguistic tasks (Levinson 2003; Majid et al. 2004; Pederson et al. 1998). According to Levinson and his MPI colleagues, this correlation cannot be attributed to factors such as gender, literacy, cultural conservativism, subsistence patterns, or ecological zones, none of which determine FoR choice across the various samples, though literacy and urbanization may be associated with the relative FoR to some extent (Levinson 2003:193–197; Majid et al. 2004). They therefore interpret the correlation between linguistic and non-linguistic FoRs as evidence for linguistic relativity, arguing that the habitual use of a particular FoR in language fosters the use of the same FoR in spatial cognition more generally, even in non-linguistic contexts.[53]

[52] For a visual representation of this task (known as ‘Animals-in-a-row’) and the different possible responses, see Figure 6.4 in §6.2.2.2.

[53] This conclusion is further supported by evidence from gesture patterns (Levinson 2003:244–271).

During the same period, the MPI's findings were corroborated by researchers working in other parts of the world. Wassmann and Dasen (1998), working with a sample of Balinese speakers, reported a strong preference for geocentric coding in both linguistic and non-linguistic tasks. In a large study on 545 children from rural Nepal (mostly speaking Nepali, an Indo-Aryan language) as well as from rural and urban Hindi-speaking communities in India, Mishra, Dasen and Niraula (2003) observed a correspondence between linguistic and non-linguistic FoR preference at least at a group level, though they also found a strong degree of task specificity and individual variation (see also Niraula, Mishra & Dasen 2004).

3.3 Relativity or universalism?

3.3.1 Li and Gleitman's (2002) reply

In response to the reports of cross-cultural differences in spatial reasoning discussed in the previous section, Li and Gleitman (2002) attempt to explain away the key differences as merely *ad hoc* reactions to the physical environment. In particular, they argue that the presence of salient landmarks near the experiment sites may have invited the use of allocentric (i.e., non-egocentric, cf. §2.5.1) encoding among many of the populations tested by the MPI, and they attempt to show that even English speakers solve the same tasks in an allocentric way when in the presence of salient landmarks.

Li and Gleitman (2002:274-280) conducted a version of the Animals-in-a-row task with 40 English-speaking undergraduate students, who were tested in one of three conditions: indoors with blinds down, indoors with blinds up, and outdoors. Participants in the 'Blinds-Down' condition produced fewer geocentric responses than participants in the 'Outdoor' or 'Blinds-Up' conditions, prompting Li and Gleitman to conclude that when participants have visual access to surrounding landmarks such as salient buildings, they are far more likely to solve the task in a geocentric way. Additionally, Li and Gleitman (2002:280-282) conducted a variant in which toy duck ponds were placed on the tables prior to the experiment to serve as potential landmarks. One duck pond was placed on the right/southern end of the stimulus table, and an identical duck pond on one end of the test table (the right/northern end for half the participants, and the left/southern end for the remaining participants). Participants overwhelmingly oriented the animals with respect to this tabletop landmark, whichever end of the test table it had been placed on. Li and Gleitman interpret this as further evidence that responses to the task are context-dependent, and determined largely by the presence of salient landmarks rather than linguistic patterns. They point out that in the MPI experiments, Dutch speakers were tested indoors but the Tenejapans outdoors, and so only the latter had visual access to salient local landmarks. Thus, Li and Gleitman argue that the different experimental results obtained from the Dutch and Tenejapan samples is not evidence of linguistic relativity, but evidence of the role the surrounding environment plays in spatial cognition.

Li and Gleitman (2002:286-290) propose that the cross-linguistic diversity in FoRs is due to the fact that some groups, like the Tenejapans, are not schooled and live in "small, mutually familiar, geographical area[s]", where knowledge of salient local environmental features may be shared throughout the community far more than is possible in very large, mobile groups such as speakers of English, Dutch, or Japanese. In their view, linguistic FoR systems simply reflect, rather than determine, underlying conceptualizations of space. Li and Gleitman (2002:290, original emphasis) write:

> [L]inguistic systems are *merely* the formal and expressive medium that speakers devise to describe their mental representations and manipulations of their reference world. Depending on the local circumstances in which human beings find themselves, they select accordingly from this linguistically available pool of resources for describing regions and directions in space.

3.3.2 Levinson et al.'s (2002) counter-reply

In a rebuttal, Levinson et al. (2002) identify a number of methodological and conceptual issues in Li and Gleitman's experiments, and observe that Li and Gleitman made a number of erroneous assumptions about the MPI's original results (see also Levinson 2003:197–206). Levinson et al. (2002:162-163) point out that in the original studies, the Tenejapans were tested under a low veranda rather than completely outdoors, and that many of the groups tested indoors (such as Aboriginal Australians) in fact produced strongly geocentric (or in Levinson's terminology, 'absolute') responses. Further, some groups tested outdoors produced strongly egocentric results. The authors also observe that participants in Li and Gleitman's 'Outdoor' condition did not produce strongly geocentric responses, but a mix of egocentric and geocentric responses which may be due to a number of methodological simplifications. In particular, Li and Gleitman's experiments reduced the wait time between the two tables, used a swivel chair instead of walking the participant between tables, and used only three animals instead of four (from which the participant must choose the correct ones). As Levinson et al. argue, these changes to the experiment design make the task considerably easier for participants, who second-guessed the purpose of the experiment (as evidenced by the fact that a majority of Li and Gleitman's participants verbally indicated that they could see two ways to solve the task). In the original, more challenging version, the participant's attention is directed away from the true purpose of the experiment because of the need to remember the identity of the animals, and not just their direction and order. Although it is not clear why this should have been more of an issue in the Outdoor condition specifically, Levinson et al. (2002:171) propose that participants in this condition may have been more exposed to surrounding distractions such as passers-by, and that mistakes made by egocentric coders could show up as apparently geocentric responses. In any case, Levinson et al. (2002:169-172) were unable to replicate Li and Gleitman's results for the Outdoor condition with the more rigorous methodology – a new sample of Dutch university students produced strongly egocentric results.

As Levinson et al. show, another serious issue with Li and Gleitman's argument is that it conflates the intrinsic and absolute FoRs, both of which are simply 'allocentric' for Li and Gleitman. As a result, Li and Gleitman's 'duck pond' experiments fail to demonstrate that English speakers remember spatial arrays in an absolute way when a salient landmark is available. Instead, the duck pond may be interpreted by participants as part of the array, and so apparently 'absolute' or 'geocentric' responses are ambiguous with array-internal or intrinsic ones (Levinson et al. 2002:173–174).[54] With their own variations on the duck pond experiments, Levinson et al. (2002:174-179) demonstrate that intrinsic coding, rather than absolute coding, is almost certainly in play here.[55] Since intrinsic coding is both available and idiomatic in English and Dutch, the duck pond results (from both studies) are perfectly consistent with the linguistic relativity hypothesis.

[54] Levinson et al. (2002:179-182) further object that Li and Gleitman conflate the absolute FoR with (non-egocentric) landmark-based systems, which the former take to be a crucial distinction. However, this is arguably less of an issue, given that both are geocentric systems and there is some grey area between the two (see §2.4 for discussion), and given that the duck ponds are not really 'landmarks' anyway (as mentioned previously, they are interpreted as part of the tabletop array rather than as independent features of the surrounding environment).

[55] Some of these variants will be discussed further in §6.2.4.2.

Levinson et al. therefore reject the argument that FoR use is determined by the environment or other non-linguistic factors. Contrary to Li and Gleitman's assumption, the Tenejapans do not live in a small, geographically cohesive community, but are spread across a large area, and use the same absolute directions even when far removed from familiar territory. The same is true of many other groups of absolute coders. And factors like schooling, literacy, gender and age were not found to correlate significantly with FoR choice in the larger study (Levinson et al. 2002:182–183). This appears to leave linguistic practice as the best predictor of non-linguistic FoR use.

3.3.3 Further developments

Subsequently, additional experiments have been conducted to advance this debate. Church (2005) ran indoor and outdoor conditions of the Animals-in-a-row task (using the MPI's methodology) with English-speaking students at an American university campus, and found nearly identical results across the two conditions (as predicted, responses were mostly egocentric), contrary to Li and Gleitman's results from a similar sample. In four new experiments, Li et al. (2011) aimed to test how Tenejapan participants would solve rotation tasks that had only one 'correct' solution – an egocentric one or a geocentric one (see also Abarbanell 2010; Li, Abarbanell & Papafragou 2005) – arguing that the MPI's open-ended tasks may have been interpreted differently in different cultures (cf. Newcombe & Huttenlocher 2000:192–194). Participants performed the tasks in one of two conditions, an 'egocentric condition' that demanded an egocentric strategy, or a 'geocentric condition' that demanded a geocentric strategy to solve.[56] Li et al. found that participants' performance was significantly better in the egocentric condition of each task, despite the relativist prediction that a geocentric strategy would be more natural to the Tzeltal-speaking Tenejapans, who hardly ever use terms for 'left' and 'right'. They also observed that as the complexity of the tasks increased, participants' performance in the geocentric condition worsened far more than in the egocentric condition, again suggesting that cognitively, egocentric encoding is more natural to the Tenejapans. However, in a study of Dutch and Hai||om schoolchildren, Haun et al. (2011) found that children struggled to implement their

[56] For example, in one experiment, participants sat on a swivel chair and watched as the experimenter hid a coin in a box to the left or right of the chair. Participants were then blindfolded and spun around slowly (90°, 180°, 270°, or 360°), after which the blindfold was removed. They then had to retrieve the coin. In the egocentric condition, the boxes were on rods attached to the chair, and so rotated with the participant. In the geocentric condition, the boxes were placed on the ground near the chair.

non-preferred strategy (i.e., geocentric for the Dutch and egocentric for the Hai||om) in a variant of the Animals-in-a-row task, even after they were trained in how to use such a system. Haun et al. therefore argue that cross-cultural variation is not simply due to varying interpretations of the task instructions, but reflects real differences in FoR preference – and competence – cross-culturally. Haun et al. also found that the Hai||om children did not converge on an egocentric strategy when the complexity of the task was increased (contra Li et al. 2011), whereas the Dutch children produced consistent egocentric results in their outdoor experiments (contra Li & Gleitman's 2002 environmental determinism).

The studies mentioned above have clarified some issues. In particular, there is now a considerable body of evidence showing that results do not depend on indoor vs. outdoor test conditions, and Li and colleagues appear to have moved away from manipulating this variable (e.g., Li & Abarbanell 2018). However, the research since the mid-2000s has also led to new points of contention. Bohnemeyer and Levinson (2011) raise a number of objections to Li et al. (2011), challenging their methodology as well as their interpretation of the results (see also Everett 2013:94–98). Certain issues resemble some of the earlier problems with Li and Gleitman's (2002) study. For example, just as Li and Gleitman conflated intrinsic and geocentric FoRs, Li et al. conflate the direct FoR and the relative FoR (see §2.3 for this distinction). In at least some of Li et al.'s experiments, it is likely that participants in the 'egocentric condition' used the direct FoR (a subtype of egocentric FoR thought to be universal even by relativists – e.g., Danziger 2010) rather than the relative FoR (which was pitted against geocentric FoRs in the original MPI experiments).[57] In addition, Li et al.'s experiments target *competence* in egocentric and geocentric FoRs, rather than FoR *preference*. This is a crucial point because relativists do not deny that all FoRs are universally available, nor that Tenejapans (or any group) could show competence in different FoRs under the right circumstances – the relativist claim is instead about preference and habitual use. In any case, Bohnemeyer and Levinson point out that Li et al.'s 'egocentric' and 'geocentric' conditions are in fact different tasks, and due to various features of task design (rather than underlying cognitive style), the egocentric conditions are easier to solve. Bohnemeyer and Levinson also object to Li et al.'s view that in the

[57] In any case, experiments by Haun and colleagues have shown that in some cultures, a geocentric solution is preferred even over a direct FoR solution for some tasks (Haun & Rapold 2009), though not in all conditions (Haun 2011).

earlier MPI studies, cross-cultural variation was merely due to pragmatic inference (according to Li et al., participants recognized the ambiguity of the instruction to 'make it the same' but opted to interpret this in terms of local linguistic conventions – whether left and right or some set of geocentric directions). Bohnemeyer and Levinson remark that Li et al.'s account is highly implausible because (among other reasons) it is unlikely that in pondering what the experimenter wants, an English speaker (for example) would consider the relative frequency of left/right terms and cardinal terms in the English language to reach the decision that she should arrange the animals left to right, because the terms *left* and *right* are more common in English.

At present, it appears that any consensus is still far away. In response to Haun et al. (2011) and Bohnemeyer and Levinson (2011), Li and colleagues have defended their findings and continued to argue against linguistic relativity (Abarbanell & Li Under review; Abarbanell, Montana & Li 2011; Li & Abarbanell 2018; Li & Abarbanell Under review). They attempt to challenge the relativity hypothesis on the basis of: (i) a pragmatic inference account (described above) of cross-cultural variation; (ii) experimental results showing cognitive flexibility in different groups; (iii) results showing task-specific effects; and (iv) results showing that training children to use or understand new spatial lexemes does not strongly affect their non-linguistic spatial performance. However, it is questionable whether any of their arguments are strong enough to refute the relativity hypothesis. The first two arguments were already addressed above – the pragmatic inference account is implausible, and the demonstration of cognitive flexibility does not undermine the finding that *habitual* ways of thinking about space vary cross-culturally. As for (iii), relativists have long acknowledged that task-specific effects exist (e.g., Mishra, Dasen & Niraula 2003; Senft 2001; Wassmann & Dasen 1998), with egocentric coding more common on some tasks than others (see also §6.5.1). Thus, this finding is by no means new. While it has been interpreted as evidence against very strong versions of linguistic determinism (e.g., Mishra, Dasen & Niraula 2003:379–381), it does not rule out weaker versions of the relativity hypothesis, since it is still the case that speakers of different languages tend to produce very different spatial behaviours *on the same task*, even if some tasks tend to prompt more egocentric responses than others. Likewise, (iv) should not concern relativists simply because it does not rebut any claim that relativists make – relativists claim that *habitual* patterns of naturalistic language use may influence non-linguistic representations of space, but not that *any* exposure to spatial language (as found, for example, in an artificial training procedure to an experiment) will necessarily influence non-linguistic spatial cognition in an immediately testable way. In fact, to the extent that Li and colleagues have investigated cognitive correlates of habitual language use, their results actually show cross-cultural variation that is quite consistent with linguistic relativity, though they play this down (Abarbanell & Li Under review:5–13).

It should also be noted that even if Li and colleagues' results and interpretations are valid, they need to be corroborated in samples other than speakers of English or Tzeltal, especially considering the linguistic situation in Tenejapa has apparently changed somewhat since the original MPI studies, as Abarbanell (2010) herself documents. In fact, recent work elsewhere has generally supported the relativity hypothesis. Dasen and Mishra (2010) compile the results of an extensive cross-linguistic project examining children's spatial language and cognition in Bali, India, Nepal and Switzerland (Mishra, Dasen & Niraula 2003; Niraula, Mishra & Dasen 2004; Wassmann & Dasen 1998; cf. §3.2.2). They conclude that their results are in line with a moderate version of linguistic relativity, though they also acknowledge a degree of task specificity, as well as the influence of other variables (see §3.4 for discussion). Similarly, the 'MesoSpace' research group (introduced in Chapter 2) reports evidence of correlations between linguistic and non-linguistic FoR use, with the exception of communities using predominantly intrinsic or mixed FoRs in discourse – whose speakers produce geocentric responses in spatial memory tasks (Bohnemeyer 2011; Bohnemeyer et al. 2014; Le Guen 2011a).[58] The findings from the intrinsic and mixed cases are explained by Bohnemeyer et al. in terms of an innate, pan-simian bias towards geocentric FoRs (cf. Haun et al. 2006) that is only overcome by a learned egocentric bias transmitted through language and culture. Importantly, Bohnemeyer et al.'s statistical modelling suggests that the correlation between geocentric language and cognition is not reducible to covariation with non-linguistic variables, contra Li and Gleitman (2002) (though writing frequency and topography were significant independent factors – see §3.4). Findings from single-community studies have provided further support for linguistic relativity. For example, Meakins et al. (2016) report that Gurindji people in

[58] In Murrinhpatha (northern Australia), however, Gaby, Blythe and Stoakes (Forthcoming) report a mixture of egocentric and geocentric strategies in spatial memory, along with intrinsic and mixed strategies in language.

northern Australia, who are undergoing a linguistic shift from a cardinal system to an English left/right system (cf. Meakins 2011; Meakins & Algy 2016), mostly produced geocentric results in Animals-in-a-row, though participants with a tertiary education gave significantly more egocentric responses, which the authors attribute to increased exposure to English and associated literacy practices.

3.4 The environment reconsidered

3.4.1 Palmer’s Topographic Correspondence Hypothesis

As discussed in §3.3, the position that non-linguistic spatial cognition is determined by the immediate experimental environment (i.e., outdoors with visual access to landmarks, or indoors) has been discredited. However, some scholars have proposed that the environment plays a less immediate but still crucial role in the relationship between spatial language and cognition. This proposal is that FoR choice (in both language and cognition) is shaped by features of the surrounding environment with which speech communities have become familiar over time. In particular, Palmer (2002; 2004; 2007; 2015) points to correlations between topography and systems of geocentric spatial reference (in his terminology ‘absolute’ spatial reference), arguing that perceptual input of topographic features feeds into mental representations of physical space, which in turn motivate the spatial representations encoded in language. Correlations between linguistic and non-linguistic representations of space therefore emerge because both are ultimately responses to the environment (Palmer 2015:210, 222–223). This challenges the relativist view that non-linguistic representations of space are largely shaped by language rather than environment. Palmer (2015:211) formulates the underlying empirical claim here as a ‘Topographic Correspondence Hypothesis’, making two complementary predictions:

> (i) … [T]hat languages spoken in diverse topographic environments, even when they are closely related, will tend to have systems of absolute spatial reference that differ in ways that correlate to topographic variation, and further that individual languages spoken in a range of environments will show similar diversity.
>
> (ii) … [T]hat languages spoken in similar topographic environments will tend to have similar systems of absolute spatial reference, regardless of phylogenetic, areal or typological affiliation, and that similar environment will lead to similar spatial systems, even in entirely unrelated languages spoken in completely separate parts of the world.

To test this hypothesis, Palmer (2015:214–215) proposes the ‘Environment Variable Method’, which involves two complementary dimensions of comparison:

i. A comparison of linguistic spatial systems in closely related languages (or varieties of the same language) that are spoken in diverse topographic environments.

ii. A comparison of linguistic spatial systems in genetically and areally unrelated languages that are spoken in similar topographic environments.

Palmer (2002; 2005; 2007; 2015) presents preliminary evidence for the Topographic Correspondence Hypothesis, along both lines of comparison proposed by the Environment Variable Method. For example, the spatial reference systems of Makassarese, Embaloh and Aralle-Tabulahan, three closely related Austronesian languages of Indonesia, are all tailored to the diverse topographic environments in which they are spoken (Palmer 2015:215–216). Makassarese, spoken on a coastal peninsula, employs directional terms for ‘landward’, ‘seaward’, ‘clockwise around peninsula’, and ‘anticlockwise around peninsula’ (Adelaar 1997:69–70). Embaloh, spoken in a riverine environment, has terms for ‘upriver’, ‘downriver’, ‘away from river’, ‘towards river’, and ‘across river’ (Jukes 2006:194–196; Liebner 2005). Aralle-Tabulahan, spoken in a mountainous region that also has many rivers, uses ‘upriver’, ‘downriver’, ‘uphill’, ‘downhill’, ‘along’ (same altitude along hillside) and ‘across’ (same altitude on far side of river/valley) (McKenzie 1997). Meanwhile, a number of unrelated languages spoken in the same type of environment show similar systems of geocentric reference. For example, Aralle-Tabulahan (Austronesian, Sulawesi), Samo (Trans New Guinea, New Guinea Highlands), Dyirbal (Pama-Nyungan, North Queensland) and Florutz German (Indo-European, Italian Tyrol) are all spoken in mountainous areas with rivers, and all four languages make use of an ‘uphill-downhill’ axis as well as an ‘upriver-downriver’ axis (see Palmer 2015:216–218 for references and discussion).

Of particular relevance to this thesis are Palmer’s (2015:218–220) observations about spatial reference in four atoll-based languages of the Pacific (see also Palmer 2007): Marshallese, Kiribati, Tokelauan and Iaai. In line with the Topographic Correspondence

Hypothesis, all four languages display remarkable similarities in their systems of geocentric reference, which closely reflect the unique topography of atolls.[59] In particular, all four languages make use of a grammaticized 'lagoonward-oceanward' axis on land, as well as cardinals (used for directions perpendicular to the lagoonward-oceanward axis, or when on the open sea), and two languages (Marshallese and Tokelauan) also employ a grammaticized 'landward-seaward' axis on water.[60] However, as Palmer (2015:220) notes, the four languages do not make for an ideal comparison as they are genetically related – all are members of the Oceanic branch of Austronesian. As discussed in Chapter 1, it is for this reason that Palmer proposes Dhivehi as an important point of comparison (Dhivehi being the only language indigenous to an atoll environment that is not part of the Austronesian family). The Topographic Correspondence Hypothesis predicts that Dhivehi should use a grammaticized lagoonward-oceanward axis like other atoll-based languages.

Despite the preliminary evidence for Palmer's hypothesis, some questions remain as to how exactly such a hypothesis should be interpreted and evaluated:

- The same topographic features may not be conceptualized or engaged with in the same ways in different cultures. To what extent might sociocultural factors mediate the relationship between topography, spatial cognition, and language?
- How can we as outsiders tell *a priori* what another community will perceive as most salient in their environment? Even putting aside sociocultural factors, some locations offer several possible environmental cues that could form the basis for different geocentric systems.
- Is geocentric language used more frequently in places with salient topographic features? Or should we only expect that geocentric spatial systems match local topography, even if geocentric reference is rare in some languages?
- Do the relevant topographic directions necessarily need to be encoded in a grammaticized way, as Palmer (2015) assumes (cf. §2.4.3)? Is there a correlation between grammaticized directions and frequently used ones? Where the two do not go hand in hand, is grammaticization more crucial to Palmer's hypothesis than frequency of use?

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[59] As described in Chapter 1, this topographic environment comprises narrow strips of land and reef surrounding a central lagoon.
[60] See §2.4.3.2 for a discussion of Palmer's (2015) grammaticization criterion.

- What about speech communities that tend to use intrinsic or egocentric FoRs, non-topographic landmarks, or a mixture of strategies? Is this a matter of arbitrary linguistic (or cultural) preference, or does this perhaps reflect a scarcity of salient topographic features? In particular, is there a correlation between egocentric FoRs and urban environments, as Palmer (2015:211) suggests (see also §3.4.2)?

The question of grammaticization was partly addressed in Chapter 2, and will be considered from a Dhivehi language perspective in Chapters 4 and 5. The question of egocentric FoRs and urban environments will be discussed in the following section, and revisited in Chapter 5 in the context of data from urban environments in the Maldives. Possible answers to the remaining questions will also be considered in Chapter 5.

3.4.2 Other hypotheses and findings

The possibility of a relationship between geography and spatial reference has also been considered elsewhere in the literature. As discussed in §3.3.1, Li and Gleitman (2002) assume that Tzeltal speakers use a geocentric FoR because they live in a location with salient topographic cues. One important difference between Li and Gleitman's position and Palmer's is that Li and Gleitman believe that FoR choice is highly sensitive to whatever environment individuals find themselves in at the time (e.g., indoors vs. outdoors), whereas Palmer (2015) does not make this claim. Nonetheless, both Li and Gleitman and Palmer identify topography as a factor that motivates geocentric spatial reference. In contrast, Levinson and his MPI colleagues reject what they call 'ecological determinism', and claim that FoR patterns do not correlate with environment (Levinson 2003:48; Majid et al. 2004:112), with the possible exception of a link between egocentric FoRs and urban environments (e.g., Majid et al. 2004:111–112).

However, as Palmer (2015:213–214) observes, Majid et al. (2004) categorize 'environment' rather coarsely, with some of their environment types corresponding to broad ecological zones such as 'tropical' and 'temperate', rather than fine-grained topographic environments. Further, they only consider the choice between major FoR types (relative, intrinsic or absolute in their taxonomy), rather than subtypes of absolute or geocentric systems. In any case, as Dasen and Mishra (2010:116–117) point out, among the 20 languages in Majid et al.'s study, there is only one 'rural' language that prefers egocentric over geocentric reference (though some use intrinsic or mixed FoRs), while all of the ‘urban’ languages use egocentric rather than geocentric FoRs as a major strategy. Thus the link between the urban-rural divide and FoR choice appears to be more robust than Majid et al. suppose (Majid et al. 2004:112 only state that there “might be an association”). As mentioned in §3.2.1, the urban-rural divide has been shown to relate to FoR patterns even within some languages: urban speakers of Tamil tend to use the relative FoR far more than rural speakers, who prefer cardinal directions (Pederson 1993). Other studies have demonstrated the same urban-rural divide both within and across languages. Mishra, Dasen and Niraula (2003) report a much stronger geocentric preference in their two rural locations (in India and Nepal) than in Varanasi (an Indian city), where egocentric and geocentric FoRs are both in use. Similarly, the use of egocentric FoRs is prevalent in urban locations in Bali and Nepal, while geocentric FoRs prevail in rural Bali and rural Nepal (Dasen & Mishra 2010).[61]

Why should egocentric FoRs be used more often in cities, and geocentric FoRs more often in rural areas? Some scholars suggest that features of the urban landscape foster egocentric FoRs over geocentric FoRs: the grid-like environment possibly favours the use of relative ‘left’ and ‘right’, and there is restricted visual access to environmental cues like the path of the sun (e.g., Dasen & Mishra 2010:116; Mishra, Dasen & Niraula 2003:372; Palmer 2015:211). Alternatively, social differences between urban and rural populations might be responsible (e.g., Dasen & Mishra 2010:116, 308–309; Pederson 1993:297–298, Footnote 6). Compared to rural communities, urban populations tend to have higher levels of literacy and schooling, greater familiarity with artifacts such as photos and diagrams, greater contact with foreigners, more diverse occupations and lifestyles, greater cultural and linguistic diversity, and a large proportion of people who are not well established (e.g., temporary residents and immigrants). Some of these factors (e.g., literacy) could conceivably nurture the use of egocentric FoRs, while others (e.g., a less established population) might make it harder for geocentric systems (which rely on shared knowledge of the environment) to take root. Whatever the reason, the relationship appears not to be a completely deterministic one – Levinson (2003:212) observes that many communities

[61] Dasen and Mishra (2010) also documented strong use of egocentric FoRs in Geneva, though they did not collect data from rural Switzerland. Anecdotally at least, rural people in Western countries do not use geocentric FoRs in small-scale space, though they might for medium-to-large scale spatial reference. More research is needed on this topic.

living in the 'big outdoors' do not use geocentric FoRs as their main strategy, and Mishra, Dasen and Niraula (2003:375–376) report that children from urban Varanasi use cardinal directions (among other strategies).[62]

Some recent work has argued in favour of an intermediate position between ecological determinism and Levinson's ecological skepticism. This intermediate position is compatible with linguistic relativity, but does not deny the role of the environment either. For example, Dasen and Mishra (2010:307) note that the various geocentric systems in their cross-linguistic study are all suited to the topographic environments in which they are used: cardinal directions in the flat Ganges plains, an 'up-down' axis in the Himalayas, and a 'mountainward-seaward' axis in Bali. And as described earlier, Dasen and Mishra also present evidence of an urban-rural divide in FoR choice. However, they conclude that the environment alone does not determine FoR choice, since other factors (such as some of the social ones mentioned above) may also be at work, forming "an eco-cultural web that works as a system" (Dasen & Mishra 2010:308–309). As discussed in §3.3.3, Dasen and Mishra also argue for a moderate version of linguistic relativity, and so language, environment, and social factors all contribute to FoR choice in their view.

A similar conclusion is reached by members of the MesoSpace research group. For example, Polian and Bohnemeyer (2011) show that topography plays a crucial role in defining geocentric axes in different Tzeltal-speaking communities and in constraining the use of geocentric FoRs. But they argue against any deterministic effect that would override the role of language (note that Majosik' is a Tzeltal-speaking community in Tenejapa, Mexico). Polian and Bohnemeyer write (2011:889):

> Environmental influences can only serve as evidence against linguistic influences if it can be shown that environmental factors determine FoR use independently of language. Li and Gleitman's position predicts, for example, that if one were to discover somewhere in the Rocky Mountains an English-speaking community in a place whose topography is the exact replica of that of Majosik's, then, all else being equal, those English speakers should use the terms *up* and *down* in the same way the inhabitants of Majosik' use *ajk'ol* and *alan*, and those English speakers would show the same linguistic and cognitive bias

[62] Some scholars have also pointed to Manhattan's *uptown-downtown* axis as an example of a geocentric system in a highly urban environment (Li & Gleitman 2002:289–290; Palmer 2015:211–212). However, there is no evidence that New Yorkers use this axis in small-scale (e.g., tabletop) space, in contrast to many groups who predominantly use geocentric FoRs at this scale (see §3.2.1).

> in favor of absolute FoRs. This kind of environmental determinism entails that any population that has a suitable feature in its local environment exploits it for modeling FoRs on it, which is clearly not the case for most English-speaking riverine or mountainous (etc.) communities. Anthropologists have long ago stopped trying to find strong determinants for a group's spiritual or cosmological beliefs. Similarly, linguists are unable to strictly predict on cultural and environmental grounds what kind of color term system, demonstrative system, or tense-mood-aspect system a given language has. There appears to be no reason to assume that the relation between environmental factors and FoR use in language and cognition is any more direct. And the indirect, constraining role of topography and population geography confirmed in the present study in no way precludes language from playing a key role in guiding the acquisition of culture-specific styles of referential practice.

Palmer's (2015) Topographic Correspondence Hypothesis may also be vulnerable to this kind of objection, at least if it is assumed that a few hundred years is enough for spatial reference to adapt to the local topography. However, Polian and Bohnemeyer's position may go a little too far in the other direction (though it is still less skeptical than Levinson's). Based on the evidence reviewed in this section as well as the previous one, it is clear that the environment in which speakers reside does have a close relationship with their FoR choice – certainly much closer than any possible relationship between the environment and such things as tense-mood-aspect marking.

An intermediate position between skepticism and determinism is also supported by evidence from the MesoSpace group's wider comparison of 11 languages (or language varieties) spoken in Mexico, Nicaragua, and Spain (Bohnemeyer et al. 2014; Bohnemeyer et al. 2015). Bohnemeyer and colleagues show that topography is a statistically significant factor in predicting FoR use. However, they also identify a number of other significant predictors including population density, literacy, frequency of writing, frequency of L2 use, first language, and language group (membership in the Mesoamerican sprachbund). This suggests firstly that topography is not the only relevant environmental variable – population density was also significant in their study. Secondly, the fact that linguistic variables are significant is consistent with linguistic relativity, and suggests that language is involved in transmitting not only systems of spatial reference, but also corresponding ways of thinking about space. This transmission may occur within communities as well as across communities that are in contact. Bohnemeyer et al. (2015:197) therefore propose a "Linguistic Transmission Hypothesis" which holds that "[u]sing a language may facilitate the acquisition of cultural practices of non-linguistic cognition shared among the speakers of the language". Such a hypothesis does not deny the effects of topography or other variables, but emphasizes the role of language in spreading new ways of conceptualizing space. An additional finding of the MesoSpace group is that the use of shape-based meronyms in spatial descriptions tends to suppress the use of the relative FoR (Bohnemeyer & Tucker 2013; Eggleston 2012). Shape-based meronymy is highly productive in many languages of Mesoamerica, and its availability as a linguistic resource helps to explain patterns of FoR use in such languages. Thus, in addition to the factors described earlier, the lexical and grammatical resources of a language would appear to impact the FoRs used by its speakers.

Furthermore, some research has suggested that FoR choice may relate to the ways in which people interact with their environment, rather than the environment itself. In Yucatec, men but not women use cardinal direction terms (Bohnemeyer 2011:904; Bohnemeyer & Stolz 2006:308–309; Le Guen 2011a). This appears to reflect occupational biases and cultural practices specific to men. For example, Bohnemeyer (2011:904) notes that "…the four edges of the *milpa*, the tropical garden where people plant their corn, beans, squash, chili, and so on, are supposed to be aligned with the cardinal directions, as are the walls of a traditional house". Similarly, though speakers of Mopan overwhelmingly use array-internal and SAP-landmark strategies, cardinal directions are used more often by men, who work in the fields, than by women, who work inside the house or village (Danziger 1999). In some cases, environmental interaction may also explain different patterns of non-linguistic FoR use within a community. In a non-verbal spatial memory task carried out by 97 individuals in a predominantly Ancash Quechua-speaking community in the Peruvian Andes, Shapero (2017) found significantly higher rates of geocentric responses among participants who had experience working in the surrounding highlands as herders. As Shapero (2017:1293) explains, "both highland pastoralism and the use of the Absolute FoR draw on a similar cognitive ability to keep track of one's position among various landmarks in a fixed coordinate system".

3.5 Summary and questions for the current study

The precise nature of the relationship between frames of reference, cognition, and the environment has proven to be controversial. This chapter has reviewed the main developments in the recent literature on this topic. Traditionally, spatial language and thought was assumed to be universally egocentric, as it is in English and familiar European languages. However, this assumption was turned on its head by the extensive cross-linguistic project carried out by Levinson and his MPI colleagues in the 1990s to early 2000s. Levinson's group showed that there is substantial cross-cultural variation in FoR use in both spatial language and spatial cognition, with a correlation between patterns of speaking and patterns of thinking. This led to an argument for linguistic relativity – that habitual use of a particular FoR in language leads to the use of the same FoR in spatial thinking. This controversial Whorfian interpretation was challenged almost immediately by psychologists (Li & Gleitman 2002), who attempted to show that all FoRs are equally available to all groups, and that FoR choice depends on the experimental environment rather than language. However, Li and Gleitman's study suffered from numerous methodological flaws as well as conceptual misunderstandings (Levinson et al. 2002). Li and colleagues' more recent work has illustrated some degree of cognitive flexibility in FoR selection, but has not successfully refuted the evidence for cross-cultural diversity in *habitual* FoR use, and so this work should not be taken as counter-evidence to linguistic relativity.

Although it is now clear that FoR choice does not simply depend on whether participants are indoors or outdoors at the time, many scholars have proposed that the environment in which individuals live may influence FoRs in language and cognition. Palmer's (2015) Topographic Correspondence Hypothesis makes a fairly strong prediction that geocentric spatial reference closely reflects the local topographic environment, and that languages necessarily attend to salient topographic features in grammaticized systems of geocentric reference. While this hypothesis may turn out to be too strong, Palmer's Environment Variable Method is a useful approach to investigating the relationship between FoRs and topography. Other scholars have made weaker claims, identifying the environment as one of several variables that impacts FoR choice without fully determining it. This is compatible with linguistic relativity. Either way, there is now considerable evidence of a correlation between urban environments and egocentric FoRs, as well as a weaker correlation between rural environments and geocentric FoRs. It is also well attested that geocentric reference tends to invoke salient topographic features in the local environment. Finally, there is growing evidence that the ways in which we interact with the environment may be more relevant than the environment itself when it comes to FoR choice. Given that urbanization and new technology are rapidly changing how people around the world engage with their environment, this is a particularly important topic for further investigation.

This review of the literature has focused on the relationship between FoR use, cognition, and the environment, as this relationship is of particular relevance to this thesis. It should be noted, however, that other aspects of FoRs have also been investigated in the literature, though these are largely outside the scope of this chapter and/or this thesis. One such area of inquiry is the classification of FoRs, which was reviewed in Chapter 2. Another area is gesture and its relationship with FoRs in spatial language and cognition (e.g., Danziger 2010; de Ruiter & Wilkins 1998; Haviland 1993; 1998; Kita, Danziger & Stolz 2001; Le Guen 2011a; Le Guen 2011b; Levinson 2003:244–271). In addition, the acquisition of FoRs in children has been studied in some detail by Dasen and colleagues (see Dasen & Mishra 2010 for a comprehensive overview) as well as by others (e.g., Abarbanell & Li Under review; Brown 2001; Brown & Levinson 2000; Cablitz 2002; de Léon 1994; de Léon 1996; Gentner et al. 2013; Levinson 2003:307–313; Shusterman & Li 2016b; Shusterman & Spelke 2005; Tanz 1980).

As introduced in Chapter 1, a study of FoRs in Dhivehi language and cognition can contribute in several ways to our understanding of the relationship between FoRs, cognition, and the environment. Dhivehi is a particularly interesting case study because it is spoken on atolls, a highly distinctive and threatened topographic environment. Following Palmer's Environment Variable Method (§3.4.1), it therefore represents a good point of comparison to unrelated atoll-based languages such as Marshallese (Austronesian). FoRs have been described in a few other South Asian languages, as discussed at various points throughout this chapter. A study of Dhivehi will therefore add to our understanding of FoRs in the South Asian linguistic area, and a comparison with other languages of the region will complement the comparison with unrelated languages spoken on atolls – do FoRs in Dhivehi resemble FoRs in languages of the region (including other Indo-Aryan languages), or do they more closely resemble those in unrelated languages spoken in similar topographic environments? Other South Asian languages use a mixture of FoRs. If Dhivehi is like this too, then what does this mixture of FoRs look like for Dhivehi? For example, do all speakers use a range of FoRs, or are there different preferences among different communities or subsections of communities, such as the urban-rural divide discussed in

§3.4.2? Much of the literature has focused on languages in which a single FoR is predominant (see §3.2), and so more studies describing the range and nature of variation in mixed-FoR languages are needed. Dhivehi is an under-described language, and its systems of spatial reference may be shifting under the pressures of social, technological, economic, linguistic and cultural changes taking place in the Maldives. It is therefore important to document traditional systems of spatial reference in the language before they are lost, even though the language as a whole is not currently endangered.

4 Spatial reference in Dhivehi

4.1 Outline and data sources

This chapter describes spatial language in Dhivehi. The purpose of the chapter is to demonstrate not only how frames of reference are expressed in Dhivehi, but also to describe the main features of Dhivehi spatial language more generally, in order to place FoRs in a broader context. The organization of the chapter is roughly based on the 'grammars of space' in Levinson and Wilkins (2006a): §4.2 addresses deixis, §4.3 addresses topological relations, §4.4 covers positional/postural verbs, §4.5 discusses motion descriptions, §4.6 frames of reference, and finally §4.7 concludes by discussing some typological and theoretical implications.

The data in this chapter is drawn from a variety of sources. Some example sentences are drawn from narrative texts, from direct elicitation, or from previous works on Dhivehi. Most examples, however, are drawn from texts elicited with the aid of certain stimuli. Some of these stimuli were developed by members of the Max Planck Institute (MPI) for Psycholinguistics (Ameka, de Witte & Wilkins 1999; Bowerman & Pederson 1992; Levinson et al. 1992; Wilkins 1993), and provided much of the data for the grammars of space in Levinson and Wilkins (2006a). Other stimuli were developed with members of the broader comparative project on spatial reference in atoll-based languages (cf. §1.1). The advantage of using stimuli-based tasks is that the stimuli and methodology are purposely designed to elicit descriptions rich in spatial language, including ones that may occur infrequently in a corpus of more naturalistic texts. Table 4.1 below lists the various spatial language elicitation tasks from which data in this chapter (and Chapter 5) is drawn, along with the types of spatial language targeted. The methodologies of the first five tasks are described in Chapter 5, which discusses the use of FoRs in those tasks and presents some quantitative results. The methodologies of the remaining three tasks will be briefly discussed in the relevant sections of this chapter.

Table 4.1: Spatial language elicitation tasks

Task	Sub-domain of space targeted
Man and Tree	FoRs in static relations
Route Description	Motion descriptions; FoRs in motion descriptions
Verbal Animals-in-a-row	FoRs in static relations; orientation descriptions
Virtual Atoll Task	Large(r)-scale spatial descriptions; wayfinding
Object Placement Task	Semantics of front/back/left/right terms; knowledge of geocentric directions
Topological Relations Picture Series (TRPS)	Topological relations; positional/postural verbs
Picture Series for Positional Verbs (PSPV)	Positional/postural verbs; topological relations
Frog Story	Manner of motion, path of motion

4.2 Deixis

This section briefly describes some features of spatial deixis in Dhivehi, and particularly the use of demonstratives. Since demonstratives are not the main focus of this thesis, in this section I provide only a broad overview. Dhivehi demonstratives play a role not only in spatial deixis, but also in person deixis and discourse deixis (see Gnanadesikan 2017:85–88), though I will not address all of these functions here.[63]

Dhivehi has a three-way distinction between speaker-proximal, addressee-proximal and distal deixis. This distinction is encoded by the demonstratives *mi* 'this near me', *ti(ya)* (L. *te*) 'that near you', and *e* 'that over there, away from us', glossed as DEM1, DEM2 and DEM3 respectively (following Gnanadesikan 2017). There is no number distinction. For consistency, I will follow Gnanadesikan's (2017) analysis of Dhivehi demonstratives as proclitics, though they have previously been treated as independent words in some other works on Dhivehi (e.g., Cain & Gair 2000).[64] They may procliticize to verbs as well as noun phrases. Demonstratives fill various grammatical roles in Dhivehi. In (15), *mi* is a determiner while in (16) it is a pronoun:

[63] Further work on Dhivehi demonstratives might apply Wilkins' (1999) demonstrative questionnaire, in order to develop a more detailed semantic analysis.

[64] Gnanadesikan (pers. comm.) notes that in favour of the clitic analysis, Dhivehi demonstratives fuse with words like *eti* 'thing' (forming *mīti* 'this thing', *tīti* 'that thing near you' and *ēti* 'that thing over there'), they are normally written as part of the following word, and they would be subminimal words if they were independent words.

(15) ***mi***=*mīhā* *kurumattu*

DEM1=person front.LOC

'in front of **this** person'

DIV_MT_LD_20140320_2_1_HA7_SI1_N, 5:50

(16) ***mi***=*o* *emme* *mattu* *bari-n̊*

DEM1=COP most top.LOC row-ABL

'**This** is from the topmost row.'

DIV_MT_LD_20131130_1_1_MM1_HS1_N, 2:33

Adverbial uses of demonstratives are also very common in Dhivehi. In general, *mi* modifies verbs denoting activities (or states, etc.) perceived as being near the speaker, especially those actually performed by the speaker (i.e., verbs with first-person subjects). Similarly, *ti(ya)* may be used with verbs denoting actions near the hearer or performed by the hearer (i.e., second-person verbs). Finally, *e* is used with verbs denoting activities construed as taking place away from the deictic centre, especially where there is a third-person subject. Since Dhivehi clauses ordinarily feature 'pro-drop' when an argument is retrievable from context (cf. Cain & Gair 2000:37; Gnanadesikan 2017:246–248), and since person is not marked on the verb in many tenses/aspects, an adverbial demonstrative is often the only formal clue as to the identity of the subject of a clause (cf. Gnanadesikan 2017:86–87). For example, an idiomatic way to say 'goodbye' in Dhivehi is *mi=danī*, lit. 'this/here going' – the fact that it is the speaker who is going as opposed to someone else can be inferred only by pragmatic context and the use of the speaker-proximal demonstrative *mi*. Similarly, the addressee-proximal demonstrative *ti(ya)* (L. *te*) often creates an implicature that the omitted subject is second person, as in (17) below:

(17) *kīk̊* *hē* ***te***=*kera-nū?*

what Q **DEM2**=do.PRES-PROG

'What are you doing?'

DIV_O_LF_20131222_Kalhakuru_and_the_five_thieves_part_2, 6:07

Note that the demonstrative in (17) cannot simply be analyzed as a personal pronoun. Personal pronouns in Dhivehi take different forms (e.g., *kalē* 'you', *ahareň̊* 'I'), and can co-occur with demonstratives (e.g., *ahareň̊ mi=danī* 'I'm going').[65] However, it is possible that *te* 'DEM2' in (17) is a demonstrative pronoun (such that the question would literally mean something like 'What is that one doing?').

Although third-person subjects tend to attract the distal demonstrative *e* more than the speaker-proximal or addressee-proximal demonstratives, the actual choice of demonstrative sometimes relates to how a spatial relationship is construed, rather than to the actual location of the referent:

(18)	*gaha*	***mi**=hirū*	*vāt̊*	*farāt-u.*	*huri*	*iru,*
	tree	**DEM1**=stand.PST.FOC	left.hand	side-LOC	stand.PST.PTCP	when

..	*mīhā-ge*	*kanāt̊*	*farāt-aṣ̊*	*gaha*	***e**=herū.*
	person-GEN	right.hand	side-DAT	tree	**DEM3**=stand.PST.PROG

'The tree is **here** on (our) left-hand side. When it is (like that) … the (same) tree is **there** to the (toy) person's right-hand side.'

DIV_MT_LF_20131223_1_1_Z1_AZ1_NW, 9:27

Example (18) is noteworthy in that it contains both *mi* and *e*, but both forms are used in relation to the same tree standing in the same place (with no intervening movement or rotation of the speech-act participants). First the scene is described from the speaker's own point of view (i.e., using the relative FoR), prompting the speaker-proximal form *mi*. In the next sentence, the distal form *e* locates the same tree with respect to the toy man's own facets (i.e., the intrinsic FoR). The use of *e* in this context appears to be motivated by the fact that the toy man's facets are independent of the speaker, and so may be regarded as

[65] However, demonstratives are involved in the *formation* of some pronouns. This is especially true of third-person pronouns, which are periphrastic: *ēti* 'it' (from *e eti* 'that thing'), *emīhun* 'they' (lit. 'those people'), *ebaimīhun* 'they' (lit. 'that group people'), *ēnā* 'he/she', L. *esora* 'he' (lit. 'that guy'), L. *emīhā* 'she' (lit. 'that person'), etc. (cf. Cain & Gair 2000:19; Gnanadesikan 2017:88-96). Speaker-proximal and addressee-proximal equivalents also exist for these pronouns, e.g., *mīti* 'it (near me)', *tīti* 'it (near you)', etc. In some cases these are ambiguous – *mimīhun* (lit. 'these people'), for example, can refer to a group of people near the speaker, but can also refer to a group that includes the speaker (i.e., 'us').

separate from the deictic centre. Dhivehi demonstratives can therefore support more precise spatial descriptions such as those employing FoRs or other kinds of relations.

Finally, a number of other Dhivehi words can also invoke spatial deixis. These include several words meaning ‘far’ or ‘near’, such as *duru* ‘far’, *bit̊-doş̊* ‘far/wall side’ (especially of furniture in a room), *kairi* ‘near’, *magat̊* ‘near side’, *doş̊* ‘near’, and *gāt̊* ‘near’ (especially of a person), as well as several body-part terms such as *kurimati* ‘front’, *fahat̊* ‘back’, *furagas* ‘back (esp. of an animate)’, *vāt̊* ‘left hand’ and *kanāt̊* ‘right hand’. Many of these terms are discussed further in later parts of this chapter, particularly §4.3.3 on locative/relational nouns and §4.6 on FoRs.

4.3 Topological relations

4.3.1 Background

Topological relations are non-projective spatial relations such as AT, IN, ON, UNDER, OVER, and so on (Levinson, Meira & The Language and Cognition Group 2003; Levinson & Wilkins 2006b). Such relations are ‘non-projective’ in the sense that there is no projection of coordinates from a viewpoint, from a facet of the ground object itself, or from features of the wider environment (in contrast to frames of reference – see §4.6 as well as Chapter 2). Instead, topological relations express contrasts in variables such as containment, support, attachment, proximity and contiguity. Although topological relations are often described as non-angular (e.g., Levinson & Wilkins 2006b:3), some topological relations contrast vertical superiority (ON, OVER, ABOVE, etc.) with vertical inferiority (UNDER, BELOW, BENEATH, etc.), and may even be projective in cases where the figure is not in contact with the ground object.[66] Thus, the precise boundary between topological relations and frames of reference is not clearly defined.

This section discusses the expression of topological relations in Dhivehi. In §4.3.2 I introduce the Dhivehi locative case, which is used for the basic topological relation AT. In §4.3.3 and §4.3.4 I discuss how locative/relational nouns and converb phrases respectively express more precise topological relations. Finally, in §4.3.5 I comment on the structure of

[66] As discussed in §2.1, in this thesis I use the terms ‘figure’ and ‘ground’ (or ‘ground object’) to refer to the item to be located (the figure) and the item against which the figure is located (the ground), following Talmy (1983).

Dhivehi's 'basic locative construction' (in the sense of Levinson & Wilkins 2006b) and discusses topological relations in Dhivehi from a typological perspective.

Much of the data presented in this section was collected by administering Bowerman and Pederson's (1992) 'Topological Relations Picture Series' (or 'TRPS'), a series of 71 line drawings of objects in various spatial configurations (see Figure 4.1 below for an example). The task involves asking a native speaker 'Where is the X' for each picture, where 'X' is the figure object in yellow (such as the cup in Figure 4.1 below).[67] Part of the exercise also involves asking the speaker about possible alternative descriptions, and about descriptions which might be ungrammatical or infelicitous (see Levinson & Wilkins 2006b:9 for further discussion). Two consultants from Laamu Fonadhoo participated separately in this task, producing descriptions in both standard Dhivehi and in the Laamu dialect.

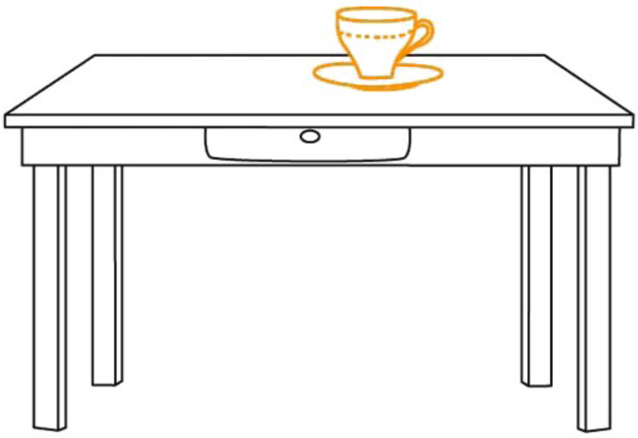

Figure 4.1: Example of a picture from the TRPS
(Bowerman & Pederson 1992)

4.3.2 Locative case

Standard Dhivehi has a locative case marked by the suffix *-ga* (written *-gai* or as a separate word *gai* in the standard Dhivehi orthography), the pronunciation of which varies between [gæː], [gaː] and [ga]. In the Laamu dialect, however, there is a combined genitive/locative case, marked by the bare 'oblique' form of the noun without any suffix (cf. §1.2.1), e.g., *mā* 'flower', but *malu* 'flower.LOC'/'flower.GEN'.[68] In both dialects, human referents are

[67] The question was posed in Dhivehi: *kobā…?* 'Where is the…'

[68] Note that for some nouns in the Laamu dialect, the direct/unmarked case and the genitive/locative case are identical, e.g., *mēzu* 'table'/'table.GEN'/'table.LOC'.

exceptional in that locative marking cannot attach directly to the noun itself, but must attach to the noun *gai* ‘body’.[69] In standard Dhivehi, for example, ‘in/on the book’ is expressed as *fotu-ga* ‘book-LOC’ while ‘at/on the child’ is expressed as *darī-ge gai-ga* ‘child-GEN body-LOC’ (lit. ‘at the child’s body’) (cf. Cain & Gair 2000:16).

The locative case may indicate co-location of the figure and ground without specifying a more precise relationship, though contact between the figure and ground is normally implied. It thus expresses the basic topological relation AT, and may be translated as ‘at’, ‘in’, ‘on’ or ‘by’, depending on the context. An example is (19) below:

(19)	*ekkala*	*kana-**ga***	*eba=huri-ek̊*	*nan̊*	*mal-ek̊*
	aforementioned	corner-**LOC**	CONT=stand.PST.3-NEGC	NEG	flower-INDF

‘There’s a flower **in** the corner, isn’t there?’
DIV_RD_LGd_20140108_2_1_HS4_MM3_W, 0:23

Like Tamil, Dhivehi employs what Pederson (2006:405) calls a “pragmatically inferencing” strategy for marking basic locative relationships: the precise topological relation may be left unspecified if it is obvious or unimportant in the context. In contrast, English and many other languages use a “semantically specifying” strategy that requires the overt specification of a more precise topological relation even when the nature of that relation is obvious or unimportant. Thus, English uses the relation IN in (19) above while Dhivehi simply uses locative marking. This is also the case for (20) and (21) below; similarly, in (22) and (23) below the Dhivehi locative case is used for the relation ON:

(20)	*den̊*	*mīhā*	*inī*	*gahu-**ga***
	then	person	sit.PST.FOC	tree-**LOC**

‘Then the person is **in** the tree.’
DIV_MT_LD_20131130_2_1_MT1_MA3_W, 1:00

[69] A similar situation exists for the ablative/instrumental case, which must attach to *farāt̊* ‘side’ or *at̊* ‘hand’ when the referent is human. For example, ‘from the person’ is expressed as *mīhā-ge farāt-un̊* ‘person-GEN side-ABL’ (lit. ‘from the person’s side’).

(21) *bāga^{n}ḍu hurī tuvālī-**ga***
hole stand.PST.FOC towel-**LOC**
'The hole is **in** the towel.'
DIV_TRPS_LF_20150115_II2, Picture 18[70]

(22) *tofi otī mīhā-ge bolu-**ga***
hat lie.PST.FOC person-GEN head-**LOC**
'The hat is **on** the person's head.'
DIV_TRPS_LF_20150115_II2, Picture 5

(23) *stēmpu inī siṭīurai-**ga***
stamp sit.PST.FOC envelope-**LOC**
'The stamp is **on** the envelope.'
DIV_TRPS_LF_20150115_II2, Picture 3

4.3.3 Locative/relational nouns

Dhivehi also has a number of locative or relational nouns (or "nominal postpositions" in the terminology of Gnanadesikan 2017:113–115). These convey topological relations that are more precise than basic co-location. Grammatically speaking, relational nouns in Dhivehi are somewhere in between ordinary nouns and true postpositions. Like postpositions in many other languages, they take other nouns as objects and often assign case to them; but like nouns, they may themselves inflect for case, as illustrated in (24) and (25) below for the relational noun *mati* 'top':

(24) *jōḍu hurī mēzu matī-ga*
cup stand.PST.FOC table top-LOC
'The cup is on the table.'
DIV_TRPS_LF_20150115_II2, Picture 1

[70] Examples from the three tasks involving picture stimuli (PSPV, TRPS, Frog Story) are labelled by picture number – refer to the original stimuli (Ameka, de Witte & Wilkins 1999; Bowerman & Pederson 1992; Mayer 1969) for these pictures.

(25)	*fen̊*	*hoḷi*	*otī*	*gas*	*buḍu*	*matī-ga*
	water	pipe	lie.PST.FOC	tree	base	top-LOC

‘The hose is on the tree stump.’

DIV_TRPS_LF_20150115_II2, Picture 21

Relational nouns may also inflect for cases other than the locative. For example, *matin̊* ‘top.ABL’ means ‘from the top’ or ‘over’ (see §4.5.2). Other common relational nouns include *daṣu* ‘bottom’, *tere* ‘inside’, *bēru* ‘outside’, *dēterē* ‘between’, *medu* ‘middle’, *farāt̊* ‘side’, *hama* ‘level’, *dimā(lu)* ‘direction’, *fahu* ‘back’, *koḷu* ‘end’, *kuri* ‘tip, top, front’, *ari/arimati* ‘side, flank’, *faḷi* ‘section’, and *kairi* ‘near’. In this section I discuss the use of *mati* ‘top’ and some other relational nouns used in descriptions of the pictures in the Topological Relations Picture Series.

mati ‘top’

The relational noun *mati* ‘top’ generally expresses a relation in which the figure is vertically superior to the ground object while in contact with it, as for (24) and (25) above. It can often be translated by ‘on’ or ‘on top of’ in English. It is also possible to use *mati* if the figure is not vertically superior to the ground, but at the surface or intrinsic ‘top’ of the ground object. An example of this is (26) below:

(26)	*bēs*	*malam̊*	*inī*	*kaṣi*	*matī-ga*
	medicine	plaster	sit.PST.FOC	shin	top-LOC

‘The band-aid is on the shin.’

DIV_TRPS_LF_20150115_II2, Picture 35

A scene for which one might expect *mati* to be used is the case of butter on a knife (TRPS Picture 12), however, *mati* is apparently not possible for such a scene – instead, one must use either a converb construction (see §4.3.4) or else the bare locative marking described earlier in §4.3.2. It is not entirely clear why *mati* is not possible for this scene, since in the picture the butter is on the knife and in contact with it, and examples like (26) show that adhesion is not a relevant factor. However, my informants suggest that the knife could easily be turned, after which the butter would no longer be vertically superior (and indeed, the butter is canonically on the underside when the knife is in use). In addition, the flat side of a knife blade is not construed as the intrinsic top, whereas the front of a shin could be (note that for the description in (26), the pictured band-aid is on the front side of a standing leg, just above the ankle). This suggests that for *mati*, the intrinsic facets of the ground object may actually be more relevant than the vertical relationship between figure and ground.

When inflected for other cases, *mati* conveys different spatial relations, as mentioned in passing earlier in this section. In some descriptions of static location, the dative form *maccaṣ̊* (L. *mattaṣ̊*) can express a relation of vertical superiority *without* contact, translating to 'above' or 'higher than' in English:

(27)	*gahu-ge*	*kuri*	*otī*	*gē-ge*	*furāḷu*	*maccaṣ̊*
	tree-GEN	tip	lie.PST.FOC	house-GEN	roof	top.DAT

'The tip of the tree is above the roof of the house.'

DIV_TRPS_LF_20150115_II2, Picture 49

In addition, *mati* may take dative or ablative/instrumental case in motion descriptions, to indicate a path to or over/from the top of a landmark object. These uses of *mati* are beyond the scope of this section, but will be revisited in §4.5.2. The use of dative marking in locative descriptions will be addressed further in §4.6.4.3.

daṣu 'bottom'

The relational noun *daṣu* expresses vertical inferiority, and roughly translates as 'bottom', 'below', 'under', or 'the space below'. Unlike *mati* 'top', *daṣu* 'bottom' in the locative case may be used whether or not the figure and ground are in contact:

(28)	*māli*	*inū*	*sīlingu*	*daṣu*
	spider	sit.PST.FOC	ceiling.GEN	bottom.LOC

'The spider is on the ceiling.'

DIV_TRPS_LF_20150115_II2, Picture 7

(29)	*boaḷa*	*otū*	*go*^{n}*ḍī*	*daṣu*
	ball	lie.PST.FOC	chair.GEN	bottom.LOC

‘The ball is under the chair.’

DIV_TRPS_LF_20150115_II2, Picture 16

<u>*(e)tere* ‘inside’</u>

The relational noun *(e)tere* ‘inside expresses containment within a bounded space, and can often be translated as ‘in’, ‘inside’, ‘within’, or ‘among’. Example configurations include a rabbit in a cage (TRPS Picture 54), a fish in a tank (TRPS Picture 32), an apple in a bowl (Picture 2), and many other cases where the figure is in a bounded (or semi-bounded) space. Example (30) below is typical:

(30)	*foṣi*	*otū*	*dabahu*	*terē*
	box	lie.PST.FOC	bag.GEN	inside.LOC

‘The box is in the bag.’

DIV_TRPS_LF_20150115_II2, Picture 14

<u>*bēru* ‘outside’</u>

The relational noun *bēru* ‘outside’ expresses non-containment:

(31)	*kuttā*	*otū*	*gē*	*bēru*
	dog	lie.PST.FOC	house.GEN	outside.LOC

‘The dog is outside the house.’

DIV_TRPS_LF_20150115_II2, Picture 6

<u>*dimā(lu)* ‘direction’</u>

The relational noun *dimā(lu)* ‘direction’ has a variety of functions, some of which pertain to descriptions of orientation or motion rather than location. In locative descriptions, *dimā(lu)* may combine with *mati* to express vertical superiority without contact (i.e., OVER), similar to the use of *maccaṣ̊* ‘top.DAT’ described earlier. Unlike most other relational nouns, however, *dimā(lu)* assigns comitative case to the NP expressing the ground (as opposed to the genitive or oblique case):

(32) *vilāga^{n}ḍu otī farubadayā dimā matī-ga*

cloud lie.PST.FOC mountain.COM direction top-LOC

'The cloud is over the mountain.'

DIV_TRPS_LF_20150115_II2, Picture 36

Without *mati*, *dimā(lu)* can mean 'in the direction of' or 'in line with':

(33) *bolā dimālu gaha*

head.COM direction tree

'(Is) the tree in line with the (man's) head?'

DIV_MT_LF_20131216_2_2_FH1_MA4_NE, 9:44

4.3.4 Verbally described relations

Some topological relations in Dhivehi cannot be expressed comfortably with bare locative marking or with relational nouns. In such cases, a verbal element is generally used to express the resultative state of some process that the figure must have gone through in order to arrive at its current location. For example, the relation AROUND is expressed with a converb form of *vaṣanī* 'twisting, encircling', as in the following examples:

(34) *riben̊ inī uṣ̊battī-ge vaṣai=gen̊*

ribbon sit.PST.FOC candle-GEN encircle.CVB=SUC

'The ribbon is around the candle.' (lit. 'having encircled the candle')

DIV_TRPS_LF_20150115_II2, Picture 4

(35) *koṣiga^{n}ḍu hurī gē-ge vaṣai=gen̊*

fence stand.PST.FOC house-GEN encircle.CVB=SUC

'The fence is around the house.' (lit. 'having encircled the house')

DIV_TRPS_LF_20150115_II2, Picture 15

The same converb construction is used for the relation THROUGH, but with a verb such as *herenī* 'is pierced':

(36) *tīru* *inī* *āfal-aṣ̊* *herī=fa*
arrow sit.PST.FOC apple-DAT pierce.IN.CVB=SUC
‘The arrow is through the apple.’ (lit. ‘has been pierced into the apple’)
DIV_TRPS_LF_20150115_II2, Picture 30

Other converbs that may be used in this construction include *jahāfa* ‘fixed’, *harukoffa* ‘fixed, attached’, *aḷāfa* ‘fixed’, *lāfa* ‘fixed’, *assāfa* ‘tied’, *amunāfa* ‘strung through’, *aḷuvāfa/eḷuvāfa* ‘hanging on/from’ and *laggāfa* ‘leaning against’ (L. *lakkoffa*). These are typically used to describe scenes for which there is no suitable relational noun and for which bare locative marking of the ground NP is not possible or would be overly vague. Further examples of such scenes from the TRPS include a balloon on the end of a stick (Picture 20), papers on a spike (Picture 22), a phone on a wall (Picture 25), a crack in a cup (Picture 26), a picture hanging on a wall (Picture 44), a headband around a head (Picture 46), hooks on a wall (Picture 50) and a ladder against a wall (Picture 58).

Like converbs in Tamil (Pederson 2006:414–415), Dhivehi converbs in this construction literally refer to motion events, even though the construction has a locative reading. This means that a converb like *vaṣaigen̊* ‘encircling’ can only be used if the figure has moved along a path around the ground object in order to arrive at its present configuration. If the figure did not follow the stated path, one must use a different converb or even a different construction. For example, a ring is slid down the length of a finger rather than wrapped around the circumference:

(37) * *a^{n}goṭi* *otī* *i^{n}gilī-ge* *vaṣai=gen̊*
ring sit.PST.FOC finger-GEN encircle.CVB=SUC
‘The ring is around the finger.’ (lit. ‘having encircled the finger’)
DIV_TRPS_LF_20150115_II2, Picture 10

Instead of the converb construction in (37), the scene is most comfortably expressed by simply marking the ground NP for locative case (described in §4.3.2):

(38) *a^{n}goṭi* *inī* *i^{n}gilī-ga*

ring sit.PST.FOC finger-LOC

'The ring is on the finger.'

DIV_TRPS_LF_20150115_II2, Picture 10

4.3.5 Discussion

4.3.5.1 Basic locative construction

In their cross-linguistic survey of spatial language, Levinson and Wilkins (2006b:15) introduce the notion of a 'basic locative construction' (or 'BLC'), which they define as "the predominant construction that occurs in response to a Where-question (of the kind 'Where is the X?')", or alternatively as "the construction used in the basic locative function". In this section I consider the shape of Dhivehi's basic locative construction.

Despite some variation in how the ground and spatial relation is expressed in Dhivehi, the spatial descriptions in the preceding sections all express the figure as a noun phrase subject, and (barring the occasional ellipsis) use a positional/postural verb as the verb in the main (or only) clause. The figure NP, as the subject of the sentence, takes the direct (unmarked) case. The positional/postural verb is selected on the basis of the characteristics of the figure and its spatial relationship to the ground object – this will be discussed further in §4.4. The positional/postural verb typically follows the subject directly, taking on special 'focus' marking but not inflecting for person or number. This is in contrast to the usual word order in Dhivehi, which is verb-final (the final verb taking person marking in certain tenses/aspects). The use of a focus construction is presumably motivated by the fact that the location of the figure is new information and has been specifically requested with a Where-question (see Gnanadesikan 2017:258–261 for a discussion of focus constructions in Dhivehi).

The remaining elements of locative descriptions in Dhivehi are more variable. One possibility is for the NP expressing the ground to take locative marking directly, as described in §4.3.2. This is especially favoured in some contexts where the relationship between figure and ground is canonical and there is contact between the two. A second possibility is for the same locative marking (or occasionally dative marking) to attach to a relational noun which heads the NP in which the ground is expressed. The relational noun may assign case to the noun that refers to the ground – typically the genitive or oblique case, but sometimes the comitative. The use of a relational noun conveys a more precise spatial relationship in terms of such variables as containment, vertical superiority, contact, etc. Finally, a third possibility involves a subordinate, converb clause – this is a kind of resultative construction that describes the scene as the outcome of a prior motion event (such as encircling, piercing, or attaching). This option is preferred only when such a prior event can be inferred and when the first two options are not suitable. As with relational nouns, converbs may assign case to the ground NP. However, the ground NP here is a separate argument in a subordinate clause, rather than part of the NP headed by the relational noun.

Given that the basic locative construction is supposed to be the *predominant* construction occurring in response to a Where-question, as well as the construction used in the basic locative function, the converb construction described above should probably not be considered to be a subtype of Dhivehi's BLC, but as a separate construction that is sometimes recruited for a locative function. Not only is it limited to a relatively small number of scenes from the stimuli, but it is literally a kind of resultative or periphrastic passive construction (see Cain & Gair 2000:41–42) rather than a locative one. Such constructions are generally not considered subtypes of basic locative constructions in the grammars of space published in Levinson and Wilkins (2006a). It should be noted, however, that the converb construction in Dhivehi still employs a positional/postural verb in its main clause, just like the 'true' BLC. Thus, although it may be analyzed as a separate construction, the converb construction is related both formally and semantically to Dhivehi's BLC. However, both of the first two possibilities mentioned in the previous paragraph (and described in §4.3.2 and §4.3.3) may be considered subtypes of the basic locative construction, as they are more similar formally (both express the spatial relation in an NP) and functionally (both have a purely locative function). Dhivehi's basic locative construction may therefore be defined as follows:

$$\textbf{Figure NP + positional verb +} \begin{Bmatrix} \textbf{ground-}\textsc{loc} \\ \textbf{ground + relational noun} \end{Bmatrix}$$

The shape of Dhivehi's BLC is not unusual cross-linguistically – many languages make use of positional/postural verbs, case marking, and relational nouns (or adpositions) (Levinson & Wilkins 2006b:15–16). However, if we consider the distribution of Dhivehi's grammatical resources across the scenes depicted in the TRPS, we find that Dhivehi is quite different to some of its distant Indo-European relatives, and is more similar to its Dravidian neighbours. Germanic languages like English and Dutch (van Staden, Bowerman & Verhelst 2006) have large numbers of prepositions to specify highly precise topological relationships, whereas Dhivehi has a more limited set of relational nouns. Moreover, the relational nouns that Dhivehi does have are more limited in their applications, since many spatial relations are described without relational nouns, but simply by marking the ground NP for locative case.

4.3.5.2 Carving up topological space

I now turn to the question of how Dhivehi distributes its various available constructions (the converb construction and both subtypes of the BLC) across a number of different spatial scenes, and how this distribution compares to other languages. For simplicity, Levinson and Wilkins (Levinson & Wilkins 2006c:514–526) consider eight key scenes from the TRPS in their summary of topological relations cross-linguistically.[71] These are represented in Figure 4.2 below:

[71] In the TRPS, the relevant pictures are Picture 1 (cup on table), Picture 2 (apple in bowl), Picture 3 (stamp on envelope), Picture 10 (ring on finger), Picture 13 (light over table), Picture 16 (ball under chair), Picture 30 (arrow through apple) and Picture 70 (apple on needle).

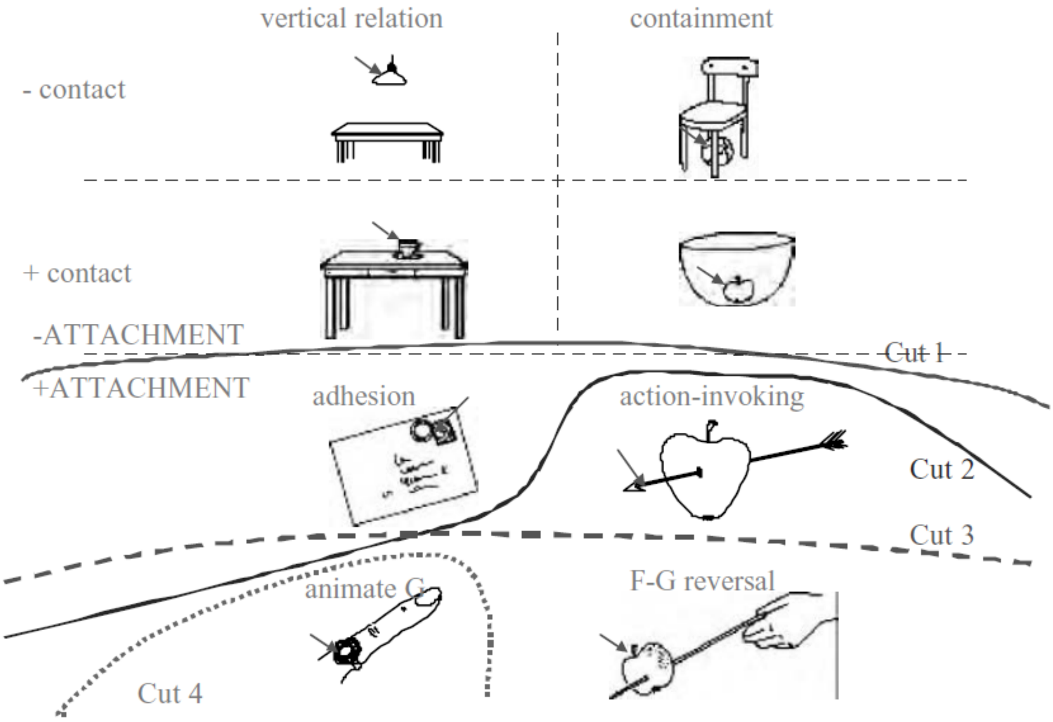

Figure 4.2: A similarity space for topological relations with 'cuts' made by different languages according to whether or not the BLC is used for scenes within the space (from Levinson & Wilkins 2006c:517; reproduced with permission of Cambridge University Press)

As Levinson and Wilkins (2006c) explain, some languages apply their BLC to more of these scenes than others. For example, Arrernte and Kilivila extend their BLCs only to the scenes above Cut 1 in Figure 4.2 above, relying on action or resultative constructions for all the attachment scenes. Other languages go further – in addition to the attachment scenes, Yukatek expresses the stamp on envelope scene in its BLC, but not any of the scenes below Cut 2. Tzeltal includes the arrow through the apple, to extend down to Cut 3. Japanese is not unlike Arrernte or Kilivila, except that in Japanese the ring on finger scene defies easy description in any kind of construction, presumably because the ground is animate. Instead, Japanese reverses the figure and ground for such a scene, describing the relation in terms of the finger. This is demarcated by Cut 4 in Figure 4.2. In contrast, a number of other languages including English and Dutch are able to capture all eight scenes with their BLCs.

According to Levinson and Wilkins, these findings show that while there are no simple universals in the topological domain, languages conform to the same similarity space in which a BLC codes for a number of adjacent regions in the space (rather than opposite corners). Furthermore, distinctions within a BLC such as the use of different adpositions or relational nouns also respect the layout of the similarity space. At the core of this space are scenes like the cup on a table or apple in a bowl, i.e., a small, inanimate, manipulable figure object in contact with a larger, relatively stationary ground object. The more one alters the parameters of these core scenes, the more likely one is to encounter constructions other than the BLC. Levinson and Wilkins formulate this as a kind of implicational hierarchy shown in Figure 4.3 below:[72]

Likelihood of other constructions ↑

1. Figure is impaled by Ground
2. Figure is stuck to Ground
3. Figure is 'damage' or negative space (e.g. crack, hole)
4. Figure is part of whole (part of Ground)
5. Figure is adornment or clothing
6. Figure is inanimate, movable entity in contiguity with ground

↓ *Greater likelihood of BLC*

Figure 4.3: The hierarchy of scenes most likely to get coding in the 'basic locative construction' (BLC) (adapted from Levinson & Wilkins 2006c:516; with permission of Cambridge University Press)

To what extent does Dhivehi conform to the typological generalizations reported by Levinson and Wilkins? In terms of the range of scenes covered, Dhivehi's BLC can be used for all eight scenes in Figure 4.2 above, though for the arrow through the apple and the apple on the skewer, speakers generally prefer a converb construction. A converb construction is also not unnatural for the stamp on the envelope (i.e., 'the stamp is stuck to the envelope'), though the use of the BLC for this scene is at least as likely. The ring on the finger was described using the BLC, as in example (38) from §4.3.4 – this is in keeping with the hierarchy in Figure 4.3 above, and is unlike the Japanese pattern in which an animate ground attracts an alternative construction.

[72] They add the caveat that though the hierarchy is "reasonably robust", some languages from their sample expose some problems with it – e.g., the position of clothing and adornment given an animate ground (Levinson & Wilkins 2006c:515).

As for distinctions between various subtypes of the BLC, the use of bare locative marking on the ground NP is impossible for the top two (-CONTACT) scenes in Figure 4.2 above, the locative marking entailing co-location of figure and ground. Bare locative marking is possible but dispreferred for the next two scenes (+CONTACT, -ATTACHMENT), but is more natural for the +ATTACHMENT scenes, and in particular for the ring on the finger. Meanwhile, relational nouns are obligatory for the top two scenes, most preferred for the next two, and not unnatural for the stamp on the envelope. However, there are no suitable relational nouns in Dhivehi for any of the scenes below Cut 2 in Figure 4.2. These findings all conform to the layout of the similarity space proposed by Levinson and Wilkins, providing further evidence for their typological claims. In terms of the hierarchy in Figure 4.3, although some version of the Dhivehi BLC is possible at all six levels, relational nouns are more likely at the higher-numbered levels and bare locative marking at the lower-numbered levels (the lowest of which also attract converb constructions). This too supports Levinson and Wilkins' typology.

An interesting feature of Dhivehi is its expression of the light over the table scene. While many languages in Levinson and Wilkins' sample use a different lexical item for this relation, Dhivehi actually uses a different subtype of the relational noun construction, as demonstrated in (39) below (see also (32) and (33) in §4.3.3):

(39)	*boki*	*otī*	*mēz-ā*	*dimālu*	*matī-ga*
	light	lie.PST.FOC	table-COM	direction	top-LOC

'The light is over the table.' (lit. 'at the top of the direction with the table')

DIV_TRPS_LF_20150115_II2, Picture 13

This is still clearly a relational noun construction (and thereby a subtype of the BLC), but it is more complex than the usual relational noun construction described in §4.3.3. Here the relational noun heads a more complex NP that includes another relational noun *dimālu* 'direction' as well as the ground NP, which is inflected for comitative case. In this structure, the relational noun *mati* 'top' refers not to the top of the ground object itself, but to the top of an imagined line or direction projected from the ground object. The figure NP is described as being literally on top of this imaginary line. Note that scenes in which the figure is vertically *inferior* to the ground object (such as the ball under the chair) are described more simply with the basic relational noun construction (using the relational noun *daṣu* 'bottom'), and so the distribution of Dhivehi's resources for coding OVER and UNDER relations is asymmetrical in this respect.[73]

The coverage of the various constructions across the eight key scenes from Figure 4.2 above is illustrated in Figure 4.4 below, modelled on the diagrams in Levinson and Wilkins (2006c:553–562). Note that only the constructions in CAPS are subtypes of Dhivehi's BLC. The numbers refer to the order of pictures in the TRPS (Bowerman & Pederson 1992).

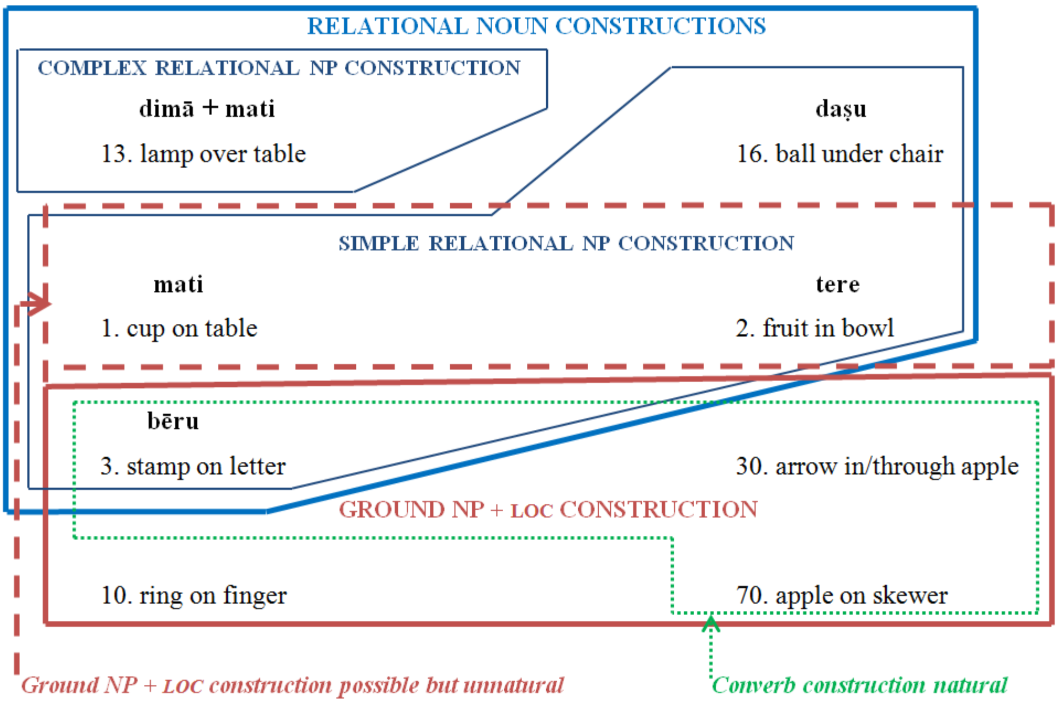

Figure 4.4: Distribution of Dhivehi grammatical constructions across key topological scenes

In addition to the existence of a separate subtype of the relational noun construction for the lamp over table scene, what is interesting about Figure 4.4 is the fact that each relational noun covers just one type of scene each. This is in contrast to many of the languages in Levinson and Wilkins' sample, which 'reuse' the same spatial terms for multiple scenes – English, for example, uses the preposition *on* for the cup on table, stamp on letter, ring on

[73] The use of *mati* 'top' with dative marking may also express some OVER relations, as in (27) in §4.3.3 (a cloud over a mountain). It is not entirely clear why this construction cannot be used for the lamp over table scene.

finger, and apple on skewer scenes. Dhivehi's relational nouns are comparatively precise and specialized to highly specific topological relations.

While it is true that Dhivehi's positional/postural verbs can each apply to more than one of the eight key scenes, these are not included in Figure 4.4 because they are selected more on the basis of the figure object's orientation and other characteristics, rather than on the spatial relationship between figure and ground. This is typical of 'small-set' positional verb languages, which also include Dutch, Yélî Dnye, Arrernte and Kilivila (Levinson & Wilkins 2006c:524). In such languages, positional verbs generally classify the figure according to its shape, orientation or other properties, while figure-ground relationships are expressed elsewhere in the clause (e.g., through adpositions or relational nouns). On the other hand, some languages like Tzeltal have much larger sets of positional verbs that code figure-ground relationships very precisely (Brown 2006:240–250). Nonetheless, as Levinson and Wilkins (2006c:524) observe, positional verbs in 'small-set' languages supplement the spatial information provided in other parts of the clause, "so that the interaction between the ground-marking system and the predicate-marking system yields a cross-cutting, fine-grained classification of spatial scenes". An account of locative descriptions in Dhivehi would therefore not be complete without an exploration of the various positional/postural verbs they employ. This subject is taken up in the next section of this chapter.

4.4 Positional/postural verbs

4.4.1 Background

In contrast to languages like English which simply use one verb (e.g., *be*) for expressing location or existence in their basic locative constructions, Dhivehi has at least six different positional/postural verbs for statements of location or existence: *hunnanī* 'standing', *innanī* 'sitting', *onnanī* 'lying', *tibenī* 'being', *uḷenī* 'being, existing', and *vanī* 'being, becoming'. The selection of the appropriate verb depends on various properties of the figure, including animacy, spatial orientation, shape, number, and spatial relationship with the ground object (e.g., part of the ground, firmly attached to it, hanging loose, separate, immersed, etc.). As Cain and Gair (2000:30) note, the choice of positional/postural verb also varies according to dialect and idiolect, and some of the finer distinctions are a matter of national debate.

There are prescriptive norms for the choice of positional/postural verbs (e.g., Saudiq 2012 [1993]), though as Gnanadesikan (2017:264) observes, these do not always reflect actual usage. While this section does not aim to be the final word on what is clearly a complex, varied and evolving part of Dhivehi grammar, it is intended to add some further detail to the semantic classifications identified by Cain and Gair (2000:28–30) and Gnanadesikan (2017:262–266). The data presented in this section is drawn primarily from descriptions elicited with the aid of the Topological Relations Picture Series (cf. §4.3) as well as various other description tasks. In particular, some examples are drawn from descriptions elicited from one consultant (a 34-year-old man in L. Fonadhoo) using the Picture Series for Positional Verbs, or 'PSPV' (Ameka, de Witte & Wilkins 1999). The procedure for this task is the same as for the Topological Relations Picture Series: for each picture, the consultant was asked in Dhivehi 'Where is the X?' (where 'X' is the figure). The consultant was also asked about possible alternative descriptions for some pictures.

4.4.2 *hunnanī* 'standing'

Probably the most general of Dhivehi's positional/postural verbs, *hunnanī* 'standing' is used in a wide range of situations. Cain and Gair (2000:28) identify six main types of referents which generally take *hunnanī*: (i) anyone actually standing; (ii) a male; (iii) an inanimate object with vertical orientation; (iv) a plurality of objects regardless of orientation; (v) abstract qualities; and (vi) a container with the open side up. I will briefly discuss each of these in turn, and then suggest two additional categories: (vii) masses (e.g., butter, water, etc.); and (viii) negative space (e.g., cracks, holes, etc.).

(i) Anyone standing

In its most basic meaning, *hunnanī* is used for any human actually standing (including figurines, statues, etc.), as in (40) below:[74]

[74] In Dhivehi, the verbs *hunnanī* 'standing', *innanī* 'sitting', and *onnanī* 'lying' are typically inflected for the past tense in basic statements of location, presumably because the figure entered into the spatial relationship in the past, even though the relevant spatial relationship still applies in the present (cf. Cain & Gair 2000:28; Gnanadesikan 2017:264). When in the simple present tense, these verbs may have a habitual reading (Gnanadesikan 2017:265), though this is not always the case.

(40) *kujjā* *hurī* *furāḷu* *matī-ga*

child stand.PST.FOC roof top-LOC

'The child is (standing) on the roof.'

DIV_TRPS_LF_20150220_AR9, Picture 34

However, in data from the Man and Tree game (see §5.2), many descriptions of the toy man use *innanī* 'sitting' (cf. §4.4.3), despite the fact he is standing. I discuss this further in §4.4.6.

(ii) A male

Cain and Gair (2000:28) state that *hunnanī* 'standing' is used for men, though a more precise characterization would be that it is used for a (singular) man or boy unless he is known to be currently sitting or lying down. An example is (41) below:

(41) *abdullah* *hunnanī* *māle-ga*

Abdullah stand.PRES.FOC Malé-LOC

'Abdullah is in Malé.'

Cain and Gair (2000:28), transliteration and glossing adapted

However, as Gnanadesikan (2017:264) notes, the restriction of *hunnanī* to male referents (and *innanī* 'sitting' to female referents) is a prescriptive norm that many speakers do not follow in practice. It should also be noted that since actual posture generally overrides other factors (though see §4.4.6 for some possible exceptions), the use of picture stimuli – where the figure is necessarily in some posture or other – can unfortunately shed no light on the relationship between gender and positional/postural verbs in Dhivehi. Therefore, my own data does not confirm or deny this use of *hunnanī* 'standing' (nor the use of *innanī* 'sitting' for female referents – see §4.4.3), but it is included here following Cain and Gair's (2000) analysis and because it is a widely known use (albeit a prescriptive one) among speakers.

(iii) An inanimate object with vertical orientation

According to Cain and Gair (2000:28), "any inanimate object with vertical orientation" takes the verb *hunnanī* 'standing'. This appears to be a broadly accurate classification, applying, for example, to the tree in (42) below, as well as to a number of other figure objects from the TRPS and PSPV including a house, a fence, a book standing upright on a shelf, and a shoe standing upright on the ground.

(42)	*gas*	*hurī*	*farubadai-ge*	*matī-ga*
	tree	stand.PST.FOC	mountain-GEN	top-LOC

‘The tree is (standing) on top of the mountain.’

DIV_TRPS_LF_20150115_II2, Picture 65

This category also includes objects perceived to be ‘leaning’ against something else, as in (43) below, as well as vertically oriented objects that have been affixed to something beneath them, as in (44):

(43)	*da^{n}ḍi*	*hurī*	*gahu-ga*	*laggā=fa*
	stick	stand.PST.FOC	tree-LOC	lean.CVB=SUC

‘The stick is leaning against the tree.’

DIV_PSPV_LF_20150120_II2, Picture 1

(44)	*da^{n}ḍi-ga^{n}ḍu*	*hurī*	*bim-aș̊*	*jahā=fa*
	stick-piece	stand.PST.FOC	ground-DAT	fix.CVB=SUC

‘The stick is fixed in the ground.’ (lit. ‘has been fixed in the ground’)

DIV_PSPV_LF_20150120_II2, Picture 20

However, some ‘vertical’ objects from the stimuli did not (or did not always) attract *hunnanī* ‘standing’. These were generally hanging or dangling objects, such as a painting hanging on a wall, or else they were objects tied in place at the middle, such as a stick tied to a tree trunk. Depending on the precise nature of the attachment, such scenes generally involve either *innanī* ‘sitting’ or *onnanī* ‘lying’ (see §4.4.3 and §4.4.4, as well as the discussion in §4.4.6). This suggests that *hunnanī* ‘standing’ generally requires the figure to be supported from underneath.

(iv) Plurality of inanimate objects with any orientation

Inanimate objects in the plural take *hunnanī* ‘standing’, regardless of their orientation:

(45) *toḷi-tak̊* *hurī* *mēzu* *matī-ga*

toḷi-tak̊	*hurī*	*mēzu*	*matī-ga*
bean-PL	stand.PST.FOC	table	top-LOC

‘The beans are on the table.’

DIV_PSPV_LF_20150120_II2, Picture 25

(v) Abstract qualities

Abstract qualities or entities also take *hunnanī* ‘standing’ in statements of existence:

(46)

e=de	*mīhun-ge*	*terē-ga*	*rahumat̊terikan̊*	*hurī*
DEM3=two	people-GEN	inside-LOC	friendship	stand.PST.PROG

‘There is friendship among those two people.’

Cain and Gair (2000:28), transliteration and glossing adapted

(47)

gabūlu_nu=kurā	*varas̊_gina*	*sababu-tak̊*	*eba=huri*
approve_NEG=do.PRES.PTCP	very_many	reason-PL	CONT=stand.PST.3

‘There are very many reasons not to approve (it).’

Gnanadesikan (2017:264), transliteration and glossing adapted

(vi) A container with open side up

A container with the open side up requires the use of *hunnanī* ‘standing’, even if it has a fairly flat shape:

(48)

ba^{n}ḍiyā	*hurī*	*gofiga^{n}ḍu-ge*	*matī-ga*
pot	stand.PST.FOC	branch-GEN	top-LOC

‘The pot is (standing) on the branch.’

DIV_PSPV_LF_20150120_II2, Picture 48

At first glance this could be regarded as falling under (iii) ‘inanimate object with vertical orientation’, except that an upside-down bottle, for example, cannot take *hunnanī* ‘standing’, even though it has a vertical orientation (in such a case *onnanī* ‘lying’ is used – see §4.4.4). However, it may be that both (iii) and (vi) belong to a single category of objects in ‘upright’ position.

(vii) Masses

A use of *hunnanī* 'standing' not reported by Cain and Gair (2000) is with non-countable masses such as water, sugar, butter, etc.:

(49) *bataru* *hurī* *vaḷī-ge* *tiḷai-ga*

butter stand.PST.FOC knife-GEN blade-LOC

'The butter is on the blade of the knife.'

DIV_TRPS_LF_20150115_II2, Picture 12

(viii) Negative space

Another use of *hunnanī* 'standing' not listed by Cain and Gair (2000) is with negative space such as cracks or holes:

(50) *re^{n}du* *hurī* *jōḍu-ga*

crack stand.PST.FOC cup-LOC

'The crack is in the cup.'

DIV_TRPS_LF_20150115_II2, Picture 26

4.4.3 *innanī* 'sitting'

Referents that generally take the verb *innanī* 'sitting' may be classified into nearly as many categories as for *hunnanī* 'standing'. Cain and Gair (2000:28-29) list the following categories: (i) anyone actually sitting; (ii) a female; (iii) an animate biped or multiped; and (iv) a fruit still attached to the tree. My data suggests the following two categories may be added: (v) an object closely attached to something; and (vi) a part of a whole.

(i) Anyone sitting

The verb *innanī* literally means 'sitting', and may be used to describe the location of sitting (or crouching) people or animals, regardless of gender or number:

(51)	*kujjā*	*inī*	*alifān-ga*^{n}*ḍu*	*kairī-ga*
	person	sit.PST.FOC	fire-piece	near-LOC

‘The child is (sitting) near the fire.’

DIV_TRPS_LF_20150220_AR9, Picture 38

(52)	*buḷā*	*inī*	*kunā*	*matī-ga*
	cat	sit.PST.FOC	mat	top-LOC

‘The cat is (sitting) on the mat.’

DIV_TRPS_LF_20150220_AR9, Picture 40

(ii) A female

Cain and Gair (2000:28-29) report that *innanī* ‘sitting’ is used for women. More specifically, this verb is used for females of any age, but only with singular referents (i.e., the location of a young girl or an older woman would be expressed with *innanī* ‘sitting’, but the location of a group of females would not). Further, *innanī* ‘sitting’ may only be used in this way when the referent is not known to be currently standing or lying down (this would prompt the use of *hunnanī* ‘standing’ or *onnanī* ‘lying’). However, as mentioned in §4.4.2, this use of *innanī* ‘sitting’ for women but not men is in fact more of a prescriptive norm and is not (or is no longer) reflected in actual usage. When questioned, my consultants reported that *innanī* ‘sitting’ should be used for women (subject to the conditions mentioned above); however, my data does not reveal which positional/postural verb they would use for women in practice – the picture series do not include any scenes where the figure is obviously female, and even if such scenes were to be added, a positional/postural verb would most likely reflect the actual posture of the figure in the scene (e.g., for a woman standing, the use of *hunnanī* ‘standing’ could be accounted for under (i) ‘anyone standing’ in §4.4.2).

(iii) An animate biped or multiped

According to Cain and Gair (2000:28-30), *innanī* ‘sitting’ is used for animals with two legs or more than four legs. This is partly confirmed by the TRPS data – in (53) below, the figure is an owl, and in (54) it is a spider:

(53)	*bakamūnu*	*inī*	*gahu-ge*	*tofaḷa-ek̊-ga*
	owl	sit.PST.FOC	tree-GEN	hole-INDF-LOC

‘The owl is (sitting) in a hole of the tree.’

DIV_TRPS_LF_20150220_AR9, Picture 67

(54)	*māli*	*inū*	*sīlingu*	*daṣu*
	spider	sit.PST.FOC	ceiling.GEN	bottom.LOC

‘The spider is on the ceiling.’

DIV_TRPS_LF_20150115_II2, Picture 7

However, the data also contains examples of *innanī* ‘sitting’ with some four-legged animals such as the rabbit in (55), even if the animal does not obviously have a sitting posture in the picture:

(55)	*musaḷa*	*inū*	*koṭṭu*	*terē*
	rabbit	sit.PST.FOC	cage-GEN	inside.LOC

‘The rabbit is (sitting) inside the cage.’

DIV_TRPS_LF_20150115_II2, Picture 54

In a few scenes where an animal was the figure, the two consultants used different verbs. For example, one consultant used *onnanī* ‘lying’ for the spider on ceiling scene. Some further examples of differences are discussed in §4.4.6.

(iv) A fruit still attached to the tree

A fruit still attached to the tree takes *innanī* ‘sitting’, even if it appears to be hanging from a narrow stem:

(56)	*annāru*	*inī*	*gahu-ga*
	pomegranate	sit.PST.FOC	tree-LOC

‘The pomegranate is in the tree.’

DIV_TRPS_LF_20150115_II2, Picture 27

(v) An object closely attached to something

In at least some cases, an object closely attached to a ground object takes *innanī* 'sitting'. 'Closely attached' here should be taken to mean that the figure object is in close proximity or contact with the ground object while physically attached to it, and not, say, hanging from it at a distance. Examples include (57) and (58) below:

(57) *dati* *inī* *rōnu-ga*
peg sit.PST.FOC line-LOC
'The peg is on the line.'
DIV_TRPS_LF_20150115_II2, Picture 33

(58) *mudi* *inī* *kan̊fatu-ga*
ring sit.PST.FOC ear-LOC
'The earring is on the ear.'
DIV_TRPS_LF_20150115_II2, Picture 69

Other examples already given in this chapter include a stamp stuck to an envelope (23), a band-aid on a shin (26), a ribbon tied around a candle (34) and an arrow through an apple (36).

(vi) A part of a whole

Finally, spatial relationships in which the figure is a physical part of the ground object also involve *innanī* 'sitting':

(59) *logo* *inī* *ṭīṣārṭu-ge* *kurimatī-ga*
logo sit.PST.FOC t-shirt-GEN front-LOC
'The logo is on the front of the t-shirt.'
DIV_TRPS_LF_20150115_II2, Picture 68

4.4.4 *onnanī* 'lying'

The verb *onnanī* 'lying' is also used for a large number of related categories. Cain and Gair (2000:29) list the following: (i) anyone actually lying down; (ii) a singular inanimate with a horizontal orientation; (iii) a legless inanimate or quadruped; (iv) a natural phenomenon; (v) a container with open side down; and (vi) a fruit detached from the tree. My data suggests that another category may be (vii) an item hanging over or from another object.

(i) Anyone lying down

Anyone or anything actually lying down takes the verb *onnanī* ‘lying’:

(60)	*donkamana*	*otī*	*e*^{n}*du*	*matī-ga*
	Don Kamana	lie.PST.FOC	bed	top-LOC

‘Don Kamana lay on top of the bed.’

Cain and Gair (2000:29); transliteration and glossing adapted

(ii) A singular inanimate with a horizontal orientation

An inanimate object in the singular takes *onnanī* ‘lying’ if it has a roughly horizontal orientation, as in (61). This includes spherical objects, as in (62):

(61)	*dōni*	*otī*	*mūdu-ga*
	boat	lie.PST.FOC	sea-LOC

‘The boat is at sea.’

DIV_TRPS_LF_20150115_II2, Picture 11

(62)	*bōḷa*	*otī*	*bim̊*	*matī-ga*
	ball	lie.PST.FOC	ground	top-LOC

‘The ball is on the ground.’

DIV_PSPV_LF_20150120_II2, Picture 7

(iii) A legless animate or quadruped

Cain and Gair (2000:29) state that *onnanī* ‘lying’ is used with a legless animate or quadruped. For the former, they give a snake as an example:

(63)	*harufa*	*vina-ga^{n}ḍu*	*matī-ga*	*otī*
	snake	grass-piece	top-LOC	lie.PST.PROG

‘The snake is on the grass.’

Cain and Gair (2000:29); transliteration and glossing adapted

In the TRPS data, an example of *onnanī* ‘lying’ for a quadruped is (64) below:

(64)	*buḷā*	*otī*	*go^{n}ḍi*	*daṣu-ga*
	cat	lie.PST.FOC	chair	under-LOC

‘The cat is under the chair.’

DIV_TRPS_LF_20150220_AR9, Picture 31

(iv) A natural phenomenon

A natural phenomenon such as a season takes *onnanī* ‘lying’:

(65)	*mi=otī*	*vai*	*e^{m}burē*	*mūsum̊*
	DEM1=lie.PST.FOC	wind	turn.IN.PRES.PTCP	season

‘This is the season of changing winds.’

Cain & Gair (2000:29); glossing and transliteration adapted

(v) A container with open side down

An upside-down container takes *onnanī* ‘lying’:

(66)	*ba^{n}ḍiyā*	*otī*	*gas*	*buḍuga^{n}ḍu-ge*	*matī-ga*
	pot	lie.PST.FOC	tree	base-GEN	top-LOC

‘The pot is (upside-down) on the tree stump.’

DIV_PSPV_LF_20150120_II2, Picture 12

However, in accordance with category (ii) above (singular inanimate with horizontal orientation), (66) could also be used for a pot lying on its side. In either case, the pot is not standing upright – upright orientation requires the use of *hunnanī* ‘standing’ (see §4.4.2).

(vi) A fruit detached from the tree

A fruit detached from the tree takes *onnanī* 'lying', though in many cases this coincides with category (ii) above (singular inanimate with horizontal orientation). An example is (67) below:

(67)	*āfalu*	*otī*	*taṣi*	*terē-ga*
	apple	lie.PST.FOC	vessel	inside-LOC

'The apple is in the bowl.'

DIV_TRPS_LF_20150220_AR9, Picture 2

In contrast, a fruit still attached to the tree takes *innanī* 'sitting' (see §4.4.3) while fruits in the plural take *hunnanī* 'standing' regardless of their position (see §4.4.2).

(vii) A hanging object

With the exception of fruit on a tree, an item hanging from or over another object generally takes *onnanī* 'lying':

(68)	*kōṭu*	*otī*	*hedun̊*	*aḷuvā*	*haruga^{n}ḍu-ga*
	coat	lie.PST.FOC	clothing	hang.CVB	shelf-LOC

'The coat is on the rack.' (lit. 'clothes-hanging shelf')

DIV_TRPS_LF_20150115_II2, Picture 9

(69)	*vāga^{n}ḍu*	*otī*	*gofiga^{n}ḍu-ga*	*aḷuvā=fa*
	rope	lie.PST.FOC	branch-LOC	hang.CVB=SUC

'The rope is hanging over/from the branch.'

DIV_PSPV_LF_20150120_II2, Picture 33

4.4.5 Other positional and existential verbs

In addition to the positional/postural verbs described above, the verbs *tibenī* 'being' and *uḷenī* 'being, living' are generally used for animates, but do not imply any particular posture. The verb *tibenī* 'being' is generally used for plural animates (including animals):

(70) *fanifakusa-tak̊* ***tibī*** *fāru-ga*

bug-PL **be.PST.FOC** wall-LOC

‘The bugs are on the wall.’

DIV_TRPS_LF_20150115_II2, Picture 52

Gnanadesikan (2017:265-266) observes that *uḷenī* ‘being, living’ has an inherently durative sense:

(71) *mi=fada* *grūp-tak̊* *nuvata* *gēng-tak̊* *māle-ga* ***uḷenī***

DEM1=kind group-PL or gang-PL Malé-LOC live.PRES.FOC

varaṣ̊.ves *minivan.kam-ā-eku-ga=eve*

very.much freedom-COM-with-LOC=END

‘Such groups or gangs **exist** in Malé with a lot of freedom.’

Gnanadesikan (2017:266); glossing adapted

Finally, *vanī* ‘being, becoming’ is very occasionally used in locative statements:

(72) *kurumattu* *ferāt-aṣ̊* ***vanū*** *gaha*

front side-DAT **be.PRES.FOC** tree

‘The tree would **be** to the front side.’

DIV_MT_LGd_20140108_4_2_MM3_HS4_W, 3:27

Although these three verbs do not imply any particular posture, they are used in the same kinds of locative/existential descriptions as the postural verbs described in the previous sections. And like the postural verbs described in the previous sections, these verbs are also used for a variety of grammatical functions beyond the scope of this thesis – for example, *uḷenī* ‘being, living’ can mean ‘try to’ following an infinitive or can express habitual aspect when following a converb (Gnanadesikan 2017:225–226; Reynolds 2003:42).

4.4.6 Problem cases and discussion

A small number of descriptions elicited with the TRPS and PSPV defy classification into any of the categories listed in the previous sections. For example, not all vertically oriented objects take the verb *hunnanī* ‘standing’, as mentioned briefly in §4.4.2. One type of exception is for hanging or dangling objects, which take *onnanī* ‘lying’ as discussed in §4.4.4. But in some cases vertical objects take *onnanī* ‘lying’ even if they are not obviously hanging, as in the case of a (vertically oriented) stick perceived to have been nailed or similarly affixed to a tree trunk:

(73)	*da^{n}ḍi-ga^{n}ḍu*	*otī*	*gahu-ga*	*haru*	*lā=fā*
	stick-piece	lie.PST.FOC	tree-LOC	firm	put.CVB=SUC

‘The stick has been fixed to the tree.’

DIV_PSPV_LF_20150120_II2, Picture 55

What is surprising about (73) is that it does not use *innanī* ‘sitting’, which is generally used for attachment scenes (except ‘hanging’ relationships). It is possible that in the image which prompted the description (PSPV Picture 55), the stick was in fact perceived to be hanging, though on the basis of my consultants’ reports and on the basis of the photograph in question, this seems unlikely. Another possibility is that *onnanī* ‘lying’ is preferred simply because the stick in the image is quite long – long objects tend to take *onnanī* ‘lying’ unless standing on their base (in which case they take *hunnanī* ‘standing’). Alternatively, it could be that *innanī* ‘sitting’ tends to be used for canonical rather than non-canonical attachment.

Another interesting case is that of a flag flying from a flagpole, which is described with *hunnanī* ‘standing’:

(74)	*dida*	*hurī*	*da^{n}ḍī-ge*	*kuri-aș̊*	*nagā=fa*
	flag	stand.PST.FOC	stick-GEN	top-DAT	take.CVB=SUC

‘The flag has been raised to the top of the flagpole.’

DIV_TRPS_LF_20150115_II2, Picture 56

Although the flag in (74) is longer horizontally than vertically, it is presumably perceived as ‘standing’ because of its upright position which is canonical for flags. The salience of this position appears to prompt *hunnanī* ‘standing’, even though either *innanī* ‘sitting’ or *onnanī* ‘lying’ might seem appropriate on account of the flag being tied to the flagpole at one end. A further consideration that may be relevant is the fact that the flag is perceived (and indeed described) as having been raised along the pole’s vertical axis in order to arrive at its current position. This may be seen as a ‘standing’ process that attracts the verb *hunnanī* ‘standing’, unlike some other scenes featuring attached or hanging objects.

The third category for *onnanī* ‘lying’ in §4.4.4 (‘legless animate or quadruped’) may also need to be reviewed given that fish take the verb *innanī* ‘sitting’:

(75)	*mas*	*inī*	*ṭēnku-ge*	*terē-ga*
	fish	sit.PST.FOC	tank-GEN	inside-LOC

‘The fish is inside the tank.’

DIV_TRPS_LF_20150115_II2, Picture 32

While the use of *onnanī* ‘lying’ for a fish is possible, it would generally suggest that the fish has died, according to my consultants. It therefore appears that the use of *onnanī* ‘lying’ for legless animates and quadrupeds relates more to having support from underneath the body rather than to the number of legs per se. Example (75) might also suggest that suspension in liquid is another category for *innanī* ‘sitting’, though further evidence of this is still required.

For some scenes, the two consultants used different positional/postural verbs. One consultant used *innanī* ‘sitting’ (perhaps under the fifth category, ‘close attachment’) for a large number of scenes from the stimuli, including a ring on a finger, a balloon tied to a stick, a jewel on a necklace, an apple on a skewer, a cigarette between a pair of lips, a belt around a waist, a headband around a head, chewing gum stuck to the underside of a table, and a cork in a bottle. However, the other consultant preferred *onnanī* ‘lying’ or *hunnanī* ‘standing’ for these scenes, for reasons that were not always clear. Some drawings are slightly ambiguous as to whether the objects are in mid-air or on a flat surface, which may account for some of the differences. In addition, some scenes fulfil certain criteria belonging to other verbs – for example, the cork in the bottle is in an upright position, prompting *hunnanī* 'standing' despite the attachment relationship. In many cases, however, it is difficult to account for the variation.

A particularly surprising finding is the use of different verbs for a few scenes that showed an animal actually sitting. One consultant (AR9) used *innanī* 'sitting' for TRPS Picture 6 (dog sitting outside a kennel) but the other consultant (II2) used *onnanī* 'lying' for the same scene. For TRPS Picture 31 (cat sitting under a table), however, AR9 used *onnanī* 'lying' and II2 used *innanī* 'sitting'. This suggests that actual posture does not necessarily determine the choice of positional/postural verb in Dhivehi. Even for human referents, the choice of positional/postural verb is often at odds with actual posture. In the Man and Tree game (see §5.2), for example, many descriptions of the toy man in the photos used *innanī* 'sitting', even though the man is clearly standing in the photos.[75] Clearly, the use of positional/postural verbs in Dhivehi requires further investigation still.

4.5 Motion

This section concerns the expression of motion events in Dhivehi. I address the encoding of source and goal (§4.5.1), motion through topological space (§4.5.2), manner and path of motion (§4.5.3) and the use of certain directional verbs (§4.5.4). Data is drawn primarily from Route Description data (see §5.3.1 for methodology) and from a telling of the 'Frog Story' by a speaker of standard Dhivehi, though a few examples presented in this section are from direct elicitation sessions as well as from previous works on the language.[76] The 'Frog Story' is a story developed by a native speaker consultant based on the book *Frog, where are you?* (Mayer 1969), a picture book without any printed text. The story is about a boy and his dog as they search for a pet frog. Many of the illustrations depict movement and action scenes (such as an owl flying out of a tree), and so they are effective at eliciting descriptions that encode path and/or manner of motion (e.g., Slobin 2004).

[75] A search for *mīhā hurī* 'the person is (standing)…' and certain tense and dialect variations revealed 413 tokens, while a search for *mīhā inī* 'the person is (sitting)…' and variations revealed 207 tokens.
[76] The Frog Story and elicited data was collected in August 2015 from a Dhivehi speaker living in Melbourne.

4.5.1 Source and goal

In Dhivehi, the ‘source’ of a motion path is marked by the ablative/instrumental case suffix -*n̊* (allomorphs -*in̊*, -*un̊*). This generally translates as ‘from’ or ‘out of’, as in (76) below:

(76)	*gahu-ga*	*in̊*	*lōvaḷ-**un̊***	*nukutī*	*bakamūn-ek̊*
	tree-LOC	sit.PST.PTCP	small.hole-**ABL**	exit.PST.FOC	owl-INDF

‘**Out of** the small hole in the tree came an owl.’

DIV_FrogStory_Me_20150821_AH3, Picture 14

The same ablative/instrumental marking appears on nouns indicating an intermediate point in a more complex route, or for a point that is passed on the way to the ultimate goal:[77]

(77)	*ãã*	*kanāt̊*	*farāt-aṣ̊*	*goho*	*mi=i*^{n}*dī*	*dūñu*
	yes	right.hand	side-DAT	go.IMP	DEM1=sit.PRES.PTCP	bird.GEN

kairi-n̊	*dūñ=ā*	*bampar-ā*	***dētere-in̊***	*goho*
near-ABL	bird=CONJ	speed.bump-COM	**between-ABL**	go.IMP

‘Yes, go to the right-hand side, **(by) near** the bird which is here, (then) go **(by) between** the bird and the speed bump’

DIV_RD_LF_20131119_3_4_IS1_MH1_NW, 0:29

The ‘goal’ of a motion path is marked in Dhivehi by the dative case suffix -*aṣ̊*:

[77] A similar syncretism of ‘route’ and ‘source’ paths with ablative case is attested in some other Indo-Aryan languages (see Pantcheva 2011:198–202 for Hindi and Persian).

(78)	*bok̊*	*āilāy-aṣ̊*	*alvadān̊*	*kiya-mun̊,*
	frog	family-DAT	goodbye	call-SIM

	kujjāy=ā	*kutt=ā*	*gey-**aṣ̊***	*danī*
	child=CONJ	dog=CONJ	house**-DAT**	go.PRES.PROG

‘Saying goodbye to the frog family, the child and the dog are going home.’

DIV_FrogStory_Me_20150821_AH3, Picture 28

(79)	*kujjā*	*galu-ge*	***macc-aṣ̊***	*arai=gen̊*	*bok̊*	*hōdanī*
	child	rock-GEN	**top-DAT**	climb.CVB=SUC	frog	search.PRES.PROG

‘The child is searching for the frog after climbing **on top of** the rock.’

DIV_FrogStory_Me_20150821_AH3, Picture 17

Note that the dative in Dhivehi is used to indicate that the figure actually comes into contact with the stated goal, or even enters inside the goal. If the figure only reaches a point close to the goal, the dative instead attaches to one of the relational nouns *kairi* ‘near’ or *gāt̊* ‘near’. This is especially the case where the goal is a human (cf. Gnanadesikan 2017:63). An example of dative marking attaching to a relational noun instead of a human goal is shown in (80) below:

(80)	*dekun-aṣ̊*	*mi=mīhunnā*	***gāt-aṣ̊***
	south-DAT	DEM1=person.COM	**near-DAT**

‘to the south, **to near** us’

DIV_RD_LMm_20140101_2_3_AH2_AAR2_NNE, 1:38

For some place names such as *Māle* ‘Malé’, the dative suffix is commonly omitted:

(81)	*e=daturu-ga*	*mamma=ves*	*diya*	*mi*	***māle***
	DEM3=journey-LOC	mother=EMPH	go.PST.3	FILL	**Malé**

‘On that trip, even mother also went, um, **(to) Malé**.’

DIV_O_LK_20131230_1_YAR1_Yoosuf's story_N, 0:44

In addition to expressing the relation TO, the Dhivehi dative may be used to express the illative function INTO:

(82)	*fullā*	*kulliakaṣ̊*	*huṭṭum-un̊,*	*kujjāy=ā*	*kuttāy=ā*
	deer	suddenly	stop.GER-ABL	child=CONJ	dog=CONJ

fenga^{n}ḍ-aṣ̊	*veṭṭenī*
puddle-DAT	fall.PRES.PROG

‘When the deer stops suddenly, the child and the dog fall **into the puddle**.’

DIV_FrogStory_Me_20150821_AH3, Picture 22

4.5.2 Motion through topological space

A range of relational nouns and converbs are used in motion descriptions in Dhivehi. Many of these are the same as those described in §4.3 for static topological relations. For example, the relational noun *mati* ‘top’ with ablative/instrumental marking is used to express the relation OVER:

(83)	*goho*	*e=rī^{n}dū*	*eccu*	***mattun̊***	*lai=gen̊*
	go.IMP	DEM3=yellow	thing.GEN	**top.ABL**	put.CVB=SUC

‘Go by passing over that yellow thing.’ (lit. ‘…by the top of that yellow thing’)

DIV_RD_LF_20140313_1_3_MA9_HU1_NE, 0:15

Similarly, *kairi* ‘near’ with ablative/instrumental marking is used in route descriptions to express motion BY or VIA a ground object (cf. also (77) in the previous section):

(84)	*rat̊*	*kulaige*	*eccu*	***kairin̊***	*mi=danū*	*i^{n}gē?*
	red	colour.GEN	thing.GEN	**near.ABL**	DEM1=go.PRES.PROG	TAG

‘(I’m) going by near the red-coloured thing, OK?’

DIV_RD_LF_20140313_1_4_HU1_MA9_NE, 1:00

The relational noun *dētere* ‘between’ with ablative/instrumental marking expresses motion between two ground objects (cf. also (77)):

(85)	*hāl=ā*	*rī^{n}dū*	*kulaige*	*eccā*	***dētere-in̊***	*lā=fa*
	rooster=CONJ	yellow	colour.GEN	thing.COM	**between-ABL**	put.CVB=SUC

mi=danū	*i^{n}gē?*
DEM1=go.PRES.PROG	TAG

‘I’m going by passing **between** the rooster and the yellow-coloured thing, OK?’

DIV_RD_LF_20140313_1_4_HU1_MA9_NE, 0:24

The relation THROUGH is expressed with the ablative/instrumental of the relational noun *(e)tere* ‘inside’. This is mostly restricted to motion ‘through’ an enclosed space, however; it is not typically used, for example, to express an intermediate point along a path (as in the English use of *through* in *you drive through Adelaide on the way to Perth*) – this would instead be expressed with bare ablative/instrumental marking on the noun that denotes the intermediate point, as described in §4.5.1. An example of *etere-in̊* ‘inside-ABL’ is shown in (86) below:

(86)	*huḷa^{n}g-aṣ̊*	*mi=i^{n}dī*	*foṭṭu*	***etere-in̊***	*vannānū*
	west-DAT	DEM1=sit.PTCP	box.GEN	**inside-ABL**	enter.FUT.PROG

‘(It) will be entering **through** (lit. ‘by the inside of’) the box which is here to the west.’

DIV_RD_LD_20140316_4_4_IS6_HI1_N, 1:30

The relation UNDER in Dhivehi is expressed with the ablative/instrumental of *daṣu* ‘bottom’:

(87)

mi=danū	…	*vāt̊*	*farātu*	*huri*	*rat̊*
DEM1=go.PRES.PROG		left.hand	side.LOC	stand.PST.PTCP	red

kulai-ge	*etī-ge*	***daṣun̊***
colour-GEN	thing-GEN	**bottom.ABL**

'(I) am going…**under** the red-coloured thing which is on the left-hand side.'

DIV_RD_LF_20140313_1_4_HU1_MA9_NE, 1:08

The relation AROUND is expressed in Dhivehi with the verb *vaṣanī* 'encircling'. Typically this verb combines with the auxiliary verb *lanī* (lit. 'putting') in a compound verb formation:

(88)

dekunu	*kanu*	*malu*	*kairin̊*	***vaṣā***	***lā=fa***
south	corner.LOC	flower.GEN	near.ABL	**encircle.CVB**	**put.CVB=SUC**

gos	*hā*	*kurimatī-ga*	*mi=maḍu*	*koṣ̊*	*lī*
go.CVB	rooster	front-LOC	DEM1=calm	do.CVB	put.PST.3

'**After going around** the flower at the southern corner, (it) stopped in front of the rooster.'

DIV_RD_LD_20131129_3_4_MI1_IM1_W, 0:16

A participial construction headed by *got̊* 'way' is used to describe motion construed as proceeding in a straight line:[78]

[78] Note that in this example and many subsequent examples, *vī* 'be.PST.3' following an infinitive has a modal function and is translated as 'have to…'.

(89)

kuri-aş̊	***dā***	***got-aş̊***	*gos*	*gēṭu*	*vaṣā*
forward-DAT	**go.PRES.PTCP**	**way-DAT**	go.CVB	gate	encircle.CVB

lān̊	*vī*
put.INF	be.PST.3

‘After going **straight** forward, (you) have to go around the gate.’ (lit. ‘going in the going way…’)

DIV_RD_LD_20131204_2_2_AS1_AS2_W, 1:18

Another way to describe a straight path is with the adverb *sīdalaş̊* ‘straight’:[79]

(90)

vāt̊	*farāt-aş̊*	*huri*	***sīdal-aş̊***	*dān̊*	*vū*
left.hand	side-DAT	stand.PST.PTCP	**straight-ADVZ**	go.INF	be.PST.3

‘(You) should go **straight** to the left-hand side.’

DIV_RD_LF_20131118_1_4_AR1_KZ1_NW, 3:17

Motion construed as running in a diagonal path may be expressed by the adjective *kati* ‘diagonal, not straight’ with the adverbializing suffix *-koş̊* (a grammaticalization of the converb of *kuranī* ‘doing’) or else with the dative suffix *-aş̊*. These possibilities are shown in (91) and (92) respectively:

(91)

den̊	***kati-koş̊***	*lā=fa*	*umān̊*	*vū*
then	**diagonal-ADVZ**	put.CVB=SUC	come.INF	be.PST.3

‘Then (you) should come by passing **diagonally**.’

DIV_RD_LF_20131118_1_3_KZ1_AR1_NW, 4:27

[79] Alternatively, *sīdalaş̊* may be analyzed as the adjective *sīdā* ‘straight’ (*sīdāl* underlyingly) with the dative suffix *-aş̊*. Adverbs in Dhivehi are a limited class, and adverbial functions are typically carried out by case-marked nouns. It is often unclear whether these are lexically adverbs or just an adverbial use of case-marked nouns (cf. Cain & Gair 2000:31; Gnanadesikan 2017:119-120).

(92)	*e*^{n}*burēn̊*	*vū*	*miskit-ā*	*vī*	*faḷiyaṣ̊*
	turn.IN.INF	be.PST.3	mosque-COM	be.PST.PTCP	part.DAT

kuḍa-koṣ̊	***kaccaṣ̊***
little-ADVZ	**diagonal.DAT**

'(You) should turn a little bit **diagonally** to the mosque side (of the board).'

DIV_RD_LMm_20140101_3_4_AS4_ML1_NNE, 0:30

4.5.3 Manner and path of motion

There are many ways in which languages vary in their expression of motion events, though an important typological distinction (following Talmy 1985; 2007) is that between 'satellite-framed' and 'verb-framed' systems. The distinction essentially relates to how a language tends to encode the *path* of motion. In a satellite-framed language like English, path is characteristically expressed outside the verb, in separate particles or 'satellites' (e.g., *fly <u>out</u>*, *run <u>in</u>*, *swim <u>through</u>*, etc.). The verb root generally encodes the *manner* of motion. In contrast, verb-framed languages like Spanish express path in the verb root, relegating manner of motion to a separate adjunct clause or satellite.[80]

In Dhivehi, path and manner of motion are encoded in a way that is fairly typical of verb-framed languages. Path of motion is expressed in the main verb root, while manner of motion is encoded by converbs, which are syntactically subordinate. This is similar to the use of participles in Spanish and other Romance languages, which is considered a verb-framing strategy in Talmy's typology.[81] Furthermore, like in other verb-framed languages, manner of motion in Dhivehi often goes unexpressed, as indicated by the parentheses around the converb in (93) below:

[80] More recently, some researchers have proposed amendments to Talmy's original typology, in light of languages which appear to be neither satellite-framed nor verb-framed (e.g., Slobin 2004 adds a category of "equipollently-framed" languages in which manner and path are expressed by equivalent grammatical forms, such as separate verb roots in serial verb languages). Others have suggested that all such typologies are somewhat inadequate, and that variation in the encoding of motion events emerges from more basic lexical and grammatical factors that are independent of motion (Beavers, Levin & Tham 2010).

[81] Tamil is also a verb-framed language (Pederson 2006), as is Hindi (Narasimhan 2003). Verb-framing may therefore be a common pattern in South Asian languages, though some languages of the region (including Indo-Aryan ones) also exhibit other patterns (see, e.g., Feiz 2011 for a "mixed typology" in Persian).

(93)	*kujjā*	*(duve=fa)*	*ge-in̊*	*nukumejje*
	child	(run.CVB=SUC)	house-ABL	exit.PRF.3

‘The child has run out of the house.’

DIV_elicited_Me_20150822_AH3, Sentence 7

The omission of such a converb is especially common where the manner of motion is unimportant, unknown, or obvious from the context. Thus, in (94)-(96) below, manner of motion is not expressed because the various animals are all moving canonically (i.e., in the relevant scenes of the Frog Story picture book, the rat is depicted as crawling and the bees and owl as flying):

(94)	*bal-un̊*	*nukutī*	*mīdal-ek̊*
	hole-ABL	exit.PST.FOC	rat-INDF

‘Out of the hole came a rat.’

DIV_FrogStory_Me_20150821_AH3, Picture 11

(95)	*kuḷa^{n}duru*	*hata-in̊*	*kuḷa^{n}duru*	*nukunnanī*
	bee	hive-ABL	bee	exit.PRES.PROG

‘The bees are coming out of the beehive.’

DIV_FrogStory_Me_20150821_AH3, Picture 12

(96)	*bakamūnu*	*kujjāyā*	*dimāl-aṣ̊*	*annanī*
	owl	child.COM	direction-DAT	come.PRES.PROG

‘The owl is coming towards the child.’

DIV_FrogStory_Me_20150821_AH3, Picture 16

When manner of motion is expressed in Dhivehi, it is possible for the converb encoding manner of motion to be accompanied by *gos* (L. *goho*) ‘go.CVB’ or *ais* (L. *afū* or *ahū*) ‘come.CVB’ in addition to a finite verb encoding path:

(97)

dūni	*uduhi=fa*	*gos*	*koṭari*	*terey-aṣ̊*	*vadejje*
bird	fly.CVB=SUC	go.CVB	room	inside-DAT	enter.PRF.3

‘The bird flew into the room.’ (lit. ‘By flying and going, the bird entered the room.’)

DIV_elicited_Me_20150822_AH3, Sentence 9

(98) Fuvahmulah Dialect:

haulu	*uduhī=fē*	*goho*	*eggamaha*	*jehī*
cock	fly.CVB=SUC	go.CVB	land.DAT	hit.PST.FOC

‘The cock reached the land by flying.’ (lit. ‘By flying and going, the cock reached the land.’)

Fritz (2002:257); transliteration and glossing adapted

Although the inclusion of *gos* ‘go.CVB’ is not obligatory in sentences of this kind, my consultants reported that they do find it preferable. Thus, a somewhat more idiomatic version of (93) above is as follows:

(99)

kujjā	*duve=fa*	*gos*	*ge-in̊*	*nukumejje*
child	run.CVB=SUC	go.CVB	house-ABL	exit.PRF.3

‘The child has run out of the house.’ (lit. ‘By running and going, the child has exited the house.’)

DIV_elicited_Me_20150822_AH3, Sentence 6

According to my consultants, there is no difference in meaning between (93) and (99). It is also possible for the converb expressing manner of motion to take the successive particle *-gen̊* rather than *-fa* (another successive particle), again with no apparent difference in meaning. However, if *-gen̊* is used, the inclusion of *gos* ‘go.CVB’ (or *ais* ‘come.CVB’) does become obligatory:

(100)

dūni	*uduhi=gen̊*	*gos*	*koṭari*	*terey-aṣ̊*	*vadejje*
bird	fly.CVB=SUC	go.CVB	room	inside-DAT	enter.PRF.3

‘The bird flew into the room.’ (lit. ‘By flying and going, the bird entered the room.’)

DIV_elicited_Me_20150822_AH3, Sentence 10

(101) *

dūni	*uduhi=gen̊*	*koṭari*	*terey-aṣ̊*	*vadejje*
bird	fly.CVB=SUC	room	inside-DAT	enter.PRF.3

‘The bird flew into the room.’ (lit. ‘By flying, the bird entered the room.’)

DIV_elicited_Me_20150822_AH3, Sentence 11

Like *-fa*, *-gen̊* is a particle (or possibly a suffix) that attaches to converbs in clause chains and certain adverbial clauses. The main function of both particles is to denote temporal succession, but there is a difference in aspect between *-fa* and *-gen̊*. As Cain and Gair (2000:41) observe, the use of *-gen̊* generally indicates “an activity that is complete prior to the time of the main verb, and the emphasis is on the activity itself” whereas converbs with *-fa “*can also indicate a complete activity, but the emphasis is on the resultive state that is of immediate relevance to the matrix predicate” (see also Gnanadesikan 2017:291-295 for discussion). In terms of motion event descriptions, this difference in aspect presumably explains the more restricted behavior of *-gen̊*: except for in the special construction with *gos* ‘go.CVB’ or *ais* ‘come.CVB’ exemplified in (97)–(100), converbs with *-gen̊* appear to be too strongly associated with prior completion of the action denoted by the converb. Since in (93) the child is still running (or has just started running) at the time of exiting the house, a converb in *-gen̊* is therefore not possible without the inclusion of *gos* ‘go.CVB’. Finally, Dhivehi converbs sometimes appear without *-fa* or *-gen̊*, though not all speakers accept a ‘bare’ converb encoding manner of motion in the kind of construction shown in (102):

(102) ?

dūni	*uduhi*	*koṭari*	*terey-aṣ̊*	*vadejje*
bird	fly.CVB	room	inside-DAT	enter.PST

‘The bird flew into the room.’ (lit. ‘By flying, the bird entered the room.’)

DIV_elicited_Me_20150822_AH3, Sentence 12

4.5.4 Directional verbs: *aranū* and *erenū* in Laamu

Dhivehi has a number of directional verbs used in motion descriptions. The most general of these is *danī* (L. *danū*) ‘going’, and other common directional verbs include *annanī* (L. *umanū*) ‘coming’, *nukunnanī* (L. *nukunnanū*) ‘exiting’, *vannanī* (L. *vannanū*) ‘entering’, *faibanī* (L. *faibanū*) ‘descending’, and *aranī* (L. *aranū*) ‘climbing up’. The involitive (see §1.2.1) of the verb *aranī* ‘climbing, going up’ is *erenī* (L. *erenū*), which has also taken on the additional senses of ‘entering’ or ‘climbing in from above’ (cf. Reynolds 2003:48), or more generally ‘descending into (a bounded space)’. Examples of *aranī* ‘climbing, going up’ and *erenī* ‘descending into, going down’ are given in (103) and (104) below:

(103)	*haruga^{n}ḍu*	*mattun̊*	*mi=**aranū***
	ladder	top.ABL	DEM1=**go_up.PRES.PROG**

‘(I’m) **climbing** over the ladder.’

DIV_RD_LD_20140319_2_4_MS5_IM3_N, 1:30

(104)	*ãã*	*atiri*	*huri*	*koṣuga^{n}ḍu*	*mattun̊*	…	*e=dētereyaṣ̊*
	yes	beach	stand.PST.PTCP	enclosure	top.ABL		DEM3=between.DAT

erēn̊	*vū*	…	*e=de*	*koṣuga^{n}ḍu*	*dētereyaṣ̊*
go_down.INF	be.PST.3		DEM3=two	enclosure	between.DAT

‘Yes, over the (fence of the) enclosure which is (towards) the beach… (you) should **go down** in between that (enclosure)…between those two enclosures (fences).’

DIV_RD_LF_20131125_2_1_MA2_AY1_NE, 1:55

In Laamu, the verbs *aranū* ‘going up’, and *erenū* ‘going down’ are also used to denote motion in certain directions in horizontal space, though the precise semantics of these verbs varies between Fonadhoo and other islands in the atoll. In most islands in Laamu, *aranū* ‘going up’ is used for motion towards but not past the interior of the island, especially when the source of the motion path is in the sea (either the lagoon or ocean) or at the waterfront. On the other hand, *erenū* ‘going down’ is used for motion towards the sea, especially when the goal of the motion path is in or close to the water. This is represented in Figure 4.5 below for the island of Dhanbidhoo, which is representative of most islands in Laamu in this respect.

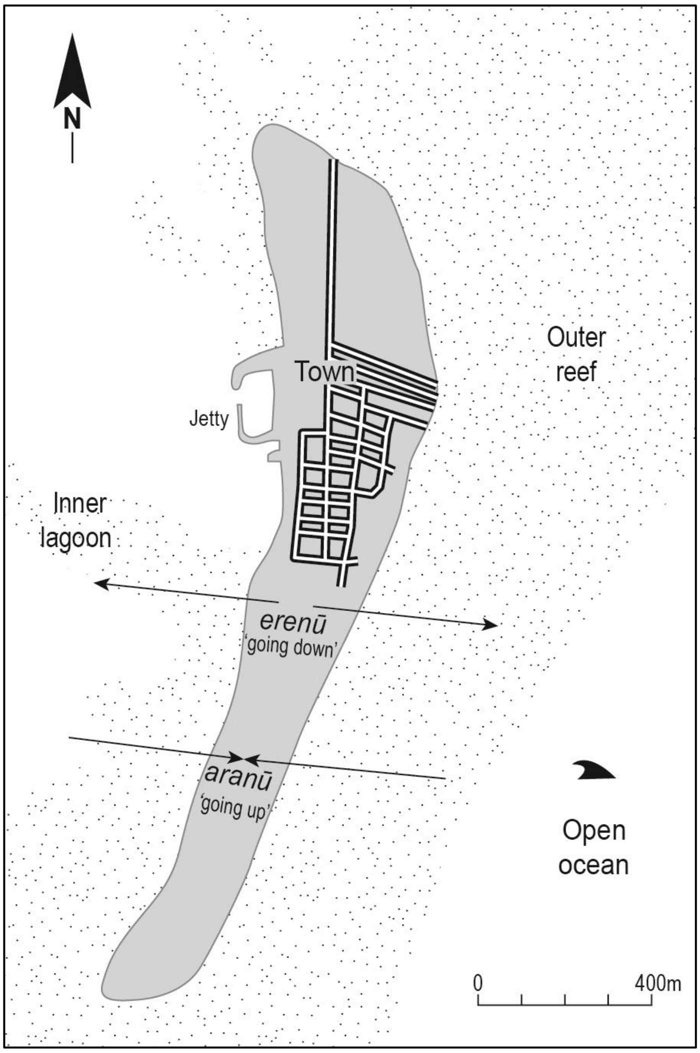

Figure 4.5: Map of Dhanbidhoo showing directions indicated by the verbs *aranū* 'going up' and *erenū* 'going down'

Thus, to say that one is going ashore, one says *eggamaṣ̊ aranū* 'going up ashore', but to say that one is going to the sea (from land), one says *mūdaṣ̊ erenū* 'going down to the sea'. In some islands, speakers also use the compound verbs *gengaranū* 'taking (something) up' and *gengerenū* 'taking (something) down' – these denote caused motion in the directions already described for *aranū* 'going up' and *erenū* 'going down' respectively. An example of *aranū* 'going up' being used for motion in an inland direction is provided in (105) below. The example was recorded in Dhanbidhoo, at an indoor location slightly inland but closer to the west/lagoonward side than to the east/oceanward side of the island:

(105)	*e=tan-uǹ*	*irumaccaṣ̊*	***arai=geǹ***	*ais*	*gē-ge*
	DEM3=place-ABL	east.DAT	**go_up.CVB=SUC**	come.CVB	house-GEN

dekunu	*kanu-ga*
south	corner-LOC

‘From there, coming by **climbing up** east, at the southern corner of the house.’

DIV_RD_LD_20131129_3_2_MI1_IM1_W, 0:46

A further example is from a part of a narrative in which the protagonist, a man called Kalhakuru, has just returned from fishing. After throwing his share of the catch into some bushes near the shore, he returns to his home (inland) to speak with his wife:[82]

(106)	*ukā*	*lā=fa*	*mi=danū*	***arai=geǹ***
	throw.CVB	put.CVB=SUC	DEM1=go.PRES.PROG	**go_up.CVB=SUC**

‘After throwing away (his share of the catch), (he) is now **going up (inland)**.’

DIV_O_LF_20131222_Kalhakuru_and_the_five_thieves_part_2, 5:48

The horizontal uses of these verbs evidently relate to their primary vertical senses, as the sea and beach are physically lower than the inland area of an island.[83] In horizontal space, *aranū* may at first have been used only for motion from water (or beach) to land, in keeping with the vertical sense of the verb; later it may have come to be used more generally for motion in an inland direction. Similarly, it is reasonable to suppose that *erenū* going down' was at first used only for motion *into* the water (in keeping with the sense of ‘descending into’), but later also for motion *towards* the water from inland.

In Fonadhoo, however, the system is slightly different: *aranū* ‘going up’ is used for motion from the water to the land, or from the *lagoon* shore to anywhere on land, even right up to the ocean shore; *erenū* ‘going down’ is used for motion towards the lagoon from

[82] Although this example is from Fonadhoo, which has a slightly different system (see Figure 4.6), it illustrates the use of *aranū* ‘going up’ for motion in an inland direction from the shore, which is common to all islands in Laamu.

[83] Although the difference in elevation here is only very slight (less than a metre for most islands), it is still reasonably salient in comparison to the flatness of the water and the flatness of the land.

anywhere on land, and for motion into the ocean from the ocean shore. This is illustrated below in Figure 4.6:

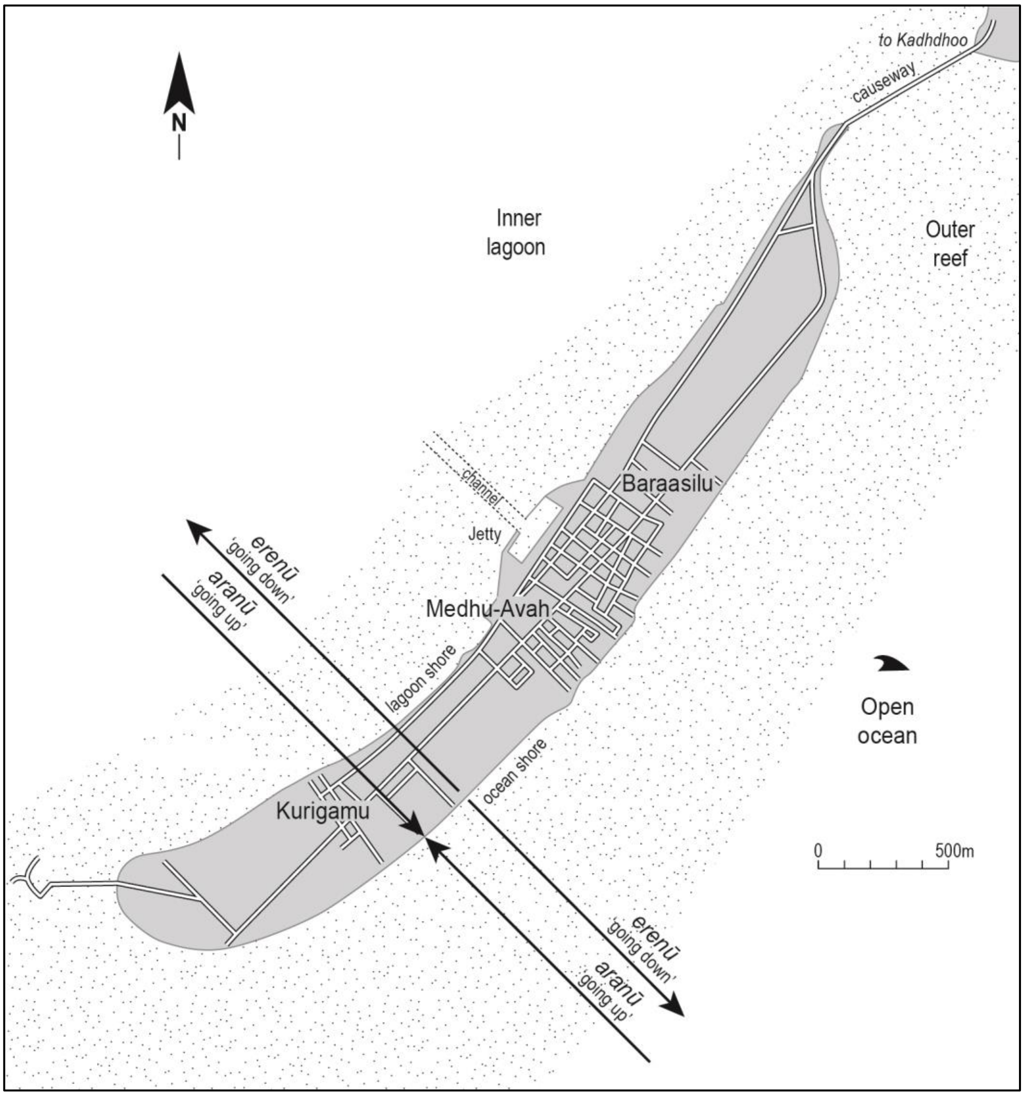

Figure 4.6: Map of Fonadhoo showing directions indicated by the verbs *aranū* 'going up' and *erenū* 'going down'

As is the case in other islands, the verbs *aranū* ‘going up’ and *erenū* ‘going down’ in Fonadhoo are usually combined with an explicit source and/or goal that provide additional information about the path. For example, the school in Fonadhoo is located near the lagoon shore, and so as the goal in a motion description, *sukūl-aṣ̊* ‘school-DAT’ collocates with the verb *erenū* ‘going down’: *sukūlaṣ̊ erenū* ‘going down to school’. The slightly different system in Fonadhoo can be explained by considering the topography of the island – up until the 2004 Indian Ocean tsunami, the oceanward side of Fonadhoo reportedly had a small ridge that stood about a metre higher than the inland area. Thus, *aranū* ‘going up’ in

Fonadhoo referred to travelling towards this ridge, while *erenū* ‘going down’ referred to travelling away from it, or else to movement into the water from anywhere on the island. These verbs have come to collocate with certain sources or goals such as the school (mentioned above), and the system continues to be used more than a decade after the tsunami.

When in the vicinity of the former ridge, however, *erenū* ‘going down’ is vague between two different directions, as shown in Figure 4.6 above, though speakers generally mention the goal of the motion event anyway, and so there is rarely confusion. An example is (107) below (recorded near the former ridge), in which the goal *atiri koḷaṣ̊* ‘to the beach end’ invites an oceanward interpretation which is indeed interpreted correctly by the interlocutor:[84]

(107)	*kairin̊*	*a*^{n}*barā*	*lai=gen̊*	***erēn̊***	*vū*	***atiri***	***koḷaṣ̊***
	near.ABL	turn.CVB	put.CVB=SUC	**go_down.INF**	be.PST.3	**beach**	**end.DAT**

‘After turning around near (the flower), (you) should **go down to the beach end** (of the flower).’

DIV_RD_LF_20131221_2_1_FH1_MA4_NW, 3:25

At the same location, it is also possible to construe the inland direction as ‘up’ (as in other islands), since the area is in a kind of crossover zone where the directions denoted by *aranū* ‘going up’ and *erenū* ‘going down’ start to switch (with respect to their compass bearings). This is especially the case if the stated goal is *eggamaṣ̊* ‘inland.DAT’, which collocates with *aranū* ‘going up’ regardless of the source location, as exemplified in (108) below, also recorded in Fonadhoo:

[84] Note that although *atiri* ‘beach’ can technically refer to any beach on the island, without further specification it is generally understood as the nearest beach to the deictic centre – in this case, the beach on the ocean side.

(108)	*mihāru*	*mi=**aranū***	***eggamaṣ̊***	*i*^{n}*gē?*
	now	DEM1**=climb.PRES.PROG**	**inland.DAT**	TAG

‘Now (I’m) going up inland, OK?’

DIV_RD_LF_20131221_2_1_FH1_MA4_NW, 2:42

Given the (historical) topographic difference between Fonadhoo and other islands in Laamu, it appears that the verbs *aranū* ‘going up’ and *erenū* ‘going down’ share largely the same semantics throughout the atoll: *aranū* ‘going up’ denotes motion to(wards) the part of the island that is perceived as highest, while *erenū* ‘going down’ denotes motion away from the highest part to(wards) lower areas. In most islands in Laamu, the inland area is perceived as being higher, even though in reality it may only be several inches higher than waterfront areas. In Fonadhoo, however, the oceanward side of the island had a small but prominent ridge that was perceived as the highest part of the island, as explained above, and this presumably brought about the different system in Fonadhoo. Although the oceanward ridge was flattened out by the 2004 tsunami, *aranū* ‘going up’ and *erenū* ‘going down’ in Fonadhoo had already come to collocate with certain landmarks like the school, and so the verbs continue to reflect the former topography of the island. This may have interesting theoretical implications, since it appears to show that in Fonadhoo at least, the directions invoked by *aranū* ‘going up’ and *erenū* ‘going down’ no longer relate purely to the vertical dimension, and have some of the abstractness associated with absolute directions (see §2.4.3.1 for a discussion of abstractness in absolute FoR systems). However, it should be noted that the primary senses of these verbs remain bound to the vertical axis, and that their secondary, horizontal uses are somewhat limited in a number of ways. For one thing, the use of *aranū* ‘going up’ and *erenū* ‘going down’ is entirely optional, and it is also perfectly idiomatic to use a more general motion verb *danū* (M. *danī*) ‘going’ or *umanū* (M. *annanī*) ‘coming’ instead. Also, when *aranū* ‘going up’ and *erenū* ‘going down’ are used, they tend to occur with an explicit source and/or goal, such that it is unidiomatic to simply say, for example, *ma erenū* to mean ‘I’m going towards the beach’. Finally, the source for *aranū* ‘going up’ and the goal for *erenū* ‘going down’ is almost always a location in or very close to the water, in keeping with the primary, vertical senses of these verbs.

Another interesting implication relates to the very fact that topography motivates the use of *aranū* ‘going up’ and *erenū* ‘going down’. On the face of it, it may seem odd that elevation should provide the basis for directional verbs on atoll islands (which are some of the flattest places on earth), rather than more unique features such as the asymmetry between the lagoon and ocean sides of islands. But in such a flat environment, even slight differences in elevation may be very salient to inhabitants, and this seems to be the case in Laamu. The verbs *aranū* ‘going up’ and *erenū* ‘going down’ might therefore be taken to provide some support for a broad interpretation of Palmer’s (2015) Topographic Correspondence Hypothesis (see §3.4.1), though Palmer did not predict a directional system based on elevation for the Maldives. I return to this point in the conclusion to this chapter.

4.6 Frames of reference

This section aims to describe the linguistic expression of spatial frames of reference (FoRs) in Dhivehi. The literature on spatial language and cognition contains several different definitions and classifications of FoRs, many of which were discussed in Chapter 2. Recall that in general, however, FoRs may be understood as strategies for representing the location, orientation or path of one object (the ‘figure’) with respect to another element (the ‘ground’), especially when the figure is separated from the ground and requires angular specification (i.e., the figure is not in contact with the ground, as for many topological relations). As I showed in Chapter 2, four main FoRs can be distinguished, with each having a number of distinct subtypes. The intrinsic FoR locates the figure purely in terms of an intrinsic facet of the ground object, such as its ‘front’ (e.g., ‘the ball is in front of the house’). The relative FoR typically employs the same vocabulary as the intrinsic FoR, but relies upon the viewpoint of the speaker or some other observer in order to assign the relevant facets (e.g., ‘the ball is in front of the tree from my perspective’). The absolute FoR is anchored on ‘fixed’ directions in the environment that are not anchored on a particular landmark – for example, a system of cardinal directions. Finally, the landmark-based FoR involves directions towards or away from some landmark in the environment, such as the location of a mountain or the sea, or in some cases even the speakers themselves. In this section I address how Dhivehi expresses each of these FoRs in turn, before discussing an interesting use of ‘front’ and ‘back’ terms that has properties of both the intrinsic and landmark-based FoRs. Data presented in this section is drawn mainly from the Man and Tree and Route Description games (see §5.2.1 and §5.3.1.1 for methodology).

4.6.1 Intrinsic frame of reference

Intrinsic FoR in Dhivehi is expressed with a number of relational nouns which refer primarily to body parts or facets:

vāt̊	‘left hand’
kanāt̊	‘right hand’
kurimati (L. *kurumatu*)	‘front’
fahat̊	‘back, rear’
furagas (L. *furagaha*)	‘back (esp. of an animate)’
bit̊-doṣ̊	‘back (esp. of furniture)’

For the most part, these terms pattern like ordinary Dhivehi nouns in that they attract the usual case marking and may also function as core arguments. Since they refer primarily to the parts or facets of an object, they closely resemble the topological relational nouns discussed in §4.3.3. Like those relational nouns, intrinsic FoR terms usually take locative case in descriptions of static location, and follow a genitive-marked ground NP. Although the Dhivehi terms for ‘front’ and ‘back’ literally refer to facets, they may also refer to adjacent regions in space, as in (109) below:

(109)	***mīhā***	***kurumattu***	*gaha*	*hurū*	*dō?*
	person.GEN	**front.LOC**	tree	stand.PST.FOC	TAG

‘The tree is **in front of the person**, yeah?’

DIV_MT_LF_20131216_1_2_SA1_MK1_NE, 3:38

When used in FoRs, the terms *vāt̊* ‘left hand’ and *kanāt̊* ‘right hand’ usually modify a more general relational noun such as *farāt̊* ‘side’, *koḷu* ‘end’ or *faḷi* ‘section, part’:

(110)	***kanāt̊***	***farātu***	*in̊*	*gaha*
	right.hand	**side.LOC**	sit.PST.PTCP	tree

‘the tree which is **on the right-hand side** (of the person)’

DIV_MT_LD_20131130_1_1_MM1_HS1_N, 1:32

Sometimes other body parts are also used in this way:

(111)

mīhā	*nagai=gen̊*	*mi=danī*	*ekkala*	*hālu-ge*	…
person	take.CVB=SUC	DEM1=go.PRES.PROG	that	rooster-GEN	

fi^{n}dafat̊	***farāt-un̊***
tail	**side-ABL**

'Having taken the (toy) person, I'm going by that rooster's…**tail side**.'

DIV_RD_LD_20140316_2_3_HAQ1_UA1_N, 0:16

It is also not uncommon in Dhivehi to describe the figure as being simply 'on one side' of the ground object. This is not a FoR per se as it does not project an angular search domain (though see Palmer 2003 for a discussion of a possible "unoriented" FoR). However, at least one Dhivehi term for 'side' appears to refer only to left and right sides and not to front or back sides:

(112)

esora-ge	***ek̊***	***arumattu***	*gaha*	*hurū?*
he-GEN	**one**	**flank.LOC**	tree	stand.PST.FOC

'The tree is **on one flank** of him?'

DIV_MT_LF_20140313_1_2_HU1_MA9_NE, 2:28

The term *arimati* (L. *arumatu*) might therefore be translated as 'flank' as in (112), and poses an interesting classificatory problem. On the one hand, the term is not as vague as a more general word like *farāt̊* 'side', but on the other hand, it still does not invoke a singular search domain like *vāt̊* 'left hand' or *kanāt̊* 'right hand'. Rather, it specifies an axis (left to right, or 'transverse') along which the figure may be located, and in effect projects two search domains at once, in opposite directions out from the ground object. Because this still represents a narrowing of the total possible search area in horizontal space, and because this particular narrowing relies on the intrinsic features of the ground object, I consider examples like (112) to fall under the intrinsic FoR.[85]

[85] This is not to suggest that the term *arimati* 'flank' can only be used in an intrinsic way – in fact, the term was also sometimes in the Route Description game (see §5.3.1) for the flanks of certain symmetrical objects

4.6.2 Relative frame of reference

Like most languages that have a relative FoR, Dhivehi employs a selection of its intrinsic FoR vocabulary for the relative FoR too. In particular, the terms *vāt̊* ‘left hand’, *kanāt̊* ‘right hand’, *kurimati* ‘front’ and *fahat̊* ‘back’ may be used in the relative FoR, especially in contexts where the ground is not perceived as having its own left, right, front or back sides. However, other terms from the intrinsic FoR, such as *furagas* ‘back (of an animate)’ or *fi*^{n}*dufat̊* (L. *fi*^{n}*dafat̊*) ‘tail’, are rarely if ever used in a relative sense, perhaps because the search domain they would invoke is already covered by the other, more general left/right/front/back (LRFB). For terms that can invoke either FoR, in many cases only context determines which FoR is intended, and misunderstandings sometimes occur even among close friends or family members speaking the same dialect of the language. As a general rule, when the ground is a faceted item such as an animate or vehicle, most speakers use and interpret these terms in an intrinsic way, though not always – (113) below is an example from a Route Description game in which *kanāt̊* ‘right hand’ is used in a relative rather than an intrinsic sense (the route passes by the rooster’s own left-hand side, which is actually the right-hand side from the speaker’s viewpoint). The use of the relative FoR here may have been motivated by the fact that the same FoR was just used in relation to the yellow hill in the scene.

(113)	***vāt̊***	***farāt-un̊***	*afū*	*mi=inū*	*ek̊nan̊*	*hāl-ek̊*
	left-hand	**side-ABL**	come.IMP	DEM1=sit.PST.FOC	TAG	rooster-INDF

	hālu-ge	***kanāt̊***	***farāt-un̊***
	rooster-GEN	**right.hand**	**side-ABL**

‘Come by the **left-hand side** (of the yellow hill), there’s a rooster here isn’t there? By the **right-hand side of the rooster** (from my perspective).’

DIV_RD_LF_20131221_1_2_Z1_AZ1_NW, 0:41

It is not clear whether the use of the relative FoR for a ground that has intrinsic LRFB sides is actually infelicitous in Dhivehi or whether it is merely unusual. Some speakers

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that lacked intrinsic fronts, backs, lefts or rights (e.g., the yellow ‘hill’). In such cases, *arimati* ‘flank’ picks out the left or right of an object from the viewer’s perspective, and thus invokes the relative FoR (see §4.6.2). However, the key point is that the term only refers to facets on an object’s left-right axis (regardless of how that left-right axis is assigned), but does not specify whether it is the left facet or the right facet.

report that examples like (113) are incorrect. On the other hand, many speakers prosodically mark the ground NP in some way if they wish to promote an intrinsic interpretation, suggesting they recognize an ambiguity. Note that there is no difference in grammatical construction between intrinsic and relative FoRs in Dhivehi, in partial contrast to English which can distinguish between *the rooster's right side* (strongly implicates intrinsic FoR) and *the right side of the rooster* (more ambiguous between intrinsic and relative FoRs). However, Dhivehi speakers sometimes explicitly draw attention to the fact that they are describing the scene from a certain viewpoint, thereby putting any ambiguity to rest:

(114)	*gaha*	*hunnanū*	***i*^{n}*ba-ge***	*vāt̊*	*farātu*
	tree	stand.PRES.FOC	**you-GEN**	left.hand	side.LOC

‘The tree is on **your** left-hand side (of the man in the photo).’
DIV_MT_LF_20131218_1_1_AA1_IU1_NW, 4:48

Note that (114) above is formally identical to a ‘direct FoR’ description, i.e., an intrinsic FoR description with a speech-act participant as the ground (cf. §2.3.3). However, (114) was used during the Man and Tree game, in reference to one of the photos in front of the participants. Thus, there was no way that the tree could be interpreted as being on the intrinsic left of the hearer, and so the construction could usefully disambiguate between relative left and intrinsic left with the toy man as the ground. In contrast, where it was necessary to clarify that a particular description should be interpreted with the intrinsic FoR, speakers always mentioned the ground (and of course, there is no viewpoint that can be mentioned in the intrinsic FoR), and typically also emphasized the ground prosodically.

Another common method for prompting a relative interpretation over an intrinsic one is shown in (115) below. In this case, a clause translating roughly to “when we are (sitting) here the way we are” effectively tells the hearer to calculate ‘left’ from her own (and the speaker’s) viewpoint, rather than from the intrinsic coordinates of the toy man in the photograph.

(115)	*gaha*	*mi=hirū*	*vāt̊*	*farātu*	*i^{n}gē?*	***mi=mīhun̊***
	tree	DEM1=stand.PST.FOC	left.hand	side.LOC	OK?	**DEM1=person.PL**

mi=tibi	***got-aṣ̊***	***tibī***	***iru***	*vāt̊*	*farātu*
DEM1=be.PST.PTCP	**way-DAT**	**be-PST.PROG**	**when**	left.hand	side.LOC

‘The tree is here on the left-hand side, OK? On the left-hand side w**hen we are here the way we are**.’

DIV_MT_LF_20131125_1_1a_KZ1_AR1_NE, 0:17

As discussed in §2.2.2, three subtypes of the relative FoR may be distinguished (following Levinson 2003:84–89). In the ‘reflectional’ subtype used in English and many other languages, the viewer’s coordinates are reflected onto the ground object such that the ground’s front is at the near side and its ‘back’ at the far side, while the ‘left’ and ‘right’ sides are the same as the viewer’s. The ‘translational’ subtype more simply projects the viewer’s coordinates forward onto the ground object, so that the ground’s ‘front’ is at the far side and its ‘back’ is at the near side – the opposite of the reflectional system – but the ‘left’ and ‘right’ sides remain aligned with the viewer’s. Finally, the ‘rotational’ subtype rotates the viewer’s coordinates 180 degrees when projecting them onto the ground object, as if the ground were another person facing the viewer (such that the ‘back’ is near, the ‘front’ is far, and the ‘left’ and ‘right’ sides inverted from the viewer’s perspective).

Dhivehi appears to use both the reflectional and translational variants of the relative FoR. In the Object Placement Task, most participants predominantly placed the figure object according to the translational system (see §5.3.4 for a more detailed presentation of the results from this task). However, a preference for the translational system was not clearly observed in the data from director-matcher tasks such as the Man and Tree game (see §5.2), where the reflectional system was more common at least for static arrays. This might suggest the existence of certain physical or visual factors affecting the selection of one system over the other in Dhivehi, as is the case in Hausa (Hill 1982) and Tongan (Bennardo 2000). Alternatively, the discrepancy may suggest that the reflectional subtype is preferred by just those individuals who are comfortable enough with the relative FoR to use that strategy in discourse, whereas in the Object Placement Task, speakers who perhaps rarely or never use the relative FoR are compelled to interpret the LRFB terms in some way or another, and mostly settle upon a translational interpretation.[86] The implications of this finding are interesting – it suggests that the translational subtype of the relative FoR may be conceptually antecedent to the reflectional subtype, since the former is adopted as the default interpretation by those who tend not to use the relative FoR at all. Nonetheless, I do not mean to explain away the translational results from the Object Placement Task as simply a matter of participants guessing at a solution on the fly. While this was probably true in some cases, many participants produced translational responses without hesitation, and gave no suggestion that they could have interpreted the instructions in any other way. Furthermore, in separate conversations with informants who did not participate in the task, it was pointed out to me a number of times that 'front' and 'back' terms in Dhivehi can refer to far and near sides respectively. This all suggests that the translational relative FoR is more than an artifact of the task, though it is difficult to tell whether it is actually the dominant subtype in Dhivehi.

Part of the difficulty relates to the analytical challenges of coding Dhivehi LRFB (left/right/front/back) terms as belonging to the relative FoR to begin with (as opposed to the intrinsic FoR), and then with the various FoR subtypes. In some cases the context and stimuli can clarify which FoR is intended, but much of the time it is hard to tell for sure. For example, when the toy man is facing the same way as the speaker and has a tree on his left, a description that says "the tree is to the left of the man" could be analyzed as intrinsic FoR, reflectional relative FoR or translational relative FoR. Furthermore, in the Route Description data, the ground object to which an LRFB term relates is sometimes unclear as speakers are describing a complex path through a variety of objects. The analysis is also bedeviled by the existence in Dhivehi of the 'FIBO' system (see §4.6.5) which employs the same 'front' and 'back' terms as the intrinsic and relative FoRs. Thus, although there are examples of both the translational and reflectional subtypes in the data, these are not the only or even the main uses of 'front' and 'back' terms in Dhivehi.

[86] Among the 88 locative descriptions from the Man and Tree game that involved a reflectional relative FoR, only 37 were from speakers in Laamu (the rest were from speakers in Malé and Addu), none of whom actually participated in the Object Placement Task. Most of the relevant tokens came from just four speakers.

4.6.3 Absolute frame of reference

4.6.3.1 Basic cardinal and intercardinal directions

Like many languages, Dhivehi has a system of four main cardinal directions supplemented by intercardinal directions. The intercardinal terms are compounds of the cardinal terms:

uturu	'north'
dekunu (L. *dekonu*, *dekona*)	'south'
iru, *irumati* (L. *iru*, *iramati*)	'east'
huḷa^{n}*gu*	'west'
iru-uturu	'northeast'
iru-dekunu (L. *i.-dekonu*, *i.-dekona*)	'southeast'
huḷa^{n}*gu-uturu*	'northwest'
huḷa^{n}*gu-dekunu* (L. *h.-dekonu*, *h.-dekona*)	'southwest'

The cardinal and intercardinal terms pattern as relational nouns in that they inflect for case and may be used in Dhivehi's basic locative construction (cf. §4.3.5.1), as in (116) below. Additionally, they may modify more general relational nouns such as *farāt̊* 'side' and *koḷu* 'end', as in (117).

(116) *gahu-ge dekon-aṣ̊ mīhā=ves hurī*
tree-GEN south-DAT person=EMPH stand.PST.FOC
'The person is also to the south side of the tree.'
DIV_MT_LD_20131130_2_1_MT1_MA3_W, 4:37

(117) *mīhā inī* ***dekonu koḷu-ga***
person sit.PST.FOC **south end-LOC**
'The person is at the **southern end**.'
DIV_RD_LD_20140316_2_3_HAQ1_UA1_N, 0:11

The Dhivehi system of cardinal directions is based on the east-west path of the sun, which has only a very small degree of seasonal fluctuation in the Maldives due to the country's proximity to the equator. One of the terms for 'east', *iru*, also literally means 'sun' and is probably a shortening of the phrase *arā iru* (L. *aran̊ iru*) ‘rising sun’, a phrase which is still sometimes used for that direction. The other commonly used term *irumati* (L. *iramati*) is transparently a combination of *iru* ‘sun’ with the relational noun *mati* ‘top’, so the term translates literally to ‘on the sun’. The term for ‘west’, *huḷa*^{n}*gu,* is also the name for the southwest monsoon that affects the Maldives for the majority of the year (April to December). Formerly this term probably meant ‘wind’ (cf. Sinhala *huḷa*^{n}*ga* ‘wind’) before it came to refer more specifically to the prevailing winds and associated monsoon season, and then also to the cardinal direction nearest to the direction from which such winds blow.[87] As directional terms both *iru(mati)* ‘east’ and *huḷa*^{n}*gu* ‘west’ appear to be relatively recent innovations, and perhaps emerged sometime between the 17th and 19th centuries according to the small amount of evidence available from historical texts. A ‘paper grant’ manuscript from the late 19th Century uses *irumati* ‘east’, but a manuscript from 1666 instead uses the now obsolete term *fūrubba* (cf. Sanskrit *pūrvā* ‘east’), as well as the obsolete *fakusama* for ‘west’ (cf. Sanskrit *paścima*).[88] The same manuscript also uses *uttara* (cf. Sanskrit *uttara*), an earlier version of the modern *uturu* ‘north’, and *dakuṣana* (cf. Sanskrit *dakṣiṇa*), which developed into the modern *dekunu* ‘south’. The system of Dhivehi cardinal directions therefore goes back to Sanskrit, with new terms for ‘east’ and ‘west’ innovated perhaps as recently as a few centuries ago.[89]

Despite being anchored to the sun’s path, on some islands the cardinal directions are ‘rotated’ by up to about 45 degrees such that they align with local topography. Fonadhoo, for example, is oriented northeast-southwest, and the local usage of cardinal directions is calibrated to the axis of the island: *uturu* ‘north’ points to what is actually northeast, *iru* or *iramati* ‘east’ points to what is actually southeast, *dekona* ‘south’ points to what is actually southwest, and *huḷa*^{n}*gu* ‘west’ points to what is actually northwest (see Figure 4.8 in §4.6.4.1 for a diagram of various geocentric directions in Fonadhoo). However, speakers

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[87] Although the southwest monsoon winds tend to come from approximately the southwest rather than ‘true’ west, the term *huḷa*^{n}*gu* as a direction refers specifically to the latter, i.e., the direction of the sunset. This 45 degree conceptual shift may have developed under the influence of the solar path and the existing system of four main cardinal directions at right angles.

[88] A ‘paper grant’ is an official document written on vellum or paper (in contrast to copper plate grants), typically for the conveyance of property. See Sattar (2009) for the paper grants in question (‘Chief Queen Kanba Aisha’s inheritance’ and ‘Grant written by Ali Maafaiy the scribe’).

[89] Note that the evolution of *huḷa*^{n}*gu* from ‘wind’ to ‘west’ is quite unusual from a typological perspective. In Brown’s (1983) sample of 127 languages, only three have a term for ‘west’ and/or ‘east’ associated with wind. In contrast, approximately 45% of languages in the sample have ‘east’ or ‘west’ terms that are derived from terms describing the path of the sun.

are aware that these rotated uses do not correspond with the ‘true’ or ‘real’ cardinal directions, and regard them only as an approximation of the latter.

The cardinal directions played a number of important roles in traditional Maldivian culture. Houses were constructed in a rectangular shape along an east-west axis with verandas facing north or south, in order to protect the interior from the harsh tropical sun and the monsoon rains (Jameel 1992). The inner chamber of a traditional house had two beds which were referred to as the ‘north bed’ (*uturu e*^{n}*du*) and ‘south bed’ (*dekunu e*^{n}*du*) (Jameel 1992:49; Reynolds 2003:47; Saudiq 2004:16), and the verandas of a house were also referred to as ‘northern’ or ‘southern’ (e.g., Saudiq 2004:37–38). Navigation was one of the basic skills taught to children (Saudiq 2004:20), and was obviously of vital importance to fishermen and traders, who had to sail hundreds of kilometres around dangerous reefs and across the open ocean. Maldivians depended on annual trade voyages for staples such as rice (Romero-Frías 2003), and finding and keeping track of one’s bearings was critical for the success of such voyages. The modernization and urbanization of the Maldives which began in the 1950s has seen immense changes to architectural patterns, urban planning, education and transportation, and knowledge of cardinal directions is no longer a necessary part of everyday life. Younger Maldivians use cardinal terms rarely or not at all, and many are unable to point to the directions accurately. However, as I will show in Chapter 5, older people and those living in certain fishing communities continue to use cardinal terms when the need arises, even in small-scale space.

4.6.3.2 Sidereal compass directions

In addition to the four basic cardinal directions and the four intercardinals, Dhivehi has a separate system of 32 sidereal (or stellar) compass directions mostly used for long distance ocean voyaging. The system was almost certainly introduced to the Maldives by Arab and/or Persian seafarers in the medieval period, though it is probable that at least some sidereal directions (with different names) were already being used in the Maldives prior to Arab contact, given that Maldivians have always relied on long-distance trade with ports in India and Sri Lanka. The directions refer to the approximate rising and setting points of various stars and constellations, with the eastern or ‘rising’ directions usually specified by the addition of the term *īrān(u)* and the western or ‘setting’ directions usually specified by the addition of the term *astamān(u).* For example, *ayyūgu īrān̊* is ‘Capella rising’ (i.e., northeast), while *ayyūgu astamān̊* is ‘Capella setting’ (i.e., northwest). However, since the general direction of travel is normally obvious from the context, it is not uncommon for speakers to omit *īrān̊* or *astamān̊*, and to simply give the star name which out of context would be ambiguous between two different directions.

Figure 4.7 below is a diagram of the compass with directions labelled in Thaana script, and the full set of Dhivehi sidereal directions, starting from north and proceeding clockwise, is given in Table 4.2 below. Note that the Arab-Maldivian sidereal compass is different from the European mariner’s compass in that European languages have only four main compass terms which are compounded in various ways to create up to 32 directions, but the Arab-Maldivian system uses 15 unique terms which can be followed either by *īrān̊* or *astamān̊*, plus two stand-alone terms (for ‘north’ and ‘south’), for a total of 32 directions.[90] This system has many similarities with the sidereal compasses used by certain Pacific peoples such as the Caroline Islanders (Goodenough 1953; Halpern 1986), who live at a similar latitude to the Maldives and who also have a strong maritime culture.[91]

[90] However, the term *muri*^{n}*gu* ‘east’/‘west’ is exceptional in that it is more commonly preceded by *arā* ‘rising’ (for ‘east’) or *ossē* ‘setting’ (for ‘west’) rather than taking *īrān̊* and *astamān̊*.
[91] Although the Carolinian compass uses many of the same stars and constellations, an important difference is that the Carolinian directions point to actual rising and setting points on the horizon, whereas the Arab-Maldivian system ‘rounds off’ the directions so that they are evenly spaced around the compass (see Halpern 1986).

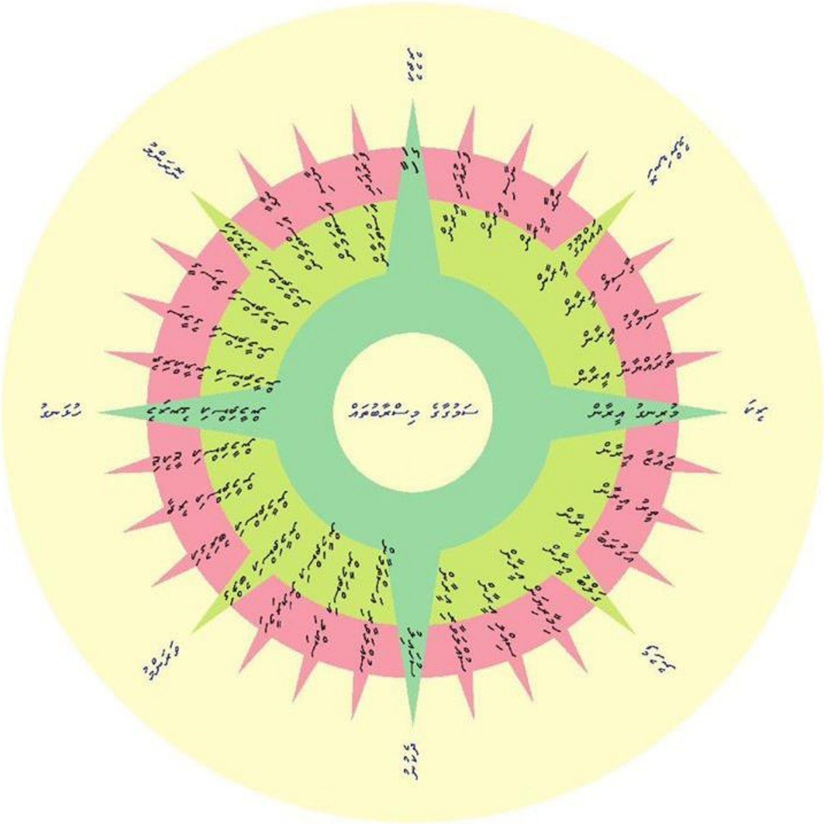

Figure 4.7: Maldivian sidereal compass with directions labelled in Thaana script (used with kind permission of Abdulla Rasheed and Abdulla Zuhury)

Table 4.2: Dhivehi sidereal directions

Dhivehi name	Star/constellation	Bearing	Degrees
gahā	Polaris (Pole Star)	North	0.00
farugadi īrān̊	Ursa Minor rising	N. by E.	11.25
nāsi īrān̊	Ursa Major rising	NNE	22.50
nāgā īrān̊	Cassiopeia rising	NE by N.	33.75
ayyūgu īrān̊	Capella rising	NE	45.00
gāsilu īrān̊	Vega rising	NE by E.	56.25
simāgu īrān̊	Arcturus rising	ENE	67.50
turiyyānu īrān̊	Pleiades rising	E. by N.	78.75
arā muri^{n}*gu* / *muri*^{n}*gu īrān̊*	Altair rising	East	90.00
jauzā īrān̊	Orion’s Belt rising	E. by S.	101.25
tīru īrān̊	Sirius rising	ESE	112.50
agurabu īrān̊	Scorpio rising	SE by E.	123.75
galbu īrān̊	Antares rising	SE	135.00
himāru īrān̊	Centauri rising	SE by S.	146.25
silli īrān̊	Carinae rising	SSE	157.50
sillavāru īrān̊	Achernar rising	S. by E.	168.75
suhailu	Pole of Canopus	South	180.00
sillavāru astamān̊	Achernar setting	S. by W.	191.25
silli astamān̊	Carinae setting	SSW	202.50
himāru astamān̊	Centauri setting	SW by S.	213.75
galbu astamān̊	Antares setting	SW	225.00
agurabu astamān̊	Scorpio setting	SW by W.	236.25
tīru astamān̊	Sirius setting	WSW	247.50
jāzā astamān̊	Orion’s Belt setting	W. by S.	258.75
ossē muri^{n}*gu* / *muri*^{n}*gu astamān̊*	Altair setting	West	270.00
turiyyānu astamān̊	Pleiades setting	W. by N.	281.25
simāgu astamān̊	Arcturus setting	WNW	292.50
gāsilu astamān̊	Vega setting	NW by W.	303.75
ayyūgu astamān̊	Capella setting	NW	315.00
nāgā astamān̊	Cassiopeia setting	NW by N.	326.25
nāsi astamān̊	Ursa Major setting	NNW	337.50
farugadi astamān̊	Ursa Minor setting	N. by W.	348.75

The existence of a highly precise system of this kind in Dhivehi is perhaps unsurprising given the vast expanses of ocean through which Maldivian mariners needed to navigate in order to reach the ports of India and Sri Lanka. Finding one’s way back to a destination in the Maldives was an even greater challenge, partly because of the narrow window provided by the northeast monsoon, which lasts only from December to April, but also because of the considerable risk of becoming shipwrecked on one of the Maldives’ many reefs. In addition, because atoll islands are extremely low-lying, they are difficult to spot from afar.

If a ship were to miss the Maldives altogether on its return journey, the monsoon winds would push it further south and west into the Indian Ocean, where there was little chance of reaching land.[92] A navigational error of even a few degrees becomes greatly magnified over a long distance, and the results can be catastrophic. Some Maldivian sailors report that finding north is a particularly important skill because if you are blown off course in or near the Maldives, you have the best chance of finding land by sailing north (the atolls of the Maldives lie in a long, double chain stretching from north to south, and the Indian and Sri Lankan mainlands are also roughly to the north of the archipelago). A number of stars and constellations can be used to find north in the Maldives, including Polaris (the Pole Star, not visible from many of the more southern atolls), Orion's Belt, and the Big Dipper.

Such was the importance of celestial navigation to Maldivians that even today many older and middle-aged men are able to recite and point to the 32 sidereal directions when prompted, with the same fluency of somebody reciting the days of the week or months of the year. This is knowledge they have retained from their youth, when they received direct instruction in navigational skills and in many cases also participated in trading voyages to Malé and abroad. Traditionally, women rarely took part in such voyages, and so most do not know the sidereal compass points. Younger Maldivians, who have grown up in a new era of mechanized boats, GPS navigational systems, Western-style education, and an increased diversity of economic opportunities, are generally unaware that the Dhivehi sidereal compass even exists, let alone what the directions are and how to locate them in the night's sky.

Although the sidereal directions were mostly used at sea, some Maldivians also use some of the terms on land. In particular, *arā muri^{n}gu* is sometimes used for 'east' and *ossē muri^{n}gu* for 'west', in lieu of the basic cardinal equivalents. Example (118) was elicited from a 45-year-old female civil servant directing a 40-year-old female civil servant in a Route Description game in L. Dhanbidhoo (predominantly a fishing community):

92 See Romero-Frias (2012) for an account of a ship that missed the Maldives on its return voyage but managed to reach the Seychelles.

(118)

den̊	*goho*	*malu-ge*	***ossē***	***muri^{n}g-aṣ̊***
then	go.IMP	flower-GEN	**set.PRES.PTCP**	**Altair-DAT**

‘Then go to the **west (lit. ‘setting Altair’)** of the flower.’

DIV_RD_LD_20140316_1_1_FI1_AA8_N, 0:20

In addition, other sidereal directions may also be used when the context demands greater precision than that provided by the basic cardinal system or by other FoRs. An example is provided in (119) below, in which a 71-year-old man is directing a 68-year-old man in the Man and Tree game in L. Fonadhoo:

(119)

ayyūgu	*farātu*	*gaha*	*bahaṭṭai=gen̊*
Capella	side.LOC	tree	keep.CVB=SUC

ayyūg-aṣ̊	*kurumatu*	*lai=gen̊*
Capella-DAT	front	put.CVB=SUC

‘Keeping the tree on the **Capella** (rising) side (i.e., northeast), (the toy man is) putting his front to **Capella** (rising) (i.e., northeast).’

DIV_MT_LF_20131221_1_2_MU1_MA1_NW, 2:27

4.6.4 Landmark-based frame of reference

4.6.4.1 Topographic landmarks

A number of terms referring to topographic features are used in Dhivehi spatial descriptions. The use of these terms could be analyzed either as the absolute FoR, intrinsic FoR, or as ‘landmark-based’, depending on one’s classification of FoRs (see §2.4 for discussion). In this thesis I classify the use of these terms as landmark-based, since they refer to particular places in the environment and operate in a head-anchored way (see §2.4.4). There is considerable variation in topographic terms between islands and dialects.[93]

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[93] For example, my consultants in Addu report that the terms *hudubit̊* ‘light side’ and *kaḷibit̊* ‘dark side’ are used in that atoll to refer to the lagoon and ocean sides of an island respectively. The two terms are obviously based on the different colours of the water and sand on either side of an atoll island. However, these terms did not appear in any director-matcher space games I recorded in Addu (see §5.2.4.2), and so appear to be used mostly to refer to parts of an island rather than in FoR descriptions.

The following list and discussion is based on the Laamu dialect (though many terms are also used in other dialects):

atiri	‘beach’
eggamu	‘inland, ashore, land’
daṣē	‘lagoon shore’
matifuṣ̊	‘ocean shore’
fuṭṭaru	‘outer reef (on ocean side)’
eterevari	‘inner lagoon’
ka^{n}ḍu	‘open ocean’

The first of these terms, *atiri*, can refer to the beach on either side of an atoll island (i.e., the lagoon side or the ocean side), but without further specification refers to the nearest beach. The term *eggamu* means ‘ashore’, but many speakers also use the term in FoR descriptions for ‘inland’, though the actual inland area of an island is normally referred to as *raṣu-tere* (lit. ‘inside the island’).[94] The terms *daṣē* ‘lagoon shore’ and *matifuṣ̊* ‘ocean shore’ are not used throughout all of the Maldives, and may be unique to Laamu. The former is probably related to *daṣu* ‘bottom’, as the lagoon side of some islands is slightly lower in elevation than the ocean side (cf. §4.5.4). The term *matifuṣ̊* ‘ocean shore’ appears to be a combination of *mati* ‘top’ and *fuṣ̊* ‘side, back side’, the ocean side of some islands being slightly higher and also regarded as the ‘back’ of the island. The term *fuṣ̊* also appears in *fuṭṭaru* (from *fuṣ̊-ṭaru*), ‘outer reef’. The terms *eterevari* ‘lagoon’ and *ka^{n}ḍu* ‘ocean’ are never used in FoR descriptions in my corpus.

Topographic landmark terms are mostly used on land rather than on the water, and the directions they invoke extend only as far as the shore on either side of an island, though *eggamu* ‘inland, ashore’ may also be used on the water. A map of the main geocentric directions and landmarks in Fonadhoo (including the rotated cardinal system discussed in §4.6.3.1) is shown in Figure 4.8 below (note that Baraasilu, Medhu-Avah and Kurigamu are the names of administrative wards in Fonadhoo):

[94] On the other hand, some speakers of other dialects use *eggamu* only for ‘land’ rather than ‘inland’, such that an object would be described as having an *eggamu* side only if part of it were in the sea.

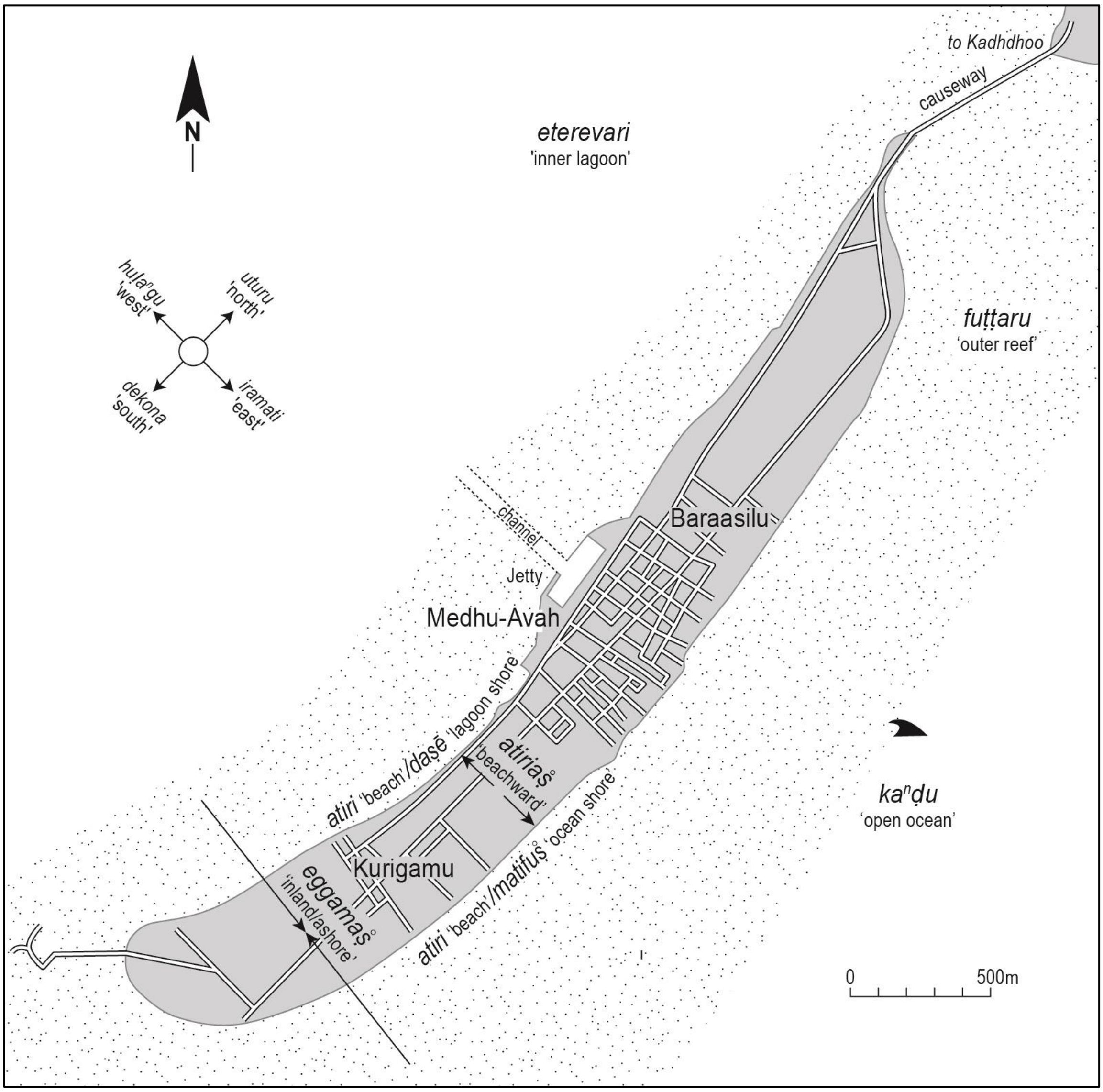

Figure 4.8: Map of geocentric directions and landmarks in Fonadhoo

Unlike some other languages with similar directional axes, the use of topographic directions in Dhivehi is not obligatory or even conventional in motion or locative descriptions. Where a FoR description is necessary, the topographic terms are in competition with other landmarks and the cardinal system, as well as the intrinsic and relative FoRs. In addition, the Dhivehi topographic terms listed above are nouns referring primarily to particular locations on or around an island – their use as more general directions is somewhat limited, and they have also not grammaticalized into clitics, affixes, demonstratives or other grammatical classes, in contrast to the directional terms in some languages.[95] Nonetheless, two of the terms, *atiri* ‘beach’ and *eggamu* ‘ashore, inland’, can participate in a special grammatical construction (see §4.6.4.3 for further details), and all of the listed terms are distinct from most ordinary nouns and place names in that they are able to modify *farāt̊* ‘side’, *koḷu* ‘end’, and similar terms, as in (120) below:

(120)	*rī^{n}dū*	*malu*	***atiri***	***farāt-un̊***	*haraga^{n}ḍu*	***eggamu***	***koḷ-un̊***
	yellow	flower.GEN	**beach**	**side.ABL**	ladder.GEN	**inland**	**end-ABL**

‘By the **beach side** of the yellow flower, by the **inland end** of the ladder.’
DIV_RD_LF_20131221_2_4_MA4_FH1_NW, 2:48

Like most nouns in Dhivehi, the topographic terms listed above can also attract case marking. For example, they take dative case when acting as the goal of a motion or orientation description:

(121)	***matifuṣ-aṣ̊***	*mūna*	*a^{n}burai=gen̊*	*bō*	*mattu*	*gaha*	*inū*
	ocean.shore-DAT	face	turn.CVB=SUC	head	top.LOC	tree	sit.PST.PROG

‘Turning (his) face **to the ocean shore**, the tree is on (his) head.’
DIV_MT_LF_20131216_1_1_MK1_SA1_NE, 6:49

4.6.4.2 Other landmarks

Dhivehi speakers also make spatial descriptions by employing ad hoc landmarks such as place names, buildings, roads, artifacts and even nearby people. These landmarks are used especially for directions perpendicular to the beachward-inland and lagoonward-oceanward axes. For example, inhabitants of Medhu Avah, the central ward in Fonadhoo, often referred to the neighbouring wards of Baraasilu (to the northeast) and Kurugamu (to the southwest) in the Route Description and Man and Tree games – see Figure 4.8 in §4.6.4.1 for the locations of these wards. Inhabitants of Baraasilu and Kurigamu often referred to Medhu Avah for one direction, and to the next island in the chain (Gaadhoo or Kadhdhoo) for the other direction – see Figure 1.3 in §1.2.4.1 for a map of Laamu.

[95] Manam (Oceanic, Papua New Guinea; Lichtenberk 1983:569–584) for example, has a landward-seaward axis expressed by nouns, demonstratives, verbs and verbal suffixes.

When an ad hoc landmark is used to locate a figure with respect to a ground object, the landmark is often expressed in a relative/participial clause headed by a noun such as *farāt̊* 'side':[96]

(122)	*gaha*	*hurū*	*mīhā-ge*	***Barāsil-ā***	***vī***	***farātu***
	tree	stand.PST.FOC	person-GEN	**Barāsil-COM**	**be.PST.PTCP**	**side.LOC**

'The tree is **on the Baraasilu side** of the person.' (lit. 'on the side that is associated with Barāsilu')

DIV_MT_LF_20140330_1_2_AKM1_AM4_NE, 3:00

In another common construction, landmark terms are used with the relational noun *dimā(lu)* 'direction' (see §4.3.3). This relational noun assigns comitative case to the noun that refers to the landmark. The *dimā(lu)* construction is used mostly in orientation descriptions, as in (123) below, but also sometimes in locative descriptions, as in (124):

(123)	***sukūl-ā***	***dimāl-aṣ̊***	*kurumatu*	*lā=fa*
	school-COM	**direction-DAT**	front	put.CVB=SUC

'(the man is) facing **towards the school**'

DIV_MT_LGd_20140108_3_2_YI1_JH1_W, 2:48

(124)	*mihāru*	***sukūl-ā***	***dimāl-aṣ̊***	*gaha*	*e=innanū*
	now	**school-COM**	**direction-DAT**	tree	DEM3=sit.PRES.PROG

'now the tree is **towards the school**'

DIV_MT_LGd_20140108_3_2_YI1_JH1_W, 3:13

In contrast, terms invoking the intrinsic and relative FoRs and cardinal directions (including sidereal directions) all tend to modify *farāt̊* 'side' (or similar nouns) directly instead of appearing in the relative/participial clause or *dimā(lu)* constructions (the topographic terms introduced in the previous section can participate in all three constructions). Some consultants find the use of non-topographic landmark terms as bare

[96] Since Dhivehi does not use relative pronouns, 'relative clauses' in the language are perhaps more accurately described as participial clauses that modify the head noun (see Gnanadesikan 2017:199–201).

modifiers ungrammatical; however, they are sometimes used this way in discourse, as shown for example in (125) below:

(125)	*sukūlu*	*ferāt-aṣ̊*	*kurumatu*	*jahai=gen̊*	*inū*
	school	side-DAT	front	hit.CVB=SUC	sit.PST.FOC

‘(the person) is facing to the **school side**’

DIV_MT_LGd_20140108_1_2_ARY1_AA4_W, 3:19

Speech-act participants (SAPs) are often used as landmarks, and tend to occur in the same kinds of grammatical constructions as other landmarks. An example of a SAP-landmark in the *dimā(lu)* construction is shown in (126) below:

(126)	*mīhā*	*kurumatu*	***mā***	***dimāl-aṣ̊***
	person.GEN	front	**I.COM**	**direction-DAT**

‘The front of the person (is) **towards me**.’

DIV_MT_LF_20131216_2_1b_MA4_FH1_NE, 0:41

Additionally, demonstratives are sometimes used to express SAP-landmark references. In (127) below, for example, the speaker-proximal demonstrative *mi* is used to ask whether the toy man is on the near side of the tree (i.e., the side closer towards the speaker):

(127)	***mi=farātu***	*huḷa^{n}g-aṣ̊*	*balai=gen̊*	*hurū*
	DEM1=side.LOC	west-DAT	look.CVB=SUC	stand.PST.FOC

‘(The man) is **on this side**, looking to the west?’

DIV_MT_LD_20131203_2_1_AU1_AR2_N, 3:06

4.6.4.3 Locative dative construction

Many of the directional terms discussed in the previous sections can also participate in a special grammatical construction I will call the ‘locative dative construction’. In this construction, dative instead of locative marking is used in what is a functionally locative description. This is somewhat similar to the use of the English preposition *to*, which is generally used in motion and orientation descriptions but is also used in certain locative descriptions, as illustrated in the free translation of (128) below:

(128)	***mi=mīhā-ge***	***utur-aṣ̊***	*hurū*	*gaha*
	DEM1=person-GEN	**north-DAT**	stand.PST.FOC	tree

‘**To this person’s north** is the tree.’

DIV_MT_LD_20140320_2_1_HA7_SI1_N, 6:10

Alternatively, one could analyze the *-aṣ̊* suffix here as an adverbializer, since many adverbs in Dhivehi are derived this way (e.g., *bodaṣ̊* ‘greatly’ is from *boḍu* ‘big’ plus *-aṣ̊*).[97] However, it is difficult to tell whether examples like *uturaṣ̊* in (128) are lexically adverbs or whether they are simply a special locative use of nouns marked for dative case (resembling the locative use of the English preposition *to*). I adopt the latter analysis because it is more parsimonious, though for the purposes of this section and chapter, the more important point is that some but not all nouns in Dhivehi may take *-aṣ̊* when acting as the anchor of a locative FoR description.

Nouns that can participate in the locative dative construction include certain topological relational nouns (e.g., *mati* ‘top’, cf. §4.3.3; *farāt̊* ‘side’), LRFB terms, cardinal directions (including sidereal compass directions), and the topographic terms *atiri* ‘beach’ and *eggamu* ‘inland’. Other landmark terms (topographic or otherwise) almost never participate in this construction.[98] In fact, consultants find the use of landmark terms (except *atiri* ‘beach’ and *eggamu* ‘inland’) in this construction ungrammatical. Examples of *atiri* ‘beach’ and *eggamu* ‘inland’ in the locative dative construction are shown below in (129) and (130) and respectively:

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[97] See also Footnote 79 in §4.5.2 as well as Cain & Gair (2000:31) and Gnanadesikan (2017:119-120).

[98] The only exception in my corpus is a single token of *sukūl-aṣ̊* ‘school-DAT’, which was used to locate the tree with respect to the toy man in the Man and Tree game.

(129)	*deň*	*hurū*	***atiri-aș̊***	*gaha*
	then	stand.PST.FOC	**beach-DAT**	tree

‘Then the tree is **beachward** (of the man)’.

DIV_MT_LF_20131216_1_2_SA1_MK1_NE, 3:29

(130)	***eggam-aș̊***	*hurū*	*gaha*
	inland-DAT	stand.PST.FOC	tree

‘the tree is **inland** (of the man)’

DIV_MT_LF_20131216_1_1_MK1_SA1_NE, 4:38

The fact that the locative dative construction allows *atiri* ‘beach’ and *eggamu* ‘inland’ but not nouns referring to other topographic features suggests that the beachward-inland axis may be conceptually more important than the lagoonward-oceanward axis. Grammatically, terms for the lagoon, ocean, and lagoon and ocean shores participate in the same constructions as nouns referring to ad hoc landmarks like buildings. The implications of these grammatical findings for Palmer’s (2015) Topographic Correspondence Hypothesis will be discussed in §4.7 as well as in Chapter 7.

4.6.5 Front = Inner, Back = Outer (FIBO)

There is also another kind of FoR in Dhivehi that is more difficult to classify straightforwardly as intrinsic, relative, landmark-based or absolute. This system makes use of terms for ‘front’ and ‘back’ in reference to a ground object that forms a part of a ring-like formation. The inner side of such an object is perceived as its front, while the outer side is perceived as its back. Thus in the Route Description game (see §5.3.1), Dhivehi speakers commonly used ‘front’ and ‘back’ terms for the inner and outer sides (respectively) of the red blocks, fences, and flowers placed near the edge of the board, as shown in Figure 4.9 below. The grey dotted line (not part of the actual array) shows the perceived ring formed by the red blocks, the sets of fences, and the flowers. The black ovals and text boxes show the ‘fronts’ and ‘backs’ of the various objects in the ring according to this system – for example, the ‘fronts’ of both sets of fences are towards the yellow hill in the centre of the board.

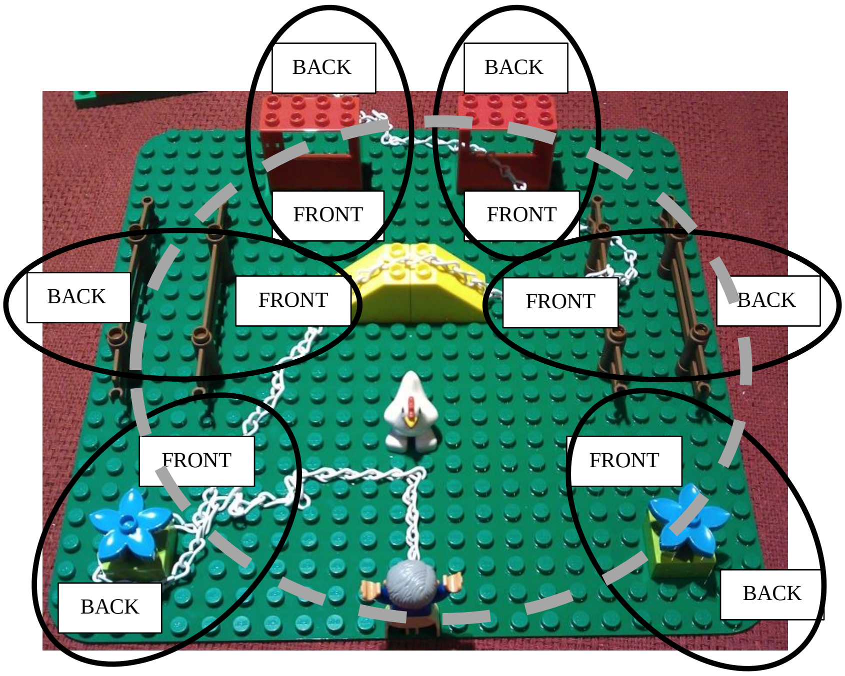

Figure 4.9: ‘FIBO’ (Front = Inner, Back = Outer) in the Route Description game

I will call this system a ‘FIBO’ system (Front = Inner, Back = Outer), and will show that it has certain features in common with both the intrinsic and landmark-based FoRs. However, since the FIBO system uses terminology that is also used by the intrinsic and relative FoRs (in particular, *kurimati* ‘front’ and *fahat̊* ‘back’), it is necessary first to establish that FIBO is not simply intrinsic or relative. The intrinsic FoR is generally characterized as relying on a perceived asymmetry inherent to the ground object (i.e., the ground object is considered to have its own LRFB sides). The FIBO system is different in that the ground object may be symmetrical, and its ‘front’ and ‘back’ are assigned based on the ground’s position within a larger array of objects. The rotational properties of FIBO are also distinct from those found in the intrinsic FoR. For example, if the toy man is ‘in front’ of one of the flowers in Figure 4.9 according to the FIBO system, such a description would remain true even if the ground object (the flower) were rotated. Recall that in contrast, rotation of the ground in the intrinsic FoR renders the proposition false – e.g., for ‘The ball is in front of the chair’, rotating the chair without moving the ball would falsify the description. And while propositions in the intrinsic FoR do remain constant under rotation of the figure-ground array (one can rotate the ball and chair together such that the ball is always at the chair’s front), FIBO relations do not hold under this test (if we rotate the toy man and flower together, the man is no longer at the flower’s front). FIBO is not a subtype of the relative FoR either, simply because ‘front’ and ‘back’ here do not depend in any way upon a viewpoint. If the viewer looks at the array in Figure 4.9 from a different angle, the fronts and backs of the red blocks, fences and flowers remain the same within the FIBO system.

In fact, in terms of how the system operates, FIBO more closely resembles a geocentric FoR. Prima facie, this is surprising – after all, FIBO uses terminology more typical of the intrinsic and relative frames, and the system is not anchored on anything in the external environment. However, if one considers the array of toy blocks in Figure 4.9 to be the environment itself, the system looks like a miniature, ad hoc version of larger landmark systems (see §2.4.4). It is as though the centre of the array is a landmark that defines the ‘front’ and ‘back’ of every item encircling it – the ‘front’ of an item is the side closer to this focal point, and the ‘back’ is the side further away. This would also account for the rotational properties of FIBO, which match those of landmark-based FoRs. As I mentioned above, FIBO relations show constancy under rotation of the viewpoint or ground, but not under rotation of the figure-ground array. Further, translational movement of the figure-ground array would falsify a FIBO proposition (as it does for landmark-based FoRs – see §2.4.4). For example, if one of the red blocks in Figure 4.9 were moved down to near where the flowers are, its front and back sides would ‘switch’.

However, FIBO differs from most landmark systems in that the anchor is not completely independent of the ground object; in fact, the ground’s position within a larger constellation helps to construct the bounded space that makes FIBO possible. That is, if the red blocks, fences and flowers in Figure 4.9 were not arranged in a ring-like formation, there would be little or no basis on which to assign ‘front’ and ‘back’ sides to objects using the FIBO system. Of course, one might still be able to rely on the edges of the green board (which do demarcate a bounded space), but there is evidence from a separate spatial experiment that an independent boundary is not necessary for FIBO (see §5.3.4).

The assignment of *kurimati* ‘front’ and *fahat̊* ‘back’ to the inner and outer sides respectively of objects in a ring-like formation is presumably related to the fact that when asymmetrical items are in such a formation, their fronts canonically face inwards. For example, furniture and appliances inside a room typically face inwards rather than towards the walls, and a group of people in conversation face each other rather than outwards. The FIBO system of front and back assignment (which applies to symmetrical ground objects) may well be modelled on canonical configurations such as these. However, an intriguing further possibility is that the system is also partly motivated by the atoll environment in which Dhivehi is spoken. Although it is more common in Dhivehi to refer to the sides of islands with topographical or cardinal direction terms, it is also possible to talk about the 'front' or 'face' of an island (*raṣegge kurimati*/*mūnu*), and sometimes also the 'back' (*raṣegge fahat̊*). Here, the 'front' or 'face' refers to the inner, lagoonward side and the 'back' refers to the outer, oceanward side. These uses of 'front' (or 'face') and 'back' are intrinsic ones, with the two sides labelled based on functional orientation, as with buildings and certain artifacts – just as the front of a building is the side one enters and the front of a television the side one watches, the front of an atoll island is the side one disembarks on after arriving by boat. This is almost always the lagoon side because of the calmer waters and lack of fringe reef on that side of the island. While the use of front and back terms for island sides is therefore an example of intrinsic FoR motivated by functional orientation, it is quite possible that once such a conceptual system is in place, it contributes to a more general conceptualization of inner sides (of objects in a ring) as 'fronts' and outer sides as 'backs', a conceptualization driven also by the distribution of fronts and backs in certain smaller-scale configurations (people in a circle, furniture in a room, etc.).

If the above conjecture is correct, then the assignment of 'front' and 'back' sides in the FIBO system is ultimately derived from the assignment of fronts and backs in the intrinsic FoR. Just as the intrinsic FoR often assigns front and back sides based on the functional orientation of a ground object, the FIBO system assigns front and back sides based on a presumed functional orientation (inwards) of a ground object that lacks its own inherent front. In effect, it is as though Dhivehi speakers imagine that the objects in the ring formation are like people, artifacts or islands facing inwards, and that any interaction with or between the objects is most likely to take place from within the semi-bounded space. Thus the position of the ground object within a larger configuration provides the basis for a presumed functional orientation of the ground, which in turn motivates the intrinsic-like assignment of front and back sides. In this respect the FIBO system could be considered a special case of the intrinsic FoR, albeit one with the rotational properties of a landmark-based system. Alternatively, it could be viewed as a special type of landmark-based system with a close connection to the intrinsic FoR.

4.7 Typological and theoretical implications

This chapter has presented an account of the main linguistic constructions and vocabulary items for expressing spatial relationships in Dhivehi. Many aspects of spatial language in Dhivehi are highly familiar from descriptions of other languages (such as those in Levinson & Wilkins 2006a), and many features are typical of Indo-European languages and/or South Asian languages more generally. Typologically widespread features include a three-way deictic system, a reliance on relational nouns and a locative case for the expression of a range of topological relations, a small set of positional verbs, verb-framed motion descriptions with sources and goals marked with case suffixes, and the use of multiple frames of reference.

An important finding is that in many ways Dhivehi more closely resembles its Dravidian neighbours than some of its more distant Indo-European cousins such as English. Dhivehi encodes a number of topological relations with converbs, and for many relations that are canonical or for which no suitable relational noun or spatial converb exists, Dhivehi prefers to simply mark the ground for locative case. Both of these patterns are attested in Dravidian (Pederson 2006), but are not present in more familiar Indo-European languages like English or Dutch. Similarly, verb-framed motion descriptions are characteristic of both Dhivehi and Dravidian languages, but Indo-European languages (with the exception of Romance) are generally thought to be satellite-framed (e.g., Talmy 2007:154).

In some areas Dhivehi also diverges from more widely attested patterns. Its spatial demonstratives appear to play a role in person indexation, even for 1st and 2nd person, a finding that may be of typological interest and could be an important topic for future research. Furthermore, although Dhivehi conforms to Levinson and Wilkins' (2006c) generalizations about topological relations, it uses a different subtype of the basic locative construction for the relation OVER, a difference which is not attested in any of the languages in Levinson and Wilkins' sample. Dhivehi's relational nouns are also relatively precise and targeted to specific topological relations, whereas many other languages have terms that conflate various relations (such as the English preposition *on*). Another feature that is unreported in the literature is the assignment of 'front' and 'back' terms to the inner and outer sides of ground objects in ring-like configurations ('FIBO'). Although the Dhivehi FIBO pattern may be highly unusual or even unique, it is in keeping with what we know about 'front' and 'back' terms in languages more generally, as such terms often relate to notions of access and interaction. Similarly, the use of a translational variant of the relative frame of reference is unusual cross-linguistically, but it is a perfectly natural solution and some recent research suggests it may be more widespread than previously assumed, even for speakers of Western European languages (Beller, Bohlen, et al. 2015; Beller, Singmann, et al. 2015; Schlossberg, Lum & Poulton 2015).

Dhivehi's options for expressing frames of reference have significant implications for Palmer's (2015) Topographic Correspondence Hypothesis. Palmer suggests that languages develop geocentric systems based on salient features of the local topography, and predicts for Dhivehi a grammaticized lagoonward-oceanward directional axis resembling those in Marshallese and other atoll-based languages of the Pacific. However, although Dhivehi has terms that refer to the lagoon and ocean sides of islands, and although these terms are sometimes used in FoR descriptions, they behave as regular nouns and are not grammaticized like the directional clitics Palmer observes in Oceanic languages. A strict interpretation of the Topographic Correspondence Hypothesis is therefore not confirmed. It is true that *daṣē* 'lagoon shore', *fuṭṭaru* 'outer reef' and *matifuṣ̊* 'ocean side of an island' are able to directly modify nouns like *farāt̊* 'side', whereas most ad hoc landmarks tend to participate in a different relative clause construction with *farāt̊* 'side', and in this respect there is some evidence for a grammatical specialization of these topographic features. However, *eggamu* 'inland' and *atiri* 'beach (on either side of an island)' can also behave as modifiers, and these nouns also participate in a separate locative dative construction, like cardinal direction and LRFB terms but unlike *fuṭṭaru* 'outer reef', *daṣē* 'lagoon shore' and *matifuṣ̊* 'ocean shore'. If grammatically specialized behavior is to be regarded as indicative of conceptual salience, then an inland-beachward axis and cardinal directions must therefore be considered more important for Dhivehi than the lagoonward-oceanward axis, yet this was not predicted by Palmer.

Of course, this is not to say that Dhivehi's absolute FoR is completely independent of the local environment – on the contrary, absolute FoR vocabulary in Dhivehi is clearly motivated by a range of environmental features. The vast majority of the Maldives is ocean, and Maldivians have long relied on ocean travel for fishing and trade. The need for highly precise and reliable wayfinding techniques at sea would therefore have been vital, and the only available cues in such a context are the sun and the stars. Thus, it should not be surprising that Dhivehi has a system of cardinal directions based on the path of the sun as well as a more refined system of sidereal directions based on the rising and setting points of stars. It is particularly striking that the Arab/Maldivian sidereal compass system closely resembles the sidereal compass of the Caroline Islanders, a seafaring people who inhabit the same latitude as Maldivians (and for whom the night sky therefore looks very similar, cf. Halpern 1986). In addition, given the flatness of atoll islands and the open water, it may at first be surprising that Dhivehi should possess directional verbs that denote changes in topographic elevation (*aranū* 'going up' and *erenū* 'going down'), but one should consider that in such a flat environment, even slight changes in elevation may be highly salient to local inhabitants. Finally, an inland-seaward axis is not uncommon in island and coastal languages, and Dhivehi's inland-beachward axis is very similar to this kind of system, except that it happens to end at the shore rather than extending out into the water. Thus, topography and other environmental features do play a role in absolute FoR in Dhivehi, though Palmer erroneously assumed that the asymmetry between the lagoon and ocean sides of islands would be the main (or even only) environmental phenomenon that could motivate absolute FoR in the language. An interesting question is which of these environmental factors are conceptually more salient. Grammatical behaviour may offer some clues, though as discussed in Chapter 2, grammar is not always a guide to conceptual importance when it comes to FoRs. An arguably more valuable indicator is frequency of usage, a factor that will be addressed in Chapter 5.

5 Frame of reference selection in Dhivehi

5.1 Introduction

5.1.1 Overview and research questions

A principal aim of this thesis is to evaluate hypotheses on the relationship between language, culture, cognition and the environment, using Dhivehi as a case study to shed light on some of the debates introduced in Chapter 3. In Chapter 4 I described the various lexical and grammatical resources Dhivehi has for expressing frames of reference and other spatial relations. In this chapter, I report on the findings of a number of structured linguistic elicitation tasks and experiments that I conducted during fieldwork in the Maldives. In particular, data from the 'Man and Tree' game (§5.2) will be discussed in detail as this task was conducted with the largest sample and proved to be very effective at eliciting frames of reference.

The various tasks aimed to establish which FoRs are habitually used when there is a need to make precise spatial distinctions. The tasks each used different stimuli and were designed to prompt different kinds of spatial descriptions or judgements. The Man and Tree game (§5.2) and Verbal Animals-in-a-row (§5.3.2) elicited mainly locative and orientation descriptions, the Route Description game (§5.3.1) prompted motion descriptions, and the Virtual Atoll Task (§5.3.3) elicited descriptions of movement through larger expanses of space. In addition, the Object Placement Task (§5.3.4) explored how speakers interpret ambiguous LRFB (left/right/front/back) terms and also tested knowledge of certain geocentric directions. To examine FoR use in a more naturalistic context, some narrative data (§5.3.5) was also collected. Although this chapter focuses on the linguistic data from these tasks and narratives, the results will ultimately be compared to the findings of a number of non-linguistic spatial reasoning experiments in Chapter 6.

In order to see whether FoR selection in Dhivehi is influenced by demographic factors (such as age and gender) and/or by contextual factors (such as whether the data was collected indoors or outdoors), it was important to collect data from a diverse cross-section of the population and in a range of conditions. Due to the practicalities of conducting fieldwork, it was not possible to counterbalance all variables perfectly, and so some variables or combinations are represented more than others in the sample. Participants and experiment sites were selected with the following variables in mind:

- Gender (usually two men or two women in each trial)
- Age (ranging from 17-79)
- Island (all inhabited islands in Laamu Atoll, as well as some data from Malé and Addu Atoll)
- Setting (indoors, outdoors in a closed courtyard, or outdoors near the lagoon or ocean)
- Facing direction (in terms of compass directions and the direction of the lagoon)

Some information about each participant's occupation and background was also collected. This included participants' current occupation, any former occupations, their level of education and literacy, how much time they may have spent living in other locations, and whether they speak any foreign languages. The number of participants and their breakdown with respect to the above variables differed from task to task – details on sample sizes will be provided separately in the relevant sections of this chapter.

In this chapter I will show how FoR selection in Dhivehi varies according to some of the variables introduced above. In so doing, I will address the following sets of research questions with respect to Dhivehi:

1. Which FoRs and FoR subtypes are predominant?
2. Do the patterns of FoR use support Palmer's (2015) Topographic Correspondence Hypothesis? Or does the data support Majid et al.'s (2004) claim that FoRs do not straightforwardly correlate with environmental variables? Is there any evidence of an urban-rural divide, as is the case for some languages (see §3.4)?
3. Does FoR selection vary according to age, gender, occupation or other demographic variables? If so, what drives this variation?
4. To what extent does FoR selection vary according to contextual factors, such as which way the speakers happen to be facing or which task they are working on? Do speakers switch between FoRs according to the context, or do they have preferred FoRs that they use across the board?

5.1.2 Basic methodology

5.1.2.1 Rationale

Spatial descriptions were elicited through four tasks that had been carefully designed to maximize the use of spatial language and in particular FoRs. Three of these tasks (Route Description, Man and Tree, Verbal Animals-in-a-row) are similar to elicitation tasks previously employed by researchers of spatial language, while one (the Virtual Atoll Task) is a new tool for eliciting spatial language. All four tasks take the form of two-player games in which the 'director' instructs the 'matcher' to manipulate the stimulus materials in various ways in order to solve the game.

There are some disadvantages to using such elicitation tasks. Senft (2007:240–243) points out that since the tasks are unnatural and contain unfamiliar stimulus materials, it is difficult to know whether the data is representative of the language or whether the data should merely be considered an artefact of the elicitation method. Moreover, when it comes to comparative work, it is practically impossible to create elicitation tasks that can be applied successfully in a range of field sites and in a range of speech communities. Nonetheless, the use of some kind of targeted elicitation is often necessary to collect sufficient quantities of spatial language data (which may not present itself in abundance in more naturalistic text types), and to collect data that is maximally comparable across languages and communities. For these reasons, the majority of the data collected for the present project is elicited using the four main 'space games' introduced above, with supplementary data coming from narratives and direct observation in the field. In addition, native speaker judgements on the semantics of certain spatial terms were collected systematically via the Object Placement Task, as well as more informally through my own conversations with bilingual consultants.

5.1.2.2 Participant recruitment

Suitable participants for the elicitation tasks were identified in consultation with local research assistants, and at some locations, with the assistance of local island councils or research institutions. Potential participants were approached, informed in general terms about the study, and invited to participate at a time convenient to them. For tasks that required a pair of participants, generally two people of the same gender and age group were invited, and in most cases the two people already knew each other. Care was taken to ensure that participants were comfortable during elicitation sessions, and social and religious sensitivities were respected (e.g., sessions were conducted outside of prayer times).

To thank them for their time and cooperation, participants were offered a small gift – a can of tuna or a can of energy drink (or cola) for completing one of the shorter tasks, and/or a bottle of deodorant for completing two tasks or the more time-consuming Virtual Atolls Task. These gifts were chosen on the advice of a local research assistant, and proved to be popular amongst the participants who received them. The tuna cans purchased from stores in the Maldives had a value of 20 Rufiyaa (~$1.30 USD) each, the cans of drink had a value of 12 Rufiyaa (~$0.78 USD) each, and the deodorant bottles cost 40 Rufiyaa (~$2.60 USD) each. The average hourly wage at the time of the study was between 30-40 Rufiyaa/hour, and so in local terms the value of these gifts was commensurate with the time required to participate in the elicitation tasks.

5.1.2.3 Recording process

Participants playing Man and Tree, Route Description, Verbal Animals-in-a-row or the Virtual Atoll Task were recorded by individual lapel microphones hooked up to an audio recorder. The first three of these tasks were also filmed. The Virtual Atoll Task, which runs much longer and which involves few movements or gestures on the part of the participants, was not filmed, though on-screen actions were captured by screen-recording software. The Object Placement Task, which only required participants to place objects in response to instructions from the researcher, was not generally recorded by video or audio recorder, though a small sample of participants were filmed. Placements of objects in this task were noted down by the researcher using pen and paper.

5.2 Man and Tree game

5.2.1 Methodology

5.2.1.1 Stimuli and procedure

The ‘Man and Tree’ task is a photo-photo matching game originally developed by the MPI (Levinson et al. 1992). The methodology has been employed successfully in many studies on FoRs, including the 12 studies in Levinson and Wilkins (2006a) as well as many others (e.g., Bennardo 2000; Cablitz 2006; Danziger 1999; Hill 1997; Meakins 2011; Pederson et al. 1998; Senft 2001; Terrill & Dunn 2006).[99] Researchers from the MesoSpace group have used a variation with photos of a ball and chair (e.g., Bohnemeyer 2008; 2011; Bohnemeyer et al. 2015; Bohnemeyer et al. 2014; Bohnemeyer & O'Meara 2012; Bohnemeyer & Tucker 2013; Eggleston 2012; Polian & Bohnemeyer 2011). The set of photos used in the current study was originally developed by Ann Senghas and has subsequently been used by others (e.g., Edmonds-Wathen 2013; Schlossberg Forthcoming; Terrill & Burenhult 2008:95–97). The task is a 'director-matcher' game played by two participants sitting side by side but separated by a screen or curtain, as shown in Figure 5.1 below.

Figure 5.1: Men from L. Mundoo playing the Man and Tree game

The game involves two identical sets of 16 colour photographs, with one set in front of each player. Each photograph contains a toy man and a toy tree, but the 16 photographs are all slightly different in that the man may be facing in any of four directions, and may be standing in any of four different positions with respect to the tree. This broad range of permutations was the primary motivation for using this set of photos instead of the original set used by Levinson et al. (1992), which has a more limited range of spatial configurations (cf. Terrill & Burenhult 2008:96-97). The full set of photographs is shown in Figure 5.2 below (note that the codes 'R11', 'R12' etc. do not appear on the actual pictures).

[99] For discussion of the original methodology, see Pederson et al. (1998) and Senft (2007).

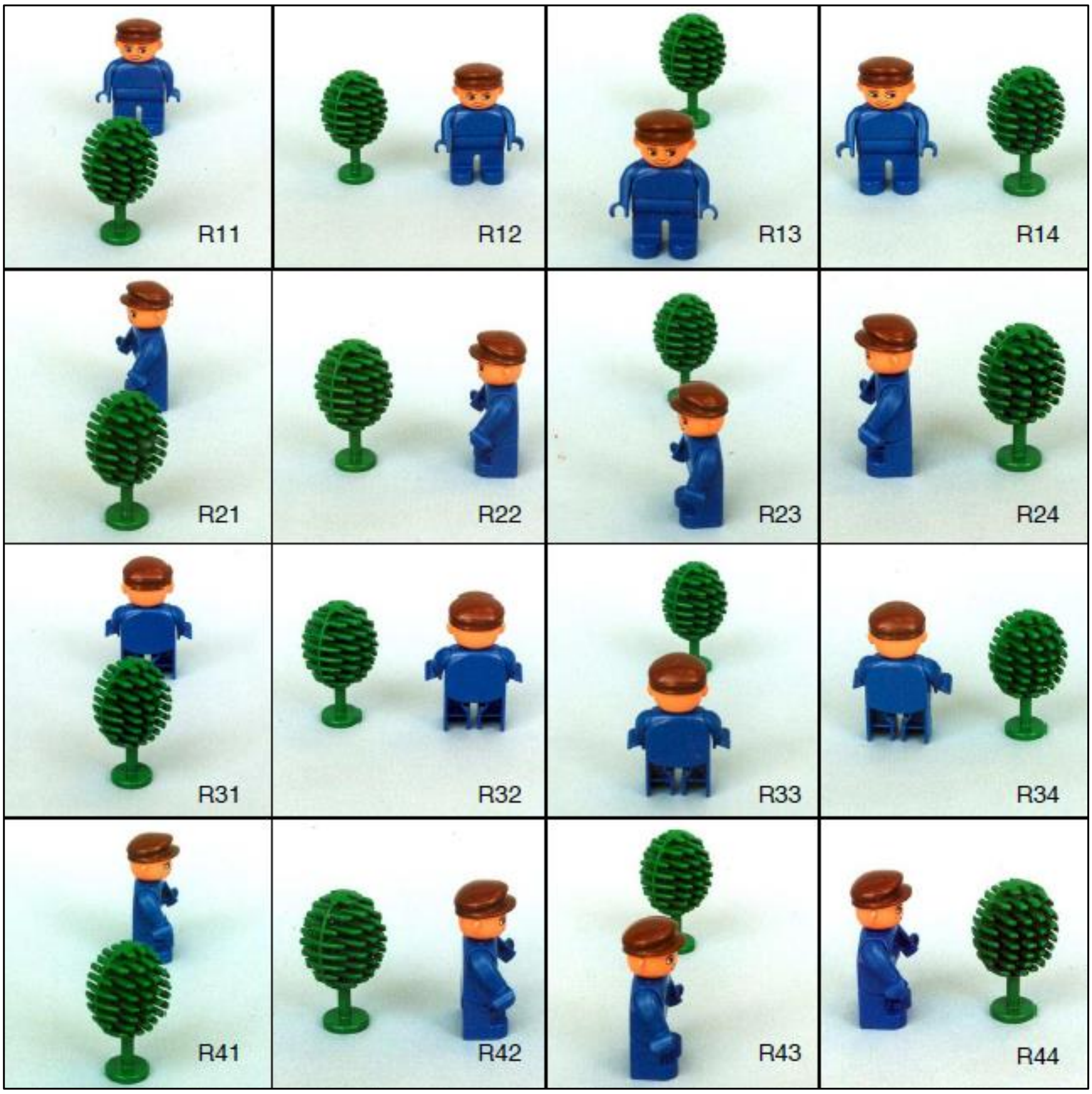

Figure 5.2: Photos in the Man and Tree game (from Terrill & Burenhult 2008:96)

After listening to a standardized set of instructions in Dhivehi, the participants take turns describing a few photographs to each other for practice. The aim is for the 'director' to pick out and describe the photographs one by one, in such a way that the 'matcher' can select the corresponding photographs from her own set, and stack them in the same order. This draws the participants' attention to the kinds of spatial distinctions they need to make in order to play the game successfully. However, the standardized instructions do not invite the use of any particular vocabulary or strategies when playing the game, and were carefully constructed to avoid using any relevant FoR terms.[100] English translations of the instructions for Man and Tree and other elicitation games are provided in Appendix I.

When the participants are ready, the cards are shuffled and scattered (face up) on the tables, with one full set of cards in front of each player. The director then selects cards one at a time and describes them to the matcher, who has to find the matching cards from her own set and place them in a pile in the correct order. For example, the director might say something like, “In this card, the tree is behind the man and the man is facing us”. The matcher may also ask questions of the director throughout the game. When a player believes a card has been correctly ‘matched’, she places it (still facing up) on a pile in the corner of the table and then moves on to the next card. This process continues until all sixteen cards have been taken or skipped (e.g., because the matcher could not find the appropriate card, or because she had already taken that card erroneously for a previous description). Each pair of participants is asked to play the game twice in the same session, taking turns as director and matcher.

5.2.1.2 Methodological issues

A number of minor methodological issues were encountered in Man and Tree, though many of these only surfaced after several pairs had already played the game. Although some of the methodological flaws confounded the results in certain ways, it was preferable to continue using the same stimuli and methods across the entire sample, in order to secure maximally comparable data. I describe the most important issues here because they have some bearing on the results in §5.2.4, but also for the benefit of future researchers who may wish to run similar tasks.

Probably the main experimental flaws related to the stimulus photographs themselves. Although the photos have been used by others previously (e.g., Terrill & Burenhult 2008), certain issues may not have been observed in those studies because of the relatively small sample sizes involved (for example, Terrill & Burenhult 2008 used six Jahai participants and six Lavukaleve participants, in contrast to a sample of 118 Maldivian participants in the

[100] In some cases, participants asked which kinds of words (e.g., cardinal direction terms, left/right/front/back terms) they should use in the game. The response given by the researcher or research assistant was simply “whatever you prefer”.

present study). It is also likely that different populations have different levels of familiarity with the kinds of toy objects in the stimulus photos or even with photos more generally, and this may have some effect on the way spatial descriptions are formed by people in different communities. For example, it is possible to describe photo R11 by saying, "The man is on top of the tree" rather than using a FoR in horizontal space. It may well be that this kind of description is more likely to be produced by people who are unfamiliar with the way in which photographs condense three dimensions into a 2D representation, but it might also be a deliberate strategy to avoid using horizontal FoRs altogether. While this is of course interesting in itself, it does obscure the results to an extent, in that we do not know which horizontal FoR would have been used if a vertical one were unavailable. Since the main purpose of the task is to reveal FoR preference for horizontal space, it would arguably be desirable to use stimuli which are less conducive to vertical descriptions. Photos that more clearly show the man and tree standing on some surface (rather than in a featureless white space) would be preferable to this end. Of course, it is also possible to get around the problem by using 3D stimuli – as the Route Description and Verbal Animals-in-a-row games do – though in such cases it is not so easy to have a large set of contrastive spatial arrays laid out together on a table.

A further issue related to the bald head of the toy man in the photographs. Older participants in particular sometimes had trouble distinguishing the back of the man's head from the front, since both were the same colour and the man's facial features were not always clearly perceived. Occasionally participants described the toy man in photos such as R32 as "a man without eyes". Although this was not generally problematic, in hindsight it would have been better for the photos to depict a person with (preferably long) hair. The photos, printed with dimensions 6.5cm by 6.5cm, would ideally have been printed somewhat larger, too.

An issue with the photos in columns 1 and 3 of Figure 5.2 was that the toy man and tree are not perfectly in line with one another. This sometimes resulted in misunderstandings between participants. For example, the tree in R33 was sometimes described or understood as being "to the right" of the man, even though the tree is only slightly to the man's right (the expected intrinsic/relative description is "in front"). This would result matching with a different photo such as R34.

In addition, an inevitable consequence of using stimuli that feature a faceted object (in this case the toy man) is that participants can get by largely with intrinsic locative descriptions coupled with vertical descriptions and/or landmark-based descriptions (e.g., 'The tree is to the right of the man and it's above him', 'The tree is in front of the man and also towards us', etc.). This allows participants to avoid both the relative and absolute FoRs for the most part. While it is of course highly interesting if participants avoid relative and absolute FoRs, the researcher may wish to find out which types of frames speakers resort to when the intrinsic FoR is unavailable. As such, it may be valuable to expand the photo set to include photos with two 'frontless' objects, such as a ball and a tree. Vertical and landmark-based descriptions would still be possible for such photos, but the unsuitability of the intrinsic FoR may prompt more relative and/or absolute FoR descriptions, providing an interesting complement to the data from the original set of photos.

Other issues related to the design of the game more generally. In particular, the stacking of 'solved' cards into piles was problematic because errors made early in a game caused difficulties later, when the correct card was no longer available to the matcher. Also, the large number of cards in the early stages of the game sometimes meant the matcher was slow to identify the correct card, or could not locate it at all.

5.2.2 Participants

In total, 118 Dhivehi speakers participated in the Man and Tree game, or 59 pairs of speakers. Of these pairs, 50 were recorded at the main field site of Laamu Atoll, which was the focus of the study. To provide a point of comparison, another four pairs were recorded in Malé and five pairs in Hithadhoo, Addu Atoll, during shorter visits. The total sample across all locations included 32 pairs of men, 26 pairs of women, and one mixed pair (in Addu). The youngest participant was 17 years-old and the oldest was 71; the mean age was 41.5 years. Participants were usually partnered with someone of a similar age, and so the sample can be divided into three age groups: 17-34 year-olds (19 pairs), 35-49 year-olds (21 pairs), and 50-71 year-olds (19 pairs).[101] A cutoff at age 34 or less for the 'young' age group was motivated by the fact that in almost all cases, participants within that age bracket

[101] The totals in parentheses are of pairs with an average age that falls within a particular age bracket. Typically both members of a pair were within the same age bracket, though in a few cases one participant was in a different age bracket – in such cases, the pair was classified according to their average age.

had been educated to GCE O Level or higher, while participants older than that had usually only been educated to Primary or Grade 7 levels.[102] The cutoff between the two oldest groups is more arbitrary, but was set at age 50 to keep the groups approximately even in size. Regardless of age or education level, all participants were literate in at least Thaana script.[103] Within the Laamu sample, participants were recruited from different islands around the atoll (especially Dhanbidhoo and Fonadhoo), and this included both fishing and non-fishing (i.e., farming or administrative) communities, as shown in Table 5.1 below:

Table 5.1: Participants in Man and Tree

Island	**Main industry**	**Pairs aged 17-34 (F, M)**	**Pairs aged 35-49 (F, M)**	**Pairs aged 50-71 (F, M)**	**Total pairs (F, M)**
L. Dhanbidhoo	Fishing	6 (3, 3)	6 (3, 3)	5 (2, 3)	17 (8, 9)
L. Gan	Fishing	2 (1, 1)	0 (0, 0)	1 (0, 1)	3 (1, 2)
L. Maabaidhoo	Fishing	0 (0, 0)	0 (0, 0)	1 (0, 1)	1 (0, 1)
L. Maamendhoo	Fishing	1 (1, 0)	1 (0, 1)	1 (0, 1)	3 (1, 2)
L. Maavah	Fishing	0 (0, 0)	1 (0, 1)	1 (0, 1)	2 (0, 2)
L. Mundoo	Fishing	1 (0, 1)	1 (1, 0)	0 (0, 0)	2 (1, 1)
TOTAL LAAMU FISHING:		*10 (5, 5)*	*9 (4, 5)*	*9 (2, 7)*	*28 (11, 17)*
L. Fonadhoo	Administrative	5 (2, 3)	6 (3, 3)	4 (2, 2)	15 (7, 8)
L. Gaadhoo	Farming	1 (1, 0)	0 (0, 0)	3 (1, 2)	4 (2, 2)
L. Isdhoo/ L. Kalaidhoo[104]	Farming	0 (0, 0)	1 (0, 1)	2 (1, 1)	3 (1, 2)
TOTAL LAAMU NON-FISHING:		*6 (3, 3)*	*7 (3, 4)*	*9 (4, 5)*	*22 (10, 12)*
TOTAL LAAMU:		*16 (8, 8)*	*16 (7, 9)*	*18 (6, 12)*	*50 (21, 29)*
Malé	Administrative	2 (1, 1)	1 (1, 0)	1 (0, 1)	4 (2, 2)
Addu Atoll (S. Hithadhoo)	Mixed	1 (1, 0)	3 (2, 1)	1 (0, 0)[105]	5 (3, 1)
TOTAL ALL LOCATIONS:		*19 (10, 9)*	*20 (10, 10)*	*20 (6, 13)*	*59 (26, 32)*

It should be noted that each participant played the game on the island in which he or she lived at the time of the study, i.e., the 17 pairs from L. Dhanbidhoo were recorded in L. Dhanbidhoo, the three pairs from L. Gan were recorded in L. Gan, and so on. In addition,

[102] GCE O Level (General Certificate of Education Ordinary Level) is a subject-based qualification awarded in some countries. It is generally achieved at age 15 or 16, and is roughly equivalent to 10th Grade in other education systems. Some Maldivian students go on to study A (Advanced) Level subjects at age 17 or 18 – roughly equivalent to 12th Grade.
[103] Due to government initiatives, the Maldives has one of the world's highest literacy rates.
[104] The communities of Isdhoo and Kalaidhoo lie on opposite ends of the same geographic island, which also goes by the name 'Isdhoo'. It is common for Maldivians to refer to communities as 'islands', and so locals typically talk about Isdhoo and Kalaidhoo as separate 'islands', especially after an administrative split that took place in 2014. However, I group them together here because they are on the same geographic island.
[105] There was one male-female pair in Addu Atoll.

pairs could be recorded indoors (13 pairs), within an enclosed courtyard (25 pairs), or completely outdoors and in close proximity to the lagoon or ocean (21 pairs). Generally, pairs either faced ‘across’ an island (i.e., towards the lagoon or ocean; 22 pairs) or ‘along’ an island (i.e., 90 degrees away from lagoonward; 21 pairs), but in many cases this was not possible due to the location, and so some pairs were seated facing another direction.[106] Thus the location and seating orientation of the participants were not held constant, but were treated as independent variables that could potentially correlate with FoR choice.

Ideally there would have been more data collected from certain locations (e.g., Malé) and from certain demographic groups (e.g., older women, especially those on fishing islands) in order to tease apart different variables more easily. However, there were a number of logistical constraints on recruiting participants in those groups. The total sample of 59 pairs is still many times larger than the samples in most other Man and Tree studies, which have typically used only three to five pairs per language, sometimes reusing the same speakers in different pairings (e.g., Terrill & Burenhult 2008). While this is not intended as a criticism of earlier studies (many languages have very few speakers to begin with), it is an advantage of the current study that it recorded a large number of independent pairs of speakers, as this allows us to examine variation in FoR use among speakers of the same language.

5.2.3 Data coding and quantitative analysis

Video and audio recordings of the tasks were imported into ELAN, a tool for video and audio annotation developed by the MPI (Sloetjes & Wittenburg 2008).[107] Recordings were synced and segmented, and a selection was then transcribed into Dhivehi Latin and translated into English by or with the assistance of native speaker research assistants. This selection included at least one Man and Tree game from each of the 59 pairs recorded.[108]

Translated files were then manually coded for the various FoR categories as outlined in Table 2.4 in Chapter 2. Certain additional distinctions were also coded: for the intrinsic and

[106] On some islands, such as Malé and L. Maamendhoo, there is no clear ‘lagoonward’ direction and so the seating orientation was assigned arbitrarily or on the basis of lighting, furniture, and other practical considerations.
[107] See http://tla.mpi.nl/tools/tla-tools/elan/
[108] One game was randomly selected from each pair. In addition, for some pairs who played their games relatively efficiently (and so produced relatively few tokens of FoRs), the second game was also transcribed and translated.

relative FoRs, the bodily axis (sagittal vs. transverse) was tagged; for object-landmark FoRs, the type of landmark was tagged (the tree in the photo vs. external landmarks, with the latter subdivided into topographic landmarks and miscellaneous landmarks); and for the absolute FoR, the type of cardinal directions was tagged (solar vs. sidereal compass, and main vs. intercardinal in the case of the former – see §4.6.3 for these terms). In addition, it was necessary to create a distinct category for 'vertical' descriptions (see §5.2.4.1). A total of six hours of Man and Tree games containing approximately 31,000 words was coded in this way.

Some descriptions using left/right/front/back (LRFB) terms were ambiguous (or vague) between the intrinsic FoR and the relative FoR (and its various subtypes), though in many cases one interpretation seemed more likely than the other. These descriptions were usually coded according to whichever FoR was predominantly used to describe similar cards by the same speaker in the same game, but also according to prosodic and syntactic cues that sometimes hinted at one particular interpretation over another (see §4.6.2). A small percentage of descriptions remained ambiguous, however, and these are represented by yellow-and-red striped bars in the graphs shown in the following sections. As descriptions of this type were very rare (0.32% of locative descriptions in the entire Man and Tree corpus), for the purposes of statistical tests they are simply treated as neither relative nor intrinsic.

In order to perform a quantitative analysis, the number of times each pair used each FoR or FoR subtype in each description type was counted, and the total number of FoR descriptions used by each pair was calculated. This was done separately for locative descriptions and orientation descriptions (see §5.2.4.3 for this distinction, as well as §2.5.2). For example, a particular pair might have made a total of 84 locative FoR descriptions, of which 12 (14.3%) involved cardinal directions, 16 (19.0%) involved vertical strategies, and the remaining 56 (66.7%) used the intrinsic FoR. Since some pairs produced many more FoR descriptions than other pairs (e.g., because they double-checked more of their descriptions), the percentage values of FoRs invoked by each pair were used for analysis, rather than raw totals. The use of percentage values ensured that the data from each pair was equally weighted in statistical analyses and in visual representations of the data, despite differences in the total number of spatial descriptions produced by each pair.

There are various ways to present and analyze these percentage values. One possible approach is to simply consider each pair's 'preferred' FoR, that is, the FoR they used most frequently. However, this would overlook FoRs used at lower frequencies, and would also fail to take into account differences in rates of usage for preferred FoRs – for example, in locative descriptions, some pairs used the intrinsic FoR 100% of the time, while some others used it as their most common strategy but less than 50% of the time.

Another approach would be to consider each pair's 'major' FoRs as defined by some arbitrary benchmark – say, a minimum level of 25%. For example, a particular pair might use both the intrinsic and relative FoRs as major strategies. Aside from the fact that the benchmark here is arbitrary, this approach suffers from the same problem of not taking into account more precise differences in rates of usage (e.g., different pairs using the intrinsic FoR as a 'major' strategy might use it at very different proportions, or two FoRs might be used as major strategies by the same number of pairs despite the fact that one is used at much higher rates overall). However, this kind of approach does at least take into account some FoRs used as non-preferred strategies.

A third approach presents the average percentage values for each FoR across the sample or subgroups within the sample, such as men vs. women. For example, the average rate at which men use cardinal directions may be calculated by adding together every male pair's percentage value for cardinal directions and then dividing by the number of male pairs. This can then be done for other FoRs used by men, and the various averages considered together produce a 'FoR profile' for men as a group. Because this approach inputs the exact proportions or percentages at which each pair uses each FoR, it results in an accurate and detailed representation of the data, and does not suffer from the issues associated with the first two approaches. As such, it is this third approach that will be adopted for the majority of §5.2.4. However, since this approach combines the data from different pairs, it shows the FoR profiles of whole groups, which may not necessarily reflect the FoR profiles of any individual pairs. If, for example, some group uses the intrinsic FoR at an average rate of 50%, this does not tell us whether every pair in that group uses the intrinsic FoR at about 50%, whether half the group uses it at around 100% and the other half at around 0%, or something in between these two possibilities. As I will mostly be interested in showing differences between groups, rather than variation between pairs within the same group, this is not such a problem, though it is worth bearing in mind that most of the graphs in §5.2.4 show the FoR profiles of groups as a whole, and do not necessarily imply that individual pairs within those groups use FoRs at exactly those rates or in those combinations. Where the behaviour of individual pairs is relevant, such as in §5.2.4.4, I turn to the first two approaches discussed above, or variants of them.

It was also possible to use pairs' FoR percentage values in non-parametric statistical tests to assess whether FoR patterns differed significantly across groups (e.g., between men and women). In particular, Kruskal-Wallis tests were performed to calculate whether FoR rates differed across more than two groups (e.g., three age cohorts) and Mann-Whitney *U* tests (two-tailed, with Bonferroni correction applied) were performed to compare two groups at a time (e.g., men vs. women). For each FoR or FoR subtype, these tests indicate whether the data is consistent with the null hypothesis that speakers use that particular FoR at roughly the same rate regardless of group affiliation, with any differences within the realm of chance, or whether there were statistically significant differences between groups. For all tests a 95% confidence interval was used (i.e., significance was defined as $p \leq .05$). The results of these tests will be presented in §5.2.4.

A possible objection to the statistical methods used in this chapter is that the use of a large number of tests (for the many combinations of FoRs, description types, and demographic groups or environmental conditions) means that even with a 95% confidence interval, some tests will produce significant results just by chance. This risk is partly mitigated in this chapter by the application of a Bonferroni correction where appropriate. However, it is important to note from the outset that the claims presented in this chapter and thesis do not actually rest on any individual test result, but are made on the basis of many test results considered together; moreover, it is not so much the fact that some significant results were obtained that is of interest – rather, it is the finding that tests on certain FoRs and FoR subtypes (such as cardinal directions) yielded significant results again and again, while others hardly ever showed significant differences between groups (e.g., the intrinsic FoR). In any case, many test results presented in this chapter are also significant at higher confidence intervals, and the number of significant results obtained is well above the 5% or so that one might expect from random chance – for example, of the 88 Kruskal-Wallis tests performed on demographic variables, some 38 of them (or 43%) produced significant results.

Another possible objection is that since there is overlap between the samples tested for the variables considered in this chapter (e.g., men, younger speakers, and indoor workers are not completely separate groups, with some speakers belonging to more than one of these categories), tests which examine only one predictor variable at a time do not conclusively show that any particular variable is causally responsible for variation in FoR choice. Results may be epiphenomenal, and it is not possible to tell how much each predictor variable contributes, if anything, to the variation observed. Unfortunately, the format of the data and the sample size do not support the use of more sophisticated methods (such as a regression analysis) for exposing the independent contributions of different predictor variables. However, additional data collection and/or coding may allow for further analysis in future. In this chapter, the issue is dealt with to some extent without statistical testing, by filtering the sample to consider subgroups (e.g., young men vs. young women), and by comparing FoR patterns across various overlapping groups (e.g., men, younger speakers, etc.) – these approaches are taken in §5.2.4.11. To be clear, though, the statistical tests presented throughout this chapter are not intended to imply that the predictor variable in question is necessarily causally responsible for the observed variation in FoR choice. They are only meant to show that certain (possibly epiphenomenal) differences between groups exist. In fact, as I will discuss throughout this chapter, certain factors are indeed likely to be epiphenomenal (for example, in §5.2.4.7 I suggest that in Dhivehi, gender-based variation in FoR choice is probably a product of occupation-based variation and traditional gender roles). Statistical results are therefore intended to be interpreted only in the light of the surrounding discussion as well as the results presented in other subsections.

5.2.4 Results

5.2.4.1 Examples of FoR descriptions

The Man and Tree task proved to be highly efficient at eliciting FoR descriptions. The six hours of coded data contained 3,013 locative descriptions and 2,001 orientation descriptions – nearly one FoR description every six words. While some speakers tended to give some extraneous information, such as the shape of the toy man's hands, most speakers were reasonably concise in their descriptions of the cards. Except where repetitions, corrections or clarifications were necessary, most speakers tended to give just one orientation description per card (e.g., ‘The man is facing us’) and one or two location descriptions (e.g., ‘The tree is to the east’, ‘The man is to the west’). This was because it was possible to describe the locations of both the man and the tree (or just one of these), but only the man was perceived as having an orientation. As such there were substantially more locative descriptions than orientation descriptions in the data.

All four major FoRs (relative, intrinsic, absolute, and landmarks) were represented in the data, though not all speakers used all of these. In fact, there was considerable variation in FoR choice, which will be described in the sections that follow. Here, however, I provide some fairly typical examples of some of the more common strategies, to give a general sense of how Man and Tree cards are described in Dhivehi:[109]

(131)	*mīhā*	*hurū*	*ir-aṣ̊*	*e^{n}burī=gen̊;*	
	person	stand.PST.FOC	east-DAT	turn.CVB=SUC	
	gaha	*hurū*	*mīhā-ge*	*furagaha*	*farāt-u*
	tree	stand.PST.FOC	person-GEN	back	side-LOC

‘The person is turning to the east; the tree is behind the person.’

DIV_MT_LGn_20140413_3_1_FS3_FR3_W, 3:36

In (131), a description of card R13, the orientation of the toy man and the location of the tree are expressed in two independent clauses. Both clauses involve focus constructions, which are typical when expressing new or contrastive information in Dhivehi. Special focus morphology is added to the main verb, which precedes the focused element (in contrast, the default word order in Dhivehi is verb-final). In the first clause, the focused element takes the form of a converb clause expressing the man’s orientation, while in the second (independent) clause the focused element is a locative-marked noun phrase expressing the tree’s location. In terms of FoRs, orientation in this example is expressed by a solar cardinal direction, a subtype of the absolute FoR, while location is expressed in the intrinsic FoR.

[109] For further examples, refer to §4.6.

Given that the card being described is R13, it would also be possible to analyze (131) as using the reflectional variant of the relative FoR; however, given the way the speaker used LRFB terms elsewhere in the game, and given the description mentions the ground but not the viewpoint, it is highly probable that (131) involves the intrinsic rather than relative FoR (see §4.6.2 as well as §5.2.3 for discussion).

(132)	*mihāru*	*barāsil-aṣ̊*	*balahaṭṭai=geṅ̊*	
	now	Baraasilu-DAT	look.CVB=SUC	
	gas	*hurī*	*vāṭ̊*	*farātu-ga*
	tree	stand.PST.FOC	left.hand	side-LOC

‘Now, [the person is] looking to Baraasilu; the tree is on the left-hand side [of him].’

DIV_MT_LF_20140414_1_2_HS7_MJ1_NE, 0:39

In (132), a different director is describing card R32. Again a converb clause is used to express the orientation of the toy man, though this time with a different converb and with ellipsis of the subject and main verb. The implied subject, the toy man, is described as looking to ‘Baraasilu’, a ward on the same island. In this example, *barāsilu* takes the same dative marking as the cardinal direction *iru* ‘east’ in (131), signifying the direction or place towards which the figure is oriented. The locative description in the second main clause is similar to that in (131), except it does not overtly state that the toy man is the ground. As such, it is also possible that the ground is the card itself, with *vāṭ̊* ‘left hand’ here invoking either the relative FoR or else an intrinsic ‘left’ derived from the way one looks at and interacts with the card (akin to the ‘left’ of a computer, for example). In this particular description it is likely that the speaker was using the intrinsic FoR with the toy man as ground, based on his descriptions of other cards in the same game. Omission of the ground object is fairly typical in Dhivehi Man and Tree descriptions.

Vertical descriptions were also common. A typical example is (133) below, from a description of card R21 (again from a different director):

(133) *gaha* *inū* *tirī* *mīhā* *innanū* *mattu*

tree sit.PST.FOC low.LOC person sit.PRES.FOC top.LOC

'The tree is below; the person is on top.'

DIV_MT_LF_20131218_2_2_AY1_MA2_NW, 2:44

Other 'vertical' descriptions were more indirect and did not explicitly state that one item was above or below the other, though they made an implicature to that effect. For example, some speakers produced descriptions along the lines of 'The tip of the tree is hiding the man's knee', 'The man is carrying a tree', 'The man has climbed the tree', and so on. These kinds of descriptions invoke the vertical dimension, at least implicitly, and were therefore coded as 'vertical' too. This 'vertical' category is somewhat broad, and for the purposes of this study I do not attempt to distinguish between absolute, intrinsic and relative FoRs in the vertical dimension (for discussions of FoRs in the vertical dimension, see Carlson-Radvansky & Irwin 1993; Carlson-Radvansky & Irwin 1994; Levelt 1984).

Finally, SAP-landmarks (e.g., 'The man is facing us'), which involve the use of a speech act participant as a landmark (cf. §2.4.4), were commonly used by many speakers. Most examples of this strategy were in orientation descriptions, as in (134) below:

(134) *mi=mīhunnaṣ̊* *kurumatu* *lai=gen̊?*

DEM1=people.DAT front put.CVB=SUC

'Facing us?'

DIV_MT_LF_20131218_2_2_AY1_MA2_NW, 1:17

Note that the question in (134), which is about whether the toy man in the photo is facing the players, technically does not contain a pronoun – the phrase *mi=mīhun̊* (dative *mi=mīhunnaṣ̊*) literally means 'these people', and is a kind of pro-phrase for the first-person plural (see Gnanadesikan 2017:89–95 for pronouns and pro-phrases in Dhivehi). This phrase is typically used as an indirect way of saying 'we' or 'us', but can also refer to a group of people near the speaker. Similarly, second-person and even first-person singular pronouns are sometimes replaced with pro-phrases or proper names in Dhivehi, and so SAP-landmark references in Dhivehi cannot always be distinguished formally from object-landmark references, though they can be distinguished conceptually according to whether they pick out a speech act participant or not.[110] Example (134) also illustrates a common light verb construction for expressing orientation in Dhivehi: a noun referring to a body part or facet (typically *kurimati* 'front', *mūnu* 'face' or *furagas* 'back') is the object of a light verb such as *lanī* 'putting', *denī* 'giving' or *jahanī* 'hitting'.[111]

5.2.4.2 Overview of FoR selection at three main locations

As outlined in Table 5.1 in §5.2.2, the Man and Tree data were collected from three main locations, Laamu Atoll, Malé, and Addu Atoll (see Figure 1.2), with Laamu providing the majority of the data and Malé and Addu serving mainly as points of comparison. As discussed in §1.2.4, Malé is highly urbanized, while Addu and especially Laamu are less developed. Additionally, the participants from Malé and Addu were in general more highly educated than those in Laamu, and more were bilingual (speaking English as well as Dhivehi), as is typical of those locations. Thus, a comparison of the data across all three locations may shed light on the extent to which urbanization, education, and bilingualism impact on FoR patterns within a language. However, this comparison must be considered a tentative one, given the relatively small number of pairs from Malé (four pairs) and Addu (five pairs) compared to Laamu (50 pairs). There is also a possible confounding factor: very different dialects are used in the three locations, and so differences in FoR use could possibly be regarded as dialectal variation rather than a product of environmental differences. Of course, this complication is more or less present in any consideration of how FoRs vary across environments, since a change in location often means a change in dialect, if only a slight one.[112]

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[110] This point may be of some theoretical interest in that it represents a further example of the difficulty with defining FoRs (even partly) in terms of their formal expression (see §2.4.3 for a discussion of this issue with respect to landmarks vs. absolute FoR). Of course, in this case we are concerned only with subtypes of one FoR (landmark references), and so formal differences would not necessarily be predicted anyway.

[111] The choice of light verb depends on the body part/facet as well as dialect and personal preference. Malé speakers typically use *lanī* 'putting' with *mūnu* 'face', and *denī* 'giving' with *furagas* 'back', while *kurimati* 'front' takes either verb. Laamu speakers show a similar pattern, though almost always use *jahanī* 'hitting' in place of *denī* 'giving'.

[112] In the case of the three locations in question, there are a number of substantial dialectal differences beyond FoR choice (see §1.2.1 as well as Fritz 2002 and Wijesundera et al. 1998), and so it may not be unreasonable to view any variation in FoRs as simply being a part of this dialectal variation. On the other hand, it is still plausible that topographic features condition variation in FoRs despite other dialectal differences. Further data from more Maldivian atolls – especially those which use the standard dialect but in a non-urban setting – could help to more fully tease apart the influences of topography and dialect, though atolls in close proximity to Malé also have more contact with the capital and with tourism, which may present another confound.

The Man and Tree data from Malé and Addu are quite different to the data from Laamu. Figure 5.3 below illustrates the average proportions at which various FoRs were used in locative descriptions at the three main field sites.[113] Geocentric FoRs are represented by shades of blue and egocentric FoRs by shades of pink/red (intrinsic and vertical FoRs are given their own colours):

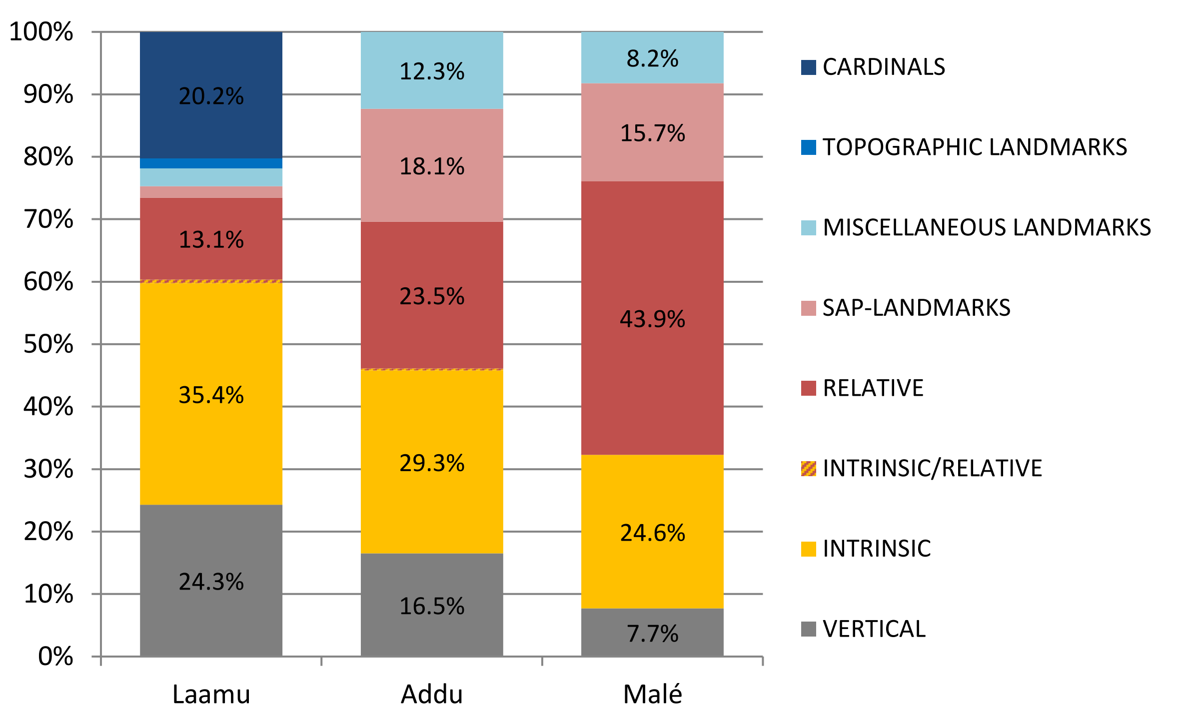

Figure 5.3: FoRs in locative descriptions in Laamu, Addu and Malé

A few important findings are illustrated in Figure 5.3. Firstly, a mixture of FoRs was used at all three locations, though not at the same proportions at each location. The only strategy that was well represented at all three locations was the intrinsic FoR, with no statistically significant difference between locations ($H(2) = 0.33$, $p > .05$). However, despite being the most commonly used strategy across locations, the intrinsic FoR was not used in the majority of locative descriptions in Laamu, Addu, or Malé, as Figure 5.3 shows. And as I will show later, the intrinsic FoR was not used in orientation descriptions, and other kinds

[113] This graph and those that follow are based on average proportions of FoR use among pairs belonging to certain subpopulations. For example, Figure 5.3 shows that on average, Malé pairs used the relative FoR in 43.9% of their locative FoR descriptions, even though some used this strategy much more or much less. It would also have been possible to use graphs that simply show the proportion of FoRs used out of a raw total, and in most cases the figures would be similar (e.g., the relative FoR was used in 113/270 or 41.9% of total Malé locative descriptions). However, some pairs produced more FoR descriptions than others, and an analysis based on raw figures would over-represent the strategies used by more verbose pairs.

of array-internal strategies were not common in orientation descriptions except for among the four Malé pairs. It would therefore be an overstatement to say that Dhivehi speakers have a clear preference for the intrinsic FoR, though it is a common strategy in locative descriptions and is used by speakers in different parts of the country. But given that it is not a clearly preferred strategy and given that it is restricted to one description type (locative descriptions), much of this chapter will focus on exploring the variation in the use of geocentric and egocentric strategies, which also have more of a bearing on the theoretical issues introduced in Chapter 3.

Secondly, two of the geocentric categories, cardinals and topographic landmarks, were used only in Laamu and never in Addu or Malé for locative descriptions, though topographic landmarks were extremely rare in Laamu (1.6% of locative descriptions).[114] However, Kruskal-Wallis tests revealed no significant differences between locations in the usage of these categories. In locative descriptions, geocentric FoRs were used more in Laamu than in Addu or Malé, though not significantly, and even in Laamu they only accounted for 24.7% of locative descriptions in total. Interestingly, most geocentric descriptions in Laamu involved cardinal directions, but all in Addu and Malé involved miscellaneous landmarks. The subtype of cardinal directions used in Laamu was almost always the solar compass system, and almost always primary compass directions rather than intercardinal ones. Sidereal compass directions were used by only one pair of old men, four times in locative descriptions and eight times in orientation descriptions. The use of miscellaneous landmarks was significantly different across locations ($H(2) = 9.50$, $p = .009$), with the strategy appearing on average in 2.9% of locative descriptions in Laamu compared to 12.3% in Addu and 8.2% in Malé. Addu and Malé speakers also used a greater variety of landmarks, including objects in the immediate vicinity such as chairs, doors or windows. When they used landmarks at all, Laamu speakers tended to use landmarks that were larger and more distant (often out of sight), such as islands, villages or houses.

[114] A closer inspection of the raw Addu data reveals that cardinal directions were in fact used to an extent by one Addu pair, though in a Man and Tree game that had not been randomly selected for translation, coding, and analysis. However, cardinals appeared to be an infrequent strategy in that game, and so the inclusion of it in the quantitative analysis would not drastically change the shape of the Addu data shown in Figure 5.3 or Figure 5.4.

Egocentric FoRs (i.e., relative FoR and SAP-landmarks) in locative descriptions were much less common in Laamu (14.9%) than in Addu (41.6%) or Malé (59.6%).[115] The difference between locations is statistically significant ($H(2) = 10.01$, $p = .007$). More specifically, Mann-Whitney *U* tests (with Bonferroni correction) showed that pairs in Laamu had significantly lower rates of egocentric FoR use in locative descriptions than pairs in Malé ($U = 22$, $p = .009$), though the differences between Laamu and Addu and between Addu and Malé failed to reach statistical significance. Compared to Malé, Laamu speakers also showed significantly lower rates of the two egocentric subtypes individually, using both the relative FoR ($U = 32$, $p = .027$) and SAP-landmarks ($U = 19$, $p = .006$) less frequently. Compared to Addu, Laamu speakers used SAP-landmarks significantly less ($U = 42$, $p = .009$), though the difference in usage of the relative FoR was not significant. There were no significant differences between Addu and Malé for any egocentric strategies.

Finally, vertical strategies appeared to be used more often in Laamu than in Addu or Malé, though again the difference between locations was not significant ($H(2) = 2.85$, $p > .05$). Like the intrinsic FoR, vertical strategies were used only in locative descriptions and not in orientation descriptions, for reasons pertaining to the conceptual nature of locative vs. orientation descriptions (see §2.5.2 as well as §5.2.4.3). For similar reasons, certain geocentric and egocentric subtypes were used more frequently in one description type or the other, and so it is necessary to examine both types of descriptions separately. Figure 5.4 below shows the average proportions of FoRs in orientation descriptions at the three main field sites:

[115] The actual proportion of relative (and hence egocentric) FoR use in Laamu and Addu may have been marginally higher, since some descriptions using LRFB terms were ambiguous (or vague) between relative and intrinsic FoRs, as discussed in §5.2.4.1. However, descriptions that were ambiguous between these two FoRs accounted for only 0.6% of locative descriptions in Laamu and 0.3% in Addu. In Malé no descriptions were ambiguous in this way.

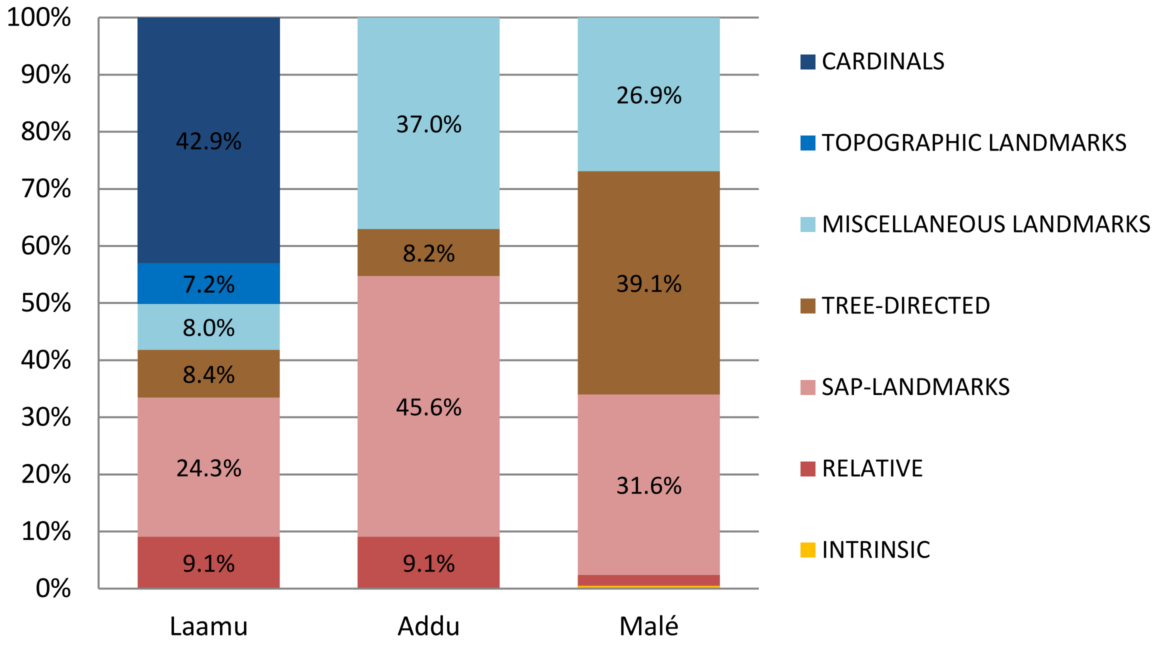

Figure 5.4: FoRs in orientation descriptions in Laamu, Addu and Malé

As Figure 5.4 shows, in orientation descriptions cardinals are again a major category in Laamu but are absent in the Addu and Malé data. A Kruskal-Wallis test revealed a significant difference across locations in the use of cardinal directions ($H(2) = 9.21$, $p = .010$). Topographic landmarks are again absent in Addu and Malé, and are rare in Laamu, as was the case for locative descriptions (see Figure 5.3); they were not used at significantly different rates across locations. Miscellaneous landmarks in orientation descriptions were used at significantly lower rates in Laamu, at least in comparison with Addu ($H(2) = 9.19$, $p = .003$; Laamu vs. Addu: $U = 45$, $p = .015$; Laamu vs. Malé: $U = 43$, $p > .05$; Addu vs. Malé: $U = 6.5$, $p > .05$). A strategy available only in orientation descriptions is the 'tree-directed' category (descriptions such as 'The man is facing the tree'), essentially a kind of landmark category where the 'landmark' is the toy tree in the card being described.[116] This was extremely popular in Malé, but used at significantly lower rates in Laamu and Addu ($H(2) = 9.19$, $p = .010$; Laamu vs. Malé: $U = 17$, $p = .003$; Addu vs. Malé: $U = 0$, $p = .048$, Laamu vs. Addu: $U = 111$, $p > .05$). Egocentric FoRs were popular in orientation descriptions at all three locations, though the majority involved SAP-

[116] The tree-directed strategy, as a kind of landmark strategy, is not possible in locative descriptions because a locative landmark-based reference must relate the tree to the man (or the man to the tree) by invoking a landmark external to the figure-ground array. In other words, since the tree is already the figure or the ground, the tree cannot simultaneously act as an anchor point external to the figure-ground array. See §2.4.4 and §2.5 for more on the nature of landmark-based FoRs.

landmarks rather than the relative FoR. There were no significant differences between locations for these categories. These results, along with the tests on locative descriptions, are summarized in Table 5.2 below:

Table 5.2: Summary of significant differences in FoR use across main locations

	Kruskal-Wallis tests:	Mann-Whitney *U* tests:		
	Comparison of all three main locations	Laamu vs. Malé	Laamu vs. Addu	Addu vs. Malé
Cardinals	O**	ns	ns	ns
Topographic landmarks	ns	ns	ns	ns
Miscellaneous landmarks	L** , O**	ns	O*	ns
Total geocentric	ns	ns	ns	ns
SAP-landmarks	L**	L**	L**	ns
Relative FoR	L*	L**	ns	ns
Total egocentric	L**	L**	ns	ns
Intrinsic	ns	ns	ns	ns
Vertical	ns	ns	ns	ns
Tree-directed	O**	O**	ns	O*
All landmarks	L** , O**	L* , O*	L**	ns
Key: L: locative descriptions; O: orientation descriptions; ns: not significant; *: $p \leq .05$; **: $p \leq .01$; ***: $p \leq .001$				

Considering Table 5.2 together with Figure 5.3 and Figure 5.4 above, it is clear that FoR patterns in Addu and Malé are broadly similar, with hardly any significant differences between them.[117] Laamu, however, shows a distinct pattern of FoR usage, with greater use of cardinals especially in orientation descriptions, less use of egocentric FoRs especially in locative descriptions, and less use of miscellaneous landmarks in both kinds of descriptions. Given that Addu and Malé are more similar in terms of social factors (education, bilingualism, occupations) than environmental ones (topography, urbanization), these results suggest that social rather than environmental factors may have a greater impact on FoR patterns in Dhivehi. If environmental factors had a stronger impact on FoR selection

[117] The one significant difference between Addu and Malé ($U = 0$, $p = .048$) was in the use of the tree-directed strategy in orientation descriptions, which was much more frequent in Malé (39.1%) than Addu (8.2%), for reasons that are not entirely clear. Of course, this may simply be a quirk of the small sample sizes from these two locations.

than social factors, we would expect to see Addu patterning more like Laamu rather than Malé, but this is not the case. The question of social versus environmental factors is addressed further in §5.2.4.5, which explores FoR patterns in different communities within Laamu Atoll.

Another important finding relates to the relative frequency of the various geocentric FoRs (cardinal directions, topographic landmarks, and miscellaneous landmarks). Topographic landmarks were used very rarely in Laamu (1.6% of locative and 7.2% of orientation descriptions), and never in Addu or Malé. Miscellaneous landmarks (e.g., houses) were invoked at all locations, and were a major strategy in Addu and Malé orientation descriptions, while cardinal directions were the predominant geocentric strategy in Laamu. The paucity of geocentric descriptions that were based on local topography appears to be evidence against Palmer's (2015) Topographic Correspondence Hypothesis (see Chapter 3). Moreover, few of the topographic terms that were used invoked the lagoon or ocean sides of islands. I discuss this point further in §5.4.

5.2.4.3 Locative vs. orientation descriptions

Comparing locative and orientation descriptions across the three locations, it is clear that there are different patterns of FoR use according to these description types, as predicted on theoretical grounds in §2.5.2 (see also Bohnemeyer & O'Meara 2012). Figure 5.5 below compares both description types at all three locations, juxtaposing the data from Figure 5.3 and Figure 5.4 in §5.2.4.2:

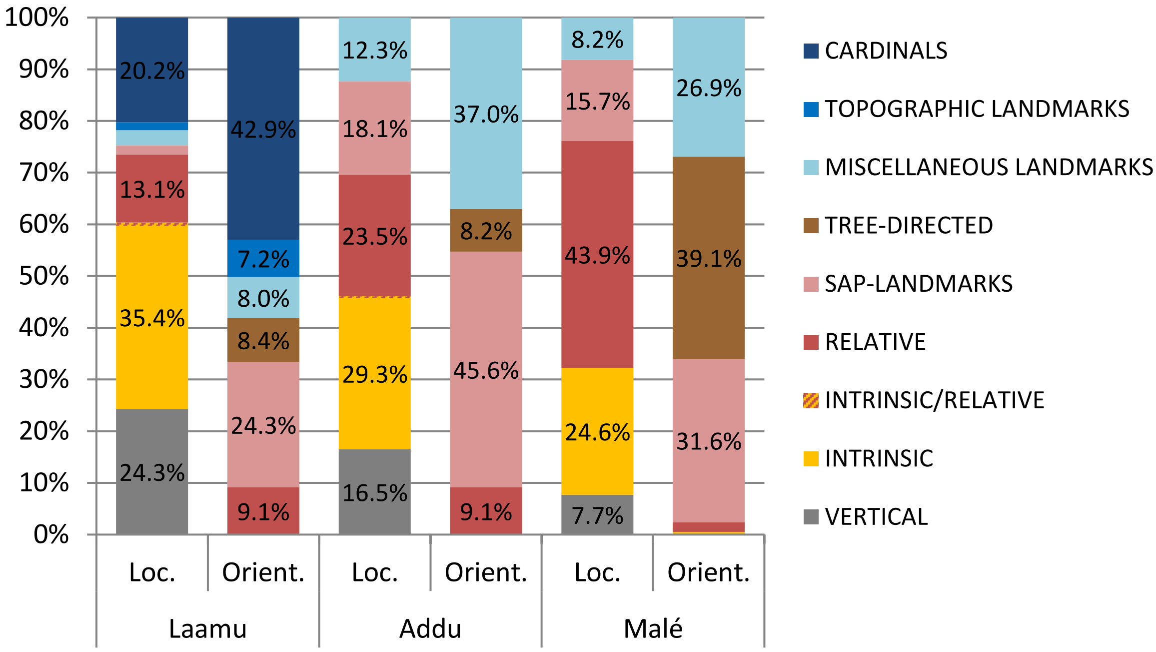

Figure 5.5: Locative vs. orientation descriptions at three locations

Many of the differences in FoR proportions in locative versus orientation descriptions can be explained in terms of how different FoRs operate and how suitable they are to each description type in Man and Tree. In particular, the intrinsic FoR is of no use in orientation descriptions because the intrinsic orientation of the toy man is always forward (i.e., he always faces forward with respect to his own body), while the tree has no discernible orientation. It is therefore unsurprising that there was only one token of an (unambiguously) intrinsic orientation description in the entire corpus – this was from a Malé speaker who said the equivalent of ‘The man is looking forward’ (for card R24, where the toy man is looking to the left from the speaker’s perspective), though this speaker also described the card in various other ways. Vertical orientation descriptions based on the way the cards lie flat on the table (e.g., ‘The man is facing up’ for cards in which the toy man faces the speaker) are in theory possible and are attested in at least Marshallese (Palmer et al. 2016; Schlossberg Forthcoming), but were never employed by the Dhivehi speakers in the current study. In Dhivehi such a description would probably be taken to mean that the man is looking up *within* the scene depicted, which is not the case for any of the 16 cards. Thus the intrinsic and vertical strategies so popular in locative descriptions are not truly available in Dhivehi for orientation descriptions.

Interestingly, however, what fills the gap here is not always the same, as Figure 5.5 shows. Egocentric FoR use in Laamu and Addu is higher in orientation descriptions than in locative descriptions, but in Malé it is actually lower, even though one might expect it to rise to compensate for the lack of vertical and intrinsic options. Geocentric FoRs are more prevalent in orientation descriptions than in locative descriptions at all three locations. In Laamu this is driven mostly by an increased use of cardinals but in Addu and Malé the difference is driven entirely by an increased use of miscellaneous landmarks (with cardinals and topographic landmarks not used at all in Addu or Malé).

The general distribution of egocentric FoRs appears to relate to the conceptual difference between the two types of egocentric strategies. It is notable that in orientation descriptions, use of the relative FoR is diminished compared to locative descriptions at all three locations, with SAP-landmarks instead representing the majority of egocentric uses, in a reversal of the pattern seen for locative descriptions. This is in keeping with a general trend for languages to employ head-anchored FoRs (including SAP-landmarks) at higher rates in orientation descriptions than in locative ones (Bohnemeyer & O’Meara 2012; Senft 2001:545–550). This trend may be explained in terms of functional differences between head-anchored and angular-anchored FoRs (see §2.4.4 for this distinction) and between locative and orientation descriptions (see also Bohnemeyer & O’Meara 2012:245). To specify the figure’s orientation, an external anchor must necessarily be invoked, and it is conceptually simpler to use that anchor’s location (i.e., to use a head-anchored FoR) than it is to identify a coordinate system within the anchor and transpose the coordinate system onto the figure (i.e., an angular-anchored FoR). However, to locate the figure, an anchor external to the figure-ground array is not required (since the ground may serve as the anchor), and even when one is used, it may still be necessary to transpose a coordinate system from the anchor anyway (e.g., in an egocentric case, if the figure does not lie along a vector connecting the ground and the speaker, it is not possible to use a SAP-landmark description, though the relative FoR may be possible). In addition, the toy man’s orientation with respect to the speaker may have some degree of social salience, and so descriptions like ‘The man is facing me’ or ‘The man is turning his back to me’ are very natural. In contrast, describing one item as being located on the near or far side of the other is not necessarily an obvious strategy, and also has to compete with a larger range of locative strategies, including intrinsic and vertical ones.

As for the lower overall use of egocentric FoRs in orientation descriptions compared to locative descriptions in Malé, a combination of factors appears to be at work. Firstly, the Malé speakers frequently used the relative FoR in locative descriptions (at 43.9%), but as discussed, the relative FoR as an angular-anchored FoR is not as likely in orientation descriptions for conceptual reasons. SAP-landmarks take up some of the slack here, rising from 15.7% to 31.6%, but not enough to make up the difference. Secondly, the greater use of tree-directed and landmark FoRs reduces the proportion of egocentric descriptions. While it is not entirely clear why the Malé speakers used the tree-directed strategy at such high levels, it may in part be an artefact of their lower rates of vertical descriptions compared to Laamu and Addu speakers – if one perceives the man as being above or below the tree in certain cards, then one is less likely to think of the man as facing the tree or turning his back to it in those cards. Finally, for many pairs in the sample there appeared to be a 'division of labour' between FoRs in locative and orientation descriptions, possibly to avoid the confusion that may result from consistently using the same vocabulary. Since the Malé pairs generally opted to use the relative FoR in locative descriptions, they may have deliberately avoided it in orientation descriptions. In Laamu and Addu where the relative FoR was less popular, this effect was diminished. Although one might expect that it would be less cognitively demanding to keep just one FoR activated across both description types, most speakers at all locations tended to switch FoRs across description types, and in Malé this usually meant the relative FoR was reserved for locative descriptions. For example, (135) below (describing card R42) is typical of the Malé data. It uses the relative FoR for the man's location but a landmark for his orientation, even though it would have been possible to use relative 'right' for the man's orientation too. This kind of division of labour between FoRs is discussed in further detail later in this section.

(135) *mīhā* *hurī* *gahu-ge* *kanāt̊* *farātu-ga,*
person stand.PST.FOC tree-GEN right.hand side-LOC

dor-ā *dimāl-aș̊* *balahaṭṭai=geṅ̊*
door-COM direction-DAT look_after.CVB=SUC

'The person is on the right-hand side of the tree, looking towards the door.'

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The higher proportions of geocentric FoRs in orientation descriptions follow naturally from the fact that vertical and intrinsic strategies are not truly available for this description type, and from the fact that the relative FoR is more restricted than in locative descriptions. In Addu and Malé, this rise in geocentric descriptions is characterized by a greater use of miscellaneous landmarks, while in Laamu it is characterized mostly by an increased use of cardinals, which jump from 20.2% to 42.9%, and only partially by an increase in topographic landmarks (1.6% up to 7.2%) and miscellaneous landmarks (2.9% up to 8.0%). However, in Laamu topographic and miscellaneous landmarks (which are head-anchored strategies) still make up a slightly greater share (25.9%) of geocentric orientation descriptions than geocentric locative descriptions (18.2%).

Given the general tendency (discussed earlier) for head-anchored FoRs to take over in orientation descriptions, why does an angular-anchored cardinal system remain popular in orientation descriptions in Laamu, with only a slight increase in topographic and miscellaneous landmarks? Again there are probably several reasons for this. For one thing, in locative contexts cardinals must compete with a greater range of strategies. It appears that many of the Laamu speakers who had a good command of the cardinal system found it simpler to use vertical or intrinsic strategies much of the time in locative descriptions, but resorted to cardinals more in orientation descriptions, where the intrinsic and vertical strategies were not available. A similar division of labour was discussed earlier in the context of the Malé data, where speakers tended to allocate different FoRs to locative versus orientation descriptions, and the same basic phenomenon can also explain the Laamu data. For example, the description in example (131) in §5.2.4.1 is typical of much of the Laamu data – it uses the intrinsic FoR to locate the tree but a cardinal direction to orient the man.

Such an approach, which essentially allocates different FoRs to different functions, may help to minimize errors and confusion by avoiding the use of the same vocabulary items (such as terms for the cardinal directions) to describe different elements of a photo. This may be particularly effective where one of the FoRs has a limited application (e.g., vertical strategies can only be used for describing location). There are at least two ways in which confusion could arise when using the same FoR to describe different elements of a photo. Firstly, a description such as 'The man is on the east side, facing west' is prone to a mistake in which the locative and orientation information get mixed up in the matcher's mind or even in the director's utterance (i.e., the matcher picks the card showing the man on the west side and facing east, or the director describes that scene unwittingly).[118] Secondly, many locative descriptions in Dhivehi use a locative dative construction (see §4.6.4.3) where location is expressed with the use of a dative-marked noun. Since datives are also used to express orientation, locative and orientation descriptions can sound somewhat similar. However, where different FoRs are allocated to locative and orientation descriptions respectively, and one of these FoRs can only be used in one description type (say, only in locative descriptions) because of its conceptual nature, these issues can be mitigated or avoided entirely. For example, a description like (131) in §5.2.4.1, where the tree is described as 'behind' the man and the man described as facing 'east', is less prone to a mix-up of locative and orientation information because there is no way that 'behind' in (131) could be taken to refer to the man's orientation. Although operating in multiple FoRs may impose a higher processing load and so might be expected to be unlikely, the benefits may outweigh the costs in some communicative tasks like Man and Tree, at least for many speakers. It is also worth noting that in most Laamu descriptions, either an intrinsic or vertical FoR is one of the FoRs activated, and these strategies probably do not impose as much of a processing load as the relative or absolute FoRs, which are more complex coordinate systems (see Chapter 2).

There are also other likely reasons for the prevalence of cardinal directions in Laamu orientation descriptions. For speakers who know the cardinal directions well, it may actually be simpler to specify the man's orientation with a cardinal direction than to appeal to a landmark. Many landmark references are ad hoc ones, and require the speaker to look around and pick something suitable in the environment that the hearer can also identify. Using cardinal directions takes out the decision-making, and does not require both speakers to be able to identify the same landmarks.[119] A final consideration is that in many languages

[118] Note that this may not necessarily result from confusing east with west (though that is another possible error source), but from forgetting which direction was used in which element of the description – bear in mind that matchers are often unable to find the right card straight away due to the large number of cards on the table early in the game, and so they often forget aspects of the description during their search for the card. When the two players do not do enough to clarify the description, this can result in errors. Directors also sometimes mix up orientation with locative information due to the repetitive nature of the task, though this occurs less often.

[119] The use of ad hoc landmarks in the immediate environment can be problematic because the dividing screen restricts each player's view of the surrounding environment, such that, for example, the matcher may not

(such as English), the use of cardinal directions is mostly restricted to large-scale contexts, and so scale may be relevant in Dhivehi too. As we have seen, it is both possible and reasonably common in Laamu to use cardinals in small-scale, locative descriptions in Man and Tree. But it may be that cardinals are even more common in orientation descriptions because of the somewhat larger scale imagined by a speaker when describing the man as facing (or looking, moving, etc.) in a particular direction that extends beyond the edges of the card and tabletop. Thus there are many possible factors that may account for the increased use of cardinal directions in Laamu orientation descriptions despite the general tendency for orientation descriptions to favour head-anchored FoRs. It is likely that the increase is due to a combination of some or all of these factors.

Looking at all head-anchored FoRs (SAP-landmarks, topographic and miscellaneous landmarks, tree-directed) together reveals that head-anchored FoRs in Laamu are still far more prevalent in orientation descriptions (48.0%) than in locative descriptions (6.3%), despite the increased use of cardinals in the former. In Addu and Malé, where cardinals were not used, head-anchored FoRs were even more dominant in orientation descriptions: in Addu, head-anchored FoRs were used in 90.8% of orientation descriptions and 30.4% of locative descriptions; in Malé, they were used in 97.6% of orientation descriptions and 23.9% of locative descriptions. This is in line with Bohnemeyer and O'Meara's (2012: 238–245) typological generalization (discussed earlier in this section) that head-anchored FoRs tend to be more common in orientation descriptions than locative ones.

5.2.4.4 Correspondences between FoRs

The previous sections showed that Dhivehi speakers use a range of FoRs in Man and Tree, and that even individual pairs tend to use a range of strategies in the game, rather than sticking to one FoR consistently. As discussed, the tendency is for speakers to use angular-anchored FoRs in locative descriptions but head-anchored FoRs (i.e., landmarks) or cardinal directions in orientation descriptions. But the graphs in the previous sections do not show exactly which FoRs tend to be used together by the same speakers, and which tend to be used by different speakers. For example, 20.2% of locative descriptions in

know about a chair or window on the director's side of the setup, and hence may not be able to interpret descriptions which invoke those items as landmarks. Another potential problem is that there may be multiple chairs or windows in the vicinity.

Laamu involved cardinal directions, and 13.1% involved the relative FoR. Did most Laamu pairs use a little of each strategy, or did these descriptions come from entirely different pairs? 42.9% of orientation descriptions in Laamu involved cardinals, but with which kinds of locative descriptions were these usually paired? In order to shed some light on these sorts of questions, it is necessary to look at the behaviour of individual pairs, rather than the FoR profiles of the entire sample or of subgroups within the sample.

The graphs in Figure 5.6 to Figure 5.8 below show the FoR profiles of every pair in the sample. Each pair is labelled according to their atoll or city (i.e., 'L1' to 'L50' refer to pairs in Laamu, 'M1' to 'M4' pairs in Malé, and 'A1' to 'A5' pairs in Addu). The left column for each pair shows FoRs in locative descriptions while the right column shows FoRs in orientation descriptions. Pairs are ordered first by location, and then loosely according to FoR preference. Such graphs are rich in detail and so are somewhat difficult to interpret; as such, this chapter generally uses graphs that show average FoR proportions (e.g., Figure 5.5 in the previous section). However, the graphs in the figures below are intended to give a sense of the kind of variation in individual pairs' FoR use, and also to show which FoRs commonly co-occur and which do not.

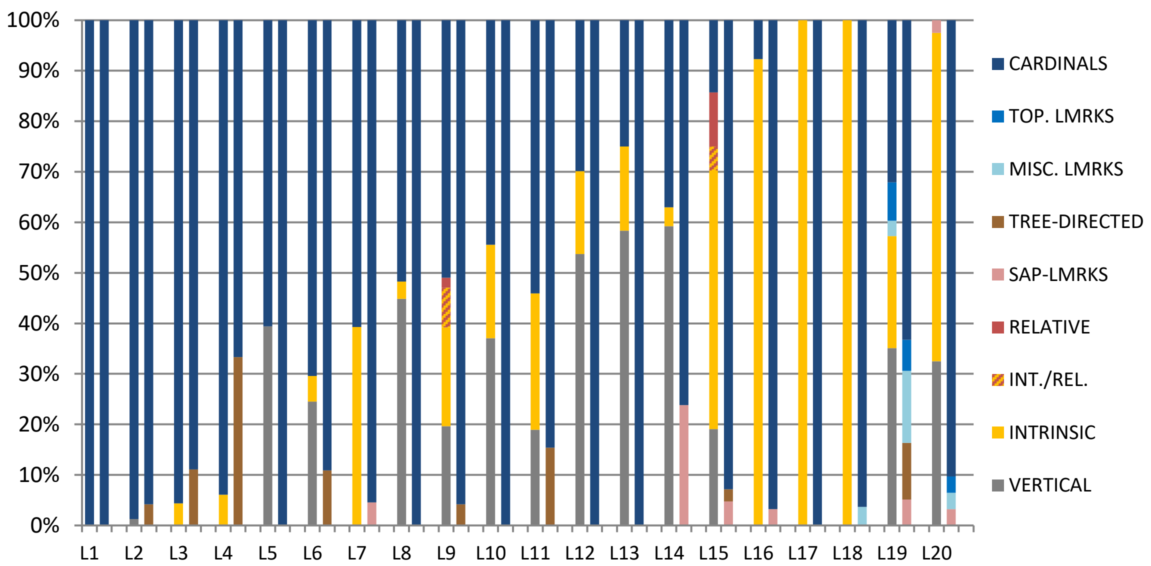

Figure 5.6: FoR profiles for pairs L1-L20

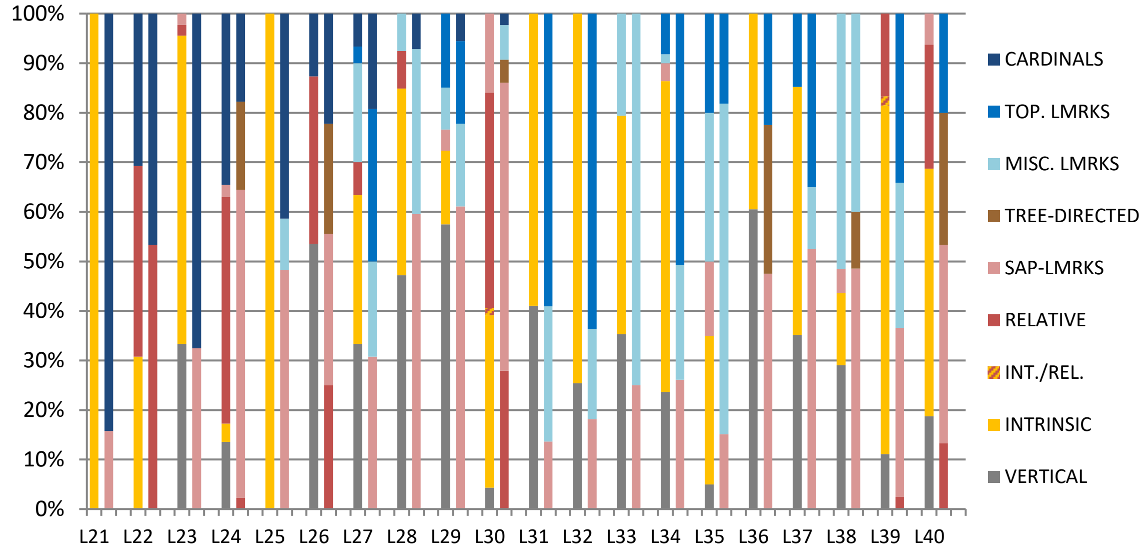

Figure 5.7: FoR profiles for pairs L21-L40

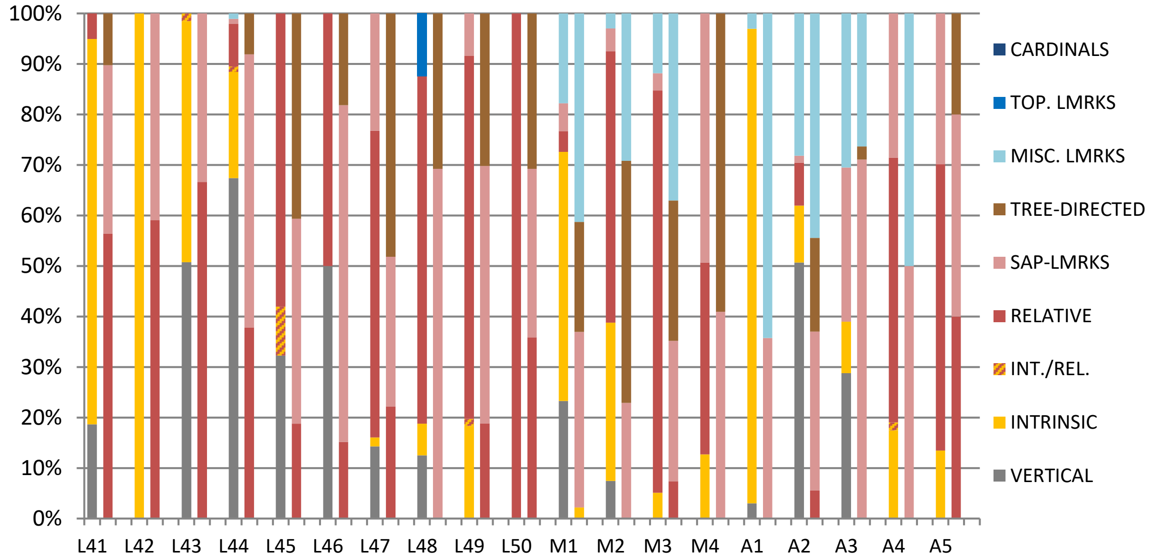

Figure 5.8: FoR profiles for pairs L41-A5

The graphs show that many pairs used quite a range of FoRs; for example, pair A2 used vertical strategies, intrinsic FoR, relative FoR, SAP-landmarks, miscellaneous landmarks, and the tree-directed strategy. On the other hand, some pairs used the same FoR in (almost) all their descriptions of a particular description type. In locative descriptions, this was often the intrinsic FoR (e.g., L41, L42) or cardinal directions (e.g., L1, L2), but sometimes the relative FoR (e.g., L49, L50). In orientation descriptions, cardinal directions were the predominant strategy for many pairs (L1-L23), while other pairs tended to use a mixture of various landmark strategies, sometimes with some supplementary use of cardinals or the relative FoR. No pairs used just one subtype of landmark in close to 100% of their orientation descriptions, nor the relative FoR. A few pairs used cardinals in (nearly) all their locative and orientation descriptions (e.g., L1, L2); this level of consistency was never observed for other FoRs (even if one were to count all subtypes of landmarks as the same strategy).

The graphs also show that pairs using cardinal directions rarely used the relative FoR. Although 30 of 59 pairs used cardinal directions, and 28 pairs used the relative FoR, only nine used both of these strategies, and only two pairs (L22 and L34) used both more than marginally. This suggests that although Dhivehi is a language with 'mixed' FoRs, individual speakers (or pairs of speakers) overwhelmingly tend to favour at most one of the ternary, angular-anchored FoRs. Pairs using cardinals also tended not to use other geocentric strategies – only eight pairs used cardinals in conjunction with miscellaneous landmarks, and only four of these also used topographic landmarks (no pairs used cardinals with topographic landmarks without also using miscellaneous landmarks) – though topographic landmarks were relatively rare across the entire sample anyway.

On the other hand, there was a strong association between the two egocentric FoRs. SAP-landmarks were used by most pairs (44 of 59, or 75%), but especially by pairs also using the relative FoR: 26 out of 28 pairs (93%) using the relative FoR also used SAP-landmarks. The association is not quite as strong in the other direction – of the 44 pairs who used SAP-landmarks, only 26 (59%) also used the relative FoR. However, SAP-landmark users were still more likely than average to use the relative FoR (only 47% of pairs in the entire sample used the relative FoR). Thus, use of the relative FoR strongly implies use of SAP-landmarks, but use of SAP-landmarks only weakly implies use of the relative FoR.

If we ignore strategies that pairs use marginally, and consider only 'major' strategies as defined by usage above some benchmark proportion (say, at least 25% of descriptions in either description type), we see that most pairs used at least one of the intrinsic FoR, vertical strategies and landmarks, and many *only* used some combination of these as major strategies. What these three strategies have in common is that they are conceptually simpler FoRs and may well be found in all (or nearly all) languages, as discussed in Chapter 2.

Many pairs used some combination of these 'universal' strategies in tandem with either cardinal directions or the relative FoR, but only two pairs used cardinals together with the relative FoR as major strategies. Four pairs used cardinals as their only major strategy.
Table 5.3 below shows the various combinations of FoRs used as major strategies, and the number of pairs who used each combination.[120] For simplicity, landmarks are grouped as one category here.

Table 5.3: Choice of major strategies (≥ 25%) in locative or orientation descriptions

Number of pairs using mainly 'universal' strategies:			
Intrinsic, vertical & landmarks	6	Intrinsic & landmarks	6
Vertical & landmarks	4	Landmarks	1
Number of pairs using mainly cardinals and 'universal' strategies:			
Cardinals	4	Cardinals & vertical	6
Cardinals & intrinsic	7	Cardinals & landmarks	2
Cardinals, vertical & landmarks	1	Cardinals, intrinsic & landmarks	1
Cardinals, intrinsic & vertical	1	Cardinals, intrinsic, vertical, & landmarks	1
Number of pairs using mainly relative FoR and 'universal' strategies:			
Relative & landmarks	7	Relative, intrinsic & landmarks	5
Relative, vertical & landmarks	4	Relative, intrinsic, vertical & landmarks	1
Number of pairs using mainly relative FoR and cardinals (and 'universal' strategies):			
Relative, intrinsic & cardinals	1	Relative & cardinals	1

I now turn to the question of which FoRs in locative descriptions corresponded with which FoRs in orientation descriptions. As mentioned earlier, very few pairs produced close to 100% of their locative and orientation descriptions in the same FoR – locative descriptions often used vertical strategies or the intrinsic FoR, which were not represented in orientation descriptions, while orientation descriptions often used landmarks, which were not used so much in locative descriptions. Table 5.4 below shows the numbers of pairs using various combinations of FoRs as major strategies in locative and orientation

[120] Although §5.2.4.2 showed that speakers at different locations use different FoRs, the tables in this section do not distinguish between locations. This is because the main purpose of the present section is to illustrate which FoRs tend to 'go together' and which tend not to, rather than which speakers use them or which were the most popular overall.

descriptions (again merging all subtypes of landmarks for simplicity), and Table 5.5 shows the numbers of pairs using these combinations as their preferred (i.e., most common) strategies.[121] For example, 14 pairs (24%) used the relative FoR as a major strategy in locative descriptions and landmarks as a major strategy in orientation descriptions (though they may also have had other major strategies).

Table 5.4: Correspondences between major strategies across description types

		Major strategy (≥ 25%) in orientation descriptions			
		Relative	Landmarks	Cardinals	*TOTAL*
Major strategy (≥ 25%) in locative descriptions	Vertical	3 (5%)	18 (31%)	9 (15%)	*25 (42%)*
	Intrinsic	5 (8%)	20 (34%)	11 (19%)	*29 (49%)*
	Relative	5 (8%)	14 (24%)	1 (2%)	*15 (25%)*
	Landmarks	1 (2%)	8 (14%)	0 (0%)	*7 (12%)*
	Cardinals	1 (2%)	3 (5%)	15 (25%)	*16 (27%)*
	TOTAL	*9 (15%)*	*39 (66%)*	*24 (41%)*	

Table 5.5: Correspondences between preferred strategies across description types

		Preference in orientation descriptions			
		Relative	Landmarks	Cardinals	*TOTAL*
Preference in locative descriptions	Vertical	1 (2%)	8 (14%)	4 (7%)	*13 (22%)*
	Intrinsic	2 (3%)	11 (19%)	7 (12%)	*20 (34%)*
	Relative	3 (5%)	12 (20%)	0 (0%)	*15 (25%)*
	Landmarks	0 (0%)	4 (7%)	0 (0%)	*4 (7%)*
	Cardinals	0 (0%)	0 (0%)	11 (19%)	*11 (19%)*
	TOTAL	*6 (10%)*	*35 (59%)*	*22 (37%)*	

Table 5.4 and Table 5.5 show a number of interesting correspondences in FoR use. In particular, they show that a large minority of pairs makes substantial use of cardinals in both description types, and another large group makes considerable use of cardinals in orientation descriptions, but uses vertical or intrinsic FoRs in locative descriptions. Another large minority uses the relative FoR in locative descriptions and landmarks in orientation descriptions. Other pairs mostly use vertical or intrinsic FoRs in locative descriptions in combination with landmarks in orientation descriptions, though some use landmarks in both

[121] Note that the totals in these tables need not add up to 59 pairs or 100%, as many pairs used more than one FoR as a major strategy, and some pairs had more than one preferred strategy (i.e., there was a tie between their two most preferred strategies).

description types. All other combinations are rare or absent. These include any combination involving the relative FoR in orientation descriptions, any combination of the relative FoR with cardinals, and any combination of landmarks with cardinals. These findings are in accordance with the discussion earlier in this section as well as in previous sections, and again highlight: (i) a general preference for vertical strategies, intrinsic FoR, relative FoR or cardinals in locative descriptions; (ii) a general preference for landmarks or cardinals in orientation descriptions; and (iii) a strong tendency for speakers using cardinals to avoid landmarks and the relative FoR.[122]

5.2.4.5 Locations within Laamu Atoll

As well as variation between atolls (discussed in §5.2.4.2), the Man and Tree data show variation in FoR selection within Laamu Atoll, with FoRs used at different proportions on different islands. This is shown in Figure 5.9 for locative descriptions and Figure 5.10 for orientation descriptions. As mentioned in §1.2.4, two islands in Laamu were selected as primary field sites within the atoll: Fonadhoo, the atoll capital, and Dhanbidhoo, a fishing community. As such, most of the pairs in the Man and Tree sample were from one of these two islands. In addition, the sample included small numbers of pairs from other islands in the atoll (see §5.2.2), who were recorded during shorter visits to those islands.

However, the FoR proportions shown in Figure 5.9 and Figure 5.10 do not necessarily reflect community-wide practices in islands where the sample size was very small (the number of pairs from each island is indicated in parentheses in Figure 5.9 and Figure 5.10), and may merely reflect the FoR preferences of a handful of speakers. For example, the use of the intrinsic FoR in 100% of locative descriptions in Maavah may not necessarily reflect a strong preference for that FoR in Maavah more generally, and it is plausible that the intrinsic FoR simply happened to be favoured by the two Maavah pairs recruited for the experiment (after all, many pairs in the entire sample used the intrinsic FoR at high rates).

[122] A reviewer asks whether certain FoRs were more efficient or successful than others (i.e., was there a relationship between FoR choice and the time it took a pair to complete the task, or between FoR choice and the number of successfully matched cards?). Impressionistically, speakers who were fairly consistent in their FoR choice completed the task more quickly and successfully than those who used a mixture of strategies, but it is not possible to make any strong claims here due to several confounding factors. For example, older speakers (who tended to use different FoRs to younger speakers, as will be shown in §5.2.4.8) were often slower to find the cards and to pick them up. The same confounding factors were present in the tasks to be discussed in §5.3.

Thus the columns for islands other than Fonadhoo and Dhanbidhoo (where much larger numbers of pairs were recorded) in Figure 5.9 and Figure 5.10 should be viewed with this limitation in mind.

In most islands in Laamu, fishing is a major economic activity and employs a large portion of the adult male population, while in others, residents are mostly employed in farming or administrative work, as outlined in Table 5.1 in §5.2.2. It is therefore possible to categorize islands in Laamu as either 'fishing islands' or 'non-fishing islands', as shown in Figure 5.9 and Figure 5.10.[123] Two 'fishing islands' (Dhanbidhoo and Gan) also have some farmers, but farming is not the most important industry on those islands, and so for the purposes of analysis they are simply treated as fishing islands here.

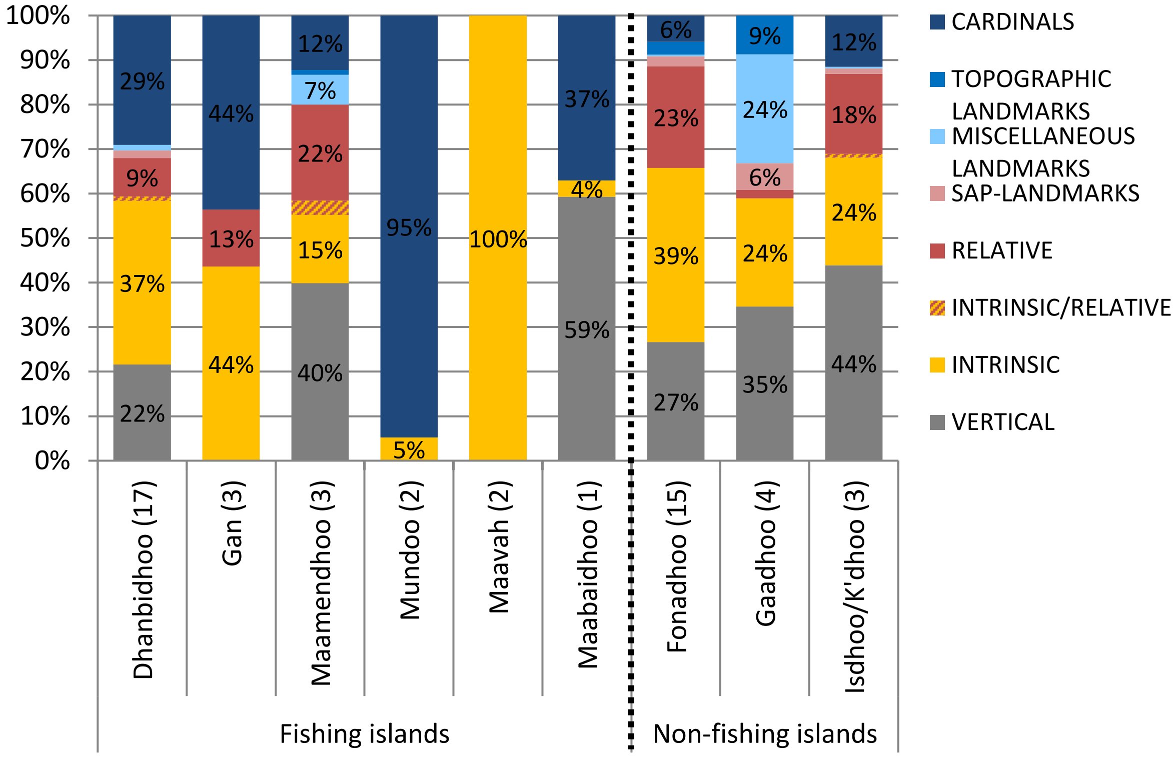

Figure 5.9: FoRs in locative descriptions on islands in Laamu Atoll

[123] It is possible to further subdivide non-fishing islands into farming islands (Gaadhoo, Isdhoo/Kalaidhoo) and administrative islands (Fonadhoo), though as I will explain later, there are very few differences in FoR patterns between farming and administrative islands, and so this subdivision is not shown in the figures.

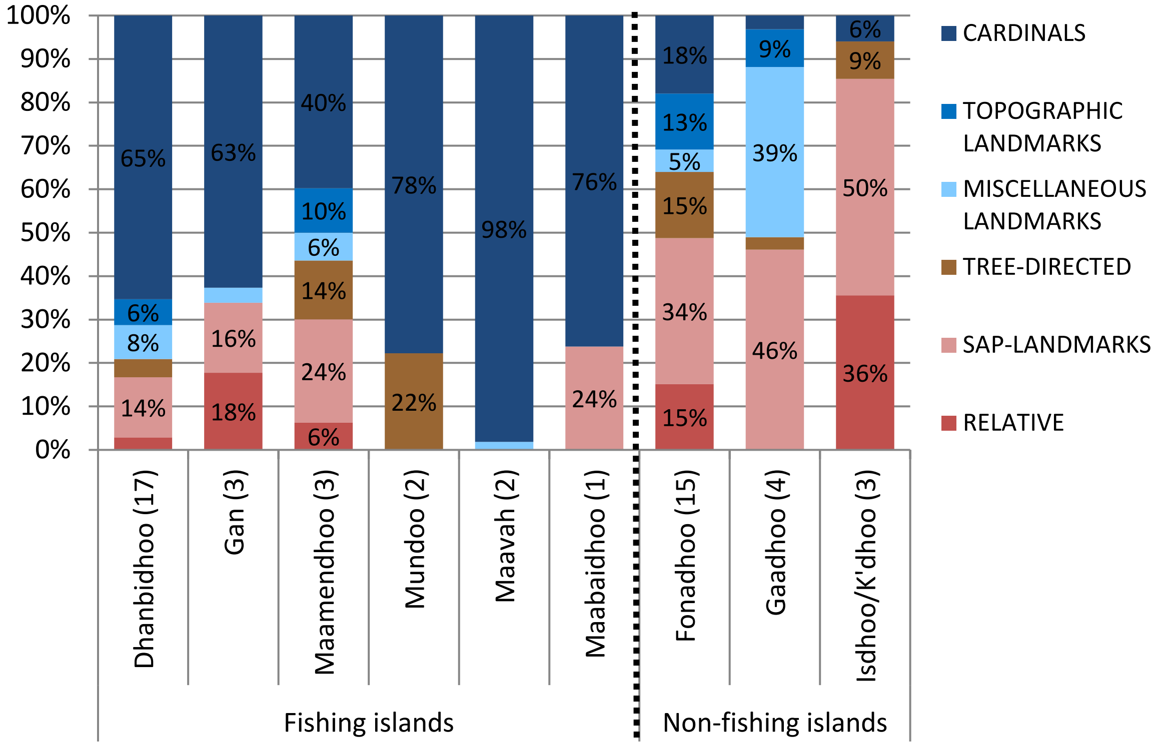

Figure 5.10: FoRs in orientation descriptions on islands in Laamu Atoll

Beyond the considerable variation that may be put down to the individual preferences of speakers on islands with small numbers of pairs, Figure 5.9 and Figure 5.10 show a more systematic pattern of variation in FoR choice. On fishing islands, cardinal directions are used more often than on non-fishing islands, especially in orientation descriptions (where vertical and intrinsic strategies are unavailable, as discussed in §5.2.4.3), and egocentric FoRs are used less often, again especially in orientation descriptions. Figure 5.11 and Figure 5.12 below compare fishing and non-fishing islands more directly, grouping all the pairs from fishing islands on the one hand and all the pairs from non-fishing islands on the other. As the graphs show, not only are cardinals used more often on fishing islands than non-fishing islands, but on fishing islands they are used considerably more often than egocentric strategies, whereas on non-fishing islands they are used considerably less than egocentric strategies.

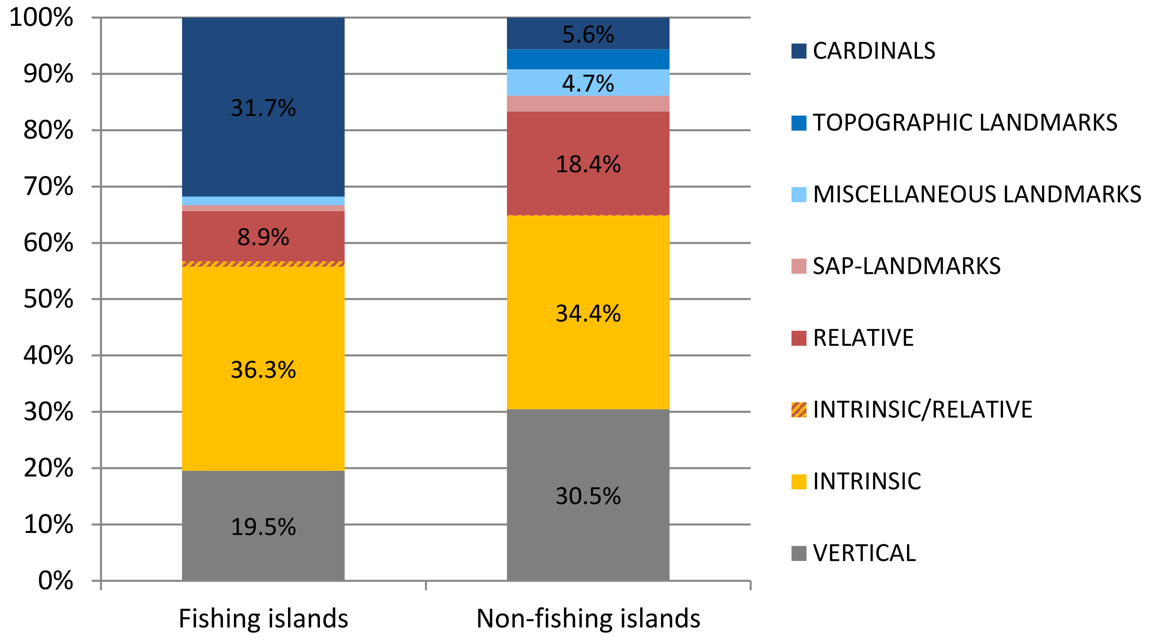

Figure 5.11: FoRs in locative descriptions in fishing vs. non-fishing islands in Laamu

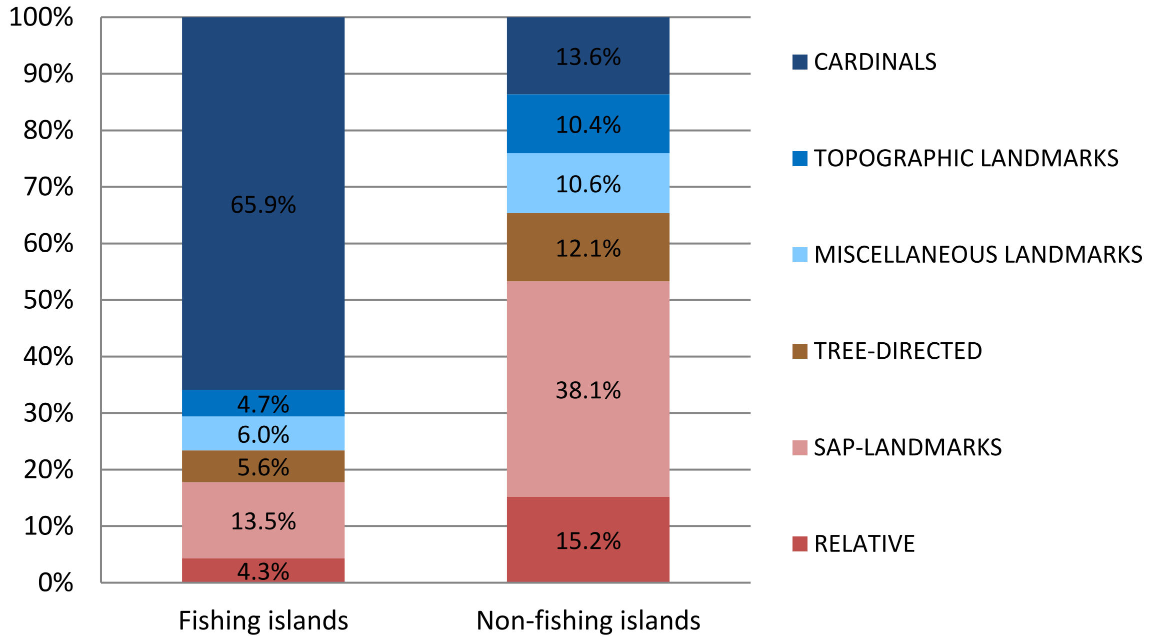

Figure 5.12: FoRs in orientation descriptions in fishing vs. non-fishing islands in Laamu

Mann-Whitney *U* tests comparing fishing and non-fishing islands revealed a number of significant differences in FoR rates. Egocentric FoRs were used significantly more on non-fishing islands in both locative descriptions (U = 214, p = .048) and orientation descriptions

(U = 108, p = .000), and in orientation descriptions each egocentric subtype was also used significantly more on non-fishing islands (relative FoR: U = 217, p = .029; SAP-landmarks: U = 111, p = .000). Geocentric FoRs in orientation descriptions were used significantly more often on fishing islands (U = 117, p = .000), driven largely by the high use of cardinal directions. Cardinal directions were used significantly more often on fishing islands, in both locative descriptions (U = 164, p = .001) and orientation descriptions (U = 109, p = .000). Although they were relatively uncommon in general, in locative descriptions topographic landmarks (U = 232, p = .017) and miscellaneous landmarks (U = 235, p = .046) were significantly more common on non-fishing islands than on fishing islands.[124] Landmarks as a combined category were more common on non-fishing islands in both locative descriptions (U = 202, p = .015) and orientation descriptions (U = 121, p = .000). No significant differences were found for the vertical, intrinsic, or tree-directed strategies.

Similar results are obtained by performing the same statistical test on FoR rates from just one fishing island (Dhanbidhoo) versus FoR rates from just one non-fishing island (Fonadhoo). In orientation descriptions, egocentric FoRs generally (U = 51, p = .003) and SAP-landmarks in particular (U = 57, p = .006) were significantly more common in Fonadhoo than Dhanbidhoo. In Dhanbidhoo, cardinal directions were significantly more common in both locative descriptions (U = 70, p = .014) and orientation descriptions (U = 54, p = .003) compared to Fonadhoo, and the high rate of cardinals also meant that geocentric FoRs (in total) were significantly more common in Dhanbidhoo (locative descriptions: U = 76, p = .041; orientation descriptions: U = 50, p = .002). In locative descriptions topographic landmarks were significantly more common in Fonadhoo than Dhanbidhoo (U = 94, p = .038), and in orientation descriptions landmarks combined were significantly more common in Fonadhoo (U = 62, p = .011). There were no significant differences for miscellaneous landmarks, nor for other categories (vertical, intrinsic, tree-directed).

[124] Pairs in Gaadhoo in particular seemed to favour miscellaneous landmarks, and also used topographic landmarks more often than pairs on most other islands (see Figure 5.9 and Figure 5.10). They also used the relative FoR less than pairs on other islands, even other non-fishing islands. It is not clear whether these findings really reflect a distinct FoR pattern in Gaadhoo, or whether they are simply a quirk of the small sample size (four pairs) there.

In two of the three ‘non-fishing’ islands (Gaadhoo and Isdhoo/Kalaidhoo), the main industry is farming, while on Fonadhoo most people are employed in administrative or domestic work. Mann-Whitney *U* tests comparing FoR rates in Fonadhoo versus the farming islands revealed no statistically significant differences in the use of any FoR categories except miscellaneous landmarks in locative descriptions, which were significantly more frequent in the farming islands ($U = 19$, $p = .020$). The difference was due to very high rates of usage in Gaadhoo (see also Footnote 124), where miscellaneous landmarks including houses, a school building, and a nearby toilet were used in 24.4% of locative descriptions (compared to 0.3% in Fonadhoo and 0.4% in Isdhoo/Kalaidhoo). Aside from the popularity of miscellaneous landmarks among the four Gaadhoo pairs, the FoR profile of the farming islands appears to be very similar to the FoR profile of Fonadhoo, an administrative island. Thus, the more important distinction is simply between fishing islands on the one hand and non-fishing islands (whether farming or administrative) on the other.

Despite their geographical proximity to other islands in Laamu, non-fishing islands in Laamu are in many ways more similar to Addu and Malé (see §5.2.4.2) in their FoR profiles than to Laamu fishing islands, as shown by the graphs in Figure 5.13 and especially Figure 5.14 below:

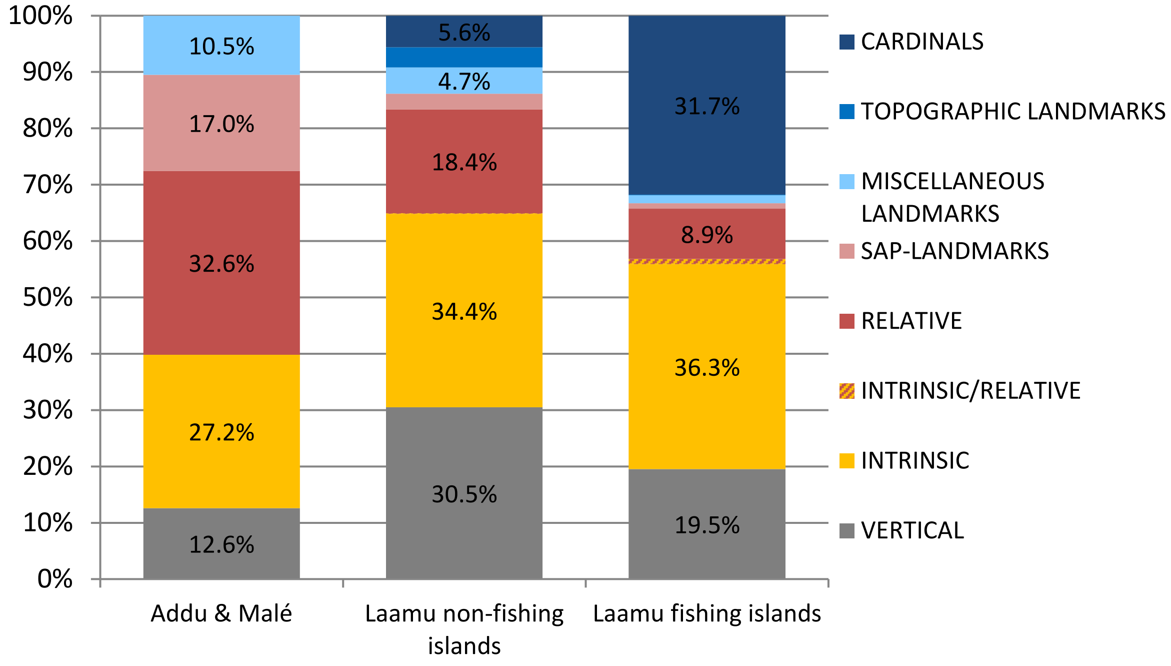

Figure 5.13: FoRs in locative descriptions in three categories of islands

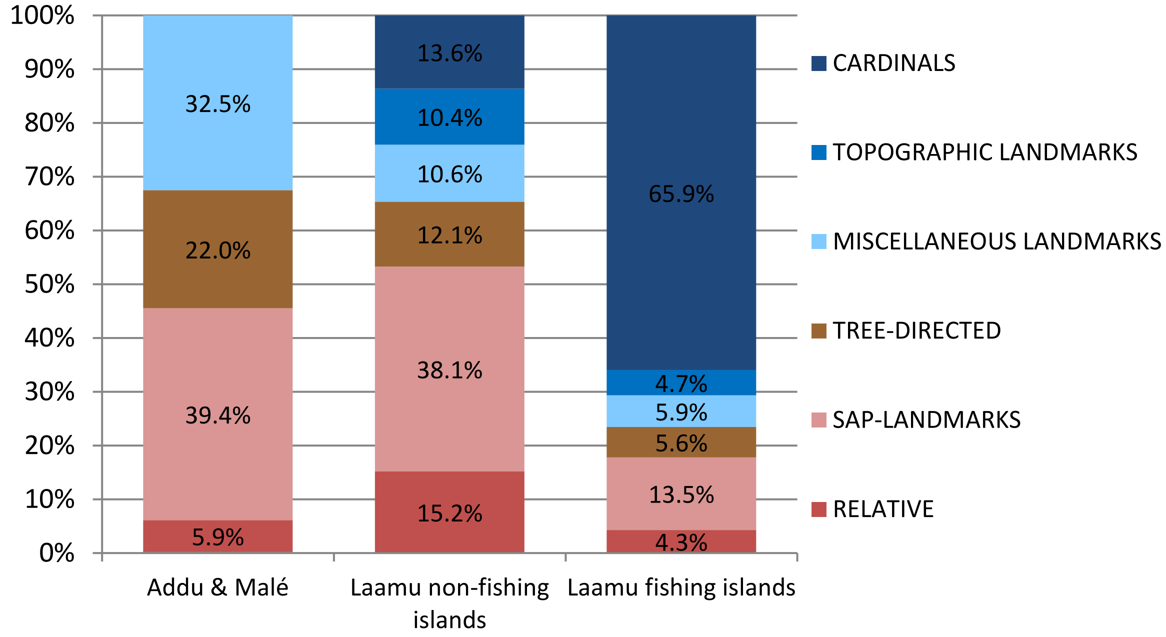

Figure 5.14: FoRs in orientation descriptions in three categories of islands

Although cardinal directions and topographic landmarks are represented in the data collected on Laamu non-fishing islands but not in the Addu or Malé data, the overall rate of geocentric FoR use (which includes miscellaneous landmarks as well as cardinals and topographic landmarks) is very similar at these locations: 13.9% of locative descriptions in

Laamu non-fishing islands compared to 10.5% in Addu and Malé (combined), and 34.7% of orientation descriptions in Laamu non-fishing islands compared to 32.5% in Addu and Malé. In Laamu fishing islands, however, geocentric FoRs are used more than twice as often (33.3% in locative descriptions and 76.6% of orientation descriptions). Laamu non-fishing islands also have rates of egocentric FoR use more closely resembling those in Addu and Malé, at least in orientation descriptions: 53.3% in Laamu non-fishing islands and 45.3% in Addu and Malé, compared to just 17.8% in Laamu fishing islands. Statistical tests showed that Laamu non-fishing islands do not have significantly different rates of use for many FoR categories compared to Addu and Malé combined ($p > .05$, Mann-Whitney U tests). The only exceptions to this were SAP-landmarks in locative descriptions ($U = 37$, $p = .007$), total egocentric FoRs in locative descriptions ($U = 50$, $p = .033$), landmarks combined in locative descriptions ($U = 36$, $p = .007$), and miscellaneous landmarks in orientation descriptions ($U = 43$, $p = .016$), which were used at higher rates in Addu and Malé, as well as vertical strategies in locative descriptions ($U = 50$, $p = .035$), which were used at higher rates in Laamu non-fishing islands.

Differences in education may at least partly explain the lower rates of vertical strategies in the Addu and Malé data (12.6% of locative descriptions compared to 30.5% in Laamu non-fishing islands). Residents of Addu and Malé are relatively well educated, and most of the participants in the Addu and Malé samples had been educated to at least a secondary level (see §5.1.3). Secondary education is associated with lower rates of vertical strategies, even within Laamu alone (see §5.2.4.9 for discussion). The lower rates of vertical strategies in Addu and Malé may also have had an effect on rates of other FoRs, since speakers who tend to avoid vertical strategies in the game have more opportunities to use other FoRs for the relevant cards, and especially SAP-landmarks (in cards that can be described vertically, the toy man is towards the speaker from the tree or vice-versa). Thus a significant difference in the use of SAP-landmarks (and egocentric FoRs more generally) in Addu and Malé versus Laamu non-fishing islands shows up in locative descriptions, but not in orientation descriptions where vertical strategies are unavailable. The other significant difference between these locations, which was the higher rates of miscellaneous landmarks in Addu and Malé orientation descriptions (32.5% versus 10.6% in Laamu non-fishing islands), instead relates to different regional patterns of geocentric FoR use – as described earlier, Addu and Malé speakers in the sample used miscellaneous landmarks as their only geocentric strategy, whereas Laamu speakers used a greater range of geocentric FoRs. It appears that this difference was significant only in orientation descriptions because in locative descriptions geocentric FoRs of any kind were relatively rare for both groups. Table 5.6 below summarizes the key statistical findings presented in this section:

Table 5.6: Summary of significant differences in FoR use across island types

	Mann-Whitney *U* tests:			
	Fishing vs. non-fishing islands (Laamu)	Dhanbidhoo vs. Fonadhoo (Laamu)	Administrative vs. farming islands (Laamu)	Laamu non-fishing vs. Addu & Malé
Cardinals	L** , O***	L* , O**	ns	ns
Topographic landmarks	L*	L*	ns	ns
Miscellaneous landmarks	L*	ns	L*	O*
Total geocentric	O***	L* , O**	ns	ns
SAP-landmarks	O***	O**	ns	L**
Relative FoR	O*	ns	ns	ns
Total egocentric	L* , O***	O**	ns	L*
Intrinsic	ns	ns	ns	ns
Vertical	ns	ns	ns	L*
Tree-directed	ns	ns	ns	ns
All landmarks	L* , O***	O*	ns	L**
Key: L: locative descriptions; O: orientation descriptions; ns: not significant; *: $p \leq .05$; **: $p \leq .01$; ***: $p \leq .001$				

Taken together, the evidence strongly suggests that in Dhivehi, FoR usage varies according to location, even within an atoll such as Laamu. However, what matters most here is not the environment (built or topographic) per se, but the predominant subsistence patterns or economic activities at each location, as these lead people to interact with and discuss their environment in different ways. As discussed in §1.2.4, most islands in Laamu share very similar topographic features: an exposed reef on the outer or oceanward side, calmer waters on the inner or lagoonward side, and a flat, narrow strip of land in between. But some of these islands are inhabited by fishing communities and others by non-fishing communities. With much of their population spending long periods on fishing boats out at sea, fishing communities interact heavily with the surrounding marine environment, whereas non-fishing communities interact only with the terrestrial and built environments.

On the open waters, where there are no landmarks and where egocentric FoRs are inadequate, navigating by cardinal directions is crucial to a successful voyage. The data from the Man and Tree game show that many people in fishing communities continue to use cardinal directions on land, at least when the context requires a certain degree of spatial precision. Members of administrative and farming communities, who spend almost all their time on land (and often indoors), use landmarks and egocentric FoRs at significantly higher rates, and their FoR patterns overall are more different to FoR patterns on fishing islands than to those in Addu and Malé. This implies that for Dhivehi, occupational biases have a bigger influence on FoR use than the urban-rural divide. Interestingly, however, members of farming communities appear not to use cardinals any more than people in Fonadhoo, an administrative island – this presumably suggests that the kind of small-scale farming practiced in the Maldives does not require paying such close attention to the cardinal points (e.g., by noticing the path of the sun) as does fishing on the open waters. In the following sections I discuss the impact of occupation further, as well as its relationship with other variables such as gender and age.

5.2.4.6 Occupation and FoR choice in Laamu

Occupational differences corresponded with differences in FoR choice not only at the level of islands or communities, but also at the level of individual pairs. As suggested in the previous section, the main difference is between fishermen or sailors and the rest; farmers behave more like indoor workers than fishermen in their FoR patterns. However, there were relatively few fishermen and farmers in the sample, and some pairs contained one fisherman with one indoor worker, or one farmer with one indoor worker. Thus, in order to conduct a quantitative analysis, each pair in Laamu was sorted into one of the following categories: (i) 11 pairs containing at least one (former) fisherman or sailor (henceforth 'fishermen/sailors' or simply 'fishermen'); (ii) seven pairs containing at least one (former) farmer (henceforth 'farmers'); and (iii) 32 pairs containing two people who were 'indoor workers' (including retired, students, and unemployed).[125] The data reported here for the 'fishermen' and 'farmer' categories is therefore not entirely representative of fishermen or farmers as such, but does at least show how (or whether) FoR patterns differ when a pair

[125] No pairs contained both a farmer and a fishermen/sailor, though most of the 'farmer' pairs and 'fishermen' pairs contained an indoor worker. Pairs from Addu and Malé, who were all indoor workers, were excluded from the analysis so that regional variation in FoR choice (see §5.2.4.2) would not be a confounding factor.

includes even one fishermen or farmer. Figure 5.15 below shows average FoR rates by occupational category:

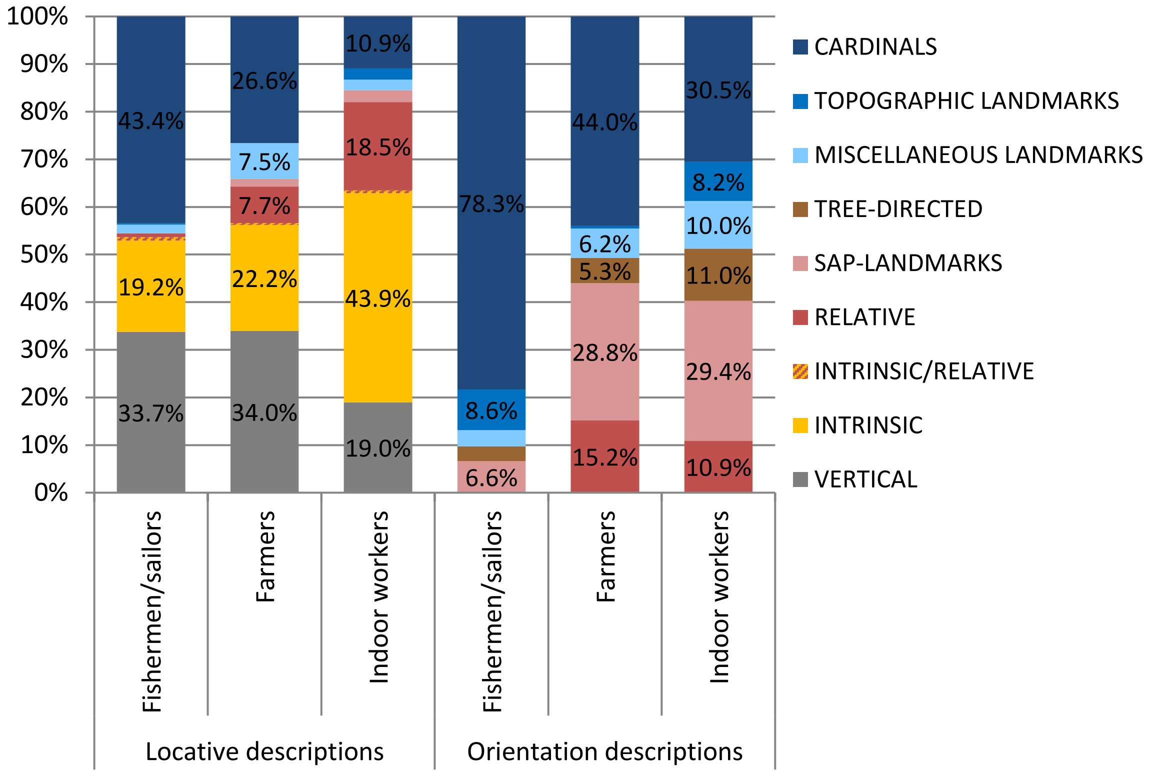

Figure 5.15: Average FoR rates in Laamu by occupation

Kruskal-Wallis tests revealed statistically significant differences in FoR rates across groups for vertical strategies in locative descriptions, landmarks and relative FoR in orientation descriptions, and for SAP-landmarks, egocentric FoRs, cardinals, and geocentric FoRs in both description types (see Table 5.7 below for summary). Mann-Whitney *U* tests (again with Bonferroni correction) also showed significant differences between fishermen and indoor workers for SAP-landmarks in orientation descriptions ($U = 60$, $p = .003$), egocentric FoRs combined (locative descriptions: $U = 95$, $p = .039$; orientation descriptions: $U = 51$, $p < .001$), cardinals (locative descriptions: $U = 55$, $p < .001$; orientation descriptions: $U = 63$, $p = .003$), geocentric FoRs combined (locative descriptions: $U = 62$, $p = .003$; orientation descriptions: $U = 55$, $p < .001$), and landmarks (all subtypes combined) in orientation descriptions ($U = 80$, $p = .018$). Additionally, there was a significant difference between fishermen and farmers for SAP-landmarks in locative descriptions ($U = 17$, $p = .033$). Interestingly, there were no significant differences between farmers and indoor workers. These results are summarized in Table 5.7 below:

Table 5.7: Summary of significant differences in FoR use across occupations in Laamu

	Kruskal-Wallis tests:	Mann-Whitney *U* tests:		
	Comparison of three occupations	Fishermen vs. indoor workers	Fishermen vs. farmers	Farmers vs. indoor workers
Cardinals	L*** , O**	L*** , O**	ns	ns
Topographic landmarks	ns	ns	ns	ns
Miscellaneous landmarks	ns	ns	ns	ns
Total geocentric	L** , O**	L** , O***	ns	ns
SAP-landmarks	L* , O**	O**	L*	ns
Relative FoR	O*	ns	ns	ns
Total egocentric	L* , O**	L* , O***	ns	ns
Intrinsic	ns	ns	ns	ns
Vertical	L*	ns	ns	ns
Tree-directed	ns	ns	ns	ns
All landmarks	O*	O*	ns	ns
Key: L: locative descriptions; O: orientation descriptions; ns: not significant; *: $p \leq .05$; **: $p \leq .01$; ***: $p \leq .001$				

Given the relatively small numbers of fishermen and especially farmers in the sample, and given that most fishermen and farmers were paired with indoor workers, these results must be interpreted somewhat cautiously. However, it is clear that compared to pairs of indoor workers at least, the presence of even one fisherman in the director-matcher pair is associated with a much greater use of cardinals, and with much lower use of egocentric FoRs. Farmers' FoR profiles appear to be somewhere in between those of fishermen and indoor workers, though on the available evidence they are closer to the latter, especially in their orientation descriptions (as shown earlier in Figure 5.15). This concurs with the finding (presented in the previous section) that FoR patterns on farming islands are closer to those on administrative islands than those on fishing islands.

5.2.4.7 Gender and FoR choice in Laamu

In the Laamu data, FoR choice also varies according to the gender of the speakers, as shown in Figure 5.16 below (recall that every speaker in the Laamu sample was paired with another speaker of the same gender, as described in §5.2.2). As with the variation between different atolls (§5.2.4.2), between different islands in Laamu (§5.2.4.5), and between people with different occupations (§5.2.4.6), the differences between genders were mostly in the use of geocentric and egocentric FoRs.

According to Mann-Whitney *U* tests, men in Laamu used cardinals at significantly higher rates than women (locative descriptions: $U = 201$, $p = .023$; orientation descriptions: $U = 173$, $p = .007$). In orientation descriptions, the higher rate of cardinals among men also resulted in a significant difference between genders in rates of geocentric usage more generally ($U = 176$, $p = .010$), though there were no significant differences for miscellaneous or topographic landmarks in either description type. Compared to men, in locative descriptions women had significantly higher rates of the relative FoR ($U = 216$, $p = .047$) and SAP-landmarks ($U = 223$, $p = .026$), as well as egocentric FoRs in general ($U = 171$, $p = .004$). In orientation descriptions, women had significantly higher rates of SAP-landmarks ($U = 199$, $p = .035$) and egocentric FoRs generally ($U = 186$, $p = .018$). In orientation descriptions women also used landmarks significantly more often than men ($U = 205$, $p = .048$). Rates of usage of the vertical, intrinsic, and tree-directed strategies were not significantly different between men and women.

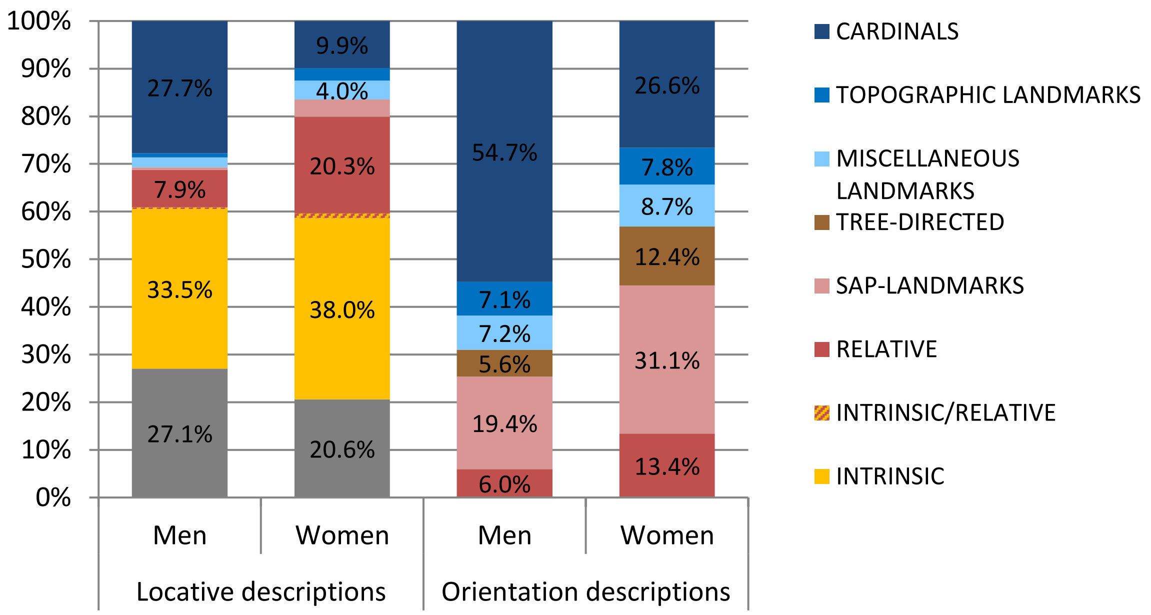

Figure 5.16: Average FoR rates in Laamu by gender

In the literature, gender differences in FoR use (and competence) have been reported for some other languages, but have been explained in various ways. Danziger (1999), analyzing data from a similar photo matching task, identifies a tendency in Mopan Maya (Mayan, Guatemala/Belize) for men to use relative and geocentric FoRs more than women (who prefer the intrinsic FoR, SAP-landmarks, and the tree-directed strategy).[126] She treats these differences in the speech of Mopan men and women as sociolinguistic in nature, stating that "[t]hey play the role of linguistic indices within the community, as well as that of linguistic symbols" (Danziger 1999: 101), although she also acknowledges considerable differences in the ways that Mopan men and women are socialized and where they work (men work in the fields, while women work indoors). In contrast, for Yucatec Maya (Mayan, Mexico/Belize), Bohnemeyer (2011: 904) reports that while men but not women tend to use cardinal directions (see also Bohnemeyer & Stolz 2006: 308–309; Le Guen 2011), this is apparently not a 'genderlect' feature since not all male speakers use cardinal direction terms, and such terms are not used to express a masculine identity. Instead, Bohnemeyer attributes this gender difference to occupational biases and other cultural practices specific to men – for example, he notes that "…the four edges of the *milpa*, the tropical garden where people plant their corn, beans, squash, chili, and so on, are supposed to be aligned with the cardinal directions, as are the walls of a traditional house" (Bohnemeyer 2011: 904).

In the case of the Laamu data reported here, it is likely that the situation is similar to Yucatec Maya. There is no indication that Dhivehi speakers in Laamu perceive the use of cardinal directions as an index of masculinity, nor the use of egocentric FoRs as an index of femininity, and in any case both kinds of FoRs were used by speakers of both genders – it is just that men are more likely to use cardinal directions more frequently than women, and women are more likely to use egocentric FoRs more frequently than men. This difference in FoR selection probably relates more to occupational biases and to some extent education and socialization patterns. Many men in Laamu work as fishermen, and many older men formerly worked as fishermen or sailors on trading ships. Older men also report that navigation was one of the basic skills taught to them as children – in times before GPS

[126] Note that Danziger's (1999) labels for FoRs are different to my own – her terms are 'Speech Participant Right/Left' (relative FoR), 'Scene-Internal' (tree-directed), 'Self-as-ground' (SAP-landmarks) and 'Geography' (geocentric).

technology, knowledge of the cardinal directions was imperative to survival on the open waters. In contrast, women mostly stay on land, and spend most of their time working indoors or near their houses in the company of other women. Furthermore, friendship groups are single-sex, and conservative religious norms prohibit spending much time with persons of the opposite sex unless they are family members. Men attend the mosque at prayer times, while women pray in the privacy of their homes (though a few mosques for women exist). In the late afternoon, young men typically gather to play football together, while young women play volleyball or *bashi*.[127] Thus, even men who do not go fishing may be more likely than women to pick up cardinal directions from other men, due to the greater amount of time they spend together. The gender differences in Figure 5.16 are therefore likely to have originated in occupational differences, but may be reinforced by the general segregation of men and women in other cultural activities.

5.2.4.8 Age and FoR choice in Laamu

Some recent studies have pointed to intergenerational changes in FoR choice in some indigenous Australian communities (Edmonds-Wathen 2013; Meakins 2011). In these cases, older speakers are reported to use the absolute FoR more frequently than younger speakers, who have begun to shift to other languages and who live less traditional lifestyles (e.g., by attending school). In the Laamu data, age also corresponds with differences in FoR patterns. As I will show in this section, older speakers use cardinal directions at higher rates than younger speakers, who use more egocentric descriptions.

As described in §5.2.2, each participant in Laamu was paired with another participant of a similar age, and the sample can be divided into three age cohorts: 17-34 years (16 pairs), 35-49 years (16 pairs), and 50-71 years (18 pairs). The cutoff at age 34 was used because most participants aged 34 or under had completed at least GCE O Level, whereas participants older than this had only been educated to a primary level or in some cases a lower secondary level. The cutoff between the two older groups was set at age 50 to keep

[127] *Bashi* is a Maldivian game played with tennis equipment. One player stands with her back to the net and serves the ball backwards over her head. Players on the other side of the net then try to catch the ball.

the groups roughly equal in numbers. The average FoR proportions of each of these three age groups in Laamu are shown in Figure 5.17 below.[128]

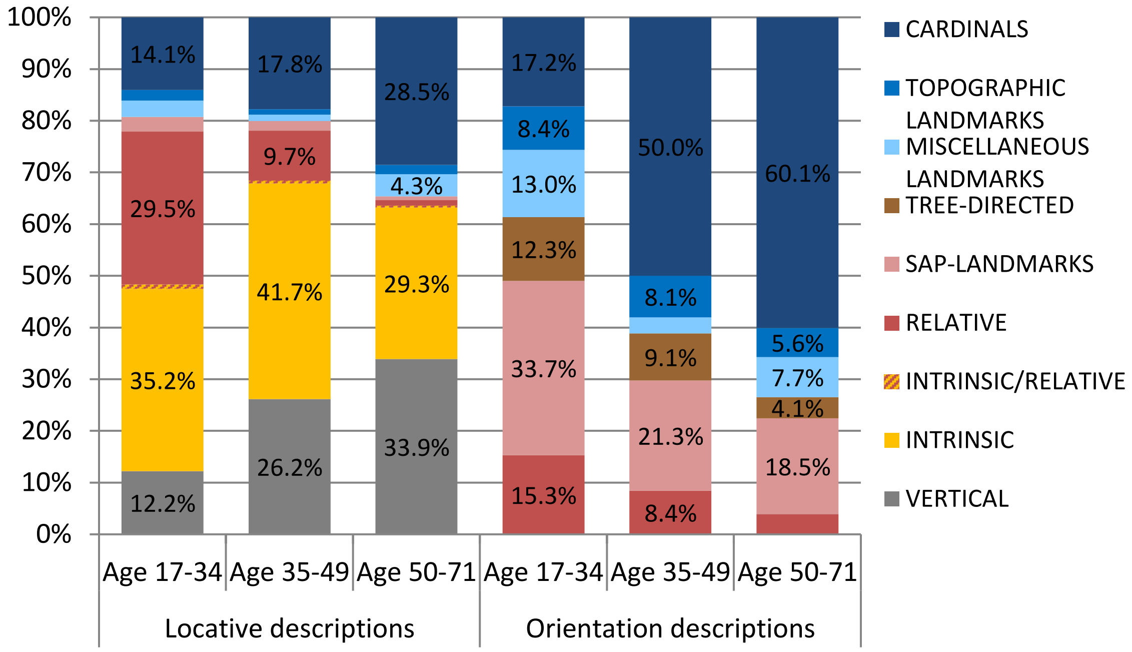

Figure 5.17: Average FoR rates in Laamu by age group

Figure 5.17 shows that older people in Laamu use cardinals more frequently than younger age groups, especially in orientation descriptions. They also use vertical strategies at higher rates but use egocentric strategies less (and hardly at all in locative descriptions). Unsurprisingly, the differences between the oldest and youngest age groups are the most extreme, with the middle group falling in between for most categories, though seemingly closer to the oldest group in most respects, and especially in the high rate of cardinals in orientation descriptions.

Statistical testing also supports these findings. Kruskal-Wallis tests show statistically significant differences between age groups for the relative FoR (locative descriptions: $H(2) = 9.59$, $p = .008$; $p = .014$ for orientation descriptions), egocentric FoRs combined (locative descriptions: $H(2) = 8.09$, $p = .018$; orientation descriptions: $H(2) = 6.28$, $p = .043$), vertical descriptions ($H(2) = 8.43$, $p = .015$), cardinals in orientation descriptions

128 As with gender (§5.2.4.7), this analysis excludes the small number of pairs from Addu and Malé, who showed very different FoR patterns as discussed in §5.2.4.2.

($H(2) = 9.82$, $p = .007$) and geocentric FoRs combined in orientation descriptions ($H(2) = 8.04$, $p = .018$). Bonferroni-corrected Mann-Whitney *U* tests show significant differences mostly between the youngest and oldest groups. Compared to the oldest group, the youngest group used the relative FoR at significantly higher rates (locative descriptions: $U = 67$, $p = .006$; orientation descriptions: $U = 72$, $p = .012$) as well as egocentric FoRs combined (locative descriptions: $U = 66$, $p = .015$; orientation descriptions: $U = 71$, $p = .048$). But the oldest group used vertical strategies ($U = 60$, $p = .015$), cardinals ($U = 58$, $p = .009$ for orientation descriptions) and geocentric FoRs combined ($U = 62$, $p = .018$ for orientation descriptions) significantly more than the youngest group. Compared to the middle group, the youngest group used cardinals significantly less ($U = 73$, $p = .045$ for orientation descriptions), though no other differences between these two groups were significant. There were no significant differences in FoR rates between the oldest and middle group. The statistical results are presented in summary form in Table 5.8 below:

Table 5.8: Summary of significant differences in FoR use across age groups in Laamu

	Kruskal-Wallis tests:	Mann-Whitney *U* tests:		
	Comparison of three age groups	Young vs. old	Young vs. middle	Middle vs. old
Cardinals	O**	O**	O*	ns
Topographic landmarks	ns	ns	ns	ns
Miscellaneous landmarks	ns	ns	ns	ns
Total geocentric	O*	O*	ns	ns
SAP-landmarks	ns	ns	ns	ns
Relative FoR	L** , O*	L** , O*	ns	ns
Total egocentric	L* , O*	L* , O*	ns	ns
Intrinsic	ns	ns	ns	ns
Vertical	L*	L*	ns	ns
Tree-directed	ns	ns	ns	ns
All landmarks	ns	ns	ns	ns
Key: L: locative descriptions; O: orientation descriptions; ns: not significant; *: $p \leq .05$; **: $p \leq .01$; ***: $p \leq .001$				

It is unlikely that these differences in FoR patterns are caused by any physical or cognitive changes that people experience as they age. All three age groups are a long way past the early developmental periods of childhood; moreover, some pairs in each age group showed FoR patterns that were unusual for their age (e.g., young people with high rates of cardinals, or older people with very low rates of cardinals), suggesting that other factors are at work.

Education may be one such factor – as mentioned earlier, speakers in the youngest age group were more highly educated than speakers in the older groups, who grew up in a period when access to schooling (and particularly upper secondary schooling) was more limited. Education looks particularly likely because the middle group patterns more like the oldest group than the youngest, most highly educated group. I will discuss the role of education further in the following section. Another likely factor is the ongoing decline in the proportion of fishermen and sailors in the population, and the increase in indoor workers. As described in previous sections, fishermen and sailors interact with the marine environment in special ways, whereas indoor workers interact mostly with just the terrestrial and artificial environments. If fishing (and sailing) is associated with higher use of cardinals, and indoor work with higher use of egocentric strategies (as shown in §5.2.4.5 and §5.2.4.6), then it is not surprising that the use of cardinals should be highest in the generation that contained the most fishermen/sailors, and the use of egocentric strategies highest in the generation with the most indoor workers.

Of course, education and occupation are closely intertwined, and so it is not really possible to separate the two completely. Economic development and modernization bring greater access to schooling and to higher levels of schooling, but also bring a greater range of white-collar jobs, some of which require higher levels of schooling in the first place. Aside from this, training for a particular occupation and the experience of working in that occupation is educational in itself. Learning to fish or sail on the open waters involves learning navigational skills, including the use of cardinal directions. In former times, when it was assumed that most boys would grow up to be fishermen or sailors, navigation was reportedly one of the basic skills taught to children (Saudiq 2004:20), though it is unclear whether this practice ended with the introduction of a formalized national primary education system in 1978 or earlier (see §5.2.4.9 for further discussion of the education system). Meanwhile, learning to work in an office or factory exposes people to spatial arrays and artefacts (such as paperwork, computers, etc.) that employ egocentric (including relative) distinctions but which do not require knowledge of geocentric directions.

5.2.4.9 Education, bilingualism, and previous places of residence

Previous sections raised the possibility that education may have an impact on FoR choice. This section addresses the role of education further, and briefly considers some additional demographic variables (bilingualism, and time spent abroad or in cities or resort islands) that could conceivably be linked to greater exposure to egocentric FoRs.

Traditionally, education was highly valued by Maldivians, though until recently most Maldivians had access to only a very basic level of education; higher levels of education were the preserve of the wealthy elite, who could afford to send their children abroad for further study (Colton 1995:88, 99). Traditional schools were run privately or by island communities and focused on teaching the Quran, though children also learned literacy, numeracy, and other skills such as navigation, with some islands even having dedicated schools for navigation (Saudiq 2004:20, 123; Sobir et al. 2014:69). Children would complete this basic education at about the age of 11. The traditional education system began to disappear in the second half of the 20th century. The 1960s saw the introduction of English medium public schools in Malé, and a modern, formalized education system in English medium was nationalized in 1978 (Sobir et al. 2014:69). At first only primary schools were opened throughout the atolls, but as students moved through the system, more and more high schools began to open in the following decades, though opportunities for tertiary education remain mostly confined to Malé.

For the purposes of analyzing the Man and Tree data, it is possible to divide most of the Laamu sample into two groups: speakers with only a primary or traditional education (34 pairs), and speakers with an upper secondary education, i.e., GCE O Level or higher (11 pairs). Since speakers were paired with someone of a similar age, in most cases both speakers had the same level of education. In the few cases where they did not, I classify pairs based on the educational level of the director (of the game translated and coded for analysis).[129] Figure 5.18 below shows the average FoR rates in Laamu by level of education (primary vs. upper secondary):

[129] Five pairs had a director who had reached only a lower secondary level of education. Because of the small numbers, and because all of these speakers were partnered with someone of a different education level, these pairs were excluded from the analysis presented in this section.

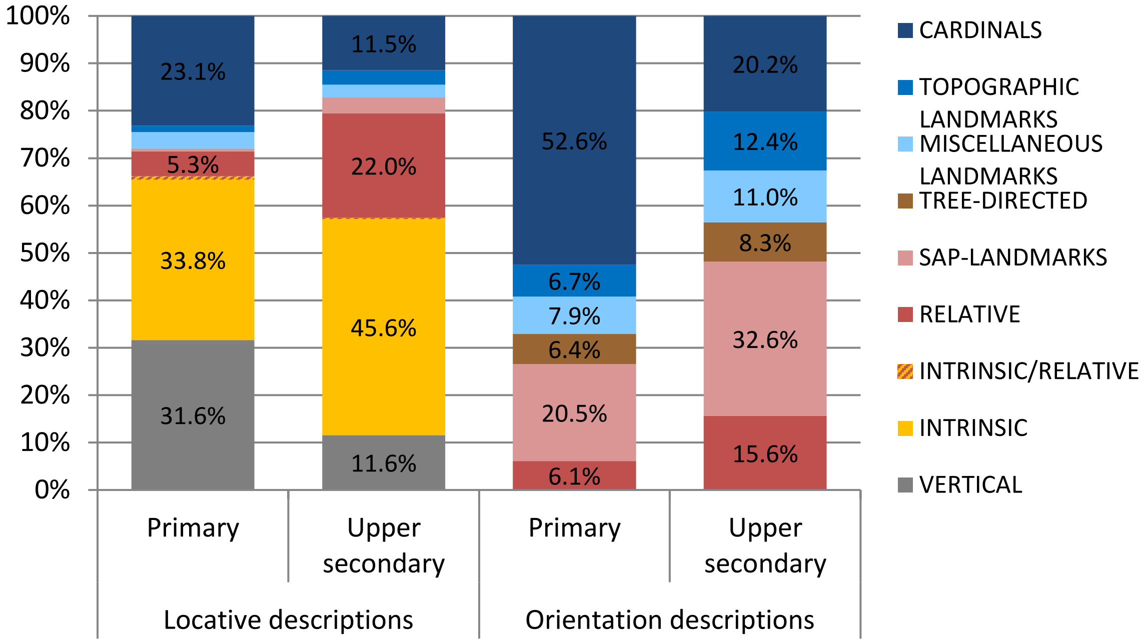

Figure 5.18: Average FoR rates in Laamu by level of education

Figure 5.18 shows a much higher rate of egocentric FoR use in speakers with an upper secondary education, and much lower rates of cardinal directions and vertical strategies. Mann-Whitney *U* tests revealed some significant results: compared to speakers with only a primary education, speakers with an upper secondary education used egocentric FoRs in locative descriptions significantly more (U = 266, p = .037). They used vertical strategies (U = 84, p = .005), cardinals in orientation descriptions (U = 100, p = .019) and geocentric FoRs in orientation descriptions (U = 110, p = .039) significantly less.

As described in the previous section, nearly all speakers in the 17-34 age range had been educated to an upper secondary level, while older speakers had generally been educated to only a primary level, and so it is not really possible to tease apart the influences of education and age. However, there are some good reasons to think that education may have a hand in shaping FoR patterns among Dhivehi speakers. Increased engagement with reading, writing, and other school activities may well foster the use of egocentric FoRs at the expense of geocentric ones.[130] But note that as mentioned briefly in Chapter 1, nearly all Maldivians (regardless of education level) nowadays are literate to at least a basic standard, and so any possible effects on FoR choice of literacy per se (as discussed in earlier work such as Levinson 2003:94) are not sufficient as an explanation here – rather, it seems that engagement with reading, writing, and related activities may be responsible for greater use of egocentric FoRs. Similarly, the lower rates of vertical strategies among more educated speakers might be explained by greater exposure to educational materials, and in particular to photos, drawings and diagrams, all of which familiarize people with two-dimensional representations of three-dimensional space. Thus, a highly educated speaker is more likely to recognize, for example, that the toy man is not really 'above' the tree in certain photos, but just further behind or away from it.

Learning English might also play a role. Although all schooling is currently conducted in English medium (with the exception of Dhivehi and Islam classes), in practice most students in Laamu do not achieve conversational fluency until the later years of secondary school. The greater levels of engagement with the English language throughout secondary school probably come with increased exposure to egocentric FoRs, which might then impact on FoR choice even when speaking Dhivehi. Students engage with English through books, worksheets, and multimedia, but also through their teachers, many of whom are Indians and Sri Lankans fluent in (South Asian) English.[131] However, if English itself is responsible, then one would expect bilinguals throughout the entire Laamu sample to show higher rates of egocentric FoRs (some older speakers learned English not from school, but from working in tourism or from living in Malé, Addu, or abroad). Yet Mann-Whitney *U* tests reveal few significant differences between the 27 pairs who claimed to speak only Dhivehi and the 15 pairs who claimed to speak some English as well (eight pairs containing one monolingual with one bilingual were excluded), though the monolinguals used

[130] A number of school subjects and activities may subtly foster egocentric FoR use, at least at a conceptual level. For example, although mathematics is not usually thought of as 'reading', numbers and operations must be read in a particular direction (Dhivehi uses a left-to-right order as English does, despite the Thaana script running from right to left), and digits are also assigned different values depending on their placement in a number (units, tens, hundreds, etc.). In addition, games and sports may also encourage students to pay attention to egocentric and intrinsic relations rather than geocentric ones.

[131] Due to a shortage of local teachers, approximately 30% of teachers in the Maldives are foreigners (Sobir et al. 2014:74).

cardinals in orientation descriptions significantly more (U = 110, p = .012), as well as vertical strategies (U = 92, p = .003).[132]

One might also expect higher rates of egocentric FoRs to be found among speakers who have previously lived abroad, on resort islands, or in cities like Malé or Addu. While this seems plausible enough, no significant differences were found between the 26 pairs of speakers who had never left the atoll and the 13 pairs of speakers who had spent at least five years (combined) abroad, on resort islands, or in cities (p > .05, Mann-Whitney U tests). However, the possibility that some influence of this kind went undetected is hard to rule out. Many pairs included one speaker who had never left the atoll and one speaker who had spent some amount of time abroad, on resort islands, or in cities. Moreover, speakers who had lived in one of these outside locations had done so for greatly varying periods of time (from a few weeks in many cases to 25 years in the case of one 58-year-old man), and the precise locations varied from speaker to speaker too. But the data at least show that moving to one of these different environments for some period of time and then returning to live on an atoll does not have an obvious effect on FoR patterns.

Table 5.9 below summarizes the results of the statistical tests discussed in this section:

[132] It is possible of course that some participants who claimed to speak only Dhivehi in fact could speak some English, and that some who claimed to know some English in fact did not know very much. Unfortunately, for practical reasons it was not possible to get accurate assessments of all participants' English proficiency (aside from the large number of participants to check, people were often too shy or embarrassed to use English in front of the researcher, and were vague or uncertain when estimating their own level of competence). Thus, it may be the case that a high level of proficiency in English corresponds with greater use of egocentric FoRs at the expense of geocentric FoRs, though the Laamu data cannot speak to this. The high rates of egocentric FoRs in Addu and Malé, where most participants were fluent in English, could be taken to support this, though there are also other factors in play at these locations, as discussed in §5.2.4.2.

Table 5.9: Summary of significant differences in FoR use in Laamu according to education, bilingualism, and time spent in cities/resorts/abroad

	Mann-Whitney *U* tests:		
	Primary vs. upper secondary	'Monolinguals' vs. 'bilinguals'	Only lived in Laamu vs. lived in cities/resorts/abroad for 5+ years (combined)
Cardinals	O*	O*	ns
Topographic landmarks	ns	ns	ns
Miscellaneous landmarks	ns	ns	ns
Total geocentric	O*	ns	ns
SAP-landmarks	ns	ns	ns
Relative FoR	ns	ns	ns
Total egocentric	L*	ns	ns
Intrinsic	ns	ns	ns
Vertical	L**	L**	ns
Tree-directed	ns	ns	ns
All landmarks	ns	ns	ns
Key: L: locative descriptions; O: orientation descriptions; ns: not significant; *: $p \leq .05$; **: $p \leq .01$; ***: $p \leq .001$			

5.2.4.10 Situational variables

It is clear from the preceding sections that a range of demographic variables are linked to FoR choice in Dhivehi. I turn now to consider the question of whether the experimental conditions had any impact on FoR choice in the task. In particular, two elements of the experimental setup were deliberately varied across the sample: whether participants were indoors or outdoors when playing the game, and the direction participants faced.

Regarding the first variable, all pairs in Laamu were recorded in one of three conditions: indoors with no visual access to the outside world through windows or open doors (nine pairs), in an enclosed courtyard with limited visual access to topographic features (20 pairs), or fully outdoors and with clear visual access to the lagoon or ocean (21 pairs). Participants in each condition were counterbalanced as far as possible for demographic factors such as age and gender.[133] Interestingly, however, no statistically significant differences between these conditions were found (see also Table 5.10 at the end of this section). Moreover, in most cases the non-significant differences were not in the direction predicted by Li and Gleitman (2002), who, as discussed in Chapter 3, assume that geocentric FoRs are more available in outdoor contexts, and egocentric FoRs in indoor contexts. For example, cardinals were actually used at higher rates by the indoor pairs (26.3% of locative descriptions and 42.7% of orientation descriptions) than by the outdoor pairs (13.7% of locative descriptions and 39.0% of orientation descriptions), and egocentric FoRs slightly less. The findings therefore fail to support the notion that FoR selection is determined by how much visual access the speaker has at the time to features of the wider world.

The facing direction of participants is another variable that could be expected to influence FoR choice in Man and Tree. As described in §5.2.4.3, certain strategies are mostly restricted to certain description types (locative versus orientation descriptions), or are more likely in one description type for functional reasons (e.g., landmarks in orientation descriptions, or intrinsic FoR in locative descriptions). Further, some strategies are more available for cards that show the man and tree arranged on a particular axis with respect to the speaker/viewer. In particular, vertical and SAP-landmark strategies are more available when the man and tree are in line with the speaker (it is only in these cards that the man can be perceived as being above or below the tree, or on the near or far side of it). Additionally, SAP-landmarks in orientation descriptions are possible for cards in which the man is facing towards or away from the speaker.[134] These biases mean that for directions coinciding with a speaker's sagittal axis, the speaker can draw upon vertical and SAP-landmark strategies

[133] It would also have been possible to ask (some) pairs of speakers to redo the task in different conditions, in order to see whether or how they adapt their FoRs to the new conditions. However, it is quite possible that speakers would simply continue to use strategies they found successful in the first set of conditions, and so reruns would not necessarily reveal much about the experimental conditions themselves. I therefore opted to focus on recruiting new participants rather than repeating tasks with a smaller sample.

[134] Speakers occasionally used SAP-landmarks to describe cards in which the toy man faces across the speaker's field of view (i.e., towards or away from the dividing screen), such that 'The man is facing me' meant 'facing towards my side of the table' and 'The man is facing you' meant 'facing towards your side of the table'. Descriptions of this kind were often unsuccessful, firstly because the matcher has to realize that the director has in mind the transverse rather than sagittal axis, and secondly because on the matcher's side of the table, the corresponding cards cannot properly be described in such a way (e.g., since the cards are already on the matcher's side of the table, it does not make much sense to think of any of the men on the cards as facing the matcher's side of the table), and so the matcher must also try to imagine the description from the director's perspective. Most pairs who used this strategy for such cards encountered these difficulties early on and subsequently abandoned the strategy along their transverse axis.

instead of, say, other landmarks or cardinal directions. Since the main topographic landmarks on atoll islands lie along just one axis, the frequency of topographic landmark references may therefore be affected by the facing direction of participants – if the facing direction lines up with the beachward-inland (and lagoonward-oceanward) axis, topographic landmark references may be less common (in comparison with a perpendicular facing direction) due to ‘competition’ with the vertical and SAP-landmark strategies in many cards. However, this ‘competition’ effect is not predicted to impact the use of miscellaneous landmarks or cardinal directions, which align with multiple axes.

In the Laamu sample, 21 pairs were seated facing ‘across’ the island (all facing lagoonward), and 17 pairs were seated facing ‘along’ the island (north in Dhanbidhoo or northeast in Fonadhoo). These groups were counterbalanced as far as possible for demographic factors, though the ‘across’ condition turned out to have more fishermen and sailors (five pairs) than the ‘along’ condition (two pairs) as well as more pairs from fishing islands (14 versus nine). The remaining pairs were seated in a variety of other facing directions, or were on islands that did not have a clear ‘lagoonward’ direction (e.g., Maamendhoo is surrounded by the lagoon on all sides – see Figure 1.3 in §1.2.4.1), and so were excluded from the following analysis. Figure 5.19 below compares the average FoR rates of pairs in the ‘across’ and ‘along’ conditions:

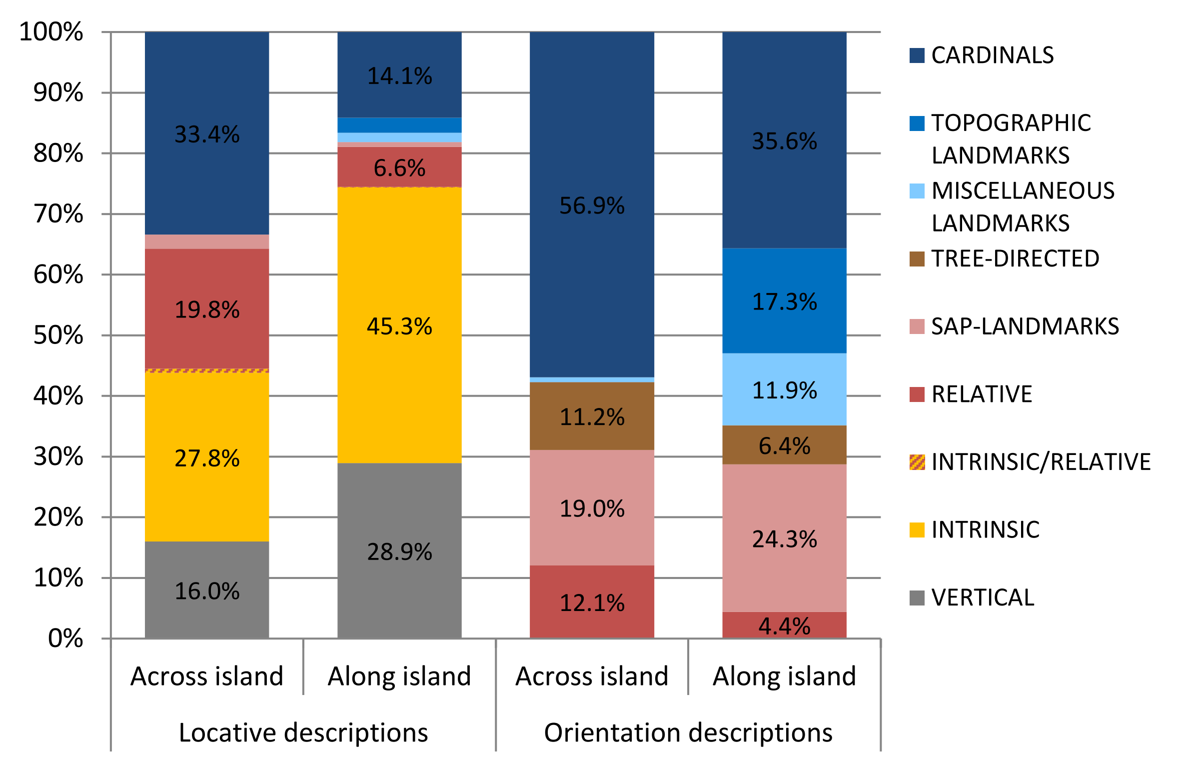

Figure 5.19: Average FoR rates in Laamu by facing direction of participants

Mann-Whitney *U* tests revealed some significant differences between the two conditions. As predicted, pairs facing 'along' used topographic landmarks at significantly higher rates in both locative descriptions ($U = 137$, $p = .032$) and orientation descriptions ($U = 84$, $p = .000$). In fact, the strategy was not used at all by any pairs in the 'across' condition, while in the 'along' condition it was used on average in 2.5% of locative descriptions and 17.3% of orientation descriptions, as shown in Figure 5.19. However, some other significant results were also found. Miscellaneous landmarks in orientation descriptions were significantly more common among pairs facing 'along' the island ($U = 106$, $p = .003$), as were landmarks generally in orientation descriptions ($U = 103$, $p = .025$), vertical strategies in locative descriptions ($U = 108$, $p = .037$), and the intrinsic FoR in locative descriptions ($U = 106$, $p = .032$). These results are summarized in Table 5.10 at the end of this section.

The results are surprising because it is hard to see how the use of some of these strategies could directly depend on which direction the speaker happens to be facing. It is possible that the differences are due to a quirk of the sampling – as mentioned above, there were more fishermen and pairs from fishing islands in the 'across' condition. However, another possible line of explanation relates to the fact that certain FoRs tend to co-occur while others do not (cf. §5.2.4.4). If one of the two facing directions affords the use of topographic landmarks more than the other, this may have ramifications for the use of other FoRs too, resulting in a number of differences beyond the use of topographic landmarks. For example, once a speaker starts using topographic landmarks along his transverse axis, he may be more likely to think of using geocentric landmarks for the sagittal axis too. This would account for the higher rates of miscellaneous landmarks (and landmarks generally) in orientation descriptions in the 'along' condition. But locative descriptions tend to favour an angular-anchored strategy (cf. §5.2.4.3), and landmarks are head-anchored. Since cardinals tend not to co-occur with landmarks (cf. §5.2.4.4), and the relative FoR is generally uncommon in Laamu anyway, pairs using landmarks in orientation descriptions are more likely to gravitate towards the intrinsic and vertical strategies in their locative descriptions.

Table 5.10: Summary of significant differences in FoR use in Laamu according to situational variables

	Kruskal-Wallis tests:	Mann-Whitney *U* tests:			
	Indoors vs. courtyard vs. outdoors	Indoors vs. courtyard	Indoors vs. outdoors	Courtyard vs. outdoors	Along vs. across
Cardinals	ns	ns	ns	ns	ns
Topographic landmarks	ns	ns	ns	ns	L* , O***
Miscellaneous landmarks	ns	ns	ns	ns	O**
Total geocentric	ns	ns	ns	ns	ns
SAP-landmarks	ns	ns	ns	ns	ns
Relative FoR	ns	ns	ns	ns	ns
Total egocentric	ns	ns	ns	ns	ns
Intrinsic	ns	ns	ns	ns	L*
Vertical	ns	ns	ns	ns	L*
Tree-directed	ns	ns	ns	ns	ns
All landmarks	ns	ns	ns	ns	O*
Key: L: locative descriptions; O: orientation descriptions; ns: not significant; *: $p \leq .05$; **: $p \leq .01$; ***: $p \leq .001$					

5.2.4.11 Comparing the variables

To conclude the discussion of Man and Tree, I turn now to a comparison of the variables discussed in previous sections. How do these variables interact, and which have the biggest impact on FoR choice? The previous sections showed that a number of FoRs and FoR subtypes varied in their usage rates across groups. To some extent FoR patterns also varied according to the direction speakers faced during the task (§5.2.4.10), though here I focus on comparing the demographic variables. The variation in geocentric strategies is of particular relevance to some of the key empirical issues and research questions introduced in earlier chapters as well as in §5.1.1. In Laamu, where the sample was largest, the predominant geocentric strategy was cardinal directions. Table 5.11 below therefore lists some of the (non-independent) groups in Laamu with the highest and lowest rates of cardinals, compared with the average rate for the entire Laamu sample:

Table 5.11: Groups in Laamu with high and low rates of cardinal direction usage

	Average proportion of cardinals in:	
	Locative descriptions	Orientation descriptions
Fishermen/sailors	43.4%	78.3%
Fishing islands	31.7%	65.9%
Age 50+	28.5%	60.1%
Men	27.7%	54.7%
Neither player speaks English	23.0%	54.8%
Primary education only	23.1%	52.6%
Entire sample	20.2%	42.9%
Both players speak some English	18.6%	24.0%
Indoor workers	10.9%	30.5%
Women	9.9%	26.6%
Upper secondary education	11.5%	20.2%
Age <35	14.1%	17.2%
Non-fishing islands	5.6%	13.6%

As Table 5.11 shows, the group with the highest average rate of cardinals is fishermen/sailors, followed by closely associated groups: people on fishing islands, people aged 50 or older, and men. There were of course some slight biases in the sample – on fishing islands, more pairs of older men were recruited than pairs of older women (see §5.2.2), and naturally, the sample from fishing islands included more people who worked as fishermen or sailors. It is therefore pertinent to ask whether the higher-than-average rates of cardinal directions displayed by some of these groups could be merely due to the sampling.

However, filtering the results shows differences in cardinal rates even when these variables are teased apart. For example, taking out the fishermen and sailors, rates of cardinal directions are still much higher on fishing islands (25.3% of locative descriptions, 60.3% of orientation descriptions) than on non-fishing islands (3.8% of locative descriptions, 9.5% of orientation descriptions). Moreover, cardinal directions were used at higher rates on fishing islands than non-fishing islands in each age and gender group. For example, of the seven pairs of women aged 35-49, the four pairs on fishing islands used cardinals in 25.4% of locative descriptions and 80.3% of orientation descriptions, whereas the three pairs on non-fishing islands did not use cardinals at all. In fact, on non-fishing islands no women used any cardinal directions and no young people did, but some men over 34 years-old used cardinals, even if they had never been fishermen or sailors. On fishing islands too men used cardinals more than women, especially in the youngest age group, which as a whole used cardinals much less than people over 34 years-old. These demographic differences are illustrated in Figure 5.20. They represent compelling evidence that island type, age, and gender are each associated with real differences in rates of cardinal direction usage.

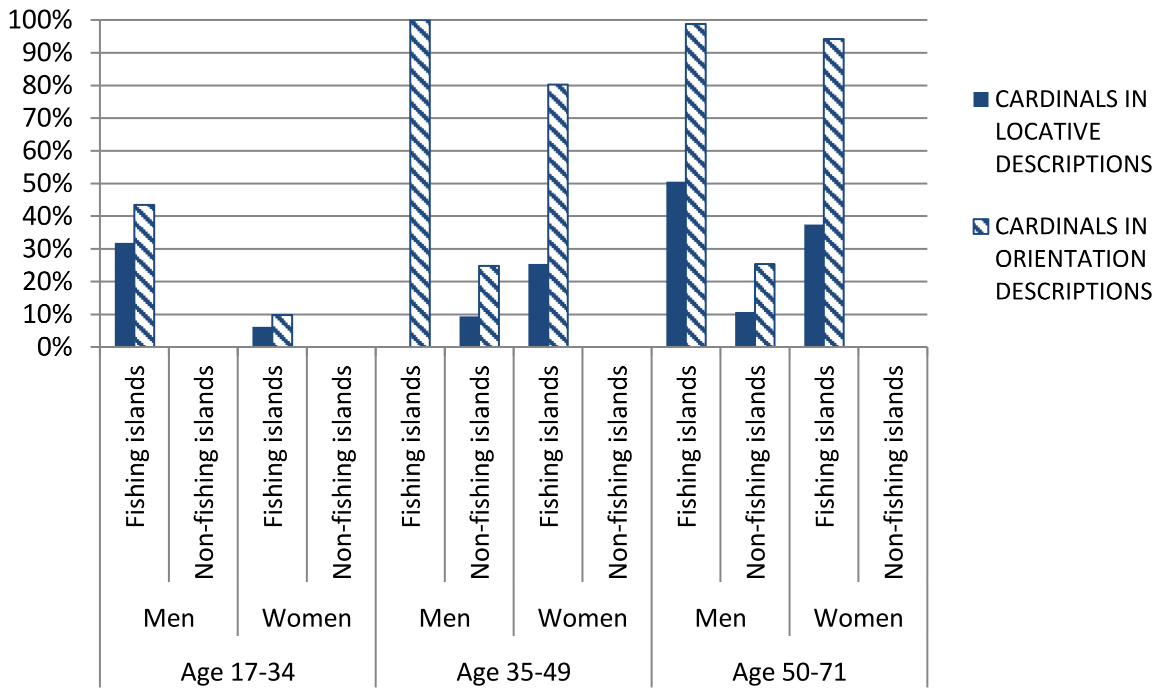

Figure 5.20: Use of cardinals in Laamu across various demographic groups, excluding pairs with fishermen or sailors

As for the other two demographic categories associated with higher rates of cardinal direction usage (monolinguals and people with only a primary education), these are harder to filter because people in these categories were almost always older than 34, and people older than 34 almost always belonged in these categories. Furthermore, young people almost all speak English to some level and have at least a lower secondary education (most have an upper secondary education). It is therefore not possible to separate the effects of age, bilingualism and education. However, the high rates of cardinals among fishermen/sailors and people on fishing islands suggest that the differences observed for age reflect changing subsistence patterns and economic activities, rather than (only) the advent of bilingualism and secondary education. Fonadhoo and other 'non-fishing' islands had fishing fleets several decades ago, and it is probably no coincidence that some middle-aged and older men on these islands use cardinal directions – their use of cardinals likely reflects what was once a more widespread strategy. Even on fishing islands, the proportion of people employed in fishing is on the decline, and the introduction of GPS technology and mechanized fishing boats has reduced the need for younger fishermen to know the cardinal directions so well. On the other hand, the use of cardinals is so well established on some fishing islands that even some young, highly educated speakers not working as fishermen use cardinals at high rates. A pair with one of the highest rates of cardinals in the entire sample was a 22-year-old man and a 19-year-old man from Mundoo, who used cardinals in 96% of their locative descriptions and 89% of their orientation descriptions. This was despite the fact that both speakers had been educated to at least O-Levels (and one speaker to A-Levels), and despite the fact that both could speak some English and neither worked as fishermen. This shows that at the very least, bilingualism and education do not have a deterministic effect on rates of cardinal direction usage, and suggests that the community in which a speaker lives has a much stronger effect.

Turning to egocentric FoRs, a comparison of usage rates across groups (shown in Table 5.12 below) reveals that egocentric FoRs (i.e., relative FoR plus SAP-landmarks) are most popular among young speakers, though a number of other groups also use these strategies at similar rates. Though the differences between these groups are slight, the data again tend to suggest that changing subsistence patterns (across generations and locations) are more closely tied to FoR rates than other factors, though education may also play some role here.

Table 5.12: Groups in Laamu with high and low rates of egocentric FoR usage

	Average proportion of egocentric FoRs in:	
	Locative descriptions	Orientation descriptions
Age <35	32.4%	49.1%
Non-fishing islands	21.2%	53.3%
Upper secondary education	25.4%	48.1%
Women	23.9%	44.6%
Both players speak some English	18.9%	42.7%
Indoor workers	21.0%	40.3%
Entire sample	14.9%	33.4%
Neither player speaks English	6.1%	28.0%
Men	8.4%	25.4%
Primary education	5.9%	26.6%
Fishing islands	10.0%	17.8%
Age 50+	1.8%	22.4%
Fishermen/sailors	0.8%	6.6%

And once again, filtering the data for age group, island type, and gender shows each of these variables to be associated with obvious differences in egocentric FoR usage, as illustrated by Figure 5.21 below. For example, in each age group, women use egocentric FoRs at higher rates than men, and non-fishing communities use egocentric FoRs at higher rates than fishing communities.

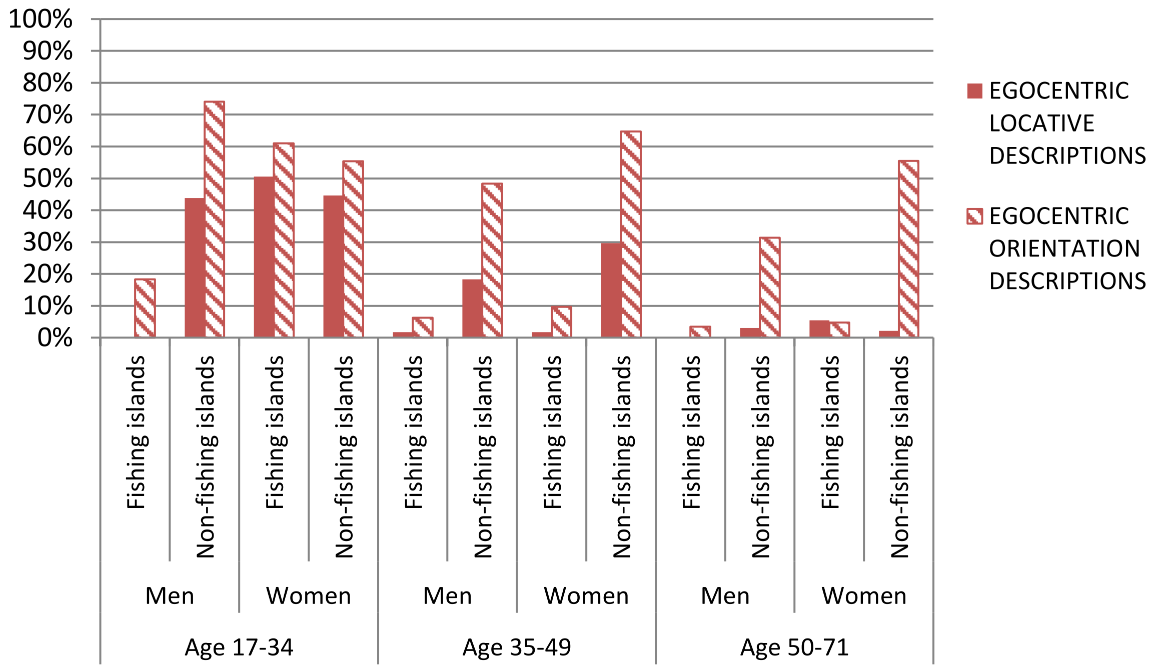

Figure 5.21: Use of egocentric FoRs in Laamu across various demographic groups

To summarize the key findings of this section, and of §5.2.4 generally, FoR use in the Man and Tree game is highly variable among Dhivehi speakers. Although FoRs vary according to whether speakers are making locative or orientation descriptions, a number of demographic factors are also clearly associated with different FoR patterns. Cardinal directions are especially common among fishermen and sailors, as well as in locations or groups in Laamu with a strong connection to fishing and sailing (fishing communities, older age groups, and men). Egocentric FoRs are more common among other groups: younger speakers (who are also more highly educated and more likely to be bilingual), non-fishing communities, and women. Egocentric FoRs are also a major strategy in the urban centres of Malé and Addu, though this is more likely due to social factors rather than environmental differences alone. Speakers who use egocentric FoRs often make landmark-based references too, while users of cardinal directions tend not to. The landmarks in question are usually buildings or villages, though in Laamu some topographic landmarks are also used – these include the beach, the inland part of the island, and occasionally the lagoon shore, ocean shore, or oceanward reef. Vertical strategies and the intrinsic FoR are also important strategies across the whole population, though vertical strategies are less common among younger, more educated speakers than older, less educated ones, probably because of how the stimuli are interpreted. FoR patterns in the task are not sensitive to whether the experiment is conducted indoors or outdoors, though the direction speakers are facing appears to affect the kinds of landmarks they select on their left and right sides, which in turn may have some consequences for their more general use of landmarks and even on the other strategies they use in the game.

5.3 Other tasks

In addition to the Man and Tree game, Dhivehi speakers at my field sites participated in a number of other spatial language tasks. These tasks were designed to shed light on different aspects of spatial language in Dhivehi – for example, the Route Description task (§5.3.1) elicits FoRs in motion descriptions, along with topological relations. Some narrative data was also collected in order to reveal patterns of spatial language use in a more naturalistic setting where no stimuli are present. For the most part, the data from these tasks and from the narratives corroborated the results of the Man and Tree game in §5.2.4. However, there were also some supplementary findings from these tasks. For reasons of space, and because this data is generally less amenable to quantitative analysis than the Man and Tree data, in this section I offer only a brief summary of the methodology and some of the main findings from each task.[135] Note that the instructions for each task (read aloud to participants by a local research assistant) are presented with translations in Appendix I.

5.3.1 Route Description game

5.3.1.1 Methodology and participants

The 'Route Description' game reported here is based on the version devised by Wilkins (1993), though with different stimuli. It is played by two participants who sit side by side, but separated by a dividing screen as in the Man and Tree game. An example of two women playing the Route Description game is shown in Figure 5.22 below. In front of each participant is a scene made up of a Lego DUPLO® plastic base (38cm x 38cm) with various pieces attached (see Figure 5.23 below). The pieces include fences, flowers, animals, and blocks of various colours and shapes. Each player has a replica of the exact same scene, except that the 'director' has a length of white chain running through the array. This chain marks the route along which the participants are to move a toy man during the task. The director simply moves her toy man along the chain, but the 'matcher' must rely on the director's instructions in order to follow the same path on his own side. The matcher is also able to ask the director questions throughout the game. After a few practice games, each pair of participants attempts four different routes, with participants alternating roles.[136]

[135] The methodology for these tasks was developed (or adapted, in the case of some tasks) in conjunction with Jonathan Schlossberg, Alice Gaby and Bill Palmer.

[136] The base scene was kept mostly identical for all four routes, though following Wilkins (1993), some small alterations were made for Routes 3 and 4, so that the scene would no longer be perfectly symmetrical along the sagittal axis. Figure 5.23 shows Route 3. The red flower, yellow flower and the sheep were not present for Routes 1 and 2, and the chicken faced the front (i.e., towards the participants), as in Figure 5.22, which shows a practice route. The toy man always started in the same position.

Figure 5.22: Fonadhoo women playing the Route Description game

Figure 5.23: DUPLO® array for the Route Description task

The task was performed by 56 pairs of adult speakers in Laamu Atoll. As with the Man and Tree game, a little more than half these pairs were from the primary field sites of Fonadhoo and Dhanbidhoo, and the rest were from other islands in the atoll, including Hithadhoo and Kunahandhoo (see Figure 1.3 in §1.2.4.1) where no Man and Tree data was collected. A cross-section of the adult population took part in the task, with participants of different ages, genders, occupations, levels of education, and so on. The sample was very similar to the one for the Man and Tree game (see §5.2.2) – in fact, most participants performed both tasks, though in different sessions and typically on different days (usually the Route Description game was played first). Most pairs were made up of two participants of the same gender and a similar age. At least two games from each pair (i.e., descriptions of at least two different routes) were selected for transcription, translation, coding and analysis. In some cases where pairs completed the routes very efficiently, three or even all four games were selected for this process, to ensure that the data obtained was a fair representation of those pairs' FoR patterns. This yielded a total of three hours and 51 minutes of data for analysis, or approximately 27,000 Dhivehi words.

5.3.1.2 Results and discussion

The Route Description game was effective at eliciting motion descriptions and topological relations, as discussed in §4.5. Several examples of how speakers described routes were provided in that section. Here, I focus on the choice of FoRs in the task. However, it is important to note from the outset that many descriptions avoided the use of FoRs to a large extent, instead making use of topological relations and in-game landmarks like the chicken or the yellow 'hill'. For example, some directors simply said that the toy man should go over the hill "from one side to the other", without stating exactly which side he should start or finish on. Excluding descriptions of this kind, the coded data still included 2,493 tokens of FoRs, or about one per eleven words. However, descriptions with LRFB (left/right/front/back) terms were often vague as to whether the FoR was anchored on the speaker's viewpoint or the toy man himself, since the toy man often faced the same way as the speakers. Thus, a description translating to "go forward" could be analyzed as a relative FoR anchored on the speaker's viewpoint (i.e., 'forward' is a direction projected through the scene from the speaker's own front) or as an intrinsic FoR anchored on the toy man (i.e., 'forward' projects from the toy man's own front side). Further, as discussed in Chapter 4, many descriptions with LRFB terms were difficult to classify due to the ambiguities between the intrinsic, reflectional relative, translational relative, and FIBO ('Front = Inner, Back = Outer') uses of these terms. Aside from presenting a challenge for the analyst, these ambiguities sometimes caused misunderstandings between the participants. An example is shown below in (136) and Figure 5.24. Up to this point in the game, the matcher (right) has correctly followed the description provided by the director (left) to take the toy man around the flower and through the fences, emerging near the red block on the right-hand side of the board (from the participants' perspective). The toy man now needs to pass by the *far* side of this red block, from right to left, before turning to come back between the two red blocks. The director gives the following instruction:

(136) *kurumattun̊* *lai=gen̊* *dān̊* *vū*

front.ABL put.CVB=SUC go.INF be.PST.3

'(The man) has to go by passing by the front (of the red block).'

DIV_RD_LD_20140318_2_2_SH3_NH2_W, 0:42

The director's use of 'front' here assumes the translational relative FoR (§2.2.2, §4.6.2): for her, the 'front' of the block is its far side. However, the matcher repeats *kurumattun̊ laigen̊?* ('passing by the front?') while moving her figurine along the *near* side of the block (see Figure 5.24). Her interpretation assumes either a reflectional relative FoR in which the 'front' is the near side, or a FIBO system in which the 'front' is the side that is closer to the centre of the array (which happens to coincide with the near side in this case). The misunderstanding is never really resolved in this instance, though the matcher soon gets back on course when the director moves on to the next part of the route.

Figure 5.24: Dhanbidhoo women discussing how to move past a red block in a Route Description game

Given that such ambiguities were common in this task, for the purposes of showing numerical results I will simply classify all instances of LRFB terms as belonging to the same supercategory. This supercategory can then be contrasted with SAP-landmarks and the various geocentric strategies. Figure 5.25 below shows the proportions at which each of these main strategies were used in the entire corpus of Route Description data.[137]

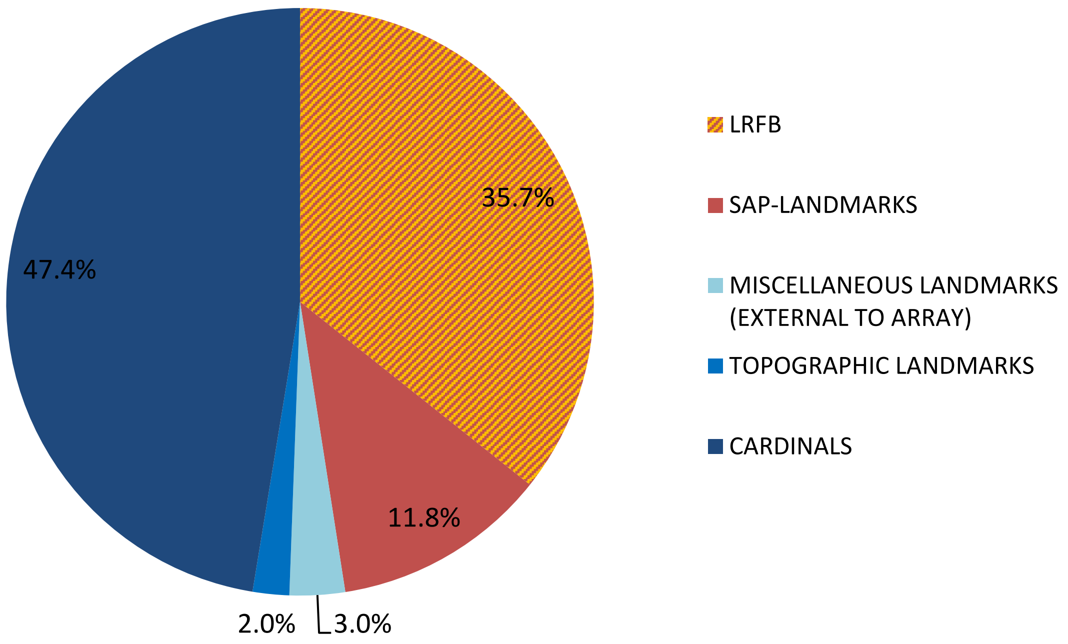

Figure 5.25: FoR choice in the Route Description game

Aside from some differences relating to the nature of the task (e.g., the absence of a vertical strategy), the mixture of FoRs is similar to that reported for the Laamu Man and Tree data in §5.2.4. There is no single strategy that was used in a clear majority of descriptions, though cardinals and LRFB terms were widely used. SAP-landmarks (e.g., 'come this way', 'the far side of the flower') were used somewhat less often but were still an important strategy, while other kinds of array-external landmarks were rare. In particular, topographic landmarks were used only 50 times (2% of FoR descriptions), suggesting that in (small-scale) motion descriptions, reference to local topography is unusual in Dhivehi. And as was the case for the Man and Tree data, nearly all of these topographic references were to *atiri* 'the beach' or *eggamu* 'inland', and not to atoll-specific features like the lagoon or ocean shores. I discuss the implications of this in §5.4.

[137] Note that unlike for the Man and Tree data, the average proportions at which pairs used each strategy were not calculated for the Route Description data, since some pairs in the latter task produced too few FoR descriptions for the use of proportions to be reliable. I therefore simply present the data here in terms of percentages of total FoR descriptions.

Another finding is that the demographic variation in FoR choice is highly consistent with that observed for the Man and Tree game. Table 5.13 below shows some of this variation for the two most popular FoR categories: cardinal directions and LRFB terms. The rows of the table are arranged from the highest rates of cardinal direction use to the lowest (and roughly from the lowest rates of LRFB use to the highest). There are striking similarities to the ranking of demographic groups shown in §5.2.4.11 for the Man and Tree data. In particular, fishermen and sailors used cardinals in a very high proportion of their FoR descriptions, and LRFB terms only very rarely. This pattern was also observed to a lesser extent for other demographic groups associated with fishing or sailing, such as those living on fishing islands, older speakers, and men.

Table 5.13: Route Description game – FoR choice across demographic groups

Group/variable[138]	Pairs	FoR tokens	Cardinals	LRFB terms
Fishermen/sailors	15	806	650 (81%)	61 (8%)
Fishing islands	35	1574	1116 (71%)	287 (18%)
Age 50+	23	969	648 (67%)	161 (17%)
Neither player speaks English	25	1431	900 (63%)	337 (24%)
Men	29	1523	925 (61%)	393 (26%)
Primary education	35	1423	858 (60%)	371 (26%)
Entire sample	56	2493	1182 (47%)	890 (36%)
Age 35-49	18	764	354 (46%)	303 (40%)
Indoor workers	32	1378	369 (27%)	733 (53%)
Both players speak some English	14	808	210 (26%)	405 (50%)
Age 17-34	15	760	180 (24%)	426 (56%)
Upper secondary education	9	507	112 (22%)	294 (58%)
Women	23	884	187 (21%)	492 (56%)
Non-fishing islands	21	919	66 (7%)	603 (66%)

Finally, as mentioned in the previous section, some of the Route Description data was collected from L. Hithadhoo and L. Kunahandhoo, islands from which no Man and Tree data was collected. Fishing is the main economic activity practiced by residents of these islands, and the Route Description data is in keeping with the more general tendency for fishing communities in Laamu to favour cardinal directions (see §5.2.4.5): the five pairs

[138] Note that for the education variable, this table counts only pairs in which both players shared the same level of education. For occupation, as there were very few pairs in which both players were fishermen or sailors, the table counts pairs with at least one fisherman or sailor as 'fishermen/sailors'.

from these islands produced 116 FoR descriptions, of which 97 (84%) involved cardinals and only five descriptions (4%) used LRFB terms.

5.3.2 Verbal Animals-in-a-row game

5.3.2.1 Methodology and participants

The ‘Verbal Animals-in-a-row’ game is a director-matcher task with the same basic setup as the Man and Tree and Route Description games. The players take turns describing arrays of toy animals to each other, with the matcher trying to recreate the array from a matching set on his own side of the dividing screen. The toy animals (shown in Figure 5.26) were a tiger, horse, dolphin and turtle (all from the Schleich® range of animal figurines), though only three animals were used in each array. Prior to the game, participants were asked to agree with each other on what to call the different animals. Each participant described four arrays each (for a total of eight arrays per pair), with the animals collectively facing a different direction in each array: away from participants, towards participants, left, or right. The three animals included varied from array to array (i.e., a different animal was omitted each time) and the ‘formation’ of the animals was also varied, with the animals standing either in single file or abreast. The combination of different facing directions and different formations meant that in half the arrays, the animals were placed sagittally with respect to the participants (i.e., one animal was nearest and one furthest away), while in the remaining arrays the animals were placed transversely (i.e., there was a leftmost animal and a rightmost animal from the participants’ viewpoint). The director’s arrays were always placed by the researcher, according to a pre-prepared list of arrays that was used for all participants.

Figure 5.26: Toy animals used in the Verbal Animals-in-a-row game

A total of 23 pairs of speakers participated in this task. This included 14 pairs from Laamu (six from Fonadhoo, five from Dhanbidhoo, and three from Kunahandhoo) as well as five pairs from Addu and four pairs from Malé. As with the other space games described in this chapter, speakers were typically partnered with someone of the same age group and gender, though different pairs were from different demographic groups. Approximately three hours of data was recorded from these 23 pairs, though this included periods of silence in between descriptions while the researcher assembled new arrays for the director to describe. A photo of a pair playing the game is shown in Figure 5.27 below:

Figure 5.27: Dhanbidhoo men playing the Verbal Animals-in-a-row game

5.3.2.2 Results and discussion

The results from the Verbal Animals-in-a-row game support the main findings from the tasks presented in previous sections. For example, speakers in Addu and Malé overwhelmingly solved the task by using egocentric FoRs, the intrinsic FoR, and miscellaneous landmarks, while the choice of FoRs in Laamu varied according to demographic factors (though generally Laamu speakers used fewer egocentric FoRs and more cardinal directions than speakers from the more urban locations). However, since these findings are largely the same as those discussed in previous sections, and are based on a smaller sample of participants, in this section I will simply give a taste of some of the spatial descriptions produced by speakers in the task, and discuss one interesting type of description in particular.

Participants generally described both the location of the animals as well as their orientation. The spatial vocabulary and grammatical constructions used were mostly the same as those used in the Man and Tree game (see §5.2.4.1). For example, (137) below is a description produced by a speaker from Malé:

(137)	*kanāt-un̊*	*vāt-aṣ̊*	*aturān̊*	*vī*
	right-ABL	left-DAT	arrange.INF	be.PST.3

‘(You) should arrange (them) from right to left.’

anē	*furatama*	*as*	*kōmas*	*den̊*	*kanzu*	*kaha^{n}bu*
FILL	first	horse	dolphin	then	moat	turtle

‘Um, first the horse, (then) the dolphin, then the tortoise.’

hurihā	*eccehi=ves*	*kaleaṣ̊*	*furagas*	*dī=gen̊*	*hunnan̊*	*vī*
all	things=EMPH	you.DAT	back	give.CVB=SUC	stand.INF	be.PST.3

‘Everything should be standing with its back to you (lit. ‘giving the back to you’).’

DIV_VAR_Ma_20150421_2_1_AMAS1_IN2_S, 1:53

However, some participants also sometimes described the *axis* along which the animals stood. As mentioned in the previous section, this could be either sagittal or transverse from the participants’ viewpoint. Interestingly, three different pairs (all from Fonadhoo) did this by mapping features of the surrounding environment onto the tabletop array. These pairs all played the game at the end of a gravel road near the reef. Two pairs described the various arrays as either *maga digaṣ̊* ‘along the road’ or *maga hurahaṣ̊* ‘across the road’. This did not refer to the orientation of the animals, but to the alignment of the axis in which they were arranged – *maga digaṣ̊* ‘along the road’ meant that the array was aligned with the long axis of the road, while *maga hurahaṣ̊* ‘across the road’ meant the array ran perpendicular to the road. A third pair mapped the alignment of the entire island onto the tabletop array. The description in (138) is for the array in Figure 5.28 below:

Figure 5.28: Animals 'along the island’ (participants facing northeast on Fonadhoo)

(138)	*ãã*	*raṣ̊*	*digaṣ̊*	*safa-ak-aṣ̊*	*e=inū*
	yes	island	long.ADVZ	line-UNSP-DAT	DEM3=sit.PST.PROG

‘Yes, they are in a line along the island.’

DIV_VAR_LF_20140411_1_1_AM5_AI3_NE, 2:59

Recall that the long axis of Fonadhoo runs northeast-southwest (see Figure 4.8 in §4.6.4). The pair in Figure 5.28 sat facing northeast, and their use of *raṣ̊ digaṣ̊* ‘along the island’ communicated the fact that the axis of the array was aligned with the long axis of the island (even if the animals were not facing along that axis). Where the axis of the array was perpendicular to the long axis of the island, the same pair used the phrase *raṣ̊ hurahaṣ̊* ‘across the island’.

It is not entirely clear whether or how such ‘across’ and ‘along’ descriptions could be analyzed in terms of FoRs. On the one hand, descriptions such as those in (138) do not go very far in terms of angular specification – aside from not knowing which way any of the animals are facing, the matcher cannot tell from (138) which animal is at which end of the line, nor which is in the middle. On the other hand, such descriptions do convey something about how the array is laid out. It seems that while (138) does not specify the orientation of any particular animal nor of the animals collectively, it does partially specify the orientation of the *line* of animals by aligning it with the orientation of an external, mutually known entity (the island). This comparison is able to work because both the line of animals and the island can be perceived as having a similar shape – they are both long. Since the description is sensitive to the orientation and geometry of the ground object, and the ground object appears to function as the anchor for the description, a plausible analysis may be that (138) and similar examples involve the intrinsic FoR. However, since some geographic knowledge is necessary for (138) in particular, this is perhaps a further grey area between the intrinsic and geocentric FoRs, to add to those raised in Chapter 2.

5.3.3 Virtual Atoll Task

5.3.3.1 Methodology and participants

The ‘Virtual Atoll Task’ was designed to elicit spatial references in a larger-scale environment, albeit a virtual one. In the task, which is played on a computer, participants navigate through a virtual atoll environment to find five treasure chests hidden on various islands. The task aims to reveal the kinds of spatial references used in larger-scale contexts, while still allowing for maximal comparability across different atoll-based speech communities.[139] To remain neutral across different atoll-based communities, the virtual atoll was a fictional place that did not represent any particular real-world atoll.

[139] The task has also been used by Jonathan Schlossberg in a concurrent project on Marshallese (see Lum & Schlossberg 2014; Schlossberg Forthcoming).

The task differs from other tabletop tasks in that the participants view the game from a more natural perspective rather than a bird's-eye view, and in that the director and matcher share exactly the same field of vision. A screenshot of a scene from the Virtual Atoll Task is shown in Figure 5.29 below.

Figure 5.29: A scene from the Virtual Atoll Task

The basic methodology is as follows (for full details see Lum & Schlossberg 2014). The 'matcher' is asked to wait outside the room while the 'director' watches a video revealing the locations of five treasure chests around the virtual atoll. The director then plays the game himself to further familiarize himself with where the treasure chests are hidden. The matcher is then called back into the room and asked to take the controls.[140] The task begins, with the director using language only (rather than pointing) to guide the matcher towards the treasure chests. As usual, the matcher is permitted to ask questions of the director. The game concludes when all five chests have been discovered, and the participants then swap roles to play a second game with the chests now hidden in different locations.

Thirteen pairs of speakers took part in the task, with one pair from Addu and twelve pairs from various islands in Laamu (five from Fonadhoo, three from Dhanbidhoo, and one each from Gaadhoo, Hithadhoo, Kunahandhoo and Maavah). A photo of one pair playing the

[140] To avoid any possible bias towards LRFB terms afforded by the arrow keys, the controls made use only of the mouse and the space bar.

game is shown in Figure 5.30 below. Note that although the controls were designed to be as simple as possible, they still required basic control of a computer mouse, and the game's methodology required the director to have a good memory and reasonable attention to detail. Thus, most of the participants recruited for the task were young adults. A total of approximately six hours of data was recorded from the task, of which a fifth was transcribed and translated.

Figure 5.30: Dhanbidhoo men playing the Virtual Atoll Task

5.3.3.2 Results and discussion

Some results from this task are reported in Lum and Schlossberg (2014), and so for reasons of space I will present only a few key findings here along with some representative examples. One finding is that like in the Route Descriptions (§5.3.1.2), speakers were actually able to avoid using FoRs to some degree. This was because the nature of the game allowed the matcher to search for the treasure with minimal input from the director – in other words, a 'trial-and-error' strategy was often adopted by participants, especially if the director had forgotten where the treasure was hidden. Despite this limitation, some FoR descriptions were still used. These often involved LRFB terms, especially *kuriaṣ̊* 'forward'. In (141) below, for example, the director tells the matcher to turn right and then to go forward:

(139) *lōnc-aṣ̊* *arā* a^{n}*burā* *lā* *mi* *kanāt-aṣ̊* *kanāt-aṣ̊*
speed.boat-DAT climb.up.CVB turn.CVB put.IMP FILL right-DAT right-DAT
‘Get up into the speed boat and turn, um, to the right, to the right.’

ãã *dēbala* *kuriaṣ̊*
yes go.IMP forward
‘Yes, go forward.’
DIV_VAT_LGd_20140107_1_2_NA1_HS3_ESE, 0:25

In addition, as the participants were seated side by side, some participants tended to speak of ‘my side’ and ‘your side’ instead of using left and right terms. An example of this SAP-landmark strategy is (140) below:

(140) *deṅ̊* *mi* *anek̊* *mi=saiḍ-aṣ̊* *mā* *vī* *saiḍ-aṣ̊*
then FILL FILL DEM1=side-DAT I.COM be.PST.PTCP side-DAT
‘Then, um, er, to this side, to the side that I’m on.’
DIV_VAT_LH_20131231_1_1_IR1_II1_ESE, 0:40

Geocentric strategies were used only rarely, unless one counts the simple use of in-game landmarks (e.g., ‘go to that island’). Topographic features such as beaches, inland areas, and the reef sides of islands were sometimes referred to, as in (141) and (142):

(141) *deṅ̊* *atiri-aṣ̊* *faibā*
then beach-DAT descend.IMP
‘Then go down to the beach.’
DIV_VAT_LF_20131227_1_1_AJ1_AR3_E, 3:45

(142) *te=raṣu* *fuṭṭaru* *farātu* *innāḷa*
DEM2=island.GEN reef side.LOC sit.FUT.3
‘(It) will be on the reef side of that island (nearer to you).’
DIV_VAT_LF_20140129_1_1_AZ2_IS3_SW, 4:17

There were a few references to the sun in the game, though participants did not derive any particular cardinal directions from the sun's position in the sky. One pair (a fisherman and a ferry operator from Dhanbidhoo) did use cardinal directions, but these were real-world cardinal directions. The two speakers were seated facing east, and used *uturu* 'north' and *dekunu* 'south' several times to refer to transverse directions on the screen – 'north' was equivalent to 'left' (or the director's side of screen) and 'south' to 'right' (or the matcher's side of screen).[141] An example is (143) below:

(143)	*kuḍadoru*	*mi=farātu*	*kanu*	*uturu*	*kanu*
	window.GEN	DEM1=side.LOC	corner.LOC	north	corner.LOC

'in the corner on my side of the window, in the north corner'

DIV_VAT_LD_20140321_1_1_HA6_MM1_E, 4:24

The fact that geocentric references were scarce may be interpreted in a few different ways. A strong possibility is that this result largely reflects the sampling. As mentioned in the previous section, young adults were selected for this task. Evidence from the other tasks presented in this chapter suggests that young adults in Laamu tend to favour egocentric and intrinsic FoRs over geocentric ones. But another possibility is that the virtual world was not immersive enough, and participants never became familiar enough with it in order to attend to features of the in-game environment such as the lagoon, the ocean, or the setting sun. And to the extent that participants were able to notice such features and derive geocentric directions from them, there may have been some prospect of ambiguity between in-game directions and more familiar real-world ones. For example, if the participants are seated facing east in the real world, but are facing the setting sun in the game, a cardinal term could point in two completely opposite directions depending on whether it is deployed from a real-world or in-game perspective. The prospect of ambiguity here might have been a deterrent against the use of cardinal directions and geocentric strategies more broadly.[142]

[141] Note that since the players' point of view in the game rotates as the matcher moves the mouse, this meant that 'north' (for example) corresponded to different directions in the game (e.g., towards or away from a particular house) at different times for this pair, in line with their constantly shifting point of view in the virtual world.

[142] Future versions of the task might use a virtual reality headset to resolve some of these issues.

Nonetheless, the results still suggest that atoll topography is not so salient as to deterministically cause Dhivehi speakers to reference topographic features in their spatial descriptions, even when such features are not only visually accessible but are actually part of the scene through which the speakers move – for example, moving from the lagoonward side of an island to the oceanward side. This finding is discussed further in §5.4, where the role of topographic references across the various space games is considered.

5.3.4 Object Placement Task

5.3.4.1 Methodology and participants

The Object Placement Task was designed primarily to explore participants' interpretations of LRFB terms, teasing apart the intrinsic and relative FoRs as well as different subtypes of the relative FoR (see §2.2.2 for a description of these subtypes). However, it also tested knowledge of geocentric directions. Unlike the games discussed in previous sections, this task was performed by one participant at a time. The advantage of such a task is that it is able to reveal in a systematic way how speakers of a language interpret FoR terms, even by speakers who might use those terms rarely or ambiguously in description tasks. Similar tasks have occasionally been used in earlier research on spatial language (e.g., Tanz 1980). Slight variants of the version reported here have been used in recent research on Marshallese (Schlossberg Forthcoming) and Australian English (Poulton 2016).

In the task, the participant would place a small object on a table according to their interpretation of a spatial instruction provided by the researcher or research assistant, who stood beside the participant. This was then repeated with various instructions and different figure and ground objects, as listed in Table 5.14 below. These objects included some small blocks and the toy man from the DUPLO® kit used for the Route Description game (see §5.3.1.1), as well as a small toy car. Conditions 1 and 2 of the task tested for intrinsic FoR vs. relative FoR interpretations. Condition 3 teased apart different subtypes of the relative FoR. Condition 4 tested for whether visual occlusion of one of the objects influences the subtype of relative FoR adopted. Condition 5 tested for the existence of an 'ascribed intrinsic' system (Pederson 2006).[143] Condition 6 tested knowledge of geocentric directions. Finally, Condition 7 teased apart the relative FoR from the 'FIBO' system described in §4.6.5 and §5.3.1.2.

Table 5.14: Conditions and instructions in the Object Placement Task

Condition	**Ground**	**Figure**	**Instructions (English translation)**
1. Fronted ground[144] – inanimate	toy car (facing left)	small cube	'Put the cube [*in front of / behind / to the left of / to the right of*] the car.'
	toy car (facing away)	small cube	'Put the cube [*in front of / behind*] the car.'
	toy car (facing towards)	small cube	'Put the cube [*in front of / behind / to the left of / to the right of*] the car.'
2. Fronted ground – animate (only ran selected trials for participants showing relative FoR in Condition 1)	toy man (facing left)	small cube	'Put the cube [*in front of / behind / to the left of / to the right of*] the car.'
	toy man (facing away)	small cube	'Put the cube [*in front of / behind*] the car.'
	toy man (facing towards)	small cube	'Put the cube [*in front of / behind / to the left of / to the right of*] the car.'
3. Non-fronted ground – figure and ground same size	green cube (small)	blue cube (small)	'Put the blue cube [*in front of / behind / to the left of / to the right of*] the green cube.'
4. Non-fronted ground – figure and ground different sizes	large cube	small cube	'Put the small cube [*in front of / behind*] the large cube.'
	small cube	large cube	'Put the large cube [*in front of / behind*] the small cube.'
5. Non-fronted ground with fronted figure	small cube	toy man	'Put the man [*in front of / behind / to the left of*] the cube.'
	small cube	toy car	'Put the man [*in front of / behind / to the left of*] the car.'
6. Geocentric	green cube	blue cube	'Put the blue cube on the [*inland / beachward / north / south / east / west*] side of the green cube.'
7. Ring configuration	six small blue cubes (arranged in a ring, with space in between cubes)	green cube (small)	'Put the green cube [*in front of / behind*] this blue cube.' (Researcher points to a blue cube from above, then repeats instruction for another three blue cubes separately.)

[143] In the 'ascribed intrinsic' system described by Pederson (2006) for Tamil, facets are assigned to the ground based on its position in relation to the figure – for example, one can say 'the horse is behind the tree' as long as the tree is (intrinsically) in front of the horse.

[144] Here the term 'fronted ground' refers to a ground object with intrinsic left/right/front/back facets (e.g., a car or a person). The term 'non-fronted ground' refers to a ground object without such intrinsic facets (e.g., a cube). This usage follows earlier works such as Tanz (1980).

A total of 41 participants performed the full version of the task, and another 11 participants performed Condition 7 only.[145] The participants were from Fonadhoo and Dhanbidhoo, and once again included men and women of various ages. Figure 5.31 below shows a participant from Dhanbidhoo performing the task:

Figure 5.31: A Dhanbidhoo man performing the Object Placement Task (Condition 7 – ring configuration)

5.3.4.2 Results and discussion

In Condition 1 (car as ground), participants overwhelmingly placed the block in a way that was consistent with the intrinsic FoR rather than the relative FoR. Only one participant displayed a mostly (reflectional) relative pattern, and two other participants produced a few relative responses each but many more intrinsic responses. However, in Condition 2 with the toy man as ground, these participants switched to a completely intrinsic pattern, suggesting that the intrinsic FoR is more likely to be used when the ground is a human rather than a car (though almost the entire sample still solved the car condition in an intrinsic way). The strong intrinsic results in these conditions are consistent with the widespread use of the intrinsic FoR in other tasks.

In Condition 3 (green cube as ground), responses were more varied, as shown in Table 5.15 below:

[145] These 11 participants had taken part in an unrelated task (which did not involve LRFB terms), but did not have time to then complete the entire Object Placement Task. They were therefore asked to attempt Condition 7 only.

Table 5.15: Results for Condition 3 of the Object Placement Task

Predominant pattern	**Participants (N = 41)**
Translational relative FoR	29 (71%)
Rotational relative FoR	4 (10%)
Reflectional relative FoR	3 (7%)
Rotational/reflectional FoR (inconsistent performance)	2 (5%)
Other	3 (7%)

While some participants gave different responses, the dominant response type was the translational relative FoR, in which the ‘front’ was the far side and the ‘back’ the near side. The fact that four participants appeared to use the rotational relative FoR (where the ‘front’ is near and the ‘back’ is far like in the reflectional system, but ‘left’ and ‘right’ are switched) is surprising given that this system was not observed in any of the description tasks. It is possible that these participants were in fact using a reflectional system but simply mixed up ‘left’ and ‘right’. Another possibility is that they had been primed by Conditions 1 and 2, where the toy car faced towards the participant for more prompts than it faced away for (see Table 5.14 in §5.3.4.1). If participants imagined that the green cube was also ‘facing’ them, this would account for an apparently rotational response pattern. This seems especially plausible given the response patterns of the three participants who did not use any subtype of the relative FoR. In most trials on this condition, these participants responded as though the green block was facing *left* (e.g., they placed the blue block to the left of the green block when told to place it ‘in front’), probably on analogy with the leftward facing direction of the car in many of the trials in Condition 1. However, since there were relatively few trials in Conditions 1 and 2 with the ground facing away from the participant, the prevalence of the translational system in Condition 3 is unlikely to be merely a priming effect from the earlier conditions.

In Conditions 4 and 5, the distribution of response patterns was very similar to Condition 3: the translational system was used by 66% of participants in Condition 4 and 71% of participants in Condition 5. The results for Condition 4 suggest that varying the size of the figure and ground objects does not substantially affect response patterns, in contrast to the situation in some languages (Hausa, Hill 1982; Marquesan, Cablitz 2006; Marshallese, Schlossberg Forthcoming; Tongan, Bennardo 2000), where the reflectional system becomes more likely when a larger ground object blocks a smaller figure object from view. However, this finding needs to be corroborated by further experiments with an even larger ground object, and without the possible priming effects from other conditions of the task. The results for Condition 5 are unsurprising – no participants displayed an ‘ascribed intrinsic’ pattern of the Tamil type (Pederson 2006).

For Condition 6, there were three key findings. Firstly, most participants were reasonably accurate when placing the blocks according to geocentric prompts: correct (or approximately correct) responses were given in 81% of trials. However, responses were often ‘calibrated’ by local environmental cues. In Fonadhoo, which is oriented northeast-southwest (see §1.2.4.1), *uturu* ‘north’ typically points to what is actually northeast, *huḷa*^{n}*gu* ‘west’ points to what is actually northwest, and so on, such that the whole system is rotated 45 degrees clockwise to match the orientation of the island. Many Fonadhoo participants placed the blocks according to this rotated system, though some placed the blocks according to the ‘true’ compass points and a few used a mixture of the two systems. Dhanbidhoo is oriented north-south (or at least, the inhabited part of the island is oriented this way – see Figure 4.5 in §4.5.4), but the house in which the task was conducted was oriented approximately 22.5 degrees off this axis, and most participants faced west-northwest for the task. Participants calibrated their placements accordingly – e.g., when told to place the blue cube to the ‘north’ of the green cube, most participants in Dhanbidhoo actually placed it to the north-northeast.[146]

Secondly, some geocentric directions attracted more correct responses than others. Of the 41 participants, 37 (90%) were correct for *ir-aṣ̊* ‘east-DAT’, 34 (83%) for *atiri-aṣ̊* ‘beach-DAT’, 33 (80%) for *dekon-aṣ̊* ‘south-DAT’, 33 (80%) for *huḷa*^{n}*g-aṣ̊* ‘west-DAT’, 32 (78%) for *utur-aṣ̊* ‘north-DAT’, and 30 (73%) for *eggam-aṣ̊* ‘inland-DAT’.[147] It seems likely that *iru* ‘east’ is slightly better known because the same term is also the word for ‘sun’ (cf. §4.6.3.1) and is associated with the sunrise. For the ‘inland’ and ‘beachward’ directions, incorrect responses were usually off by 180 degrees, suggesting that some participants got the axis right, but wrongly believed they were closer to the opposite side of the island along

[146] The use of a DUPLO® block as the ground object probably fostered this behaviour, since participants may have assumed that the figure object should be placed adjacent to one of the block’s four faces.
[147] Responses were judged as ‘correct’ if they were accurate to within 22.5 degrees of either the ‘true’ or ‘calibrated’ direction.

that axis (or else they applied the relevant directions as if they were somewhere else on the island, such as in their own home).

Thirdly, there were was also some variation according to demographic variables when it came to the number of correct cardinal direction responses. As expected, the mean proportion of correct responses (across all four cardinal directions and all participants within a group) was higher in Dhanbidhoo (87%) than Fonadhoo (79%), among men (86%) as opposed to women (78%), and in the oldest (94%) and middle (88%) age groups as opposed to the youngest age group (69%). A more dramatic difference was found for occupation: the three farmers, five fishermen, and one boat captain in the sample produced only correct responses, while the remaining 32 participants were correct in only 77% of trials. However, due to the small sample size and the generally high rate of correct responses in all groups, these differences were not statistically significant (Mann-Whitney U tests, $p > .05$).

As for Condition 7 (which 52 participants completed), 24 participants (46%) consistently placed the green block in a way consistent with the FIBO system only: on the inner side of the blue block when instructed to put it at the ‘front’ of that particular blue block, and on the outer side when instructed to put it ‘behind’ that block. Another seven participants (13%) showed this pattern in a majority of their trials. In contrast, 17 participants (33%) employed a relative FoR (usually translational), while the remaining four participants (8%) produced other response types.[148] Thus, although different interpretations of *kurumattu* (‘in front’) and *fahatu* (‘behind’) are clearly possible for a ring configuration, the FIBO system appears to be the dominant interpretation among the sample tested. This finding corroborates the FIBO analysis for many examples of ‘front’ and ‘back’ terms in the Route Description data (cf. §4.6.5, §5.3.1.2), which were often ambiguous.

5.3.5 Narrative data

A number of narratives were recorded in order to see how Dhivehi speakers use FoRs in a more naturalistic context. Ten of these narratives (approximately 44 minutes in total length)

[148] Interestingly, three of these participants produced a kind of inverted FIBO pattern in which the ‘front’ was the outside and the ‘back’ was the inside, for reasons that are unclear. The remaining participant consistently placed the ‘front’ on the left side and the ‘back’ on the right side, as a few participants did in Condition 3.

from eight different speakers in Laamu were transcribed and translated for analysis. The narratives included a folk tale, autobiographical accounts, and various anecdotes (especially relating to ocean travel).

Very few examples of FoRs were found in the narrative data, though landmark-based references were fairly common in path descriptions, as in (144) below:

(144)	*e=rē*	*da^{n}bidū-aṣ̊*	*goho*
	DEM3=night	Dhanbidhoo-DAT	go.CVB

‘On that night, (we) went to Dhanbidhoo…’

DIV_O_LH_20131231_2_Aboobakuru_story2_SE, 0:47

Landmarks were typically used without any additional FoR specification (e.g., speakers did not say ‘went north to Dhanbidhoo’ or ‘turned left towards Dhanbidhoo’). As well as islands, other landmarks in the stories included houses, streets and other locations, including topographic landmarks such as *eggamu* ‘inland, ashore’, *atiri* ‘beach’ and *faru* ‘reef’. An example is (145) below:

(145)	*den̊*	*e=hisābun̊*	*ēti*	*ki^{n}bul-ek̊*	*kam̊*
	then	DEM3=point.ABL	DEM3.thing	crocodile-INDF	COMP

e^{n}gunī=ma	*den̊*	*hama*	*maḍu~maḍu-n̊*
know.PST.PROG=TEMP	then	just	slow~REDUP-ABL

eggam-aṣ̊	*erī*
inland-DAT	climb.PST.PROG

‘Then from that point, once I knew it was a crocodile, then I just slowly came ashore.’

DIV_O_Lka_20150126_UZ1_Crocodile_story_2, 0:45

LRFB terms were uncommon, and mostly referred to intrinsic parts (e.g., the front of a boat, the back of a crocodile’). An example of a projective use is (146) below, which may be either the (direct) intrinsic or relative FoR:

(146) *gāt̊_ga^{n}ḍakaṣ̊* *ma* *huri* *hisāb-aṣ̊* *vure* *tan̊koḷek̊* *kurun̊*

approximately I stand.PST.PTCP point-DAT than little.bit.INDF front.ABL

lōncu *jehunu*

speed.boat hit.PST.3

‘The speed boat hit a little bit forward from around where I was standing.’

DIV_O_LF_20131222_Jameel_narrative_1, 1:32

Cardinal directions were also rare, with only two tokens of *iru(mati)* ‘east’ and no tokens of any other cardinal term. One example is (147) below:

(147) *mī* *iraṣ̊* *fulidū-ā* *jehi=gen̊* *e=koḷu-ga* *innāne*

FILL east.DAT Fulidhoo-COM is.hit.CVB=SUC DEM3=end-LOC sit.FUT.3

diggiri *kiyā* *faḷu* *raṣ-ek̊*

Dhiggiri call.PRES.PTCP unoccupied island-INDF

‘Um, to the east, on that end next to Fulidhoo there would be an uninhabited island called Dhiggiri.’

DIV_O_LK_20131230_1_YAR1_Yoosuf's_story_N, 2:34

This use of *iraṣ̊* ‘east.DAT’ was accompanied by a backhanded gesture to the east, which was to the speaker’s right. Note that this gesture, which is shown in Figure 5.32 below, was not simply pointing to the island of Dhiggiri, which is located in Vaavu Atoll, some 200km to the north of L. Kunahandhoo where the story was recorded (see Figure 1.2 in §1.2.4).

Figure 5.32: A Kunahandhoo man pointing east while telling a story

In a different narrative, another man from Kunahandhoo made several pointing gestures that were consistent with a geocentric conceptualization of the events in the story, even though he did not use cardinal terms. The story was about how, many years ago, the boat he was on ran into trouble just after exiting Laamu Atoll through the Maavah Channel, just north of Maavah in the west of the atoll (see Figure 5.33 below). The boat would therefore have been somewhere northwest of Maavah, and also (much further) northwest of Kunahandhoo, which is in the south of Laamu. Incidentally, the speaker was also facing northwest while telling the story, and so the main locations in the story were all in front of him. However, instead of simply pointing in front of his body when mentioning locations, he appeared to point to cardinal directions as they would have applied from the sinking boat in the story. For example, in (148) below, instead of pointing northwest (i.e., forwards) to Maavah from his current location, he actually pointed southeast (i.e., backwards), probably because Maavah was to his southeast at that point in the story. The southeastward gesture is shown in Figure 5.34.

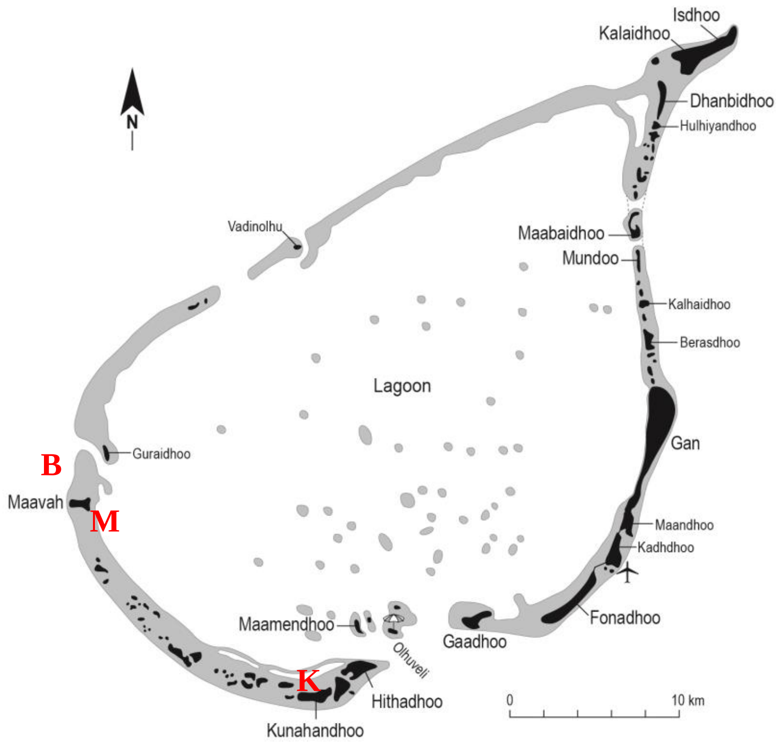

Figure 5.33: Map of Laamu Atoll showing locations of Kunahandhoo (**K**), the stranded boat in the story (**B**), and Maavah (**M**).

(148)

dōni-n̊	*fatā=fa*	*māvaṣ-aṣ̊*	*arajje*	*mīhaku*
boat-ABL	swim.CVB=SUC	Maavah-DAT	climb.PRF.3	person.UNSP

‘Someone swam up to Maavah from the boat.’

DIV_O_LK_20131230_2_IA1_Ismail's_story_NW, 0:51

Figure 5.34: A Kunahandhoo man pointing southeast while telling a story

Note that the pointing gesture in Figure 5.34 is unlikely to have been an egocentric one. An egocentric analysis would assume that the speaker was pointing backwards over his shoulder because he remembers the event taking place behind him (from his perspective at the time). Although the speaker does not say which way he was facing at the time, it seems unlikely that he would have been facing *away* from the event he witnessed, and given the context it is most likely he would have been facing *towards* Maavah, where his hopes of rescue lay. Pointing gestures of this kind therefore suggest an underlying geocentric conceptualization of the events in the story (see Haviland 1993; 1998).

5.4 Summary and further discussion

This chapter has discussed patterns of FoR use in Dhivehi as observed in a range of spatial description tasks, an interpretation task (the Object Placement Task), and narratives. A key finding is that a range of FoRs are used in Dhivehi, both among individual speakers and across different subsections of the community. Some of this variation appears to relate to the nature of the specific task and the spatial configurations within. For example, vertical references such as ‘The man is above the tree’ were possible for the Man and Tree photos but not so much for the other tasks, and the ‘FIBO’ system was possible for the Route Description task and Condition 7 of the Object Placement Task but not elsewhere. The purpose of the description is also clearly relevant, with orientation descriptions tending to attract landmark-based references much more than locative descriptions (§5.2.4.3). While it is not really surprising that such differences exist, the variation highlights the importance of collecting different types of data in work on FoRs, since not all strategies necessarily appear in all tasks or description types.

A more striking factor, however, is the variation in FoR choice within and across communities in the Maldives. While the intrinsic FoR was widely used in all groups, other strategies showed significant variation. In Laamu, the use of cardinal directions was more common among fisherman and sailors in particular, but also among fishing communities more generally, as well as among men and older speakers (§5.2.4). Although monolingualism and a lack of secondary education were also factors correlated with more frequent use of cardinals (§5.2.4.9), the rates of use here were not quite as extreme (§5.2.4.11), and speakers in these categories tended to be older people anyway. What do fishermen, older people, and men in general have in common in the Maldives? Fishing is an exclusively male occupation in the Maldives, and was traditionally the main economic activity in most island communities, and so men and older speakers have a much closer connection to fishing than do women or younger speakers, who typically work in the home or in white-collar occupations. The more frequent use of cardinal directions among fishermen and related groups may be explained by the fact that fishing on the open waters traditionally required advanced navigational skills including an awareness of the cardinal directions. This seems especially plausible given the long periods of time Maldivian fishermen spend at sea – even today in an era of motorized fishing boats, most fishermen are out at sea for most of the week, only returning to their islands on weekends. As well as using cardinal directions more frequently in their spatial descriptions, fishermen and associated groups responded more accurately when their knowledge of cardinal directions was explicitly tested in the Object Placement Task (§5.3.4). And although FoRs in general were less common in the Virtual Atoll Task (§5.3.3) and in the narrative data (§5.3.5), cardinals were still occasionally used by men from fishing islands in these texts, and the narrative data also revealed some evidence of geocentric patterns of gesture.

In contrast, egocentric FoRs were more common among younger speakers, non-fishing communities, women, speakers with a secondary education, bilinguals, and indoor workers (§5.2.4). It seems likely that this is due to a combination of three factors: a reduced familiarity with cardinal directions, exposure to egocentric FoRs in English and through English-medium schooling, and perhaps a greater suitability of egocentric FoRs to the indoor and urban environments with which these speakers habitually interact (although, as shown in §5.2.4.10, whether one happens to be indoors or outdoors during the task does not immediately affect FoR choice). Egocentric FoRs were also significantly more common in relatively urban Addu and highly urban Malé (§5.2.4.2), where there are also high proportions of bilinguals, indoor workers, and people with a secondary education.

What implications, then, do these findings have for the various hypotheses about spatial language and the environment considered in Chapter 3? A strong version of environmental determinism is clearly not supported by the Dhivehi data – despite salient topographic cues, there are many Maldivians who appear not to use any geocentric FoRs beyond the use of ad hoc landmarks such as nearby houses. As for Palmer's (2015) Topographic Correspondence Hypothesis, the Dhivehi results are somewhat harder to interpret, partly because the hypothesis itself is open to different interpretations (see §3.4.1). If Palmer's hypothesis is taken merely as a prediction about the availability and grammatical expression of certain kinds of geocentric FoRs in certain languages, then strictly speaking the quantitative results presented in this chapter do not speak to the hypothesis at all (though see §4.7 for an evaluation of Palmer's hypothesis on that criterion). However, if the hypothesis is interpreted more broadly as a prediction about which FoRs are predominant in which speech communities, or perhaps about which types of geocentric FoRs are predominant in which communities, then the Dhivehi results would appear to be counter-evidence. Geocentric FoRs are popular among some speakers and groups in the Maldives, but are not a clearly predominant strategy at a community-wide level. And among the geocentric FoRs that are used, the main subtypes are cardinal directions and, in some locations, miscellaneous landmarks such as houses. References to local topographic features are relatively rare. When topographic terms are used in FoRs, they are usually the terms *atiri* 'beach' and *eggamu* 'inland' rather than terms like *daṣē* 'lagoon shore' or *fuṭṭaru* 'oceanward reef' which are specific to atoll topography and which most resemble the 'lagoonward-oceanward' systems of other atoll-based languages. On the other hand, the widespread use of cardinal directions, although not predicted by Palmer, is arguably quite consistent with the Topographic Correspondence Hypothesis. As Palmer (2015:212) notes, cardinal directions are well suited to relatively featureless environments such as deserts, where the path of the sun is especially salient.[149] Of course, the ocean is also a flat, featureless environment, and the Maldives is predominantly ocean. Some Dhivehi speakers (namely, fishermen) spend long periods of time on the ocean, and those on land are still in a flat environment where the sun's path is salient, even though other topographic features are present too. An important lesson from the Dhivehi data might therefore be that even if geocentric FoRs generally reflect local topography, speech communities may have several topographic cues to 'choose' from, and it is not necessarily possible to predict *a priori* which ones will be used most.

It is also worth noting that patterns of FoR choice in Dhivehi broadly resemble those in other languages of the region, including other Indo-Aryan languages. As discussed in Chapter 3, Hindi and Nepali use a mixture of FoRs, with different proportions in urban and

[149] A reviewer points out that cardinal directions may potentially be well suited to featured environments too, but that in such places there is more competition with other kinds of geocentric systems.

rural locations (Dasen & Mishra 2010), and the same is true in Tamil, a Dravidian language (Pederson 1993). This regional similarity suggests that as with many other linguistic phenomena, genetic lineage and language contact may go some way to explaining a language's FoR patterns, which cannot be explained by the environment alone.

In addition, the Dhivehi results strongly support the position (touched upon in §3.4.2) that for some languages at least, the ways in which people interact with their environment are more important than the environment itself. This is evidenced by the fact that fishing was the strongest predictor of cardinal direction use in the Dhivehi data, and that membership in groups associated with fishing was also a strong predictor. The Dhivehi situation therefore has parallels with the situation in the Mayan languages Yucatec and Mopan, where men use cardinals more than women due to gender-specific occupational biases and cultural practices (Bohnemeyer 2011:904; Danziger 1999). There are also parallels with Shapero's (2017) finding that in Ancash Quechua, geocentric FoRs are more common among herders (though Shapero's study was of FoR choice in a non-linguistic task).

Finally, the data from Malé and Addu (§5.2.4.2) helps to shed light on the question of FoR choice in urban environments. Malé is highly urbanized, and the preference for egocentric FoRs there is in keeping with a cross-linguistic trend for urban environments to show high rates of egocentric FoR use (see §3.4.2). However, Addu is only slightly more urbanized than Laamu, yet FoR patterns in Addu are much more like those of Malé. And of course, non-fishing islands in Laamu also show high rates of egocentric FoRs (especially in orientation descriptions where the vertical and intrinsic strategies are unavailable – see §5.2.4.5). In any case, inhabited islands in Laamu (fishing and non-fishing) are still quite urbanized by international standards, with high population densities and grid-like networks of streets (cf. §1.2.4.1). Together, these observations suggest that physical aspects of the urban environment do not determine the use of egocentric FoRs, but occupational differences between urban and less urban communities appear to have a considerable influence.[150] This again underscores the significance of the ways in which people interact with their environment when it comes to FoR choice.

[150] Of course, other social variables which differ between urban and rural environments, such as bilingualism and education, might also play a role. However, the Dhivehi data speaks to these factors less clearly (though some analysis was provided in §5.2.4.9), since in Laamu it is mostly younger speakers who are bilingual or highly educated, and these speakers are also less likely to work as fishermen.

6 Frames of reference in Dhivehi cognition

6.1 Introduction

Chapter 5 showed that Dhivehi speakers use a range of frames of reference (FoRs) in spatial descriptions. But does this mean that Dhivehi speakers also think about space in a variety of ways? This chapter addresses representations of space in Dhivehi cognition, presenting data from three experiments which aimed to reveal which FoRs are used by Dhivehi speakers in non-linguistic spatial tasks.

As discussed in Chapter 3, much of the debate surrounding frames of reference has concerned the use of FoRs in non-linguistic tasks such as Animals-in-a-row, which are designed to show patterns of FoR use in spatial memory and reasoning. On the one hand, research by members of the Cognitive Anthropology Research Group at the Max Planck Institute (MPI) and their collaborators has revealed correlations between FoRs in language and FoRs in non-linguistic spatial behaviour (Brown & Levinson 1993; Levinson 2003; Majid et al. 2004; Pederson et al. 1998). For example, communities that predominantly use egocentric FoRs in language also tend to use egocentric FoRs to memorize spatial arrays or to make spatial inferences in non-linguistic tasks, while communities that predominantly use geocentric FoRs in language also tend to use geocentric FoRs in the same non-linguistic tasks. These findings have been interpreted by MPI researchers as evidence for the linguistic relativity hypothesis, with FoRs in language influencing FoRs in thought (e.g., Levinson 2003; Majid et al. 2004). On the other hand, other scholars have disputed the MPI's findings and maintain that spatial cognition is largely independent of language and culture (Abarbanell & Li 2009; Li, Abarbanell & Papafragou 2005; Li et al. 2011; Li & Gleitman 2002; Pinker 2007). These scholars consider human spatial cognition to be essentially egocentric, with the use of geocentric FoRs explainable in terms of environmental or task-specific factors.

However, the languages that have been given the most attention in this debate tend to rely predominantly on either egocentric or geocentric coding in spatial descriptions – for example, English predominantly uses egocentric FoRs, while Tzeltal lacks a relative left/right/front/back (LRFB) system and instead tends to use geocentric coding even in small-scale space (Brown 2006). Dhivehi, as spoken in Laamu Atoll, offers a different angle on this debate. Among Dhivehi speakers there is considerable variation in both linguistic and non-linguistic FoR choice, with egocentric, geocentric, and intrinsic coding all used in small-scale space. As Chapter 5 revealed, much of this variation correlates with social and demographic factors, and the Laamu community is undergoing significant societal change (e.g., the shift from a fishing economy to a more mixed economy, and the introduction of compulsory English-medium schooling). Dhivehi therefore offers a valuable window not just into linguistic relativity, but into how FoR patterns (in both language and thought) change over time, and how different linguistic communities around the world may have come to speak and think about space in such diverse ways.

In addition to the above, this chapter will address a number of smaller but nonetheless important questions that have emerged in the literature. These questions include:

- To what extent are the results of non-linguistic spatial reasoning experiments dependent on the details of the specific task?
- If there are different results from different experiments, what task-specific factors could account for this?
- Does it matter if participants are tested indoors or outdoors, and does the direction they face during the experiments matter?
- To what extent do the results of such experiments really reflect underlying cognitive tendencies or preferences?

The structure of this chapter is as follows. In §6.2-§6.4 I present three non-verbal spatial reasoning experiments conducted during my fieldwork in the Maldives: ‘Animals-in-a-row’, ‘Steve’s mazes’, and ‘Chips recognition’. These experiments replicated the original experimental methodologies developed by the MPI (see especially Brown & Levinson 1993; Senft 2007), with some minor differences in materials and setup. In §6.5 I then draw together the findings from the three experiments, and consider how consistent participants were in their FoR choice across the three non-verbal tasks, and how similar these results were to those obtained for the verbal tasks described in Chapter 5, thereby addressing the question of linguistic relativity. Finally, in §6.6 I summarize the key findings from the chapter and provide some further discussion.

6.2 Experiment 1: Animals-in-a-row

6.2.1 Aims

Experiment 1 aimed to reveal which frame(s) of reference Dhivehi speakers employ when memorizing an array of small objects in tabletop space. The experiment also had some subsidiary aims. These were to test whether the following variables might correspond with differences in FoR choice: (i) the setting of the task (indoors or outdoors), given Li and Gleitman's (2002) claim that experiments conducted outdoors are more likely to prompt geocentric responses; (ii) the direction participants face during the experiment (along the length of the island, with the lagoon and ocean sides to the participant's left/right, or across the island, with the lagoon and ocean sides to their front/rear); and (iii) demographic factors such as age, gender, and location, given the variation in linguistic FoR choice reported in Chapter 5.

6.2.2 Methodology

The methodology of Experiment 1 was based on the original 'animals-in-a-row' methodology devised by the Max Planck Institute (e.g., Brown & Levinson 1993:13–14; Levinson 1996:113–115; Levinson 2003:157–158; Pederson et al. 1998:575–578), although with some small modifications. The exact procedure is described in the following sections.

6.2.2.1 Materials

The original MPI experiment used four toy animals: a horse, cow, pig and sheep (Levinson 1996:114). However, Experiment 1 used a horse, tiger, dolphin and turtle, for reasons of cultural familiarity and sensitivity.[151] The toy animals, which are from the Schleich® range of animal figurines, are 2cm-4cm in width, 6cm-12cm in length and 2cm-9cm in height. They are distinctive in colour and shape, and each animal is almost perfectly symmetrical along its sagittal axis. The animals are shown in Figure 6.1 below. The experiment also required two rectangular tables with plain surfaces. These functioned as a stimulus table

[151] Many Maldivians are unfamiliar with the differences between large, four-legged farm animals such as cows and sheep, which are not found in the Maldives. Furthermore, pigs are regarded as dirty in Islam, and the inclusion of a taboo item in a memory task could have presented an experimental confound, and could also have been uncomfortable for participants. However, dolphins and turtles are common in Maldivian waters, and tigers and horses are familiar enough from books and television (the latter are also more physically distinctive from one another than cows and sheep). None of these animals are taboo in Islam or Maldivian culture.

and a test table. In addition, plastic (non-swivel) chairs were sometimes provided for older participants.

Figure 6.1: Stimuli used in Experiment 1 (Animals-in-a-row)

6.2.2.2 Setup and instructions

The two tables were placed 3-4 metres apart, with the toy animals initially at one of the tables (the stimulus table). The participant was led to the stimulus table and was briefed about the experiment. A native speaker research assistant read out a short set of instructions to the participant, carefully worded so as to avoid using any frame of reference vocabulary that might prime for certain response types. The English translation of these instructions is as follows:

> This is a simple game. Out of four animals, you will see three animals placed in a line. You will need to remember which animals they are and how they are arranged. When you are ready, we will take away the animals and wait for a small amount of time. We will then give the animals to you and ask you to make the line again, exactly as it was. You will play the game five times in total. First we will play a few practice games.

6.2.2.3 Training procedure

A brief training procedure was necessary to ensure the participant understood the task and to reduce participant errors during the main trials. The training procedure was facilitated by the native speaker research assistant, who was under my direct supervision and who had been instructed to carefully follow the procedure described below. There were three phases in the training procedure:

1. A pre-randomized selection of three animals (out of four) was arranged on the stimulus table, with the animals in single file and all facing the same direction, either to the participant's left or to their right (see Figure 6.2 at the end of this section). The participant was asked to memorize the way the animals were, and was allowed to look at the array of animals for as long as he or she liked. The animals were then scooped up and immediately placed in a heap along with the fourth (unused) animal on the same table. Without any delay, the participant was told in Dhivehi, "Arrange them just the way you remember them from before". If the participant produced an incorrect response, this was corrected (by demonstration and without any spatial language) and then the first practice trial was repeated with a new array.
2. Once the participant passed the first practice trial, another pre-randomized array of animals was placed on the stimulus table.[152] This time, after the participant memorized the array and the array was removed by the researcher, the participant was asked to wait 30 seconds before being instructed to arrange the animals as they were before, again on the same table. Any errors were corrected (simply by showing the correct array, without using any spatial terms which may prime future responses) and resulted in a repetition of this phase with a different array. If the participant claimed to have forgotten the array at any point during the training procedure, he or she was shown the same array again before the procedure continued as normal.
3. The third practice trial was similar to the second trial, except that after the 30-second delay, the participant was led to the test table to re-create the array there. The participant turned around 180 degrees while moving between the tables, as shown in Figure 6.2 below. The participant's response for this trial was not corrected in any way. Although identical to the main trials (see §6.2.2.4), this practice trial was conducted in order to familiarize the participant with turning around to rebuild the array at the test table, so that this aspect of the experiment would run more smoothly in the main trials.

[152] All arrays in the training procedure and main trials were of three animals in single file, facing the same direction as each other (either to the participant's left or right). The arrays were 'random' with certain constraints: no two arrays within the task could be identical, no two consecutive arrays could be nearly identical, no more than two consecutive arrays could face the same direction, and across the five main trials, three faced one direction (e.g., left) and the other two faced the opposite direction.

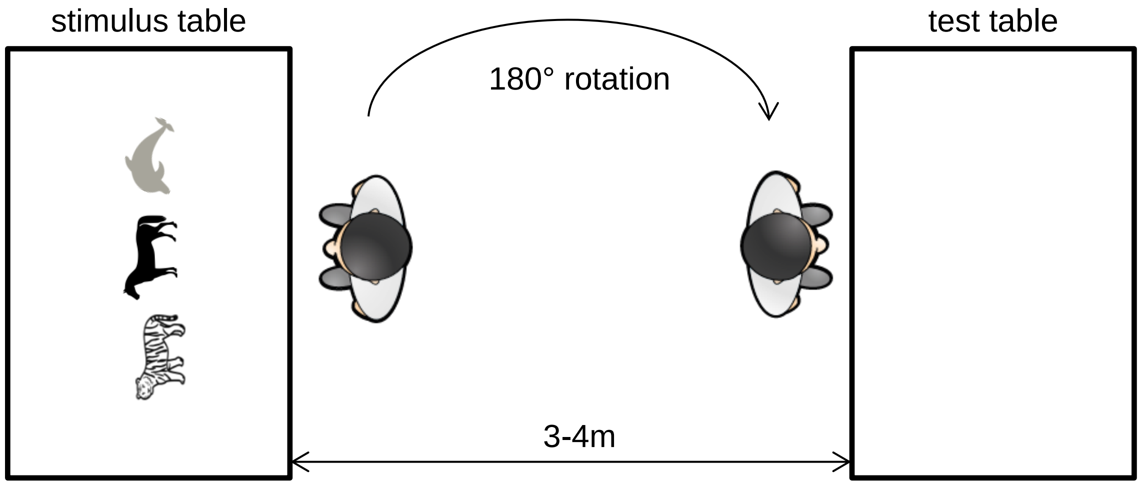

Figure 6.2: Rotation of participant in Animals-in-a-row

6.2.2.4 Main trials

There were five main trials, each of which was conducted in the same way as the third practice trial: a pre-randomized array was shown to the participant on the stimulus table, the participant was asked to memorize the array, the array was removed, the participant waited at the stimulus table for 30 seconds before being led to the test table (rotating 180 degrees in the process) where he or she was asked to arrange the animals as they were before. Figure 6.3 below shows a Dhanbidhoo woman recreating the line of animals at the test table. The main trials were not corrected in any way, and the participant was not told whether his or her responses were correct (if the participant asked directly about this, I deflected the question by telling the participant that they could find out later). If the participant claimed to have forgotten an array after it was removed but before recreating it at the test table, the trial was skipped and then repeated as an additional trial at the end of the task. After each trial, the direction and order of the animals in the participant's response array was recorded on a clipboard. At the end of the five main trials, the participant was asked how he or she had tried to remember the animals during the task.

Figure 6.3: A Dhanbidhoo woman rebuilding an array at the test table

6.2.3 Participants and conditions

59 participants from Fonadhoo and 24 participants from Dhanbidhoo were recruited for Experiment 1. Five participants from Fonadhoo were excluded from the analysis – two were only visiting Fonadhoo at the time of the experiment and so were not locals, one had only just moved to Fonadhoo from another atoll, and another two were excluded because of issues with the experimental setup.[153] This left 78 participants in total. These participants were of different ages (mean age 42.4 years) and genders (39 women, 39 men), as shown in Table 6.1 below:

[153] These last two participants were excluded for two reasons: firstly because they performed the task in an enclosed courtyard with a veranda, whereas all other participants were either in a much more open courtyard (with no roof) or completely indoors or outdoors; and secondly because both participants initially walked around to one side of the test table and had to be told explicitly that they could not stand there when reconstructing the array – this may have accidentally primed the participants to think that the experiment was not just testing memory of the arrangement of animals with respect to each other (which could be tested from any side of the table), but with respect to array-external features. In fact, both these participants produced strongly geocentric responses, despite being young, educated, bilingual women who work in indoor environments (as discussed in Chapter 5, these traits are negatively associated with geocentric FoRs in Dhivehi). I discuss this result further in §6.5.1.

Table 6.1: Participants in Experiment 1 (Animals-in-a-row)

Island	Age 16-34 (F, M)	Age 35-49 (F, M)	Age 50-74 (F, M)	Total (F, M)
Fonadhoo	18 (8, 10)	19 (12, 7)	17 (7, 10)	54 (27, 27)
Dhanbidhoo	8 (4, 4)	8 (4, 4)	8 (4, 4)	24 (12, 12)
TOTAL:	*26 (12, 14)*	*27 (16, 11)*	*25 (11, 14)*	*78 (39, 39)*

The stimulus and test tables were set up so that the direction participants faced was counterbalanced across the sample – 39 participants began facing lagoonward and 39 began facing 90 degrees clockwise from lagoonward (or 'across' and 'along' the island respectively).[154] In the Fonadhoo sample, the time and setting of the experiment was also varied (indoors at nighttime or outdoors at daytime). In Dhanbidhoo all participants were tested indoors at nighttime.

Many participants at both locations had already participated in some linguistic elicitation tasks (see Chapter 5) in separate sessions, though these sessions were always on separate days (typically weeks or months earlier) to minimize the chance of interference from one task to another. No participants had previously been involved in the other memory experiments to be described later in this chapter ('Chips recognition' and 'Steve's maze'). Upon completion of Experiment 1, participants were thanked for their time and were offered a small gift.

6.2.4 Results and discussion

6.2.4.1 Preliminary analysis: relative or absolute?

The premise of most rotation experiments such as Animals-in-a-row is that participants will have to give either 'relative' or 'absolute' responses to each trial (e.g., Levinson 2003:177–178). 'Relative' responses preserve both the direction (i.e., orientation) and order of the stimulus array with respect to the participant's left/right coordinates, while 'absolute' responses preserve direction and order with respect to absolute coordinates such as north/south/east/west. For example, suppose that from the perspective of the participant at

[154] Because Fonadhoo is oriented northeast-southwest, and Dhanbidhoo north-south, this meant that only the Dhanbidhoo participants were aligned with the main cardinal directions. However, as discussed in §4.6.3.1, in Fonadhoo cardinal directions are usually used such that they align with the long axis of the island or run perpendicular to it (e.g., *uturu* 'north' points to what is actually northeast). Thus, in terms of the way the cardinal direction system operates at each location, all participants were equally aligned with cardinal directions during the experiment.

the stimulus table, the animals are facing left, which also happens to be south, and the animals (from left to right or south to north) are 'tiger-horse-dolphin'. After the participant rotates 180 degrees and approaches the test table, a relative response rebuilds 'tiger-horse-dolphin' from left to right with the animals facing left, even though the animals are now facing north rather than south, and their order from south to north is now reversed. On the other hand, an absolute response rebuilds 'tiger-horse-dolphin' from south to north with the animals facing south, even though the animals are now facing right rather than left, and their order from left to right is now reversed. These two response types are illustrated in Figure 6.4 below:

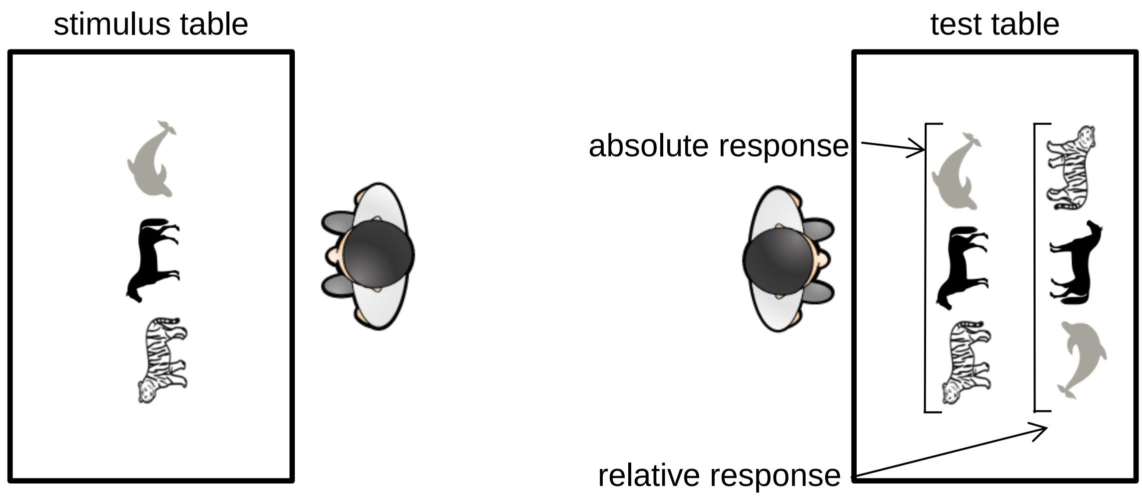

Figure 6.4: Absolute and relative responses in Animals-in-a-row

In their analyses of similar experiments, MPI researchers record both the direction (i.e., orientation) and order of animals in the arrays built by participants at the test table, since the two do not have to employ the same frame of reference in all cases (e.g., Brown & Levinson 1993:12). For example, a response may preserve the absolute direction of the animals (e.g., still facing south) but preserve their relative order (e.g., tiger still on the left, dolphin still on the right), or vice-versa. Brown and Levinson (1993:12, 18) classify responses of this kind as 'inconsistent' or 'incongruent'.[155] They also observe that some other responses are simply errors. In Experiment 1, errors involved either an incorrect ordering of animals (e.g., the dolphin in the middle rather than the horse), or the inclusion

[155] Bohnemeyer (2011:909–910) uses the term 'non-aligned'.

of the fourth (distractor) animal in place of one of the correct animals.[156] Some of these possibilities are shown in Figure 6.5 below:

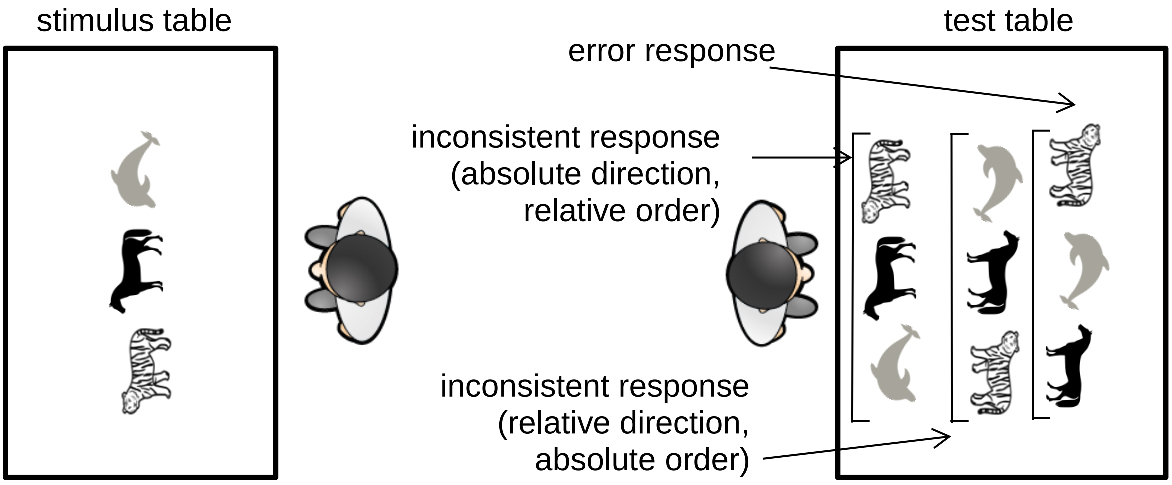

Figure 6.5: Inconsistent and error responses in Animals-in-a-row

Since each participant performs five trials, MPI researchers classify participants as 'absolute coders' if they produce at least four 'absolute' responses, 'relative coders' if they produce at least four 'relative' responses, or 'untypable'/'other' if they fail to produce at least four responses using the same frame of reference (e.g., Brown & Levinson 1993:14; Haun et al. 2011:76; Levinson 2003:158, 174). I will call this the 'strong MPI criteria'. Another metric sometimes used is to calculate a 'relative-to-absolute gradient' (also called an 'RA gradient' or 'estimated absolute tendency') from 0-100 for each participant, by giving each absolute response a value of 1, each relative response a value of 0, and each ambiguous response a value of 0.5, then dividing by the number of trials and multiplying by 100 (Brown & Levinson 1993:14–15; Levinson 2003:176–178). Participants can then be classified as 'absolute coders' if their RA gradient is from 70-100 or 'relative coders' if their RA gradient is from 0-30. These criteria are slightly weaker when considering the order of animals – for example, a participant who produces three absolute responses, a relative response and an error would be classified as an absolute coder, as would someone

[156] In early versions of the MPI experiment the fourth animal was not offered to participants at the test table, and so the latter kind of error was not possible (Brown & Levinson 1993:14). This approach was also taken by Li and Gleitman (2002), and in one of the conditions tested by Levinson et al. (2002). Other experiments have generally made the participant choose the three correct animals (out of a total of four) at the test table, under the logic that this helps to distract the participant from the true purpose of the experiment (e.g., Bohnemeyer 2011; Haun et al. 2011; Pederson et al. 1998).

who produces only two absolute responses along with three error responses.[157] When considering the direction of animals, however, the two sets of criteria are effectively equivalent – assuming participants orient the line of animals transversely (whether left or right), every response is interpretable as showing either relative or absolute direction with no 'errors', and so an RA gradient of 70-100 is generally attained only by producing at least four out of five responses with the same FoR.

Applying these coding techniques to the Maldivian data reveals that the majority of participants fall into the 'untypable' category, producing a mixture of apparently 'relative' and 'absolute' responses (as well as some errors and inconsistent responses). As shown in Table 6.2 below, the exact figures depend on whether one applies the strong or weak MPI criteria, and on whether one is talking about the direction of animals, order of animals, or overall arrangement of animals (e.g., a response is counted as 'relative' overall only if it contains both relative direction and relative order). But whichever way one looks at the data, it is obvious that untypable coders easily outnumber relative or absolute coders. It is also apparent that there were only slightly more absolute coders in the sample than relative coders.

Table 6.2: Initial classification of Maldivian participants in Animals-in-a-row (*N* = 78)

		Relative coders	**Absolute coders**	**Untypable coders**
Direction	Strong MPI criteria	14 (18%)	19 (24%)	45 (58%)
	Weak MPI criteria	14 (18%)	19 (24%)	45 (58%)
Order	Strong MPI criteria	12 (15%)	12 (15%)	54 (69%)
	Weak MPI criteria	20 (26%)	21 (27%)	37 (47%)
Overall	Strong MPI criteria	9 (12%)	11 (14%)	58 (74%)
	Weak MPI criteria	18 (23%)	20 (26%)	40 (51%)

[157] The literature is not always clear on whether an RA gradient of 30 is taken to be relative or untypable, and similarly whether an RA gradient of 70 is taken to be untypable or absolute. Here I assume the weaker cutoffs, following Pederson (1995:49), such that participants on the cusp of relative or absolute are counted in one of those groups.

Most Maldivian participants appeared to produce a mixture of ‘relative’ and ‘absolute’ responses, but one might still wonder whether over the total pool of 390 trials (five trials times 78 participants) there was a bias towards one of these FoRs. This was not in fact the case, as Table 6.3 below shows. There may have been a very slight tendency towards absolute responses over relative ones, but the difference here is within the realm of chance. Another way to view this is through mean RA gradients (calculated as per the MPI formula) – these were 51.54 for direction, 51.41 for order, and 51.15 for overall arrangements, or almost exactly halfway between a completely relative-coding population and a completely absolute-coding population.

Table 6.3: Maldivian responses to individual trials in Animals-in-a-row (*N* = 390)

	‘Relative’ responses	**‘Absolute’ responses**	**Errors**
Direction	189 (48%)	201 (52%)	0 (0%)
Order	143 (37%)	154 (39%)	93 (24%)
Overall	129 (33%)	138 (35%)	123 (32%) - 30 (8%) ‘inconsistent’ - 93 (24%) other errors

Table 6.3 also shows the proportion of errors out of the total pool of responses: 93 responses (24%) contained ‘order errors’ (also including responses that selected the distractor animal), and 30 responses (8%) were ‘inconsistent’ with respect to direction and order. Of the latter, 14 used absolute direction with relative order, and 16 used relative direction with absolute order. This rate of errors (at about one quarter of trials) is very similar to that reported for the Tamil and Tenejapan Mayan populations studied by the MPI (Levinson 2003:176), and the rate of inconsistent responses is similar at least to the Tenejapan population (Brown & Levinson 1993:18). The precedents from other studies suggest that the rate of errors among the Maldivian sample is not surprising, and that the errors can largely be explained as simple failures of memory.[158]

Given that the rate of errors is not higher than in some other populations for which a clear FoR preference was detected, the very large proportion of ‘untypable’ participants is due not so much to errors as to an apparent tendency for participants to switch between absolute

[158] A closer examination of the error responses supports this view. Many errors were in fact repetitions of responses the participant had already produced in earlier trials (including from the training procedure) – in other words, there appeared to be some interference from earlier trials upon later ones.

and relative responses throughout the experiment. This proportion of untypable participants is much higher than in the various populations studied by the MPI (see Brown & Levinson 1993:14–18; Levinson 2003:178–193; Pederson et al. 1998:578–583), who mostly show a clear tendency towards either the relative FoR (e.g., Dutch, English, Japanese) or the absolute FoR (e.g., Arrernte, Longgu, Tzeltal) in such tasks. But are Maldivians really mixed coders, switching between FoRs from trial to trial? If so, why do they switch, when presumably it would be less cognitively demanding to maintain the same FoR throughout the task? A pattern of switching between relative and absolute FoRs would be all the more surprising given that very few Maldivians switched between those FoRs in the description tasks discussed in Chapter 5. Although most participants did switch between multiple FoRs in the description tasks, this generally involved the combination of conceptually simpler strategies (vertical, intrinsic, landmarks) with at most one of the (horizontal) ternary angular-anchored FoRs (relative, absolute), which are conceptually more difficult (see §5.2.4.3 for discussion). In fact, of the 59 pairs in the Man and Tree sample, only seven pairs used both the absolute FoR and the relative left/right axis (the relative axis relevant to Animals-in-a-row), and of these only three pairs used both of the relevant strategies in more than a marginal way. Thus, if most people did not switch between relative and absolute FoRs when describing spatial arrays, why did they switch between these two FoRs when memorizing spatial arrays? The simple answer is that they did not. Instead, most of the 'untypable' coders were in fact employing a strategy that was neither relative nor absolute, but which over a number of trials superficially looked like a mixed strategy. I turn to this 'monodirectional' strategy in the following section.

6.2.4.2 The intrinsic frame of reference and 'monodirectionality'

In designing the original animals recall experiment (and other rotation experiments), MPI researchers supposed that participants would use either the relative or absolute FoR when memorizing spatial configurations in the tasks. For example, Levinson (2003:177) writes:

> The tasks in question require an 'orientation-bound' frame of reference … they cannot be solved by using an intrinsic frame of reference, which only codes the internal relations of the objects in the array to one another, and which therefore yields no single coherent solution. Rather, what is required is some coordinate system that is external to the array itself. There are, as far I know, only two such (families of) coordinate systems used by humans, namely a relative and an absolute type.

It is true that if participants notice and memorize which way the line of animals is facing (e.g., 'left' or 'north'), they must use an 'orientation-bound' (i.e., ternary) frame of reference. However, the relative and absolute FoRs are not the only ternary FoRs that are suitable for the task. A landmark-based FoR could equally be used – for example, a participant might remember that the animals are facing in the direction of the school. Thus the experiment might more accurately be characterized as pitting the (transverse) relative FoR against geocentric FoRs in general.[159]

But more importantly, it is highly questionable whether participants in such experiments need to use an 'orientation-bound' FoR at all. Participants are under no obligation to attend to elements of the array that the researcher would think obvious to attend to, having been told only in vague terms to recreate the array 'exactly as it was' or 'as you remember it'. A participant could reasonably assume that the task is about remembering which animals are used and where they stand with respect to each other, but not with respect to the participant's own left or right nor to the wider world (cf. Danziger 2011:856). After all, the toy animals are artificial objects in what must appear to be a rather strange experiment, and their configuration with respect to external entities or coordinate systems is not of obvious importance. In cultures that favour a ternary FoR, most participants still notice and mentally encode how the animals are arranged with respect to some external anchor, allowing for the comparisons of relative and geocentric FoRs made throughout much of the literature (e.g., Brown & Levinson 1993; Levinson 2003; Pederson et al. 1998). But in communities that favour the intrinsic FoR, or that use a mixture of FoRs with the intrinsic FoR prominent, it should not be overly surprising to see participants using a rebuilding strategy that preserves the intrinsic (i.e., array-internal) arrangement of the animals, but which neglects to preserve their relative or geocentric arrangement in a consistent way. The use of such a rebuilding strategy is a completely natural response to the (necessarily) vague instructions of the task; moreover, the strategy can look identical to a relative or geocentric one when applied to a

[159] From here on, I therefore use the term 'geocentric' rather than 'absolute' in the context of this experiment and similar ones, except where distinguishing absolute FoR from landmarks (refer to §2.4.4 and §2.5 for this distinction) or where quoting the terminology of others. Recent work involving such experiments also tends to use the term 'geocentric' (e.g., Haun et al. 2011; Le Guen 2011a; Li et al. 2011). The same literature also uses the term 'egocentric' instead of 'relative'. These two terms are not equivalent, though the relative FoR is a type of egocentric FoR (see §2.3and §2.5). As outlined in Chapter 2, I use the term 'egocentric' when referring to the supercategory that also includes the relative FoR, the direct FoR, and SAP-landmarks (the term 'relative' being reserved for projective egocentric references).

single trial, and so researchers are unable to 'correct' the participant in the training procedure if they wish to force a choice between ternary FoRs.

An intrinsic rebuilding strategy only requires the correct three animals to be selected and placed with respect to *each other* in the same way as they were on the stimulus table. That is, if in the stimulus array the horse is at the head of the line (as defined by the facing direction of the animals), followed by the dolphin then the turtle, an intrinsic response would rebuild 'horse-dolphin-turtle' with the horse at the head of the line. But importantly, this line can in principle face any direction, even running diagonally or sagittally with respect to the participant. This is a simple enough strategy for participants to use, but it presents serious difficulties for the analyst. An intrinsic response along the transverse axis looks identical to a relative or geocentric one. This is because relative and geocentric responses also preserve array-internal information, and additionally preserve directional information. An intrinsic response placed along the transverse axis has to face one way or the other (say, left/north or right/south), and in one case it will happen to coincide with the relative solution and in the other case with the geocentric solution (in principle, it is also possible for an intrinsic response to be placed sagittally or diagonally, but in practice this hardly ever occurs, for reasons I will discuss later). Not only does this make it difficult to detect intrinsic responses on the transverse axis, but the possibility of intrinsic responses casts doubt on responses usually interpreted as relative or geocentric – how can we tell if any given response is really relative or geocentric, when it could simply be intrinsic?

The fact that there is ambiguity between response types in individual trials (as opposed to participants producing mixed responses over a set of five trials) in the original version of the experiment is sometimes acknowledged in the literature (e.g., Bohnemeyer 2011:899, 909; Danziger 2011:856; Dasen & Mishra 2010:60; Levinson et al. 2002:177), but there appears to be no satisfying solution to the problem (cf. Bohnemeyer 2012b:21). While some methodological innovations have been implemented to allow for the possibility of 'intrinsic' responses, they either fail to do so successfully, or else they introduce other issues. These variants generally involve a 90-degree rotation of the participant and the inclusion of a salient landmark, such that the experiment can apparently distinguish between relative, absolute and 'intrinsic' responses – an 'intrinsic' response here would be oriented with respect to the landmark object, but because of the 90-degree rotation of the participant, this looks different to an absolute response. However, where the landmark object is completely separate to the array, such as the school building in Haun et al.'s (2011) experiment, this approach actually attends to landmark-based rather than true intrinsic solutions (see §2.4 and §2.5.1 for this distinction).[160] In other cases, such as the 'duck ponds' variant used by Levinson et al. (2002:176–179) (based on a similar methodology employed by Li & Gleitman 2002), participants probably think of the 'landmark' objects not as independent landmarks but actually as part of the array (cf. Levinson 2003:200; Levinson et al. 2002:173). This indeed involves the intrinsic FoR, but a problem is that the presence of the duck ponds may be interpreted differently by different participants. While some intrinsic coders may treat the duck pond as part of the array, and will orient the animals with respect to it as on the stimulus table, other intrinsic coders may ignore the duck pond but still remember the configuration of the animals with respect to each other. The latter strategy could rebuild the array facing any direction, including directions that would happen to make the response correspond with a relative or geocentric solution. In other words, the inclusion of the duck pond does not guarantee that different FoRs can be totally disambiguated in the task. Another issue is that the inclusion of the duck pond seems to bias towards the selection of the intrinsic FoR, and forces the different solution types to run on different axes (see Levinson et al. 2002:174-179), and so the different possible solutions are not all on an equal footing in this variant.

Some other studies have tried to get around the problem by adding a fourth animal at a right angle to the line of three animals (Dasen & Mishra 2010:60–61). While this method does allow for some intrinsic responses along the transverse axis to be clearly identifiable as intrinsic only, it too fails to distinguish all possible intrinsic responses from relative and geocentric ones, and also adds to the complexity of the task (making errors more likely).
Unfortunately, we are left with the original problem – how can we tell if an apparently relative or geocentric response is not intrinsic? I conclude that there is in fact no way to do this for individual trials; indeed, it is logically impossible to rule out intrinsic coding given that (correct) relative and geocentric responses by their very nature must also preserve the

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160 Haun et al. (2011) probably conflate these two solution types because they mostly follow Levinson's (2003) classification of FoRs in which the term 'intrinsic' is an umbrella for various FoRs and FoR subtypes, including landmark-based ones (see §2.4 for discussion). Confusingly, however, Haun et al. actually use the term 'object-centered' for Levinson's 'intrinsic' category (apparently to make a distinction with the direct FoR, which is also a type of intrinsic FoR), but they use it as an umbrella for both landmark-based and purely array-internal strategies, rather than for the latter alone as the term is usually used (see §2.3.3 and §2.5.1).

array-internal arrangement of the animals. However, since each participant performs five trials, it is possible to tease apart intrinsic, relative, and geocentric coders based on their overall performance in the task. This is based in part on the reasonable assumption that across the five trials, an intrinsic coder is highly unlikely to consistently orient her arrays in a way that happens to also look relative but not geocentric or vice versa. It is also based on the finding (to be explained further below) that in practice, many intrinsic coders produce sets of arrays that look different to those produced by 'mixed' coders (who use relative and geocentric FoRs in different trials). I turn to this approach in the remainder of this section.

Levinson et al. (2002:177) observe that although intrinsic responses can in principle be oriented in any direction, in practice they tend to be oriented transversely (i.e., left to right or right to left), as this arrangement follows the main axis of the table and is more visually similar to the stimulus array (see also Bohnemeyer 2011:910).[161] In fact, the Maldivian sample in Experiment 1 placed all of their responses transversely, and so any individual intrinsic response always looked identical to a relative or geocentric one. Assuming that intrinsic coders who always arrange their arrays transversely orient them leftward 50% of the time and rightward 50% of the time, and keeping in mind that the correct relative and geocentric solutions are oriented leftward or rightward in roughly equal proportions too (since the direction of the stimuli is varied), the odds of an intrinsic coder accidentally producing at least four relative-looking responses (the MPI's benchmark for a 'relative coder') are only 1/16 (6.25%), and there is the same probability of an intrinsic coder accidentally producing at least four geocentric-looking responses. Thus, participants classified in §6.2.4.1 as relative or geocentric are still almost certainly relative or geocentric, but many of the 'untypable' coders may have been intrinsic coders. However, it would appear impossible to distinguish such intrinsic coders (who orient their arrays leftward or rightward at random) from 'mixed' coders who use relative and geocentric

[161] Arguably, if visual similarity is a factor here then the response employs a kind of relative FoR, since it is sensitive to the viewpoint of the participant at the stimulus table. However, the visual similarity in question need not be spatial in nature, and may relate only to which parts of the animals are visible or prominent. For example, in all transversely oriented arrays, one side (or flank) of each animal is clearly visible to the participant, while in sagittally oriented arrays, both sides of each animal are visible. In any case, responses that preserve 'axis' information while ignoring 'direction' information cannot be regarded as canonical examples of the relative FoR, since they fail to distinguish left from right when projecting the viewer's body axes onto the array. At best, they could perhaps be considered examples of an 'undifferentiated' relative axis, comparable to the undifferentiated absolute 'across' axis in Tzeltal (Levinson 2003:148) and similar examples (e.g., Palmer 2015:198, 216), though I will not pursue that analysis here.

FoRs in different trials – ‘intrinsic’ and ‘mixed’ coders both produce a mixture of relative-looking and geocentric-looking responses, as well as leftward and rightward responses.

There is, fortunately, a particular method of orienting the animals that can only be interpreted as intrinsic, though not all intrinsic coders leave this signature. The method is what has been called ‘monodirectional’ coding (Brown & Levinson 1993:11, 15; Danziger 2001:211–212; Levinson 2003:189; Pederson et al. 1998:579, 583) or ‘unidirectional’ coding (Bohnemeyer 2011:909–910), and has been observed to varying degrees in speakers of Mopan Maya (Mayan, Belize/Guatemala; Danziger 2001:211–212), Yucatec Maya (Mayan, Mexico/Belize; Bohnemeyer 2011:909–910; Levinson 2003:189), Tamil (Dravidian, South India; Pederson et al. 1998), Iwaidja (Iwaidjan, northern Australia; Edmonds-Wathen 2012:164–167, 225–227), Arrernte (Pama-Nyungan, Central Australia; Pederson et al. 1998:583), Hai||om (Khoisan, Namibia; Neumann & Widlok 1996:367, Footnote 3) and Kgalagadi (Bantu, Botswana; Neumann & Widlok 1996:367, Footnote 3). A consistently monodirectional coder orients all his arrays in a particular direction (say, leftward), but preserves the intrinsic arrangement of the animals (e.g., horse at front of line, then tiger, then dolphin). The direction chosen is usually on the transverse axis (i.e., leftward or rightward), for the reasons to do with visual consistency discussed earlier. While each individual response looks like it could be relative or geocentric, and the set of responses as a whole looks like it could be a mix of relative and geocentric solutions, the underlying strategy involves the intrinsic FoR, with the participant paying attention only to the array-internal arrangement of the animals. Although in principle such a response pattern could reflect a mixed strategy, this is less likely than an intrinsic strategy – a mixed coder may happen to produce five arrays facing the same direction, resulting in a superficially monodirectional pattern, but assuming they choose from the relative and geocentric FoRs at equal proportions, this outcome would be expected to occur among only 6.25% of mixed coders. Thus, an occasional participant with monodirectional responses among a large number of untypable coders would be consistent with mixed coding, but a large proportion of monodirectional participants points strongly to intrinsic coding as a major strategy in the sample tested.

In Experiment 1, 22 participants out of 78 (or 28%) oriented all five arrays in the same direction, and a further 20 (26%) oriented four out of five arrays in the same direction.

Interestingly, of these 42 participants, 34 oriented their responses leftward, and eight oriented their responses rightward. A leftward bias is also apparent in Edmonds-Wathen's (2012:164–167, 225–227) Iwaidja data, though this is not remarked upon by the author.[162] The leftward tendency can probably be explained by the way most participants picked up the toy animals at the test table. Being mostly right-handed, participants tended to pick up the animals with their right hand, grasping the animal's body such that the head of the animal protruded from the gap between the thumb and index finger, which meant the animal would face leftward from the participant's point of view. This is a more comfortable and natural way of grasping the animals than having the head face rightward, where it would stick up awkwardly into the palm of the hand.[163] Having already picked up an animal such that it faces leftward, an intrinsic coder simply places the animal down still facing leftward, and then builds the rest of the array around it according to intrinsic properties (e.g., dolphin behind horse and facing it), resulting in the entire array facing leftward. Although one might suppose that even right-handed participants could just as easily use their left hand for such a basic task, Maldivians regard the left hand as dirty, using it to clean themselves after toileting – thus, unless they are handling something dirty or unless both hands are required for a task, Maldivians tend to use their right hand where possible.[164]

Regardless of which way the animals face, the use of a monodirectional strategy can distinguish an intrinsic coder from a mixed coder (who, as discussed earlier, should produce a mixture of leftward and rightward responses). However, the absence of monodirectionality does not necessarily mean that intrinsic coding was not used, since some intrinsic coders may assign different directions to their arrays at random. Thus, taking into account monodirectionality allows for relative, geocentric, and intrinsic coding

[162] I consider it likely that a leftward tendency exists in other communities where monodirectionality has been observed. To my knowledge no authors have previously remarked on such a leftward pattern, but most have not published their raw data and so it is not possible to check either way.

[163] This is true especially for the horse, which has a relatively long neck and a large head, and to a lesser extent for the tiger (see Figure 6.1 in §6.2.2.1). Although the dolphin's head does not stick up, it has a dorsal fin just behind the head that does. While the turtle is the smallest animal and its head is level with its body, it may still be more natural to hold it facing leftward, such that its head is not hidden by the participant's hand.

[164] One other possible factor is that literacy in the Thaana script (which runs from right to left) might have subconsciously influenced the participants to arrange the animals in a leftward direction; that is, a right-to-left script might bring about a more general cultural expectation for transversely arranged items to face or move leftward, all else being equal. Although there are some studies on other languages that point to an influence of script directionality on behaviour in non-linguistic tasks (e.g., Vaid 1995), I consider this explanation to be less plausible for the Dhivehi speakers in Experiment 1, given that the Thaana script coexists with a commonly used Romanized script running from left to right, and given that Maldivians do not show a clear leftward bias in other arrangement tasks.

strategies to be distinguished, with a remaining ‘untypable’ category that may include both intrinsic and mixed coders, as well as participants who made too many errors for their coding style to be detected.

6.2.4.3 Revised classification of participants

Due to the proportion of errors (32% of all trials, including ‘inconsistent’ responses), the fact that many participants did not apply their predominant strategy in every trial, and the similarities between intrinsic and other responses, it is still difficult to identify a preferred FoR for many participants, even after taking into account monodirectional intrinsic responses. However, a closer examination of the error responses reveals that many were nearly correct responses within one or more FoRs. Of the 123 errors, 30 were ‘inconsistent’ in order and direction as discussed in §6.2.4.1, and so were nearly correct responses in more than one FoR – e.g., if only the facing direction of the animals were reversed, or the front and back animals swapped, such arrays would be correct in the intrinsic FoR as well as one of the relative or geocentric FoRs. A further 65 errors were not ‘inconsistent’ as defined above, but were still nearly correct solutions. For example, a participant might have attempted a relative solution, but used the distractor animal instead of one of the correct animals, or mixed up the order of two adjacent animals in the line (e.g., horse-tiger-turtle instead of tiger-horse-turtle). Many of these kinds of errors may be interpreted as likely attempts at a correct response using a certain FoR, since they were often just one small alteration away from being, say, a correct relative/intrinsic response, but multiple alterations away from being a correct geocentric/intrinsic response (as discussed earlier, in individual trials there is always ambiguity between relative and intrinsic FoRs and between geocentric and intrinsic FoRs). Note that there are low odds of accidentally producing such ‘nearly correct’ responses by placing the animals randomly – of the 48 possible ways to select and arrange three of four animals along the transverse axis, only seven can be interpreted as ‘relative/intrinsic attempts’, seven as ‘geocentric/intrinsic attempts’, and two as ‘inconsistent’ solutions which may be relative/intrinsic or geocentric/intrinsic attempts (among the 48 possible responses, there are also 30 types of errors that do not look close to any FoR, as well as one correct relative/intrinsic solution and one correct geocentric/intrinsic solution).[165] Factoring in these attempts at correct solutions will help to classify many participants according to their preferred FoR, cutting down the number of 'untypable' participants.

The revised approach to classifying participants I will adopt here therefore incorporates 'nearly correct' solutions, and also treats sets of responses that are monodirectional as evidence of intrinsic coding. This is a slightly more complicated approach than the ones favoured in the literature (see §6.2.4.1), but it is necessitated by the large number of otherwise 'untypable' participants, who make up more than half the sample (see Table 6.2 in §6.2.4.1). However, it is still stringent enough that participants who produced ambiguous responses are not sorted into FoR categories without sufficient evidence that they used a particular FoR. Basically, the revised approach classifies each participant according to the FoR that best fits her responses, provided that the following conditions are also met:

- at least two responses are correct responses in the FoR;
- at least four responses are correct or nearly correct (including 'inconsistent') responses in the FoR;
- for a monodirectional intrinsic classification, at least four response arrays must face the same direction;
- no other analysis is an equally good fit for the data.

If these conditions are not met, the participant remains 'untypable'. For the relative and geocentric FoRs, the criteria are similar to the MPI's 'strong criteria' (discussed in §6.2.4.1), except that nearly correct solutions may be counted, provided at least two other responses are perfectly correct within the same FoR.[166] Thus a participant who produced three correct relative responses, a nearly correct relative response and an error would be classified as a relative coder, provided their responses were not equally consistent with a

[165] To be sure, the precise odds of randomly producing some kind of 'nearly correct' response (within any FoR) in a particular trial are therefore 16/48 (or 1/3), which is not in itself very low. However, the odds of randomly producing responses *in multiple trials* that are nearly correct *within the same FoR* are drastically lower.

[166] Although the benchmark was set at two correct responses, 25/27 participants who were classified as relative or geocentric coders under the new criteria in fact produced at least three perfectly correct arrays in the same FoR. The remaining two participants (classified as relative coders) each produced two correct relative responses along with a mixture of nearly correct relative responses, inconsistent responses, and errors.

monodirectional intrinsic pattern. For a monodirectional intrinsic classification, at least two responses must be correct in their array-internal arrangement, and at least four responses must be correct or nearly correct in terms of their array-internal arrangement.[167] Additionally, these four or five responses have to face the same direction, showing a monodirectional tendency. Thus for example, a participant who produced two correct intrinsic responses and three nearly correct intrinsic responses with four or five arrays facing the same way would be classified as a monodirectional intrinsic coder, provided a relative or geocentric interpretation could not account for as many arrays. The results of applying these new criteria to the data are presented in Table 6.4 below:

Table 6.4: Revised classification of participants in Animals-in-a-row (*N* = 78)

	Predominant coding type			
	Relative	**Monodirectional intrinsic**	**Geocentric**	**Untypable**
Number of participants	13 (17%)	36 (46%) - 30 leftward - 6 rightward	14 (18%)	15 (19%)

The totals for the relative and geocentric categories are only slightly higher than those in Table 6.2 (‘overall’, ‘strong criteria’) in §6.2.4.1, despite the inclusion of ‘nearly correct’ responses as relative or geocentric. However, the number of ‘untypable’ participants is now greatly reduced, with many being reclassified as monodirectional intrinsic coders. In fact, monodirectional intrinsic coders account for nearly half the sample, while relative and geocentric coders account for less than 20% each. Even if the criteria were made more stringent, and at least three (rather than two) perfectly correct intrinsic responses were required (in addition to the other criteria) for classification as a monodirectional intrinsic coder, there would still be 30 (38%) monodirectional intrinsic coders in the sample. Many monodirectional intrinsic coders made some errors in the selection or ordering of animals, but most were consistently monodirectional in orienting the animals – more than 80% placed all five arrays in the same direction (the rest placed four arrays in the same direction). The classification of such a high number of participants as monodirectional

[167] Here, ‘correct or nearly correct’ intrinsic responses include the following solution types: correct relative/intrinsic responses, correct geocentric/intrinsic responses, nearly correct relative/intrinsic responses, nearly correct geocentric/intrinsic responses, and ‘inconsistent’ responses (which would be correct with either a switch in the direction of the animals or the positions of the front and back animals).

intrinsic coders cannot be put down to chance – if a participant places three animals at random in each trial, the odds of accidentally producing a monodirectional intrinsic pattern over the course of five trials are remote. While it is possible that some participants were mixed coders who happened to orient four or five of their arrays in the same direction, it is highly unlikely that a leftward orientation would by chance occur so much more frequently than a rightward one in this scenario, since mixed coding should result in leftward and rightward placements at similar proportions, as discussed earlier. This strongly suggests that many participants used a monodirectional intrinsic strategy with the animals typically facing to the participant's left. In actual fact, the number of intrinsic coders may well be higher, since some 'untypable' participants could have used an intrinsic strategy but varied the orientation of their responses. Other participants in the 'untypable' category were presumably genuine mixed coders, or relative or geocentric coders who made too many errors for their coding strategy to be identified.

6.2.4.4 Post-experiment interviews

Immediately after completing the experiment, participants were asked by the native speaker research assistant how they had tried to remember the animals during the task. For the most part, participants' replies were consistent with their performance in the task. Many participants replied that they had remembered the animals 'from the front of the line', suggesting an intrinsic strategy, and indeed more than half the intrinsic coders (as determined by the classification in the previous section) reported that they had remembered the animals that way. Some other intrinsic coders stated that they focused on the middle animal and remembered the rest of the array in relation to the middle animal. Others used a similar strategy but focused instead on the tallest animal, or the two animals at either end of the line. Among the 14 geocentric coders, only three claimed to have remembered the animals using cardinal directions, and only one claimed to have used beachward and inland directions. However, some others gave replies that also clearly suggested a geocentric approach – for example, a few participants said something to the effect of 'I remembered which way the animals were facing regardless of which way my body turned'. Among the 13 relative coders, six reported using 'left' and 'right' to remember the animals, and most of these said they remembered the animals 'from left to right'. Another relative coder did not mention left and right but stated 'if it's facing that way [pointing left] I should turn it this way [pointing right]', suggesting a relative solution. The untypable coders gave various answers, mostly of the kinds mentioned above for the intrinsic, geocentric, and relative strategies, though they did not succeed in implementing any of these strategies consistently.

Some participants across all coding categories felt unable to answer the question, or gave a general reply that did not reveal much about their chosen strategy. For example, some participants said that they repeated the animals' names to themselves in their head (a strategy also reported by some participants who gave more informative replies), while others claimed to have 'just remembered' or to have remembered just by observing the appearance of the array. Interestingly, some participants reported using mnemonics that were inconsistent with their actual solutions during the task.[168] In particular, eight intrinsic coders claimed to have solved the task by thinking in terms of left and right, and a few others suggested they had in fact paid attention to which way the animals were facing. Some relative and geocentric coders stated they had remembered 'from the front' of the line. This could allude to an intrinsic strategy, though it is not necessarily incompatible with relative or geocentric strategies either, since some relative and geocentric coders could plausibly have remembered arrays from intrinsic front to back, while additionally retaining relative or geocentric information. The way they did this may have been beneath their level of awareness, or they may simply have neglected to mention it when asked.

Regarding the intrinsic coders who gave reports that were clearly incompatible with their performance, a few possible explanations come to mind. One is that some participants genuinely attempted to solve the task using, say, left and right, but ended up preserving only the intrinsic arrangement of animals, perhaps because of the difficulty of the task. Another explanation is that some participants simply said what they guessed was the 'correct' answer, regardless of whether they actually employed such a strategy during the experiment. Either way, an interesting finding is that relative FoR terms in particular were cited by many more participants than managed to execute the relative FoR accurately. This appears to fit with the fact that, as discussed in Chapter 5, the relative FoR in Dhivehi is associated with schooling and with speaking English, and so for participants engaging in an artificial memory test with foreign materials and in the presence of a foreigner, the relative FoR may well be perceived as the correct solution. But since not everybody in the

[168] This has also been reported in some earlier studies, especially Dasen and Mishra (2010:124–125, 157) but also elsewhere (e.g., Pederson et al. 1998:Footnote 14).

community has mastery of the relative FoR, participants attempting to use the strategy (or retrospectively claiming to have used it) exceed those who actually use it competently.

6.2.4.5 Demographic and environmental variables

Fisher's exact tests (Freeman-Halton extension) were performed to see if any coding strategies were more likely to be used by certain demographic groups or in certain experimental conditions. The only statistically significant factor was bilingualism (p = .009): participants who spoke some English were more likely to be relative coders than participants who spoke no English (the latter were more likely to be intrinsic, geocentric, or untypable coders). The distribution of monolingual and bilingual participants across the coding categories is shown in Table 6.5 below:

Table 6.5: Coding type in Animals-in-a-row according to monolingualism/bilingualism

	Relative	**Intrinsic**	**Geocentric**	**Untypable**	***Total***
Speak no English	3	27	10	11	*51*
Speak some English	10	9	4	4	*27*
Total	*13*	*36*	*14*	*15*	*78*

The numbers of participants in the intrinsic, geocentric, and untypable categories were within the realm of what might be expected from chance (i.e., although many more intrinsic, geocentric, and untypable coders were monolingual rather than bilingual, there were many more monolinguals in the sample to begin with). All speakers in the sample were literate in at least the Thaana script – as mentioned in Chapter 1, the Maldives enjoys extremely high literacy rates.

No significant differences were detected for island (Fonadhoo vs. Dhanbidhoo), gender, age group, occupation, education level, or whether the participant had lived in Malé/abroad or not.[169] However, in most cases the distribution of participants across coding types was in the direction that might be expected from the linguistic findings presented in Chapter 5. For

[169] Due to the sample size, Fisher's exact tests (with the Freeman-Halton extension) were used for most of these variables, though Chi-square tests were sometimes used where expected cell counts were sufficiently high for the purposes of performing the test reliably (expected values of 5 or more in at least 80% of cells). In all cases a significance level of $p \leq .05$ was used.

example, relative coders made up 19% of the Fonadhoo sample versus 13% of the Dhanbidhoo sample, 18% of women versus 15% of men, 27% of the youngest age group (< 35 years) versus 8% of the oldest age group (50+ years), and 33% of participants with an upper secondary education versus 10% of participants with only a primary education. None of the 12 fishermen in the sample produced a relative pattern, and none of the four farmers did (compared to 13/62 or 21% of the indoor workers). Similarly, geocentric coding was slightly more popular in many of the groups associated with geocentric coding in Chapter 5: Dhanbidhoo residents, men, older people, and people with only a primary education. Surprisingly, however, only two of the twelve fishermen were geocentric coders in Animals-in-a-row – the rest were intrinsic or untypable coders. Finally, there were no statistically significant findings for situational or environmental variables such as the facing direction of participants (across the island vs. along the island) or the location of the experiment (indoors vs. courtyard vs. outdoors).

6.3 Experiment 2: Steve's mazes

Experiment 2 applies the methodology of an MPI experiment developed by Stephen Levinson, after whom the task is named (Levinson 1993; Senft 2007:239–240). The task is also sometimes called the 'Scout game'. For descriptions of previous research using the task, see Wassmann and Dasen (1998) and Dasen and Mishra (2010).

6.3.1 Aims

In Experiment 1 (Animals-in-a-row), participants had to rebuild a complex spatial array from memory. While the complexity of that task served to distract participants from the purpose of the experiment, it also resulted in a number of errors and inconsistent performances, as discussed in §6.2. Furthermore, the intrinsic frame of reference was an available solution type – this compromised the ability of the experiment to reveal whether geocentric FoRs would be preferred over egocentric FoRs in a non-verbal spatial task. Experiment 2 and Experiment 3 (for which see §6.4) were conducted because their methodologies do not suffer from these issues as much. Experiments 2 and 3 both require the participant to memorize a stimulus and then (after a delay) to choose the matching item from a small set of options on the test table, thus reducing the chance of errors. The stimuli are different to those in Experiment 1 in that they are made up of fewer items (which also serves to reduce the chance of errors), and in that they cannot be memorized in terms of intrinsic features alone, thereby forcing a choice between geocentric and egocentric strategies.[170]

In addition, Experiments 1-3 all investigate slightly different psychological properties (see also Levinson 2003:183; Senft 2007:234–240). While Experiment 1 aimed to examine recall memory, with participants reconstructing spatial arrays themselves, Experiments 2 and 3 aimed to explore recognition memory, with participants simply choosing the item that they recognize. The main difference between Experiment 2 and Experiment 3 is that the former involves the mental completion of a path and recognition of that path, whereas the latter involves the recognition of a simple arrangement of two shapes (see §6.4). The investigation of different aspects of memory helps to uncover how robust any FoR preferences are throughout spatial cognition, or how task-specific they are. This will be discussed in further detail in §6.5.1.

6.3.2 Methodology

6.3.2.1 Materials

The stimuli for Experiment 2 consisted of six printed maps and 18 printed completion cards. The maps and cards used the same images as those in the original MPI experiment (Levinson 1993). An example of one of the maps (Map 0, the practice trial map) with its corresponding completion cards is shown in Figure 6.6 below – for the full set of maps and cards, see Dasen and Mishra (2010:64), Levinson (1993), or Wassmann and Dasen (1998:703). There are three completion cards per map, showing one egocentric solution, one geocentric solution, and one distractor solution.[171] The maps were printed on A3 paper, and the completion cards on A5 paper. All maps and cards were laminated. As Figure 6.6 shows, a small number in the top left corner identifies each map. Prior to the experiment, I

[170] To be sure, it is in principle possible to memorize the stimuli in Experiments 2 and 3 in an intrinsic way, but the nature of the task and instructions is intended to prevent this (see §6.3.2 and §6.4.2) – for example, intrinsic coders in these experiments would be faced with multiple 'correct' solutions at the test table, and in the case of Experiment 3 the instructions explicitly draw attention to the fact that the orientation of the stimulus cards is important (see §6.4.2.2).

[171] The term 'egocentric' as opposed to 'relative' is appropriate here because the participant is able to code the information with a SAP-landmark strategy in conjunction with the relative FoR (e.g., 'from left to right, the path comes <u>towards me</u> then <u>away from me</u> again'). This SAP-landmark strategy was not available in Experiment 1 because the stimuli were never arranged along the participant's sagittal axis.

labelled the back of each completion card with the card number (e.g., ‘2.3’) so that in laying out the cards I would not inadvertently mix up cards or orient them the wrong way. Finally, Experiment 2 also required two rectangular tables with plain surfaces, functioning as a stimulus table and a test table.

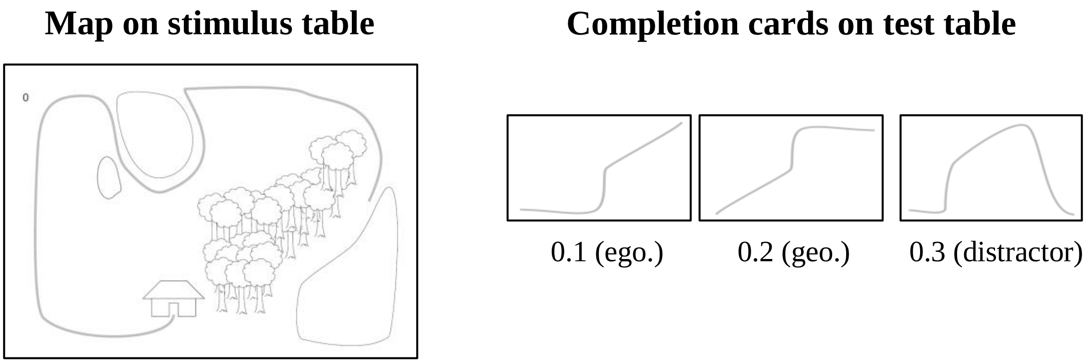

Figure 6.6: Example of stimulus map and completion cards in Experiment 2 (Steve's mazes) – stimuli originally from Levinson (1993).

6.3.2.2 Setup and instructions

The stimulus and test tables were placed 3-4 metres apart, with Map 0 and cards 0.1-0.3 initially on the stimulus table. The participant was invited to the stimulus table and was briefed about the experiment. A native speaker research assistant under my direct supervision read aloud a short set of instructions to the participant in Dhivehi. These instructions were carefully worded so as to avoid using frame of reference vocabulary (especially egocentric and geocentric vocabulary) as far as possible, while still making sense to participants. The English translation of these instructions is as follows:

> This is a very simple memory game. Here you will be shown a path [*assistant points to path on map*]. Start from the house [*points to house*] and go along the path [*traces path with finger*]. From the end of the path you have to go to the house [*points to house*]. You cannot go through the trees [*points to trees*]. And you cannot go over the ‘stones’ [*points to stones/ponds*] or back along the path [*traces finger back along part of path*]. You have to go this way [*traces finger from end of path to house via white space between trees and large pond*]. First we will practice. This card [*points to card 0.1*] shows a path leading from the end of the big path to the house [*traces finger along path shown in card to show that the route has the same shape*], doesn’t it? These other cards [*points to cards 0.2 and 0.3*] don’t show the correct path, do they?

Note that the instructions included the Dhivehi term *mihen̊* ‘this way’, but this term did not refer to the direction of the speaker, but was used to draw attention to the path the research assistant was tracing with his finger (‘You have to go this way’). Also note that the instructions included the term *fahataṣ̊* ‘back.DAT’ (‘And you cannot go over the stones or back along the path’) because it was felt that there was really no other comprehensible way to communicate the idea that the route could not be completed by doubling back. Although *fahataṣ̊* is a frame of reference term, in this context it invokes the intrinsic FoR, and is used in a sentence that tells the participant what *not* to do. Therefore, it is unlikely that the use of this term impacted on FoR choice in this task, and especially not between egocentric and geocentric FoRs, which were predicted to be the main strategies used for the task (see §6.3.1).

6.3.2.3 Training procedure

A brief training procedure was then conducted in order to further prepare participants for the experiment. This procedure took place at the stimulus table, with the same map (Map 0) and cards as in the instructions phase. The three cards were shuffled and laid down on the table next to the map. The participant was asked in Dhivehi to choose the card that shows the correct path. This was to check that the participant had understood the instructions, and in particular the notion that the lines on the cards represented paths that may or may not complete the route shown in the map. If the participant selected the wrong card, the research assistant corrected the participant by showing the right card and by drawing his finger along the section of path to be completed on the main map as well as along the path shown in the correct card, to demonstrate that the two paths were the same. The cards were then shuffled and the participant was tested again.

In the next phase of the training procedure, the participant was shown Map 0 again and told in Dhivehi, ‘Remember the way this path is. I will show three cards on the next table. You will pick the card that shows the path going from the end of the big path to the house’. The participant was allowed to look at the map for as long as he or she liked (usually 5-10 seconds) before the map was removed. After a 30-second delay (during which the participant faced the same direction), the participant turned around 180 degrees and walked to the test table, where he or she chose from three completion cards that had been placed side by side as shown in Figure 6.7 below (note that the order of the cards was randomized, and so was different for different participants). The three completion cards included one card that showed the correct path in terms of egocentric coordinates, one card that showed the correct path in terms of geocentric coordinates, and one distractor card that showed a completely incorrect path (see Figure 6.6 in §6.3.2.1). The participant's selection at the test table was not corrected in any way. If the participant asked for feedback, I deflected the question by telling the participant that he or she could find out at the end of the experiment.

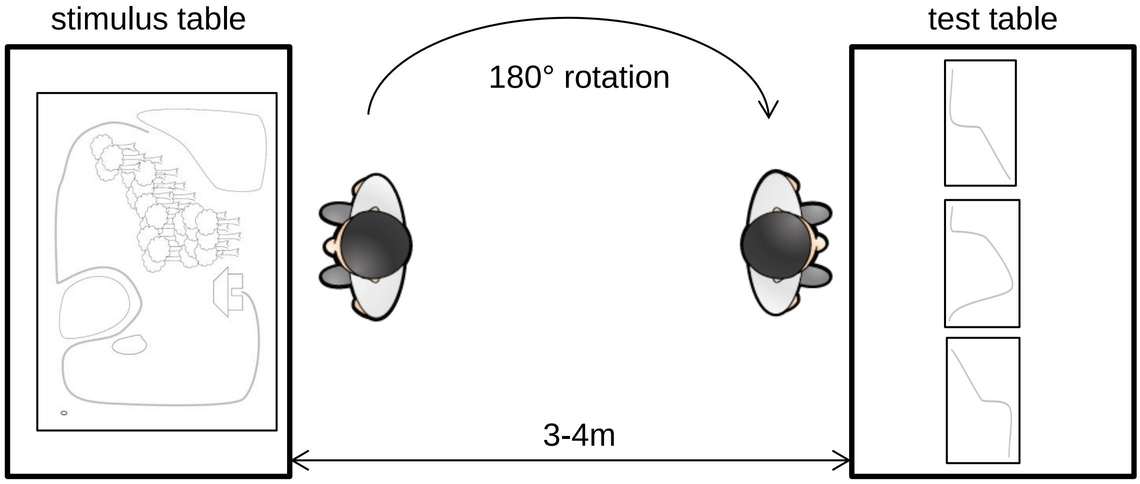

Figure 6.7: Rotation of participant in Steve's mazes

6.3.2.4 Main trials

Five main trials were conducted for each participant, using the same method as the final practice trial of the training procedure. The participant was shown a map and told that from the point where the (printed) path ended, the path should continue to the house. Figure 6.8 below shows a participant from Fonadhoo at this stage of one of his main trials. The map was removed when the participant was ready, and after a 30-second delay the participant turned around and approached the test table, where he or she chose from three completion cards. Once again, these main trials were not corrected in any way. If the participant claimed to have forgotten the path after the map was removed but before seeing the cards at the test table, the participant was shown the map again and had to wait another 30 seconds before turning to the test table. The five main trials each involved a different map with corresponding completion cards. Every participant performed these five trials in the same order. Immediately after the experiment, participants were asked how they had tried to remember the paths during the task.

Figure 6.8: A Fonadhoo man (right) looking at a map in Steve's mazes, with a research assistant (left) preparing to hide the map and begin timing 30 seconds.

6.3.3 Participants and conditions

There were 23 participants from Fonadhoo and 20 participants from Dhanbidhoo in Experiment 2. This included 22 women and 21 men, distributed across the two islands and across three age groups as shown in Table 6.6 below.[172] Because sampling was opportunistic, there were more women than men from Fonadhoo and more men than women from Dhanbidhoo, particularly in the youngest age group. The mean age of the sample was 40.9 years, only slightly younger than the mean age in Experiment 1 (42.4 years).

Table 6.6: Participants in Experiment 2 (Steve's mazes)

Island	**Age 21-35 (F, M)**	**Age 36-49 (F, M)**	**Age 51-68 (F, M)**	**Total (F, M)**
Fonadhoo	9 (7, 2)	10 (6, 4)	4 (2, 2)	23 (15, 8)
Dhanbidhoo	7 (1, 6)	6 (2, 4)	7 (4, 3)	20 (7, 13)
TOTAL:	*16 (8, 8)*	*16 (8, 8)*	*11 (6, 5)*	*43 (22, 21)*

[172] Note that because Experiment 2 was conducted during fieldwork in early 2015 – a year after Experiment 1 was conducted – the age group cutoffs are slightly higher than for Experiment 1. This was so that all participants would remain in the same age group for both experiments, and so that participants who had an upper secondary education would remain in the 'young' group.

For practical reasons, most of the Dhanbidhoo sample was tested in the same windowless room, though one participant was tested in a different windowless room and three participants were tested in an enclosed courtyard. Most of the Fonadhoo participants were tested outdoors and within view of the ocean, though six participants were tested under a low veranda and five participants were tested in enclosed courtyards. Participants were tested in one of two conditions: facing towards the lagoon (northwest in Fonadhoo, west in Dhanbidhoo) at the stimulus table or facing 90 degrees clockwise from lagoonward (northeast in Fonadhoo, north in Dhanbidhoo) at the stimulus table, with 21 participants in each condition (as well as one participant from Dhanbidhoo who was accidentally oriented at a bearing of approximately 300 degrees). Most participants had already taken part in various other experiments in the study, but on separate days (usually weeks or months prior). Most had participated in Experiment 1 (Animals-in-a-row) about a year earlier. Upon completion of Experiment 2 participants were thanked for their time and were offered a small gift.

6.3.4 Results

The 43 participants performed five main trials each (one for each map), producing a combined total of 215 trials. In 115 of these trials (53%), participants selected the egocentric solution at the test table; in 79 trials (37%) participants selected the geocentric solution; and in 21 trials (10%) participants selected the distractor card. Results were fairly similar across the five different maps – the smallest number of egocentric responses was for Map 5 (19/43 participants or 44%) and the largest was for Map 4 (28/43 participants or 65%). In terms of individual participants' performances across the five trials, twelve participants (28%) may be classified as egocentric coders according to the MPI's criteria (at least four egocentric responses out of five, see §6.2.4.1), four participants (9%) as geocentric coders, and 27 participants (63%) as untypable. According to Fisher's exact tests (Freeman-Halton extension), the different coding styles were not significantly associated with any particular demographic or environmental variable (age group, gender, occupation type, education level, island, time spent abroad or in cities, bilingualism, indoors vs. outdoors, facing direction). Again, all participants in the sample were literate. The complete range of different response patterns is shown in Table 6.7 below:

Table 6.7: Responses and classification of participants in Steve's mazes (*N* = 43)

Responses (egocentric-distractors-geocentric)[173]	Number of participants	Classification
5-0-0	6	egocentric
4-1-0	1	egocentric
4-0-1	5	egocentric
3-2-0	1	untypable (egocentric leaning)
3-1-1	3	untypable (egocentric leaning)
3-0-2	7	untypable
2-1-2	2	untypable
2-0-3	6	untypable
1-2-2	5	untypable
1-1-3	3	untypable (geocentric leaning)
1-0-4	4	geocentric
115-21-79 (53%-10%-37%)	*43*	*egocentric: 12 (28%) untypable: 27 (63%) geocentric: 4 (9%)*

As Table 6.7 shows, some untypable participants were 'egocentric leaning' or 'geocentric leaning' in that they produced three egocentric responses or three geocentric responses but also selected the distractor card once or twice, and so their response patterns tended towards one solution type or the other, even though they did not meet the stricter criteria for classification as egocentric or geocentric.[174] However, most untypable participants chose a mixture of egocentric and geocentric completion cards. Although it is likely that many of these participants are mixed coders, it is also possible that some used the intrinsic FoR, remembering only the shape of the path without attending to its orientation. An intrinsic coder would choose randomly between the 'egocentric' and 'geocentric' cards, both of which display the correct shape in terms of the intrinsic FoR. Unlike in Animals-in-a-row, it is not possible to distinguish intrinsic and mixed coders by examining response patterns across the five trials. The reports given by participants after the experiment did little to

[173] E.g., "5-0-0" means five egocentric cards were selected, zero distractor cards, and zero geocentric cards. The final row shows the total selections (i.e., across the whole sample, 115 egocentric cards were selected, 21 distractor cards, and 79 geocentric cards).

[174] Given the small number of trials and the fact that participants chose from just three options at the test table (unlike in Experiment 1, where there were many possible responses in any individual trial), I have used the stricter criteria in order to be reasonably sure that the classification of participants as egocentric or geocentric is legitimate.

clarify this, with many saying that they had no particular strategy for remembering the paths. Many others reported that they drew the shape of the path in their mind, and I also observed some people drawing lines in the air with their fingers during the 30-second wait before turning to the test table. However, these strategies were common among the egocentric and geocentric coders as well as the untypable coders. Only a few participants reported that they remembered the paths in terms of left and right, and nobody mentioned any geocentric terms.

There are two key findings from Steve's mazes that are worth highlighting. Firstly, there is the fact that a majority of participants (63%) were intrinsic or mixed coders. Secondly, unlike in Animals-in-a-row, egocentric coding (28% of participants) was more common than geocentric coding (9% of participants), suggesting that the nature of the task has an impact on FoR choice. In fact, as Table 6.7 shows, six participants were completely egocentric in their responses, whereas no participants selected the geocentric solution in all five trials. I return to both these findings – and especially the issue of task design – in §6.5.1, where the results of the three rotation tasks are compared.

6.4 Experiment 3: Chips recognition

6.4.1 Aims

Experiment 1 (Animals-in-a-row) showed which FoRs are used to remember objects arranged along the transverse axis (with respect to the speaker's viewpoint), but did not test for arrangements along the sagittal axis. Previous studies have found that egocentric responses are in fact more common along the sagittal axis than the transverse axis (Brown & Levinson 1993:29–33; Shapero 2017:1283–1284). This appears to be because sagittal configurations can be coded in terms of distance from the viewer, i.e., using a SAP-landmark strategy (speech act participant as landmark), which is a type of egocentric strategy (see §2.4.4, §2.5.1). For example, the participant may remember that object A is closer to her than object B. Although the relative FoR is available on both axes, this SAP-landmark strategy is available only along the sagittal axis, contributing to a higher incidence of egocentric solutions along that axis. Furthermore, the results from the linguistic experiments presented in Chapter 5 showed that SAP-landmarks are an important strategy for many Dhivehi speakers in verbal descriptions (see §5.2.4.2), raising the prospect that such a strategy may also be employed in spatial memory. Experiment 3 therefore aimed to investigate spatial memory of configurations along both the sagittal and transverse axes.[175]

In addition, the experiment was intended to be simpler than Animals-in-a-row in a number of ways, so that error responses would be less likely and so that responses could be interpreted more straightforwardly as egocentric or geocentric, with no apparent possibility of intrinsic solutions, as discussed in §6.3.1. For Experiment 3 ('Chips recognition'), this was achieved firstly by reducing the stimuli in each trial to two objects (rather than three from a selection of four), secondly by using symmetrical geometric shapes as stimuli (rather than toy animals with inherent fronts), and thirdly by allowing the participant to choose a response from a small set of options as in Experiment 2 (Steve's mazes). Like Experiment 2, Experiment 3 therefore tested for visual recognition of a spatial configuration (i.e., recognition memory) rather than for the more demanding process of rebuilding a spatial array from scratch (i.e., recall memory, cf. Levinson 2003:183). The methodology of Experiment 3 is described in further detail in the following section.

6.4.2 Methodology

Experiment 3 is based on the MPI 'Chips recognition' experiment developed in the early 1990s (see Brown & Levinson 1993:23–34).

6.4.2.1 Materials

Ten cards were designed and printed according to the specifications described by Brown and Levinson (Brown & Levinson 1993:27). The cards, which were printed on white paper and laminated, measured 9cm by 9cm. Five identical cards showed a yellow circle (diameter 3cm) and a smaller green circle (diameter 1.8cm), with 4cm between centres. Another set of five cards showed a red square (2.4cm by 2.4cm) and a blue square (1.8cm by 1.8cm), again with 4cm between centres. The two types of cards are shown in Figure 6.9

[175] Note that Experiment 2 (Steve's mazes), which used curved paths, did not straightforwardly test spatial memory along different axes either, though the sagittal axis was involved to some degree (e.g., a path might be remembered as moving away from the viewer and then coming back).

below. As with Experiments 1 and 2, the experiment also required two rectangular tables with plain surfaces. These functioned as a stimulus table and a test table.

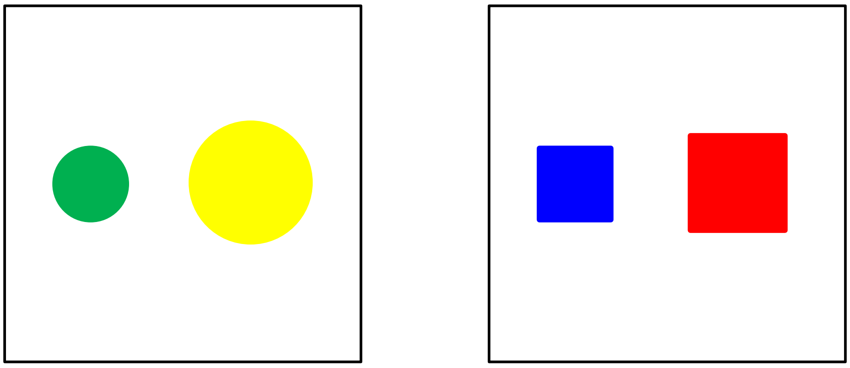

Figure 6.9: Cards used in Experiment 3 (Chips recognition)

6.4.2.2 Setup and instructions

The two tables were placed 3-4 metres apart, with the cards initially at the stimulus table. The participant was led to this table and was briefed about the experiment. A native speaker assistant read aloud a short set of instructions in Dhivehi to the participant while showing just one set of cards (yellow and green circles). The instructions were worded so as to avoid using frame of reference vocabulary as far as possible, though it was necessary to use the deictic terms *mi* 'this' and *e* 'that' to some extent. However, these terms were not used in a way that invoked a SAP-landmark FoR; rather, the use of these terms was accompanied by pointing gestures to particular cards or dots, and so *mi* 'this' did not have to correspond with an item near the speaker, and *e* 'that' did not have to correspond with an item further away from the speaker.[176] The English translation of the instructions is as follows:

> Here are five cards. Each one is the same. But if I turn them like this, they are no longer the same, see? They are no longer the same because the dots are in different places. See,

[176] A potential concern is that the use of such deictic terms at all in the instructions (even if they were not used in a SAP-landmark way) might prime for the use of a SAP-landmark strategy in the experiment, because such terms can be associated with that strategy. However, this possibility was still preferable to using, for example, relative or geocentric terms in the instructions, which would presumably be more likely to invite the use of a particular strategy. It should be noted that the demonstratives *mi* 'this' and *e* 'that' are extremely common in ordinary discourse, and may be used in various ways (see §4.2). It would not be possible to prepare idiomatic Dhivehi instructions that do not use these terms in some way or another. Of course, the fact that it is not always possible to completely avoid using spatial language in instructions is one of the difficulties with research of this kind. Researchers must aim to find a middle ground between priming participants too much on the one hand and giving incomprehensible instructions on the other.

this one has the green dot on this side and the yellow dot on that side, but this other one has the yellow dot on this side and green dot on that side.

6.4.2.3 Training procedure

A brief training procedure was necessary to ensure the participant understood the task and to reduce errors during the main trials. There were four phases in this training procedure:

1. The researcher arranged four cards from one of the sets in the pattern shown in Figure 6.10 below, such that each card showed the shapes in a different orientation (e.g., yellow dot on the left and green dot on the right, yellow dot on the near side and green dot on the far side, etc.). The fifth card of the set was then shown to the participant, with the card in one of the possible orientations, and the participant was asked to point to the matching card in the group of four. This was done at least twice, once with each set of cards (i.e., the red and blue set as well as the yellow and green set) and once on each axis (i.e., the stimulus card showed the shapes once in a sagittal configuration and once in a transverse configuration).
2. The participant was shown another card and asked to memorize it. The researcher then removed the card and set up an arrangement of four cards (from the same set) in different orientations, and immediately asked the participant to identify which card was the same. This was repeated on the other axis, showing a card from the other set. If the participant pointed to the wrong card, the trial was repeated. When the participant successfully identified two correct cards consecutively, the training procedure continued to the third phase.
3. The participant was again asked to memorize a card, except this time a 30-second delay was introduced before the pattern of four cards was laid down for the participant to choose from. This trial was repeated if the participant pointed to an incorrect card.
4. Finally, the participant was asked to memorize a card, wait for 30 seconds, and then turn around and walk to the test table to select the matching card there, as shown in Figure 6.10 below. As was the case in Experiments 1 and 2, the participant turned around 180 degrees while moving between the tables. The participant’s response for this trial was not corrected by the researcher in any way. The purpose of this trial was to familiarize the participant with the idea of turning around to choose a card at the test table.

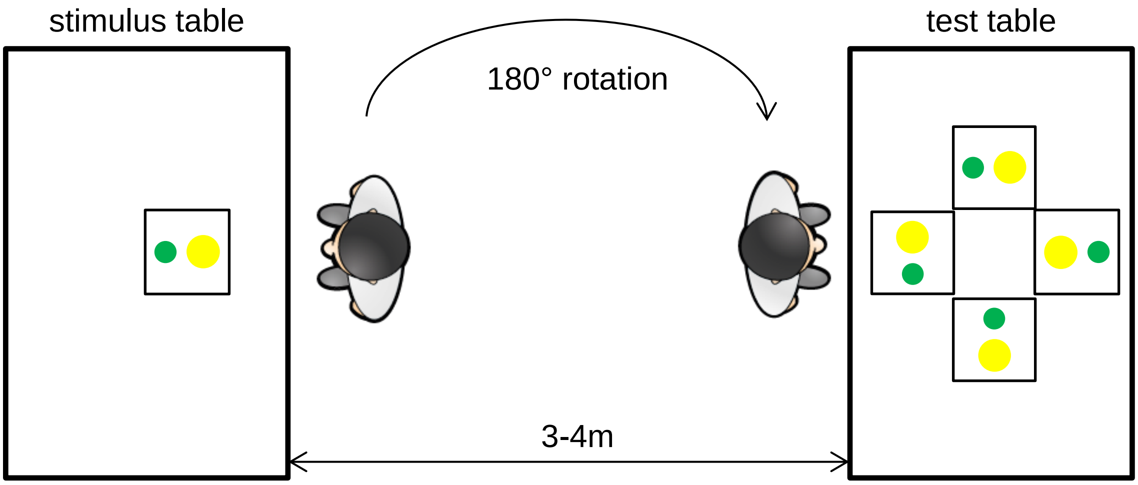

Figure 6.10: Rotation of participant in Chips recognition

6.4.2.4 Main trials

Each participant performed ten main trials. These trials were conducted in the same way as the final phase of the training procedure. The trials were carried out in a quasi-random order, with certain constraints: trials alternated between the two sets of cards (yellow and green circles, blue and red squares), no more than two consecutive trials tested the same axis, neither of the first two main trials were ever identical to the final trial of the training procedure, all four orientations of each card were tested throughout the ten trials for each participant, and the ten trials always included five transverse configurations and five sagittal configurations in the stimulus cards. These constraints were applied in order to limit interference from one main trial to the next, in order to limit any interference from particular configurations encountered in the training procedure, and to ensure maximally comparable results across participants. In addition, the arrangement of the four cards at the test table (see Figure 6.10 in the previous section) was varied from trial to trial. An example of a participant selecting a response card in a main trial is shown in Figure 6.11 below.

The main trials were not corrected in any way (if participants asked if they were correct, they were told that they could find out at the end of the task). If the participant claimed to have forgotten a card after it was removed but before making a selection at the test table, the trial was skipped and then repeated as an additional trial at the end of the task. After each trial, the researcher recorded the card identified by the participant at the test table. At the end of the experiment, participants were asked how they remembered the right card during the task.

Figure 6.11: A Fonadhoo man pointing to a response card
at the test table

6.4.3 Participants and conditions

For Experiment 3, 24 participants from Fonadhoo were recruited. These included nine women and 15 men, distributed across age groups as shown in Table 6.8 below. The mean age of the sample was 39.9 years, slightly less than the mean age in Experiment 1 (42.4 years) and Experiment 2 (40.9 years).

Table 6.8: Participants in Experiment 3 (Chips recognition)

	Age 18-35	**Age 36-50**	**Age 51-72**	**Total**
Men	8	3	4	15
Women	4	4	1	9
TOTAL:	*12*	*7*	*5*	*24*

The initial facing direction of participants was counterbalanced across the sample – 12 participants began facing towards the lagoon (or ‘across’ the island) and 12 began facing 90 degrees clockwise from lagoonward (or ‘along’ the island). The setting of the experiment was also varied in order to facilitate recruitment of participants – 11 participants conducted the task indoors, three participants outdoors, and ten participants under a low veranda. All participants had already been involved in some other linguistic or non-linguistic experiments, though not within a week, and most had participated in Experiment 1 (Animals-in-a-row) at least a year earlier and Experiment 2 (Chips recognition) a few months earlier. Upon completion of Experiment 3, participants were thanked and offered a small gift for their time.

6.4.4 Results

In each trial, the four cards at the test table were identical to each other and to the card shown at the stimulus table, except for the fact that they were oriented in various ways (see Figure 6.10 above). One card showed the correct geocentric arrangement of the chips, one card showed the correct egocentric arrangement, and the other two cards showed the chips arranged on the wrong axis and so acted as distractor cards. For example, if the stimulus card showed the green chip to the left/northwest and the yellow chip to the right/southeast, then after the participant rotates 180 degrees and walks to the test table, the correct egocentric card would show the green chip to the left/southeast and the yellow chip to the right/northwest, and the correct geocentric card would show the green chip to the right/northwest and the yellow chip to the left/southeast.[177] The two distractor cards would show the chips aligned with the participant's sagittal axis, and the selection of either of these two cards can be interpreted as an error.

The results revealed a preference for geocentric over egocentric responses. Of the combined total of 240 trials performed by the sample, 145 (60%) were geocentric selections and 89 (37%) were egocentric selections. There were only six error responses (3%), of which five were from the same 66-year-old participant. As predicted, egocentric responses were somewhat more likely to be used for sagittal configurations of chips than for transverse configurations – egocentric responses were given in 52/120 sagittal trials (43%) compared to 37/120 transverse trials (31%). These results are summarized in Table 6.9 below:

Table 6.9: Responses to individual trials in Chips recognition

	Egocentric	**Geocentric**	**Errors**
Sagittal axis (*n* = 120)	52 (43%)	63 (53%)	5 (4%)
Transverse axis (*n* = 120)	37 (31%)	82 (68%)	1 (1%)
Total (*N* = 240)	89 (37%)	145 (60%)	6 (3%)

[177] Although participants' transverse and sagittal axes were technically aligned with the intercardinal axes during the experiment, as with previous experiments the main egocentric axes of participants were aligned with (or perpendicular to) the main topographic landmarks in Fonadhoo, which also calibrate the use of cardinal directions on the island (e.g., *uturu* 'north' generally points to what is actually northeast) – see also Footnote 154 in §6.2.4.

Considering participants individually, a preference for geocentric strategies is again evident. Twelve participants (50%) were geocentric coders according to the MPI criteria (i.e., geocentric in at least 70% of their responses, see Brown & Levinson 1993:29), seven participants (29%) were egocentric coders, and five participants (21%) were ‘untypable’. Of the five untypable participants, three participants produced mostly egocentric responses in sagittal trials and mostly geocentric responses in transverse trials, one participant produced mostly geocentric responses in sagittal trials and a mixture of responses in transverse trials, and one participant produced error responses on all sagittal trials and mixed responses in transverse trials. Thus, most participants had a clear preference, and the others mostly preferred an egocentric solution along the sagittal axis but a geocentric solution along the transverse axis. Table 6.10 below classifies Maldivian participants in Experiment 3 as egocentric coders, geocentric coders, or untypable coders, along each axis individually as well as overall (i.e., considering all ten trials):

Table 6.10: Classification of participants in Chips recognition (*N* = 24)

	Egocentric coders	**Geocentric coders**	**Untypable coders**
Sagittal axis (5 trials)	10 (42%)	13 (54%)	1 (4%)
Transverse axis (5 trials)	5 (21%)	15 (63%)	4 (17%)
Overall (10 trials)	7 (29%)	12 (50%)	5 (21%)

As mentioned in §6.4.1, an aim of the experiment was to reveal how Maldivian participants would solve a non-linguistic spatial task without the intrinsic frame of reference. The data show a preference for geocentric strategies, though egocentric strategies are also well represented, especially for sagittal configurations. Relatively few participants were mixed coders, and most of the mixed coders used different FoRs on different axes rather than choosing randomly between FoRs. While geocentric solutions were slightly more common than egocentric ones in Animals-in-a-row as well, the difference is far greater in Chips recognition, suggesting that many ‘intrinsic coders’ turn to a geocentric FoR when their default strategy is not available. Alternatively (or additionally), some other feature of Experiment 3 may account for the popularity of geocentric responses. For example, one might suppose that the relative simplicity of the task allows participants to keep track of geocentric coordinates better than in Animals-in-a-row, or that for some reason participants might be more likely to assume that the researcher is testing memory of geocentric coordinates in Chips recognition but not in Animals-in-a-row. Further comparison of the tasks will be made in §6.5.1.

Following the experiment, participants reported using various strategies to remember the configurations on the cards. These strategies included the use of LRFB terms (reported by two egocentric coders), SAP-landmark strategies (one egocentric coder, two untypable coders, two geocentric coders), topographic landmarks (three geocentric coders), villages/islands as landmarks (five geocentric coders), ad hoc landmarks in the immediate environment (one egocentric coder and one geocentric coder), and cardinal directions (one geocentric coder) – as with Experiments 1 and 2, some participants' reports were at odds with their actual performance in the task, for reasons that are not entirely clear (though refer to §6.2.4.4 for speculation).

Finally, it should be noted that the choice between egocentric and geocentric strategies in Chips recognition was not strongly associated with any of the demographic or environmental variables introduced previously. However, many non-significant differences between groups were in the expected direction. For example, the proportion of men in the sample who used geocentric strategies was greater than the proportion of women who used geocentric strategies: among the 15 men in the sample, nine were geocentric coders, four were egocentric coders, and two were untypable; among the nine women, three were geocentric coders, three were egocentric coders, and three were untypable. However, this distribution was not significant ($p > .05$) according to a Fisher's exact test (2 x 3 cell with Freeman-Halton extension). Considering the 'relative-to-absolute' gradients of participants (calculated according to the formula described in §6.2.4.36.2.4.1), men had a mean RA gradient of 68.2 whereas women had a mean RA gradient of 52.2, though the difference between men's and women's RA gradients was not statistically significant ($p > .05$, Mann-Whitney *U* test). Similarly, participants with only a primary education tended to have slightly higher RA gradients (mean = 67.3) than participants with an upper secondary education (mean = 54.1); again, this difference was in the expected direction but was not statistically significant ($p > .05$, Mann-Whitney *U* test). For other variables, there were even smaller (non-significant) differences between the mean RA gradients of different groups. These variables included age group, bilingualism, setting (indoors, outdoors, or under a low veranda), and facing direction ('along island' vs. 'across island').[178] As was the case for Experiments 1 and 2, all participants in Experiment 3 were literate, and so literacy was not treated as a variable.

6.5 Comparison of experimental results

6.5.1 Overall trends and task specificity

A comparison of the results from Experiments 1-3 reveals some obvious differences, suggesting task-specific effects. Table 6.11 below shows the numbers of participants who used each FoR as their predominant strategy in the three tasks:

Table 6.11: Frame of reference choice in non-linguistic tasks

	Predominant coding type			
	Egocentric	**Geocentric**	**Intrinsic**	**Untypable**
Animals-in-a-row (*N* = 78)	13 (17%)	14 (18%)	36 (46%)	15 (19%)
Steve's mazes (*N* = 43)	12 (28%)	4 (9%)	n/a	27 (63%)
Chips recognition (*N* = 24)	7 (29%)	12 (50%)	n/a	5 (21%)

It was uncommon for participants to use egocentric coding as their predominant strategy in any of the three tasks, though in Steve's mazes it was more common than geocentric coding – although only 28% of participants in that task were egocentric coders, only 9% were geocentric coders (and as reported in §6.3.4, 53% of completion cards selected in the entire task were 'egocentric' cards, compared to 37% 'geocentric'). In contrast, geocentric coding was more popular than egocentric coding in Chips recognition, and in Animals-in-a-row the two strategies were used about equally, as shown in Table 6.11 above. Intrinsic coding was highly popular in Animals-in-a-row, but was not available or detectable in the other tasks. Finally, untypable coders were especially common in Steve's mazes, where they accounted for 63% of participants.

[178] The occupation of participants was not considered in statistical testing as most of the sample (being from Fonadhoo) was made up of indoor workers. However, one man in the sample was a fisherman and another man was formerly a sailor – both produced strongly geocentric results. Whether participants had previously lived in non-atoll environments (i.e., cities or abroad) was also not considered in statistical testing as only five participants fell into this category – of these, there were three egocentric coders, one untypable coder, and one geocentric coder.

Some of these findings are consistent with previous research involving the same (or similar) experimental tasks. For example, in their Balinese sample, Wassmann and Dasen (1998:703–705) found that half of their 28 participants in Steve's mazes chose a mixture of egocentric and geocentric completion cards in the task (corresponding to the 'untypable' category here), another quarter were consistent egocentric coders, and another quarter consistent geocentric coders. In comparison, 79% of their participants were consistent geocentric coders in their Animals-in-a-row experiment, and none were consistent egocentric coders. Their results are similar to the current study in that a large proportion of participants in Steve's mazes produced mixed responses (a point I will return to later), and in that egocentric coding was more common in Steve's mazes than in Animals-in-a-row, a tendency also observed in other studies (Danziger 2001:211–213; Dasen & Mishra 2010:132–134, 306; Mishra, Dasen & Niraula 2003:379–380).[179] As Wassmann and Dasen (1998:704) observe, Animals-in-a-row may be more amenable to the use of linguistic mnemonics than Steve's mazes – participants can more easily say to themselves 'horse, turtle, tiger, all facing north' than they can verbally encode the shape and direction of a curved path. Many Maldivian participants reported that they said the names of the animals to themselves during Animals-in-a-row, whereas in Steve's mazes participants often reported using non-linguistic mnemonics such as tracing the path with their fingers or simply visualizing the path in their minds. While it is of course true that in Animals-in-a-row, one could just as easily use an egocentric mnemonic as a geocentric one, linguistic mnemonics are bound to be influenced by the FoR patterns common in language (where both geocentric and egocentric FoRs are used in the case of Dhivehi), whereas a purely kinesthetic or visual encoding is centered on the body and so may be more likely to lead to egocentric responses (see also Dasen & Mishra 2010:155; Mishra, Dasen & Niraula 2003:380).[180]

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[179] A difference between Wassmann and Dasen's (1998) Balinese results and the results of the current study is that geocentric coding was far more common among the Balinese sample than the Maldivian sample (and egocentric coding less common) in all tasks, suggesting a cross-cultural difference in spatial cognition. However, the essential point is that both studies show similar task-specific effects on underlying patterns of spatial thinking (e.g., the tendency for Steve's mazes to produce more mixed/untypable responses than other tasks).

[180] Wassmann and Dasen (1998:704) report that the use of kinesthetic strategies in their experiment surprisingly did not foster egocentric responses. In the current study, such strategies were common among egocentric coders, but were also used by some geocentric and untypable coders, as mentioned in §6.3.4.

Wassmann and Dasen (1998:704) also note that the Steve's mazes task fosters encoding as a journey and so may be more connected to motion-coding rather than the coding of (static) direction and order. Although they do not expand on why motion-coding might involve different FoRs, the suggestion is highly plausible, particularly when considering the kinds of paths to be encoded in the task. All of the paths have at least one leg that runs either towards or away from the participant's viewpoint (sometimes at an angle), which may foster a SAP-landmark strategy that is unavailable in Animals-in-a-row. Another factor that may have contributed to egocentric coding in Steve's mazes is cultural familiarity with maps and diagrams, which are designed to be viewed with a certain orientation and which must be rotated with the viewer. Most Maldivians have little need for maps in their everyday lives, but most have had some exposure to various kinds of maps, charts, and diagrams through their schooling as well as through books, television, and the internet. The maps in Steve's mazes are quite schematic (see §6.3.2.1) and no doubt very different to the maps and diagrams most familiar to Maldivians, but may still have been interpreted by many participants as artifacts that should be turned with one's body. In contrast, the stimuli and procedure of Animals-in-a-row do not create such an expectation.

Another striking similarity with Wassmann and Dasen's (1998) study was briefly mentioned above: the large proportion of participants in Steve's mazes who produced mixed (or untypable) responses. As reported earlier, this proportion was 63% in the current study and 50% in Wassmann and Dasen's. There are at least two possible reasons for this. Firstly, as discussed earlier, Steve's mazes is less amenable to the use of linguistic mnemonics. Without language as a tool to aid in spatial memory, participants may perform less consistently on a memory task. Some recent research on homesigning deaf children suggests that the absence of conventionalized spatial language is associated with weaker performance on non-linguistic spatial tasks (Gentner et al. 2013), and so a similar effect may be present in Steve's mazes for hearing adults (and children) who do not employ a linguistic mnemonic because of the task design. For the most part, participants were at least able to avoid selecting the distractor cards (only 14.8% of cards selected by untypable coders were distractors), but it is possible that the absence of a linguistic mnemonic results in less consistency between egocentric and geocentric choices. A second possible explanation (which is not incompatible with the first) is that many of the untypable coders were remembering the intrinsic shape of the paths, and so chose randomly between the egocentric and geocentric completion cards which both showed the correct intrinsic shape. While this possibility is hard to rule out, it is not strongly supported by the kinds of reports participants gave after completing the task (as discussed in §6.3.4), and it is also hard to imagine how a participant could memorize the intrinsic shape of a path without picturing it in a certain orientation (in contrast to Animals-in-a-row, where the intrinsic coordinates of an array can be encoded by saying the names of the animals to oneself in their array-internal order).

Relative to other tasks, the design of Steve's mazes therefore tends to foster mixed and egocentric responses. But as Table 6.11 above shows, Animals-in-a-row appears to foster more intrinsic solutions, and Chips recognition perhaps fosters more geocentric solutions. Which factors specific to those tasks may have led to greater use of intrinsic and geocentric FoRs respectively? In the case of Animals-in-a-row, the existence of the 'monodirectional' strategy discussed in §6.2.4.2 allows intrinsic coders to be more easily detected than in other tasks, but it is also likely that the nature of the task fosters intrinsic solutions to some extent. Since the task requires participants both to remember the identity of the animals and to rebuild the array at the test table (as opposed to simply picking from a small set of predefined options), it involves the memorization of more elements than the other tasks and so is on the whole a more difficult task (as evidenced by the greater number of errors). Many participants clearly focused on memorizing array-internal information only, not attempting to additionally code for egocentric or geocentric information. A further factor here is the mechanics of picking up and placing the toy animals with one's right hand, which tended to foster a leftward monodirectional pattern as a default. As for Chips recognition, a number of factors prevented the use of the intrinsic FoR. These included the instructions to the task, the presence of four alternative orientations at the test table, and the fact that the chips on the cards lacked intrinsic left/right/front/back facets. However, it is less clear why participants in Chips recognition used geocentric coding more than egocentric coding, when in Animals-in-a-row the two ternary strategies were roughly equal in popularity. Possibly the difference is simply a quirk of the smaller sample in Chips recognition (N = 24), though it may somehow relate to the smaller number of items to be coded (two chips rather than three animals), or to the fact that the chips, unlike the toy animals, lack intrinsic LRFB sides that could give the impression that the array is 'facing' or ‘running’ a certain way. More work is needed to determine whether this difference is a cross-linguistic trend and if so, why.[181]

A further way to examine task specificity is at the individual level rather than at the group level. Because sampling was opportunistic and because the Chips recognition sample was relatively small, just 13 participants completed all three of the tasks reported in this chapter. It is revealing that none were consistent geocentric or egocentric coders across all tasks, though one participant was untypable in all tasks and another was an intrinsic coder in Animals-in-a-row and untypable in the remaining tasks. Table 6.12 below shows the preferred FoRs used by these 13 participants across the three tasks. The 13 participants in question happen not to display some of the basic tendencies described earlier in this section (e.g., no tendency towards the intrinsic FoR in Animals-in-a-row, nor to geocentric over egocentric FoRs in Steve’s mazes), but do demonstrate a high level of task specificity and individual preference. For example, although most geocentric coders in Animals-in-a-row switched to egocentric or untypable strategies in Steve’s mazes as one might expect from the earlier discussion, most of these participants surprisingly did not revert to a geocentric strategy in Chips recognition. In addition, one egocentric coder in Animals-in-a-row (AR1) actually switched to a geocentric frame in Steve’s mazes.

[181] Dasen and Mishra (2010) present mean RA gradients for Chips recognition and Animals-in-a-row (among other tasks) for the various populations tested in their research, some of which show higher RA gradients for Chips recognition and some lower. However, their mean RA gradients include intrinsic and mixed coders, who score ~50 and who are presumably more common in Animals-in-a-row than in Chips recognition (for the kinds of reasons discussed earlier). As such it is not possible to tell from their data whether Chips recognition tends to result in more geocentric coding than Animals-in-a-row, if intrinsic and mixed coders are set aside.

Table 6.12: FoR selection and task specificity among 13 participants

Participant (age, gender)	Animals-in-a-row	Steve's mazes	Chips recognition
AAQ1 (29, M)	geocentric	egocentric	geocentric
AU3 (54, M)	geocentric	geocentric	egocentric
FH1 (46, F)	geocentric	untypable	egocentric
KZ1 (30, F)	geocentric	untypable	egocentric
MA10 (37, M)	geocentric	egocentric	egocentric
Z1 (37, F)	geocentric	untypable	untypable
FR2 (36, F)	intrinsic	untypable	geocentric
MA4 (67, F)	intrinsic	untypable	untypable
MK1 (42, F)	untypable	untypable	untypable
AR1 (28, F)	egocentric	geocentric	egocentric
FR1 (34, F)	egocentric	untypable	geocentric
IU1 (50, M)	egocentric	untypable	geocentric
MA2 (29, F)	egocentric	untypable	geocentric

A conclusion that may be drawn from the above is that the general task-specific tendencies described earlier can only go so far in explaining the different results across the non-linguistic tasks. Individual preferences and idiosyncrasies are also clearly in play. It is likely that task-specific factors are relevant for most participants, but that different factors influence different participants depending on individual cognitive styles and interpretations of the tasks. As others have noted (e.g., Levinson et al. 2002:163), even slight methodological differences can affect experimental results in this domain, and speakers of mixed FoR languages (such as Dhivehi) may be especially sensitive to such differences (Bohnemeyer 2011). A further example of this may be found in the behaviour of two participants excluded from the analysis of Animals-in-a-row (see also §6.2.3). I had set up the experiment using a table belonging to the two participants as the test table, unaware that they usually access the table from a different side to the one required in the task. In the first (practice) trial with a rotation, both participants walked around to the wrong side of the table to recreate their arrays, and had to be corrected as to where to stand. Despite fitting the profile of egocentric frame users described in Chapter 5 (being young, educated, bilingual women working in indoor environments in Fonadhoo), both participants subsequently produced perfectly geocentric responses. While it is possible that they may have performed geocentrically anyway, I consider it likely that these participants second-guessed the purpose of the experiment when their attention was drawn to the fact that they needed to face a particular way when placing the animals, and that this caused them to switch to a non-preferred strategy.

To summarize this section, a number of task-specific factors contribute to different FoR choices in different non-linguistic spatial tasks. For Dhivehi, the overall picture is one of mixed FoRs, with the exact balance of FoRs depending on the task as well as the individual preferences of the participants who happened to be tested. As discussed in earlier parts of this chapter, demographic and environmental variables were found to be non-significant when it comes to non-linguistic FoR choice, with the exception of a significant association between bilingualism and egocentric behaviour in Animals-in-a-row. Although task-specific effects have long been noted in the literature (Dasen & Mishra 2010:306; Johnson 2014:284; Wassmann & Dasen 1998:704), Dhivehi represents a fairly extreme case in that the distribution of FoRs varies drastically across tasks, with no single FoR predominant over the entire suite of tasks. In contrast, although the FoR choices of the Dutch and Tzeltal populations in Brown and Levinson (1993) varied somewhat across four non-linguistic tasks, the Dutch speakers were still overwhelmingly egocentric coders and the Tzeltal speakers overwhelmingly geocentric coders, in keeping with their linguistic use of FoRs. The Dhivehi situation therefore accords with Bohnemeyer's (2011) argument that speakers of "referentially promiscuous" languages (i.e., languages in which all three FoRs are readily available and in which there is no default perspective) are more easily influenced by task specific factors, though this position will be refined further in the following section.

6.5.2 Linguistic relativity

In order to consider the possibility of linguistic relativity, it is possible to compare the results from the non-linguistic tasks described in this chapter with the results from the linguistic tasks described in Chapter 5. In the literature, the archetypal cases of linguistic relativity are communities that show a strong preference for just one type of FoR (egocentric or geocentric) in both language and cognition, such as the Dutch or the Tenejapans (Brown & Levinson 1993; Levinson 2003). But what ought to be predicted for communities that use a mixture of FoRs in speech? At least three distinct hypotheses may be considered:

> **Hypothesis A: relativity at the individual level**
>
> If spatial language shapes spatial thinking, then individual participants' preferred FoRs in speech should correlate with their predominant FoRs in thought. Egocentic speakers within a mixed-FoR community should tend to be egocentric thinkers, and

geocentric speakers in the community should tend to be geocentric thinkers. That is, there is a strong degree of consistency between a typical individual's speech and thinking, though different individuals speak and therefore think about space in different ways.

Hypothesis B: relativity at the group level

Communities that use a mixture of FoRs in language should also display mixed FoRs in non-linguistic spatial behaviour at the group level, but individual FoR choice may not necessarily be consistent across linguistic and non-linguistic tasks because many individuals are competent in multiple frames and need not always use the same one. The proportions at which the entire community uses FoRs should be similar in linguistic and non-linguistic tasks, provided the tasks in question are sufficiently similar (i.e., minimal impact of task-specific effects), and any differences should largely be explainable in terms of task specificity.

Hypothesis C: no correspondence between language and thought

FoR selection in non-linguistic spatial tasks does not correlate with FoR selection in linguistic spatial tasks, at either the individual or group level. If a mixture of FoRs is used in speech, then a very different mixture of FoRs will be used in non-linguistic tasks, or a clear preference for just one FoR will be displayed. This is because there is no effect of linguistic relativity, and/or because task specificity is a much bigger factor for speakers who use a range of FoRs (as proposed by Bohnemeyer 2011).

Each of these hypotheses may seem plausible enough, and it is clearly an empirical question as to which is correct. Hypothesis A sets the bar highest for linguistic relativists, while Hypothesis B is weaker (note that A also entails B, i.e., if there is relativity at the individual level then there will also be relativity at the group level). Hypotheses B and C are in fact two ends of a cline, as there may obviously be varying degrees of similarity between linguistic and non-linguistic results at the group level. Hypothesis C is consistent with an absence of linguistic relativity, although some relativists might not be troubled by this in the case of mixed-FoR languages, for which there are no strong predictions. For example, as I have mentioned previously, it may be the case that mixed-FoR groups are more susceptible to task-specific effects that obscure the relationship between linguistic and non-linguistic behaviour. In addition, it might be expected that linguistic relativity has much weaker effects in mixed-FoR languages because speakers' exposure to spatial language is much more varied than in languages where just one FoR is predominant (i.e., linguistic FoR choice is not consistent enough to have a big effect on patterns of spatial thinking).

In order to see which of the above hypotheses is supported by the Dhivehi data, I compared the results from Man and Tree and Animals-in-a-row in the subset of participants who performed both tasks. These two tasks were selected for the analysis because of the relatively large samples collected and because of the nature of the tasks – both games involved a small number of objects in a static figure-ground relationship, with at least one object that had an intrinsic left/right/front/back asymmetry (as such, both games afforded the selection of the intrinsic FoR, rather than egocentric and geocentric FoRs alone). As shown in Chapter 5, most speakers used a range of strategies in Man and Tree, but at various proportions. For the purposes of analysis, I therefore concentrated on the preferred strategy employed by each speaker. In determining the preferred strategy of each speaker in the Man and Tree task, three super-categories were distinguished in order to facilitate comparison with Animals-in-a-row: 'egocentric' (relative FoR and SAP-landmarks), 'array-internal' (intrinsic and tree-directed descriptions), and 'geocentric' (cardinals, topographic landmarks and miscellaneous landmarks).[182] For Animals-in-a-row, 'preferred strategies' were determined as per the classification and formula presented in §6.2.4.3.

The results show some evidence for Hypotheses A and B (relativity at the individual and group levels), but also point to a moderate degree of task specificity and individual variation. The group results in Table 6.13 below reveal that the array-internal strategy was more common in Animals-in-a-row than in Man and Tree, but neither task strongly favoured geocentric over egocentric strategies or vice versa (note that 'array-internal' in Animals-in-a-row is equivalent to 'intrinsic'):

[182] Vertical descriptions (of the kind 'The man is above the tree') were excluded from consideration as such a strategy is not available in Animals-in-a-row, where only relations in horizontal space can be encoded.

Table 6.13: Participants by FoR preference in Man & Tree and Animals-in-a-row (participants who performed both tasks, *n* = 43)

	Preferred strategy			
	Egocentric	**Geocentric**	**Array-internal**	**Untypable/ mixed**[183]
Man & Tree	15	17	9	2
Animals-in-a-row	9	8	20	6

As I have discussed in previous sections, the Animals-in-a-row task may foster more intrinsic/array-internal responses due to the (perceived) difficulty of the task and due to how the stimuli are physically handled. But it is probably also true that the design of Man and Tree slightly disfavours array-internal strategies, which are sometimes inadequate for describing the orientation of the man (if he is not facing towards or away from the tree) as well as for describing the man's location (though the tree's location may still be described intrinsically).

Table 6.13 above shows that many participants may be sensitive to these task-specific factors, though the mixture of strategies is otherwise not very different. It is not the case, for example, that a mixture of strategies in Man and Tree was accompanied by an overwhelming tendency towards just one strategy in Animals-in-a-row (as predicted by Hypothesis C). Thus, the results are reasonably consistent with linguistic relativity at the group level (Hypothesis B).

To check for a correlation between linguistic and non-linguistic behaviour at the individual level (Hypothesis A), Fisher's exact test (Freeman-Halton extension) was performed on the following 3 x 3 contingency table cross-tabulating participants' preferred FoRs in the two tasks:

[183] Two participants in Man and Tree had a tie for their preferred FoR (equally egocentric and array-internal), and so are classified here as 'untypable/mixed'.

Table 6.14: Cross-tabulation of participants' preferred strategies in Man and Tree and Animals-in-a-row (*n* = 36)[184]

		Man & Tree			
		Egocentric	Intrinsic/ array-internal	Geocentric	*Total*
Animals-in-a-row	Egocentric	8	1	0	*9*
	Intrinsic/ array-internal	4	5	11	*20*
	Geocentric	2	2	3	*7*
	Total	*14*	*8*	*14*	*36*

The test revealed a statistically significant relationship between FoR preference in Man and Tree and FoR preference in Animals-in-a-row (p = .005). However, as Table 6.14 shows, there is only a partial correspondence between strategies across tasks. An egocentric preference in one task tends to correspond with an egocentric preference in the other, and hardly ever with a geocentric preference. An intrinsic/array-internal preference in Man and Tree often corresponds with the same preference in Animals-in-a-row. However, geocentric coders in Man and Tree are most often intrinsic coders in Animals-in-a-row, rather than geocentric coders. Therefore, although some parts of the contingency table are consistent with linguistic relativity at the individual level (Hypothesis A), the data also reveal that many geocentric speakers switched to an intrinsic/array-internal strategy in Animals-in-a-row. This may suggest that individuals using these strategies were more sensitive to task-specific factors. The reasons for this are not entirely clear, though it is interesting to note that a similar (though less extreme) result was observed by Pederson et al. (1998:583) in a sample of Tamil speakers – 45% of linguistically geocentric Tamils showed a monodirectional intrinsic pattern in Animals-in-a-row, compared to only 12% of linguistically egocentric Tamils. Pederson (1995:49) also finds a more inconsistent performance among geocentric speakers (compared to egocentric speakers) in a separate non-linguistic task.

On the whole, the comparison of Man and Tree and Animals-in-a-row presented in this section is therefore more consistent with Hypotheses A and B (relativity at the individual

[184] *n* = 36 here because untypable coders on either task are excluded. One participant was untypable on both tasks.

and group levels respectively) than with Hypothesis C (no correlation between FoR choice in language and thought). At the group level, it is clear that a mixture of FoRs is used in both spatial language and spatial thinking, though the nature of this mixture is to some extent task-specific – in particular, intrinsic coding is more popular in Animals-in-a-row than in Man and Tree. At the individual level, there is also some evidence for a correlation between language and thought, though this correlation is only a partial one, with more consistency among egocentric coders than among geocentric or array-internal coders.

For the most part, these results may be regarded as consistent with linguistic relativity in a mixed-FoR community. But to what extent do the results point to a causal relationship between language and thought? Certainly any causal relationship here is not a deterministic one, given that many individuals used different FoRs in the linguistic and non-linguistic task under comparison. The question then becomes whether a more moderate version of the linguistic relativity hypothesis, under which language influences but does not determine patterns of spatial thinking, is correct, or whether other factors are solely responsible for the correlation. The evidence presented in this chapter suggests that language probably does have a causal role. As discussed in earlier sections, FoR choice in the non-linguistic tasks did not correlate with any of the demographic or environmental variables considered, with the notable exception of bilingualism in Animals-in-a-row (which was associated with egocentric coding).[185] Thus, the variation in coding styles cannot simply be put down to whether the participants were tested indoors or outdoors, for example, or whether the participants belonged to a fishing community or to a more white-collar community. It is of course possible that some other, as yet unknown factor is responsible, but until such a factor is identified and investigated empirically, language remains a prime suspect. It is particularly telling that the only variable (aside from linguistic FoR preference) found to correspond significantly with non-linguistic FoR choice was bilingualism – this strongly suggests that language plays a role in shaping spatial cognition.

[185] Possibly, the failure to detect more significant results for various demographic and environmental variables may relate in part to the lack of statistical power when working with small samples. However, for Animals-in-a-row at least, the sample of 78 participants was ‘larger’ than the sample of 50 dyads in Man and Tree in Laamu (the analysis in Chapter 5 being conducted on the FoR patterns of dyads, rather than individuals, such that $n = 50$ in Laamu).

Further, it appears unlikely that the direction of causality could be entirely the other way around. If spatial cognition is not influenced by spatial language at all, then the variation in non-linguistic FoR choice precedes the variation in linguistic FoR choice. Under this scenario, it would be unclear why different individuals in the community use different non-linguistic coding strategies to begin with, and it would be especially baffling why bilinguals and monolinguals tend to use different strategies, if language has nothing to do with it (and as mentioned previously, factors such as education or time spent abroad were not significant). Of course, it is trivially true that spatial cognition is necessary for spatial language, since speaking requires thinking, and so patterns of spatial language are no doubt constrained and shaped by spatial cognition (for instance, if is not possible to conceptualize the relative FoR, it would not be possible to use the relative FoR in language). But in order to explain the Dhivehi data adequately, it must also be assumed that patterns of linguistic FoR use have some effect on spatial cognitive styles (which may in turn influence linguistic FoR choice to some extent, in a positive feedback loop).

If spatial language influences thought, and if patterns of spatial language vary throughout the community (as shown in Chapter 5), then an important question is why the principled variation (according to gender, age groups, occupations, etc.) in the linguistic data is not as apparent in the non-linguistic experimental data. I believe there are two main reasons for this. Firstly, the results show that language only has a weak and partial influence on non-linguistic FoR choice among Maldivians, and so the impact of the relevant demographic factors is far more diluted in the non-linguistic data, and does not necessarily reach statistical significance with the limited sample size. As noted in earlier parts of this chapter (especially §6.2.4.5), the variation is usually in the direction of the expected pattern despite not being statistically significant. But secondly, task specificity may have obscured the relation between language and thought to some extent. In Animals-in-a-row, individuals are free to encode the array however they like, though the perceived complexity of the task probably pushes many participants towards an intrinsic strategy. In Man and Tree, a purely intrinsic (or array-internal) strategy is insufficient to solve the task, even if that is the strategy that some speakers would perhaps prefer to use. Speakers must therefore turn to externally-anchored FoRs (i.e., geocentric or egocentric), and the particular strategies they choose are partly determined by the linguistic norms of their demographic (given that each speaker was partnered with another speaker of the same age and gender, from the same location). In other words, some speakers in Man and Tree were probably using FoRs which they might not use very much in other contexts (and not in Animals-in-a-row), but which they still had some competence in and ended up using because of the task demands and/or because of their partner's FoR use. Thus, Man and Tree compels speakers to use more precise strategies that are available to the wider community (or subsection of the community), while the nature of Animals-in-a-row as a solo memory task affords more idiosyncratic behaviour (including the selection of the simpler intrinsic strategy) that does not necessarily vary according to demographic categories. This is consistent with Dasen and Mishra's (2010:305) finding (from a range of experiments in Bali, India, and Nepal) that:

> [L]anguage is more likely to fit the social norm than [non-linguistic] encoding; in other words, language is more situated at the group level, and [non-linguistic] encoding more at the individual level. [Non-linguistic encoding] is more likely to go against the social norm than language use.

A further question concerns the role of bilingualism in the relationship between spatial language and thought. As mentioned previously, bilingualism was the only variable (aside from linguistic FoR choice) found to correspond significantly with egocentric FoR choice in Animals-in-a-row. But in the Man and Tree results for the entire Laamu sample, bilingualism was not significantly associated with egocentric FoRs (see §5.2.4.9). Could contact with English affect spatial cognition without (or before) significantly influencing patterns of FoR use in Dhivehi? Such a result would not be impossible to explain (for example, it could be that bilinguals tend to 'think' in English when attempting a foreign, test-like task such as Animals-in-a-row, but still use FoRs according to local norms when speaking in Dhivehi to other Maldivians). However, on closer inspection it appears that bilingualism does correspond with linguistic FoR choice in Dhivehi to some extent. Despite the lack of statistical significance in the Laamu sample, bilingual speakers still used egocentric FoRs in speech at higher rates than monolingual speakers (see §5.2.4.9, §5.2.4.11), and this tendency does turn out to be statistically significant in the smaller subset of speakers who also played Animals-in-a-row (n = 43), for some egocentric categories at least (p = .009 for SAP-landmarks in orientation descriptions, p = .017 for any egocentric strategy in orientation descriptions, Mann-Whitney U tests). However, as discussed in Chapter 5, egocentric FoR use in language is also associated with a range of other variables including age, gender, and occupation. And of course, it should be noted that FoR usage in Maldivian English has not been documented, and so the English used by participants should not necessarily be assumed to pattern like more widely used dialects of English when it comes to FoRs.

A final question relates to whether Animals-in-a-row is a fair test of linguistic relativity in the first place, given that many participants report using (unspoken) linguistic encoding in the task. This question has been addressed in detail by others (e.g., Pederson 1995:51–59), and so I will only make a few brief observations on the subject here. Firstly, although many participants reported using a linguistic mnemonic, not all did – as discussed in §6.2.4.4, many participants claimed to have ‘just remembered’, or reported using a visual strategy. Thus the task was not necessarily a covertly linguistic one, in that participants had a ‘choice’ in whether or not to use language as a memory aid at all (and if they did, which linguistic FoR to use). Secondly, the results from Steve’s mazes suggest that the absence of a linguistic mnemonic may result in a more varied performance (as discussed in §6.5.1), casting light on the power of language in spatial thinking. But the mere *option* of using an unspoken linguistic FoR as a mnemonic does not in itself determine which FoR will be chosen – much still depends on the exact nature of the task as well as individual preference. Thirdly, if people use language as a covert tool to solve novel tasks like Animals-in-a-row and Chips recognition, it is likely that they also employ language as a tool in their more general spatial cognition. In other words, if language is naturally a part of spatial thinking, then tasks that allow the use of linguistic mnemonics can reveal interesting and valuable things about spatial cognition, in addition to tasks that preclude such mnemonics. But it would be missing the point to consider only tasks of the latter kind, which in any case are not immune from other biases, such as the kinesthetic one present in Steve’s mazes (see §6.3.4 and §6.5.1).

The model of linguistic relativity proposed to explain the Dhivehi situation is therefore a moderate one, in which language shapes spatial thinking to some extent, and more clearly for egocentric language than for geocentric or intrinsic/array-internal language. But crucially, as shown in Chapter 5, Dhivehi speakers use different FoRs in language according to their engagement with the environment (as represented by occupation, for example) as well as the ways they are socialized and educated (including the study of English). These factors mostly appear to affect linguistic practice first, and non-linguistic spatial cognition only indirectly and inconsistently. The general picture then is that ecological and sociocultural factors influence both spatial language and thought, but the influence on thought is mediated by language, and obscured to some extent by task-specific factors and individual variation. While language appears to have a causal role in this process, it is not the only or ultimate cause of FoR variation in spatial thinking. Instead, it is part of a larger, more complex relationship with the environment, culture, and cognition.

6.6 Conclusions and further discussion

This chapter has explored spatial cognition in Dhivehi speakers through three non-linguistic spatial memory tasks: Animals-in-a-row, Steve's mazes, and Chips recognition. In Animals-in-a-row, the prevalence of a monodirectional intrinsic strategy and a relatively high error rate prompted the development of a revised system of classifying participants according to coding type. In Steve's mazes, most participants produced inconsistent responses, though egocentric responses were more common than geocentric ones. In Chips recognition, the results were more strongly geocentric, though egocentric coding was well attested too.

These findings demonstrate that Maldivians have access to multiple FoRs at a cognitive level, and select them largely according to task-specific factors. In particular, the inclusion of items with inherent left/right/front/back facets (in Animals-in-a-row) tends to prompt the intrinsic FoR, while the coding of abstract paths (in Steve's mazes) tends to call for egocentric FoRs more than geocentric FoRs – this may be because participants often use a kinesthetic or purely visual strategy to remember the paths. However, responses on Steve's mazes were typically inconsistent, showing an apparent mixture of egocentric and geocentric coding. This may be because Steve's mazes did not so easily allow for the use of language as a mnemonic device, highlighting the power of language as an aid to spatial cognition more generally. In keeping with this, participants in Chips recognition, a task more amenable to the use of linguistic mnemonics, produced mostly consistent responses. Task-specific factors are also responsible for some differences between results from these tasks and results from the linguistic tasks presented in Chapter 5. For example, Man and Tree permits a vertical strategy that is not possible (or at least not so obvious) in the non-linguistic tasks.

However, task-specific factors are not deterministic, as evidenced by the different results obtained by researchers who have conducted similar tasks elsewhere. Being able to speak English tends to predict egocentric behaviour in Animals-in-a-row, and other sociocultural factors may also have weaker effects. But contrary to some previous claims in the literature (Li & Gleitman 2002), there is no evidence from the Dhivehi data that participants select FoRs differently when outdoors (and in the presence of salient landmarks) as opposed to indoors. This is particularly noteworthy given that Dhivehi speakers use multiple FoRs, and so might be expected to be more sensitive to such contextual factors compared with the more strongly egocentric or geocentric populations investigated previously in the literature (e.g., Brown & Levinson 1993; Levinson 2003; Levinson et al. 2002).

Linguistic FoR preference (as measured by Man and Tree) also partially corresponds with non-linguistic FoR choice (as measured by Animals-in-a-row). This is evident at both the group and individual levels, though the individual-level association is weak and the group-level association is only partial – egocentric language predicts egocentric thinking, but geocentric language does not reliably predict geocentric thinking, as many geocentric speakers used an intrinsic strategy in Animals-in-a-row. Still, it is at least true that egocentric language and thought seem to go together, and non-egocentric language and thought pattern together too. This finding is consistent with a moderate form of the linguistic relativity hypothesis, but also underscores the importance of task specificity and individual preference in mixed-FoR communities.

7 Conclusions

This thesis has explored several aspects of frames of reference in Dhivehi language and cognition, as well as a number of theoretical questions relating to FoRs and to spatial language and cognition more generally. While some findings are in keeping with previous research on FoRs, other findings run counter to certain claims and hypotheses made in the literature, or support them only partially. In this chapter I will summarize the key findings of this thesis, and then discuss the implications for our understanding of the relationship between language, cognition, and environment. Finally, I will consider some questions for further research.

Chapter 2 reviewed various classifications of FoRs in the literature, and argued for a framework based on the rotational properties of FoRs, as opposed to alternative criteria such as grammatical expression. Rotational properties, such as constancy under rotation of the viewpoint, reflect how a FoR operates and what it is anchored on – for example, there may or may not be a ‘projection’ of coordinates from the anchor onto the ground object, and the anchor may be the speaker/viewer, the ground object itself, or something in the wider world. A consideration of different rotational properties suggested four major FoRs: the intrinsic FoR (including the direct and object-centered subtypes), the relative FoR (including the reflectional, translational, and rotational subtypes), the absolute FoR (including cardinal and cardinal-like systems as well as geomorphic systems), and the landmark-based FoR (including SAP-landmarks and object-landmarks like nearby furniture, buildings, and features of the natural environment). However, other useful distinctions such as the division between egocentric and allocentric FoRs cross-cut these categories, and so work on FoRs must attend to multiple FoRs and FoR subtypes that group together in various ways to form different supercategories.

Chapter 3 discussed some of the main debates in the literature on FoRs and what they reveal about the relationship between language, cognition, and the environment. I addressed the dispute between linguistic relativists like Levinson et al. (2002), who argue that spatial language influences spatial cognition, and universalists like Li and Gleitman (2002), who argue that language has no such influence. I also considered more recent developments in this debate, such as the dispute between Bohnemeyer and Levinson (2011) and Li et al. (2011), and suggested that on the balance, universalists have not succeeded in refuting the evidence for linguistic relativity in the spatial domain. In particular, there is now considerable evidence that FoR choice is *not* determined or even influenced by the participant's access to salient landmarks during experiments. However, Chapter 3 also addressed more nuanced views about the role of the environment in spatial language and cognition, including Palmer's (2015) proposal that salient topographic features shape both spatial cognition and systems of absolute or geocentric spatial reference over time. Palmer's Topographic Correspondence Hypothesis therefore predicts correspondences between topographic environments and the ways in which languages express FoRs. This hypothesis motivated my research on FoRs in Dhivehi language and cognition, the results of which were presented in Chapters 4-0.

Chapter 4 described the linguistic expression of space in Dhivehi. Key features include: a three-way demonstrative system; the use of locative case, relational nouns, and converb constructions to express topological relations; a small set of positional/postural verbs; a verb-framed pattern of encoding path of motion; the limited use of the motion verbs *aranū* 'climbing' and *erenū* 'descending into' in Laamu for motion in horizontal space, in ways that are sensitive to local topographic features; and the use of a range of nouns for expressing FoRs. Many of these features are common cross-linguistically, and many are especially typical of South Asian languages – for example, Dhivehi's grammatical resources for expressing topological relations, path of motion, and FoRs are quite similar to those found in Tamil, a Dravidian language (Pederson 2006). Regarding the expression of FoRs, Dhivehi draws upon a wide range of lexemes. Firstly, there are left/right/front/back terms for expressing the intrinsic and relative FoRs, and 'front' and 'back' terms are also used in the 'FIBO' (Front = Inside, Back = Outside) system in which objects in circular configurations are construed as facing inwards. Secondly, there are cardinal and intercardinal directions based on a solar compass, though there is also a traditional system of 32 sidereal compass directions which has largely fallen out of use due to technological and social changes. Cardinal, intercardinal, and sidereal direction terms express the absolute FoR as defined in Chapter 2. Thirdly, speakers may use various entities outside the figure-ground array as landmarks in landmark-based FoRs. This includes the speakers' own bodies (i.e., SAP-landmarks), but also nearby objects such as furniture, or else buildings, villages, islands, or topographic features in the wider environment. In terms of grammatical expression, a point of interest is the existence of a 'locative dative' grammatical construction in which dative marking expresses a locative relationship – this construction allows LRFB terms and absolute FoR terms, as well as the topographic landmark terms *atiri* ‘beach’ and *eggamu* ‘inland’, but never other topographic landmark terms like *fuṭṭaru* ‘reef’ or *daṣē* ‘lagoon shore’.

Chapter 5 discussed the use of FoRs among Dhivehi speakers in a range of spatial language tasks as well as in narrative texts. In particular, I focused on the use of FoRs in the Man and Tree game, for which I presented quantitative results. The results revealed statistically significant variation across different locations and demographic groups in the Maldives, especially in the use of egocentric strategies and cardinal directions (the intrinsic FoR was common among all groups). In Laamu, fishermen and groups traditionally associated with fishing (such as men, older people, and people in fishing communities) used cardinal directions at high rates, while others tended to use egocentric FoRs instead. Bilingualism and secondary education also correspond with lower rates of cardinal direction use and higher rates of egocentric FoR use, though bilinguals and people with a secondary education in the Maldives tend to be fairly young anyway. Egocentric FoRs were also more common (and cardinal directions less common) in densely urban Malé than in Laamu, suggesting a possible effect of environment on FoR choice; however, Addu patterns more like Malé than Laamu in FoR choice, despite being only slightly more urbanized than Laamu, and fishing and non-fishing islands within Laamu show very different patterns of FoR choice to each other, despite being urbanized to an equal degree. Together, these findings suggest that sociocultural interaction with the environment is more crucial than the environment itself – despite living in the same topographic environment, fishermen need to use cardinal directions to navigate at sea, while indoor workers have no such need. The Man and Tree results were corroborated by the findings from other spatial language tasks and from the narrative data, though the different methodologies also helped to reveal some additional details. For example, results from the Object Placement Task showed that most people in the Laamu sample were able to respond accurately to cardinal direction prompts, even if they did not use cardinal direction terms in the Man and Tree game. The different tasks also included some methodological innovations, most notably the Virtual Atoll Task, which could be adapted for future research on spatial language in other languages.

Chapter 6 addressed FoRs in Dhivehi cognition, reporting on the results of three non-linguistic spatial memory tasks. The results of the Animals-in-a-row task showed a mixture of different strategies, though many participants produced an ambiguous pattern of responses. Many participants produced a 'monodirectional' response pattern suggesting an intrinsic solution, though this could sometimes also look like a mixture of geocentric and egocentric responses. I developed new criteria for distinguishing between these possibilities, as well as for interpreting certain kinds of error responses. Broadly speaking, the mixture of intrinsic, geocentric, and egocentric FoRs used in the task is consistent with the mixture of FoRs used in the linguistic tasks described in Chapter 5, and statistical testing revealed some significant but weak results in line with a moderate version of the linguistic relativity hypothesis. However, a comparison of the results from the three non-linguistic tasks (Animals-in-a-row, Steve's mazes and Chips recognition) showed that the use of FoRs is also task-specific to some extent. For example, Steve's mazes attracted a higher proportion of egocentric responses than the other tasks, in keeping with the results of previous research (e.g., Dasen & Mishra 2010). While task specificity suggests that FoR choice in such non-linguistic tasks is not completely determined by language, it is still compatible with moderate or weak versions of linguistic relativity. Finally, FoR choice in the non-linguistic tasks was not significantly associated with demographic variation for the most part (unlike the results for some of the linguistic tasks in Chapter 5), although an interesting exception is that bilinguals were significantly more likely to produce egocentric responses in Animals-in-a-row, suggesting that speaking English may facilitate the use of relative 'left' and 'right' in some non-linguistic spatial contexts. This finding provides further support for linguistic relativity.

I now turn to consider the various hypotheses (discussed in Chapters 1 and 3 especially) about the relationship between spatial language, cognition, and the environment. Firstly it must be noted that the findings of this thesis are contrary to any kind of environmental determinism. FoR use (linguistic or non-linguistic) among Dhivehi speakers is not determined by the environment the speaker happens to be in at the time, as shown by the comparison of indoor and outdoor data in both Chapter 5 (for linguistic FoR use) and Chapter 6 (for non-linguistic FoR use) – this is in keeping with most previous research on FoRs and provides further counter-evidence to Li and Gleitman's (2002) view that the use of geocentric FoRs is prompted by visual access to salient landmarks. The data presented in this thesis are also inconsistent with the notion that the topographic environment determines FoR choice. As shown in Chapter 5, many Dhivehi speakers do not use cardinal directions or topographic landmarks despite living in an environment with highly salient topographic features. Determinism would predict that all speakers living in the same environment should use the same FoR or FoRs; however, the Dhivehi data show the opposite – different speakers living on the same island often use very different FoRs. The same is true of non-linguistic FoR choice, as shown in Chapter 6.

Palmer's (2015) Topographic Correspondence Hypothesis is weaker than environmental determinism, but still makes some strong predictions about the relationship between FoRs and the environment. On the whole, the evidence from Dhivehi would appear not to support Palmer's hypothesis, although there are some ambiguous findings too. Dhivehi does not possess a grammaticized lagoonward-oceanward axis like the atoll-based languages of the Pacific. Topographic features such as the lagoon and oceanward reef are at least lexicalized in Dhivehi, though they are seldom used in FoR descriptions. In fact, of the topographic landmark terms that are used, *eggamu* 'inland' and *atiri* 'beach' are the most common, and these may also participate in a special locative dative construction. Instead of directions based on atoll or island topography, cardinal directions are the major type of geocentric FoR in Laamu. While this was not predicted by Palmer, the use of cardinal directions is in fact well suited to the flat, featureless ocean environment where the path of the sun may be the most salient environmental cue, and the flatness of atoll islands means that this cue is reasonably salient on land too. The 'calibration' of the cardinal directions to the orientation of the island (see §4.6.3.1) displays a further sensitivity to local topography. In addition, the Dhivehi sidereal compass has resemblances to other sidereal compasses used by other maritime cultures at similar latitudes (see §4.6.3.2). Some other findings also suggest an influence of topography, and even of island or atoll topography. In Laamu, the horizontal uses of the motion verbs *aranū* 'climbing up' and *erenū* 'descending into' (discussed in §4.5.4) are sensitive to slight differences in elevation. One pair of speakers in the Verbal Animals-in-a-row game spoke of the animals being *raṣ̊ digaṣ̊* 'along the island' or *raṣ̊ hurahaṣ̊* 'across the island', displaying an awareness of the island's long shape. And it is also possible to speculate that the 'FIBO' system discussed in §4.6.5 might be modelled on the shape of an atoll (though there are more compelling explanations available). However, the use of most of these features is limited, and they are not the same as a grammaticized lagoonward-oceanward axis. A conclusion here is that while we can perhaps expect languages to possess systems of geocentric reference that reflect the environment in some ways, it is not always possible to predict *a priori* exactly which features of the environment will be represented the most, nor how they might be represented grammatically.

Although the environment does not determine FoR choice, the evidence presented in Chapter 5 suggests that it still plays an important role, particularly in terms of the ways in which speakers habitually interact with their environments. As I have discussed, the mere presence of salient environmental features (such as a flat ocean or a lagoon vs. ocean distinction) is clearly not enough to guarantee the use of geocentric FoRs in language or cognition. But people who need to pay attention habitually to such topographic features, such as sailors or fishermen, do use geocentric FoRs more frequently in language (and, as shown in Chapter 6, their spatial cognition is geocentric or at least allocentric). Thus, both spatial language and spatial thinking are probably shaped by experience with the environment, and in this respect this thesis goes beyond the ecological skepticism of Levinson (2003) and Majid et al. (2004), who downplay the role of the environment (even though they do not discount it entirely). However, it seems likely that spatial language still has some effect on spatial thinking, in line with linguistic relativity – this would explain, for example, the fact that compared to monolingual Dhivehi speakers, Dhivehi-English bilinguals are significantly more likely to use an egocentric strategy in Animals-in-a-row.

The finding that interaction with the environment may influence FoR use also has interesting implications for how FoRs may shift over time within a community. It is fairly clear that in the Maldives, the traditional systems of thinking and talking about space were geocentric and intrinsic ones, and that egocentric (and especially relative) FoRs have only emerged in recent decades. This shift appears to be due to changes in the ways Maldivians interact with their environment, as well as through language contact and perhaps other sociocultural changes. It is highly likely that other communities undergoing similar changes may be experiencing shifts in FoR use too, or have experienced such shifts historically. Thus, the predominant FoRs used by particular communities or in particular languages is not arbitrary, but environmentally and socioculturally motivated. The typological question of why different linguistic communities use different FoRs (in language or thought) then becomes, at least in part, a question of how those communities have historically interacted with their environments and with other communities, and how they do so today.

This thesis has explored several aspects of FoRs in Dhivehi language and cognition, though it has also raised many further questions. In terms of spatial cognition, Dhivehi speakers' use of gesture is an important area for further study. In §5.3.5 I presented preliminary evidence that gestures produced by some older men reflect an underlying geocentric coding of events. However, this needs to be corroborated by a more thorough analysis of gestures used by Dhivehi speakers (of various demographic groups) in narratives as well as in conversations and other text types.

Many features of spatial language in Dhivehi warrant further investigation. The disappearing sidereal compass system has its origins in Arab seafarers of the medieval period – might there be other groups around the Indian Ocean which learned the same system from the Arabs? If so, do any such communities still use that system today? The FIBO system of 'front' and 'back' terms seems like a natural one, though to the best of my knowledge it has not been reported previously in the literature on FoRs. Future work might investigate how widespread this kind of system is cross-linguistically. This could be achieved by using the circular condition of the Object Placement Task along with other methods. Among Dhivehi speakers, it would also be valuable to probe further into the system – for example, are there restrictions on the size of the array, or what the ground objects can be? Similarly, more work is needed on the use of translational vs. reflectional subtypes of the relative FoR, both within Dhivehi and cross-linguistically. Why was the translational subtype predominant in the Object Placement Task, when relative 'front' and 'back' in the Man and Tree game were nearly always used in a reflectional way? Do people who rarely use the relative FoR tend to settle upon the translational subtype when compelled to make a choice? In addition, the use of positional/postural verbs in Dhivehi is a complex subject that requires a much more thorough treatment than I have been able to provide in this thesis. Aside from clarifying which positional/postural verbs tend to be used for which kinds of scenes, future work might investigate the role of prescriptive norms concerning the use of positional/postural verbs in Dhivehi (e.g., in schooling).

Another interesting question is how speakers come to agree upon a particular spatial strategy (or set of spatial strategies) in certain communicative tasks. How would speakers with very different FoR preferences solve a task like the Man and Tree game? In order to compare different demographic groups, my approach for the Man and Tree game was generally to record pairs of speakers of the same gender and roughly the same age (see §5.2.2), though an incidental effect of this was that speakers tended to use the same strategies as their partner. If both speakers are from very different demographic groups, however, a prediction might be that they would settle upon whatever strategies are mutually available. In the case of Dhivehi, one might expect speakers in such situations to rely on the intrinsic FoR, landmark-based FoRs, vertical strategies and the tree-directed strategy, and to avoid cardinal directions and the relative FoR.

Finally, it is hoped that this thesis inspires further efforts to document lesser-known languages and the traditional knowledge they contain. It is estimated that a majority of the world's 7,000 languages will become extinct by the year 2100. Languages embody the culture and knowledge of their speakers, and the loss of a language is the loss of a particular way of seeing the world. Although Dhivehi is not currently endangered, it may become endangered in the future, particularly as English becomes more and more established in the Maldives. Moreover, some aspects of Dhivehi language and culture are critically endangered. Due to rapid technological and social change over the last 50 years, many traditional aspects of Maldivian culture have not been transmitted to the youngest generations. As I have discussed in this thesis, young Maldivians are much less likely to use cardinal directions, and very few have even heard of the sidereal compass directions their grandfathers know so well. I therefore hope that this thesis has contributed – however modestly – to a better appreciation of the remarkable cultural heritage of the Maldivian people.

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Appendix I: Instructions for space games

This appendix provides the instructions given to participants playing the space games discussed in Chapters 4-6 (including linguistic and non-linguistic tasks), with loose English translations. Instructions for some games were based on those used in previous work on frames of reference (see the main chapters for references). Instructions for all games were (further) developed and refined in collaboration with Jonathan Schlossberg, Alice Gaby and Bill Palmer, and were translated into Dhivehi with the assistance of a native speaker research assistant. The same research assistant read out the Dhivehi instructions to participants (i.e., participants did not read the instructions themselves).

Man and Tree game

މިގޭމް ކުޅުމުގައި އަހަރެމެން ބަލަން ބޭނުންވާ އެންމެ މުހިންމު ކަމަކީ އެކަކު އަނެކަކާއި ވާހަކަ ދައްކާގޮތް. މީހަކާއި ގަހެއް ކުރަހާފައިވާ 16 ތަސްވީރު ތިޔަދެމީހުން ކޮންމެމީހަކަށްވެސް ދެވޭނެ. އަދި އެކަކު އަނެކަކަށް ނުފެންނަގޮތަށް ފަރުދާ އަޅުން ވަކިކުރާނެ. އަދި ފަރުދާގެ އަނެއްފަރާތް ބަލައިގެން ނުވާނެ. މިގެ ތެރެއިން އެކަކަށް "ޑައިރެކްޓަރު" އަދި ފަރާތުގެ އަނެއްފަރާތުގައިވާ ފަރާތަށް ކިޔާނީ "މެޗަރު" ޑައިރެކްޓަރު ނަމަ މެޗަރު އަށް ތަސްވީރުތައް ތަފްސީލީ ކޮށް ކިޔައިދޭން ވާނެ. ޑައިރެކްޓަރު ބުނާގޮތުން ބޭނުން ތަސްވީރުތައް އެތުރުން ހަމަ ތަރުތީބު ކުރަންވާނެއެވެ. އަދި މެޗަރު އަށް ޑައިރެކްޓަރު ކައިރީގައި ސުވާލުކުރެވިދާނެ. މިގޮތަށް މަސައްކަތް ކުރަމުންގޮސް ނިންމާލާނީ.

'What we are interested in for this game is how you talk to each other. Both of you will be given the same set of 16 pictures, each with a man and a tree. And you will be separated by a screen so you can't see each other. Please do not look over it. One of you will play the role of 'director', and the other will play the role of 'matcher'. If you are the director, you will describe the pictures in detail to the matcher. The matcher can also ask the director questions if they want to. Continue working like this until you finish the task.'

Route Description game

މިގޭމް ކުޅުމުގައި އަހަރެމެން ބަލަން ބޭނުންވާ އެންމެ މުހިންމު ކަމަކީ އެކަކު އަނެކަކާއި ވާހަކަ ދައްކާގޮތް. މިހާރު މިހުރީ ބައެއް ކުޑަތަކެތި ބޭރުމަތީގައި އޮތްކާލާފައި. ދެމީހުންނަށްވެސް ދީފައިވާ ހަމަ އެއްގޮތް އެއްޗެއް. އަދި އެކަކު އަނެކަކަށް ނުފެންނަގޮތަށް ފަރުދާ އަޅުން ވަކިކުރާނެ. އަދި ފަރުދާގެ އަނެއްފަރާތް ބަލައިގެން ނުވާނެ. ކުދިއިރުކޮޅަކުން މިގެން ކޮންމެވެސް އެއްއެއްޗެއްގައި ބޭންކޮށްގެން އަޅުވާނަން. އަދި މިބޭން ކޮޅު އެންމެން ވަކިގޮތަކަށް އަތުރާލާފައި. ބޭން އަޅުވާފައިވާ ފަރާތަށް ކިޔާނީ "ޑައިރެކްޓަރު" އަދި ފަރާތުގެ އަނެއްފަރާތުގައިވާ ފަރާތަށް ކިޔާނީ "މެޗަރު" ޑައިރެކްޓަރު ނަމަ މެޗަރު

[illegible]
މިގޮތަށް މަސައްކަތް ކުރަމުންގޮސް ނިންމާލާށެވެ.

‘What we are interested in for this game is how you talk to each other. As you can see, we have placed some toys and blocks on the table. Both of you have exactly the same setup. You will be separated by this screen. We ask that you do not peep around the screen. In a moment, we are going to place some chain on just one of the scenes. This chain will mark out a route through the scene. The person who can see the chain will be called the ‘director’. The person on the other side of the screen will be called the ‘matcher’. If you are the director, you will describe the route to the matcher so that he/she can move his/her own man along exactly the same route in his/her own landscape. The matcher is allowed to speak to the director too. Continue working like this until you finish the task.’

Verbal Animals-in-a-row game

[illegible]

‘We would like you to play a game for us so that we can listen to how Dhivehi speakers talk to each other. You will sit side by side but you will be separated by a screen. One of you will see three toy animals placed in a row. No one should peep at the other side of the screen. You will need to describe the position and order of the animals to your partner. Your partner will then arrange the animals so they are the same as yours. There is also an extra animal that will be unused each time. Both of you are allowed to talk, so if you do not understand your partner’s directions, you can ask questions. When you finish the game, you can look to see if you were right. Then, we will change the animals and the other person can have a turn at describing. We will keep changing the animals until you have both described four times.’

Virtual Atoll Task

މިކުޅެގަ ގޮތް ތައްޔާރުކުރެވިފައި ދިވެހިން އެކަކު އަނެކަކާއި ވާހަކަދައްކާގޮތް އަޑުއަހާލުމަށްޓަކައި އެވެ.
މިކޮމްޕިއުޓަރގައި ޚިޔާލީ ރަށްތަކެއް ތައްޔާރުކޮށްފައިވާނެއެވެ. މިއީ ހަވީރު ގަޑިއެކެވެ. ހަޖާނާ ހޯދުމަށް އެކި އެކި
ރަށްރަށަށް ދަތުރުކުރަންވާނެއެވެ. މިއީ ކޮމްޕިއުޓަރުން ތައްޔާރުކޮށްފައިވާ ރަށްތަކަކަށްވާތީ އަސްލު ރަށްރަށާއި ތަފާތު
ހުރުމަކީ އެކަށީގެން ވާ ކަމެކެވެ.ތިޔަބޭފުޅުން އެކަކީ ޑައިރެކްޓަރ އެވެ. ފުރަތަމަ ގޮތް ފެށުމުގެ ކުރިން ޑައިރެކްޓަރ އަށް
މިގޮތުގައި ހަޖާނާހުރި ތަންތަން ދައްކާލެވޭނެއެވެ. ގޮތް ކުޅެމުންދާއިރު ޑައިރެކްޓަރ ކޮމްޕިއުޓަރ ގައި އަތްލާގެން
ނުވާނެއެވެ. ގޮތް ކުޅޭ މީހާ އަދި ހުރިހާ ކޮންޓްރޯލްތައް އޮޕަރޭޓް ކުރާނީ މީހާ އެވެ. އެކަމަކު ހަޖާނާތައް ފޮރުވިފައިވާ ތަން
ނުދަންނާނެއެވެ.އެކަކު އަނެކަކާއި ވާހަކަ ދައްކާ ހޯދޭނެ އެވެ.
މިގޮތުން އަހަރެމެން ބަލަން ބޭނުންވަނީ މިހެން ވާހަކަ ދައްކާ ގޮތެވެ. ހަޖާނާ ބަލާ ހުރި ތަންތަން ބުނުމުގައި ބޭނުންކުރާ ބަހަކީ
އިސްކިރީނަށް ދިއްކޮށްގެން ނުވާނެއެވެ. ވާހަކަ ދައްކާއިރުގައި ބަސް ބޭނުންކުރާނީއެވެ. އިސްކިރީނަށް ދިއްކޮށްގެން ޑައިރެކްޓަރ ވަރަށް
ސަމާލުކަން ދޭން ވާނެއެވެ.
ގޮތް ކޮންޓްރޯލް ކުރުމަކީ ވަރަށް ފަސޭހަ ކަމެކެވެ. މައުސް ބޭނުންކޮށްގެން އެކިދިމާއަށް ދުވާނެއެވެ. އަދި
ސްކްރީން ބޮޑު ބޭނުންކޮށްގެން މިގޮތަށް ގެންދެވޭނެއެވެ.ބޯޓަށް އަރައިގެން ކައިރިއަށް ސްކްރީނުގެ ސްކްރީން އިން އެއް މައްޗަށް
ނުކުމޭ މައުސް އަށް ފިތާލާށެވެ. އަދި ބޯޓުން ފައިބާން ވީމާ ރަށާއި ކައިރިވުމުން މައުސް އަށް ފިތާލާށެވެ. މިއަތޮޅުގައި 5
ހަޖާނާ ފޮރުވިފައި ވާނެއެވެ. އެ 5 ހަޖާނާ ހޯދުމަކީ އެ ގޮތް ނިމުނީ އެވެ.

‘We have made a simple game which we want you to play together so that we can hear how Dhivehi speakers talk to each other. We have created imaginary islands on the computer. In the game, you will walk and sail to different islands during the late afternoon looking for treasure chests. The atoll in the game is computer-generated, so it might look a little different to atolls you may have seen in real life. One of you will be the ‘director’. Before the game we will show this person where the treasure chests are. That person will then tell the other person where to look for them during the game. However, the director is not allowed to touch the computer. The other person will be the ‘player’ – the player will operate the controls, but will not know where the treasure chests are hidden. The player can also talk and ask the director for directions during the game. Since we are interested in what words you use, we ask that you do not point at the screen, and that you only use language to direct each other. The controls are quite simple to operate. Use the mouse to change direction like this [*show participants*], and use the space bar to move like this [*show participants*]. To get on the boat, move close to the boat and then, when the hand on the screen lights up, click on the mouse like this [*show participants*]. You can also click like this to get off the boat when you are close to land. There are five treasure chests hidden around the atoll. The game finishes when the player has discovered and opened all five treasure chests.'

Object Placement Task

Condition 1:

Setup	Instruction (English)	Instruction (Dhivehi)
car facing left; give cube	'Put the cube in front of the car.'	ކާރު ކުރުމައްޗު ކޮޖި ބާއްވާ
car facing left; give cube	'Put the cube behind the car.'	ކާރު ފަހަތު ކޮޖި ބާއްވާ
car facing left; give cube	'Put the cube behind[186] the car.'	ކާރު ފުރަގަސް ކޮޖި ބާއްވާ
car facing left; give cube	'Put the cube to the left of the car.'	ކާރު ވާތް ފަރާތު ކޮޖި ބާއްވާ
car facing left; give cube	'Put the cube to the right of the car.'	ކާރު ކަނާތް ފަރާތު ކޮޖި ބާއްވާ
car facing away; give cube	'Put the cube in front of the car.'	ކާރު ކުރުމައްޗު ކޮޖި ބާއްވާ
car facing away; give cube	'Put the cube behind the car.'	ކާރު ފަހަތު ކޮޖި ބާއްވާ
car facing away; give cube	'Put the cube behind the car.'	ކާރު ފުރަގަސް ކޮޖި ބާއްވާ
car facing towards; give cube	'Put the cube in front of the car.'	ކާރު ކުރުމައްޗު ކޮޖި ބާއްވާ
car facing towards; give cube	'Put the cube behind the car.'	ކާރު ފަހަތު ކޮޖި ބާއްވާ
car facing towards; give cube	'Put the cube behind the car.'	ކާރު ފުރަގަސް ކޮޖި ބާއްވާ
car facing towards; give cube	'Put the cube to the left of the car.'	ކާރު ވާތް ފަރާތު ކޮޖި ބާއްވާ
car facing towards; give cube	'Put the cube to the right of the car.'	ކާރު ކަނާތް ފަރާތު ކޮޖި ބާއްވާ

[186] Note that two different Dhivehi terms for 'behind' or 'back' were tested in the Object Placement Task: *fahaṫ* 'back' and *furagas* 'back (esp. of an animate)', though no difference was ultimately found.

Condition 2:

Setup	Instruction (English)	Instruction (Dhivehi)
toy man facing left; give cube	'Put the cube in front of the person.'	މީހާ ކުރިމައްޗަށް ކިއުބް ބަހައްޓާ
toy man facing left; give cube	'Put the cube behind the person.'	މީހާ ފަހަތަށް ކިއުބް ބަހައްޓާ
toy man facing left; give cube	'Put the cube behind the person.'	މީހާ ފުރަގަހަށް ކިއުބް ބަހައްޓާ
toy man facing left; give cube	'Put the cube to the left of the person.'	މީހާ ވާތް ފަރާތަށް ކިއުބް ބަހައްޓާ
toy man facing left; give cube	'Put the cube to the right of the person.'	މީހާ ކަނާތް ފަރާތަށް ކިއުބް ބަހައްޓާ
toy man facing away; give cube	'Put the cube in front of the person.'	މީހާ ކުރިމައްޗަށް ކިއުބް ބަހައްޓާ
toy man facing away; give cube	'Put the cube behind the person.'	މީހާ ފަހަތަށް ކިއުބް ބަހައްޓާ
toy man facing away; give cube	'Put the cube behind the person.'	މީހާ ފުރަގަހަށް ކިއުބް ބަހައްޓާ
toy man facing towards; give cube	'Put the cube in front of the person.'	މީހާ ކުރިމައްޗަށް ކިއުބް ބަހައްޓާ
toy man facing towards; give cube	'Put the cube behind the person.'	މީހާ ފަހަތަށް ކިއުބް ބަހައްޓާ
toy man facing towards; give cube	'Put the cube behind the person.'	މީހާ ފުރަގަހަށް ކިއުބް ބަހައްޓާ
toy man facing towards; give cube	'Put the cube to the left of the person.'	މީހާ ވާތް ފަރާތަށް ކިއުބް ބަހައްޓާ
toy man facing towards; give cube	'Put the cube to the right of the person.'	މީހާ ކަނާތް ފަރާތަށް ކިއުބް ބަހައްޓާ

Condition 3:

Setup	Instruction (English)	Instruction (Dhivehi)
Green cube; give blue cube	'Put the blue cube in front of the green cube.'	ފެހި ކިއުބް ކުރިމައްޗަށް ނޫ ކިއުބް ބަހައްޓާ
Green cube; give blue cube	'Put the blue cube behind the green cube.'	ފެހި ކިއުބް ފަހަތަށް ނޫ ކިއުބް ބަހައްޓާ

Green cube; give blue cube	'Put the blue cube behind the green cube.'	ފެހި ކޮޅި ފުރަގަހު ނޫ ކޮޅި ބޭއްވާ
Green cube; give blue cube	'Put the blue cube to the left of the green cube.'	ފެހި ކޮޅި ވާތް ފަރާތު ނޫ ކޮޅި ބޭއްވާ
Green cube; give blue cube	'Put the blue cube to the right of the green cube.'	ފެހި ކޮޅި ކަނާތް ފަރާތު ނޫ ކޮޅި ބޭއްވާ

Condition 4:

Setup	Instruction (English)	Instruction (Dhivehi)
Large cube; give small cube	'Put the small cube in front of the large cube.'	ބޮޑަ ކޮޅި ކުރިމައްޗަ ކުޑަ ކޮޅި ބޭއްވާ
Large cube; give small cube	'Put the small cube behind the large cube.'	ބޮޑަ ކޮޅި ފަހަތު ކުޑަ ކޮޅި ބޭއްވާ
Large cube; give small cube	'Put the small cube behind the large cube.'	ބޮޑަ ކޮޅި ފުރަގަހު ކުޑަ ކޮޅި ބޭއްވާ
Small cube; give large cube	'Put the large cube in front of the small cube.'	ކުޑަ ކޮޅި ކުރިމައްޗަ ބޮޑަ ކޮޅި ބޭއްވާ
Small cube; give large cube	'Put the large cube behind the small cube.'	ކުޑަ ކޮޅި ފަހަތު ބޮޑަ ކޮޅި ބޭއްވާ
Small cube; give large cube	'Put the large cube behind the small cube.'	ކުޑަ ކޮޅި ފުރަގަހު ބޮޑަ ކޮޅި ބޭއްވާ

Condition 5:

Setup	Instruction (English)	Instruction (Dhivehi)
Small cube; give toy man	'Put this man in front of the cube.'	ކޮޅި ކުރިމައްޗަ މީހާ ބަހައްޓާ
Small cube; give toy man	'Put this man behind the cube.'	ކޮޅި ފަހަތު މީހާ ބަހައްޓާ
Small cube; give toy man	'Put this man behind the cube.'	ކޮޅި ފުރަގަހު މީހާ ބަހައްޓާ
Small cube; give toy man	'Put this man to the left of the cube.'	ކޮޅި ވާތް ފަރާތު މީހާ ބަހައްޓާ
Small cube; give car	'Put this car in front of the cube.'	ކޮޅި ކުރިމައްޗަ ކާރު ބޭއްވާ
Small cube; give car	'Put this car behind the cube.'	ކޮޅި ފަހަތު ކާރު ބޭއްވާ
Small cube; give car	'Put this car behind the cube.'	ކޮޅި ފުރަގަހު ކާރު ބޭއްވާ
Small cube; give car	'Put this car to the left of the cube.'	ކޮޅި ވާތް ފަރާތު ކާރު ބޭއްވާ

Condition 6:

Setup	Instruction (English)	Instruction (Dhivehi)
Green cube; give blue cube	'Put the blue cube on the inland side of the green cube.'	ފެހި ކޮޅު އުއްގަމަށް ނޫ ކޮޅު ބާއްވާ
Green cube; give blue cube	'Put the blue cube on the beach side of the green cube.'	ފެހި ކޮޅު އަތިރިއަށް ނޫ ކޮޅު ބާއްވާ
Green cube; give blue cube	'Put the blue cube on the north side of the green cube.'	ފެހި ކޮޅު އުތުރަށް ނޫ ކޮޅު ބާއްވާ
Green cube; give blue cube	'Put the blue cube on the south side of the green cube.'	ފެހި ކޮޅު ދެކުނަށް ނޫ ކޮޅު ބާއްވާ
Green cube; give blue cube	'Put the blue cube on the east side of green cube.'	ފެހި ކޮޅު އިރަށް ނޫ ކޮޅު ބާއްވާ
Green cube; give blue cube	'Put the blue cube on the west side of the green cube.'	ފެހި ކޮޅު ހުޅަނގަށް ނޫ ކޮޅު ބާއްވާ

Condition 7:

Setup	Instruction (English)	Instruction (Dhivehi)
Six blue cubes in ring; give green cube	'Put the green cube in front of this cube.' (for two random blue cubes)	ނޫ ކޮޅު ކުރިމައްތު ފެހި ކޮޅު ބާއްވާ
Six blue cubes in ring; give green cube	'Put the green cube behind this cube.' (for two random blue cubes)	ނޫ ކޮޅު ފަހަތު ފެހި ކޮޅު ބާއްވާ

Animals-in-a-row

މިއީ ވަރަށް އާދައިގެ ގޮތަކަށް ކުޅޭވޭ ގޭމް އެކެވެ. ހަތަރު ޖަނަވާރުގެ ތެރެއިން ތިން ޖަނަވާރު ބިރިއަކަށް އަތުރާލާފައި ހުއްޓާ ފެންނާނެވެ. އަދި މި ޖަނަވާރު ތަކާއި ކޮބައި ކަމާއި އަތުރާލާފައިހުރި ގޮތާއި ތަރުތީބު ހަނދާން ބަހައްޓާނެވެ. ކުޑައިރުކޮޅެއްފަހުން މިޖަނަވާރުތައް ނަގާ އަދި ކުޑަ އިރުކޮޅެއް ފަހުން މިޖަނަވާރުތައް އެހުރި ތަރުތީބުން އެހެން މޭޒެއްގައި އަތުރާލަން ބުނާނަމެވެ. މިގޮތަށް އަތުރަމުން ގޮސް 5 ތަފާތު ފަހަރު މިގޮތް ކުރެން ވާނެއެވެ. ކުދިންނަށް ކުރެނީ ފަރިތަކޮށްދުމަށެވެ.

ދެން ކުދިން ހަނދާން ހުރި ގޮތަށް އަތުރާލާނެވެ.

‘This is a very simple game. Out of four animals you will see three animals placed in a line. You will need to remember which animals they are and how they are arranged. When you are ready, we will take away the animals and wait for a small amount of time. We will then give the animals to you and ask you to make the line again, exactly as it was. You will play the game five times in total. First we will play a few practice games.’

‘Arrange them just the way you remember them from before.’

Steve’s mazes

މިއީ ވަރަށް އާދައިގެ ސިކުނޑީގެ ބޯނޑުކުޅުން ގޮތެއް. މިތަނުގައި މަގެއް ދައްކާފައި ވާނެ. ގެއިން ފެށިގެން މަގު އޮތްގޮތަށް ދޭ. މަގުގެ ނިމޭ ހިސާބުން ގެއަށް ދާން ޖެހޭނެ. ގަސްތަކުގެ ތެރެއިން ނުދެވޭނެ. އަދި ގަލުތަކުގެ މަތިންވެސް ނުދެވޭނެ. މަގުން ފަހަތަށްވެސް ނުދެވޭނެ. ދާން ޖެހޭނީ މިގޮތަށް. ފުރަތަމަ ފަރިތަ ކުރުމަށް. ބޮޑު މަގުން ފެށިގެން ގެއާއި އަދި އައި ހަމައަށް ދާން މަގު ދައްކުވާ ދޫނީ މިކާޑުގެ ދޯ؟ ދެން ހުރި ކާޑުތަކުން ރަނގަޅު މަގެއް ނުދައްކާނެ ދޯ؟

‘This is a very simple memory game. Here you will be shown a path. Start from the house and go along the path. From the end of the path you have to go to the house. You cannot go through the trees. And you cannot go over the stones or back along the path. You have to go this way. First we will practice. This card shows a path leading from the end of the big path to the house, doesn’t it? These other cards don’t show the correct path, do they?’

ރަނގަޅު މަގު ދައްކުވާދޭ ކާޑު ނަގާ.

‘Please choose the card showing the correct path.’

މިމަގު އޮތް ގޮތް ހަނދާންކުރައްވާ. ދެން ހުރި މޭޒުގައި ތިން ކާޑު ދައްކާނަން. ބޮޑު މަގުގެ ނިމޭ ހިސާބުން ފެށިގެން ގެއަށް ދާނޭ މަގު ދައްކުވައި ދޭ ކާޑު ނަގާ.

‘Remember the way this path is. I will show three cards on the next table. You will pick the card that shows the path going from the end of the big path to the house.’

ރަނގަޅު މަގު ދައްކުވާދޭ ކާޑު ނަގާ

‘Please choose the card showing the correct path.’

މިއީ އެހެން މަގެއް. މިހިސާބުން ފެށިގެން ގެއާ ހަމައަށް މަގު ދާން ޖެހޭނެ. މިމަގު އޮތް ގޮތް ހަނދާންކުރައްވާ. ޖެހިގެން ހުރި މޭޒުގައި ތިން ކާޑު ދައްކާނަން. ބޮޑު މަގުގެ ނިމޭ ހިސާބުން ގެއަށް ދާ މަގު ދައްކާދޭ ކާޑު ނަގާ.

‘This is another path. From this point here, the path should go to the house. Remember the way this path is. I will show three cards on the next table. You will pick the card that shows the path going from the end of the big path to the house.’

Chips recognition

Initial instructions:

މިތާ މިއޮތީ ފަސް ކާޑު. ހުރިހާ ކާޑެއް އެއްގޮތް ވާނެ. އެކަމަކު މިގޮތަށް އަނބުރާލިމަ އެއްގޮތެއް ނުވޭ ދޯ؟ މި އެއްގޮތް ނުވަނީ މިތިކިތައް ހުރި ތަން ތަފާތު ވީމަ. ބަލާ، މިކާޑުގައި ފެހި ކުލައިގެ ތިކި އިނީ މިފަރާތުގައި އަދި ރީނދޫ ކުލައިގެ ތިކި އިނީ އެފަރާތުގައި، އަދި މިކާޑުގައި ރީނދޫ ކުލައިގެ ތިކި އިނީ މިފަރާތުގައި އަދި ފެހި ކުލައިގެ ތިކި އިނީ އެފަރާތުގައި.

‘Here are five cards. Each one is the same. But if I turn them like this, they are no longer the same, see? They are no longer the same because the dots are in different places. See, this one has the green dot on this side and the yellow dot on that side, but this other one has the yellow dot on this side and green dot on that side.’

Practice stage 1:

މިހާރު މިކާޑަށް ބަލާ. އެހަތަރު ކާޑުގެ ތެރެއިން މިކާޑާ ވައްތަރީ ކޮން ކާޑެއް؟ ކޮން ކާޑެއްގައި މިކާޑުގައި މި ހުރި ގޮތަށް މި ހުރި ތަންތަނުގައި ތިކިތައް ހުރީ؟

‘Now, look at this card. From those four cards, which one is the same? Which card has the dots the same way and in the same place as this card?’
(at least two practice tests)

Practice stage 2:

މިހާރު މިކާޑަށް ރަނގަޅަށް ބަލާ. އަހަރެން މި އުޅެނީ މި ކާޑު ފޮރުވާން. މިކާޑުން ފެންނަ އެއްޗެއް ހަނދާންކުރައި ބަލައްޗޭ. މިހާރު މިކާޑާ ވައްތަރީ ކޮން ކާޑެއް؟ ކޮން ކާޑެއްގައި މިކާޑުގައި މި ހުރި ގޮތަށް މި ހުރި ތަންގައި ތިކިތައް ހުރީ؟

‘Now, look at this card carefully. I am going to hide this card. Try to remember what you can see. Now, which card is the same? Which card has the dots the same way and in the same place as this card?’

(at least one practice test)

Practice stage 3:

މިހާރު މިކާޑަށް ރަނގަޅަށް ބަލާ. މިކާޑުން ފެންނަ އެއްޗެއް ހަނދާންކުރައި ބަލައްޗޭ. މިހާރު މި އުޅެނީ މިކާޑު ފޮރުވާން. އަދި ތިރީސް ސިކުންތު ވަން ދެން މަޑުކޮށްލަން ޖެހޭނެ.

ދެންމެ ފެނުނު ކާޑާ ވައްތަރީ މިތަނުން ކޮން ކާޑެއް؟ ކޮން ކާޑެއްގައި މިކާޑުގައި މި ހުރި ގޮތަށް މި ހުރި ތަންގައި ތިކިތައް ހުރީ؟

‘Now, look at this card carefully. Try to remember what you can see. I am going to hide it and then we will wait for 30 seconds.’

(wait 30 seconds)

‘Now, which card is the same as the card that you just saw? Which card shows the same dots in the same places?’

(at least one practice test)

Practice stage 4:

މިހާރު މިކާޑަށް ރަނގަޅަށް ބަލާ. މިކާޑުން ފެންނަ އެއްޗެއް ހަނދާންކުރައި ބަލައްޗޭ. މިހާރު މި އުޅެނީ މިކާޑު ފޮރުވާން. އަދި ތިރީސް ސިކުންތު ވަން ދެން މަޑުކޮށްލަން ޖެހޭނެ. މިފަހަރު މިކާޑާ ގުޅޭ ކާޑު ނަގަން ޖެހޭނީ އަނގައް ބަހުން.

ދެންމެ ފެނުނު ކާޑާ ވައްތަރީ މިތަނުން ކޮން ކާޑެއް؟ ކޮން ކާޑެއްގައި މިކާޑުގައި މި ހުރި ގޮތަށް މި ހުރި ތަންގައި ތިކިތައް ހުރީ؟

‘Look at this card carefully. Try to remember what you can see. I am going to hide it and then we will wait for 30 seconds. This time, you will pick the matching card from the other table.’

(wait 30 seconds)

‘Now, which card is the same as the card you just saw? Which card shows the same dots in the same places?’

(at least one practice test)

Test trials:

މިހާރު ޓެސްޓް ފަށަނީ. ފެނުނު ހުރިހާ ކާރޑެއްވެސް ރަނގަޅަށް ހަނދާންކުރައްވާ ބަލައްވާ. ދެން ތިރީސް ސިކުންތު ފަހުން މިކާރޑާ ގުޅޭ ކާރޑު އަނެއް މޭޒުން ނަގަން ޖެހޭނެ. މިގޮތަށް ދިހަ ފަހަރު ހަދަން ޖެހޭނެ. ފުރަތަމަ ފަށާނީ މިކާރޑުން. މިކާރޑަށް ރަނގަޅަށް ބަލާ އަދި ފެނުނު އެއްޗެއް ރަނގަޅަށް ހަނދާންކުރައްވާ ބަލައްވާ.

‘Now we will start the experiment. Try to remember each card you are shown. Then you will have to pick the matching card from the other table after 30 seconds. We will do this ten times. First we will start with this card. Look at it carefully and remember what you can see.’

Appendix II: Sample texts

Man and Tree game

File name: DIV_MT_LF_20140328_1_2_HA5_AJ1_NE

Metadata: Laamu Fonadhoo; 2014-03-28; outdoors near oceanward reef; facing northeast (along island); director: HA5 (20-year-old man, security guard, O-Level education, speaks some English); matcher: AJ1 (34-year-old man, handyman and speedboat captain, primary education, lived in Malé nine years and India two years, speaks Hindi and some English).

HA5:

(149)	*furatama*	*kārḍ*
	first	card

‘The first card.’

(150)	*mīhā*	*kanāt̊*	*faḷuvaṣ̊*	*e^{n}burī=gen̊*	...	*afege*	*i^{n}gē ?*
	person	right.hand	section.DAT	turn.IN.CVB=SUC		I.GEN	TAG

‘The person is turning to the right-hand side...of me, OK?’

AJ1:

(151)	*hmm*
	yeah

‘Yeah.’

HA5:

(152)	*den̊*	*mīhā-ge*	*vāt̊*	*faḷu*	*gaha*
	then	person-GEN	left.hand	section	tree

‘Then the tree (is) on the left-hand side of the person.’

AJ1:

(153a)	*mīhā*	*kanāt̊*	*farāt-aṣ̊*	*e^{n}bure=fa*
	person	right.hand	side-DAT	turn.IN.CVB=SUC

‘The person is turning to the right-hand side…’

(153b)	*mīhā-ge*	*vāt̊*	*farātu*	*e=gaha*
	person-GEN	left.hand	side.LOC	DEM3=tree

‘…that tree (is) on the left-hand side of the person.’

HA5:

(154)	*mīhā-ge*	*...*	*uh̃ū*	*ma*	*afege*	*kanāt̊*	*faḷuvaṣ̊*	*e^{n}burī=gen̊*
	person-GEN	…	no	I	I.GEN	right.hand	section.DAT	turn.IN.CVB=SUC

‘Turning to the person's...no, I, to my right-hand side.’

AJ1:

(155)	*hmm*
	yeah

‘Yeah.’

HA5:

(156)	*ōkē*	*dō ?*
	OK	TAG

‘OK, yeah?’

AJ1:

(157)	*ōkē*
	OK

‘OK.’

HA5:

(158)	*den̊*	*devana*	*kārḍu*	*mi=innanū*	*maṣ̊*	*kurumatu*	*jahai=gen̊*
	then	second	card.LOC	DEM1=sit.PRES.FOC	I.DAT	front	hit.CVB=SUC

‘Then in the second card this one is facing me.’

(159)	*mīhā-ge*	*furagahu*	*gaha*
	person-GEN	back.LOC	tree

‘The tree (is) at the back of the person.’

AJ6:

(160) *ōkē*

OK

‘OK.’

HA5:

(161a)	*den̊*	*tinaku*	*mi=inū*
	then	third.LOC	DEM1=sit.PST.FOC

‘Then, in the third one this one is…’

(161b)	*afege*	*vāt̊*	*farāt-aṣ̥*	*e^{n}berī=gen̊*
	I.GEN	left-hand	side-DAT	turn.IN.CVB=SUC

‘…turning to my left-hand side.’

(162)	*mīhā-ge*	*kanāt̊*	*farātu*	*gaha*
	person-GEN	right.hand	side.LOC	tree

‘The tree (is) on the right-hand side of the person.’

AJ1:

(163) *ōkē*

OK

‘OK.’

HA1:

(164a)	*den̊*	*mīhā*	*maṣ̥*	*kurumatu*	*jahai=gen̊*
	then	person	I.DAT	front	hit.CVB=SUC

‘Then the person is facing me…’

(164b)	*mīhā-ge*	*vāt̊*	*farātu*	*gaha*
	person-GEN	left.hand	side.LOC	tree

‘…the tree (is) on the left-hand side of the person.’

AJ1:

(165) *ōkē*

OK

‘OK.’

HA5:

(166a)	*den̊*	*mi=inū*	*mīhā*	*afege*	*vāt̊*	*farāt-aṣ̊*	*e*^{n}*berī=gen̊*
	then	DEM1=sit.PST.FOC	person	I.GEN	left.hand	side-DAT	turn.IN.CVB=SUC

‘Then the person here is turning to my left-hand side…’

(166b)	*mīhā-ge*	*vāt̊*	*farātu*	*gaha*
	person-GEN	left.hand	side.LOC	tree

‘…the tree on the left-hand side of the person.’

AJ1:

(167) *ōkē*

OK

‘OK.’

HA5:

(168a)	*den̊*	*mi=inū*	*mīhā*	*afege*	*kanāt̊*	*farātaṣ̊*	*e*^{n}*berī=gen̊*
	then	DEM1=sit.PST.FOC	person	I.GEN	right.hand	side.DAT	turn.IN.CVB=SUC

‘Then the person here is turning to my right-hand side…’

(168b)	*mīhā-ge*	*furagahu*	*gaha*
	person-GEN	back.LOC	tree

‘…the tree at the back of the person.’

AJ1:

(169) *ōkē*
OK
‘OK.’

(170) *mīhā vāt̊ farāt-aṣ̊ e^{n}burī=gen=ē ?*
person left-hand side-DAT turn.IN.CVB=SUC=QUOT
‘The person is turning to the left-hand side, you said?’

HA5:

(171) *kanāt̊ farāt-aṣ̊*
right.hand side-DAT
‘To the right-hand side.’

AJ1:

(172) *hmm ōkē*
yeah OK
‘Yeah, OK.’

HA5:

(173a) *den̊ mi=inū mīhā maṣ̊ furagaha jahai=gen̊*
then DEM1=sit.PST.FOC person I.DAT back hit.CVB=SUC
‘Then the person here is turning his back to me…’

(173b) *mīhā kurumattu gaha*
person front.LOC tree
‘…the tree at the person's front.’

AJ1:

(174) *mīhā furagaha jahai=gen̊ ?*
person back hit.CVB=SUC
‘The person (is) showing his back?’

HA1:

(175)	*kurumattu*	*gaha*
	front.LOC	tree

‘The tree at the front.’

AJ1:

(176)	*kurumattu*	*gaha*	...	*ōkē*
	front.LOC	tree		OK

‘The tree at the front...OK.’

HA5:

(177)	*den̊*	*mi=inū*	*mīhā*	*kanāt̊*	*farāt-aṣ̊*	*e^{n}berī=gen̊*
	then	DEM1=sit.PST.FOC	person	right.hand	side-DAT	turn.IN.CVB=SUC

‘Then the person here is turning to the right-hand side.’

(178)	*mīhā*	*kurumattu*	*gaha*
	person	front.LOC	tree

‘The tree (is) at the front of the person.’

AJ1:

(179)	*ōkē*
	OK

‘OK.’

HA5:

(180a)	*den̊*	*mi=inū*	*mīhā*	*furagaha*	*jahai=gen̊*
	then	DEM1=sit.PST.FOC	person	back	hit.CVB=SUC

‘Then the person here is showing his back…’

(180b)	*mīhā-ge*	*vāt̊*	*faḷu*	*gaha*
	person-GEN	left.hand	section.LOC	tree

‘…the tree (is) at the left-hand side of the person.’

AJ1:

(181) *ōkē*

OK

‘OK.’

HA5:

(182)	*deṅ̊*	*mīhā*	*furagaha*	*jahai=geṅ̊*	*mīhā-ge*	*fahatu*	*gaha*
	then	person	back	hit.CVB=SUC	person-GEN	back.LOC	tree

‘Then the person (is) showing his back, the tree (is) behind the person.’

AJ1:

(183) *ōkē*

OK

‘OK.’

HA5:

(184a)	*deṅ̊*	...	*mīhā*	*afege*	*vāt̊*	*farāt-aṣ̊*	*e^{n}berī=geṅ̊*
	then		person	I.GEN	left.hand	side-DAT	turn.CVB=SUC

‘Then, the person turning to my left-hand side…’

(184b)	*furagahu*	*gaha*
	back.LOC	tree

‘…the tree at the back.’

AJ1:

(185) *ōkē*

OK

OK

HA5:

(186a)	*deṅ̊*	*mīhā*	*furagaha*	*jahai=geṅ̊*
	then	person	back	hit.CVB=SUC

‘Then the person (is) showing his back…’

(186b) *mīhā-ge* *kanāt̊* *farātu* *gaha*

person-GEN right.hand side.LOC tree

'…the tree (is) on the right-hand side of the person.'

AJ1:

(187) *ōkē*

OK

'OK.'

HA5:

(188) *den̊* *mīhā* *maṣ̊* *kurumatu* *jahai=gen̊* *mīhā-ge* *kurumattu* *gaha*

then person I.DAT front hit.CVB=SUC person-GEN front.LOC tree

'Then the person (is) facing me, the tree (is) at the front of the person.'

AJ1:

(189) *ōkē*

OK

'OK.'

HA5:

(190a) *den̊* *mīhā* *vāt̊* *farāt-aṣ̊* *e*^{n}*berī=gen̊*

then person left.hand side-DAT turn.IN.CVB=SUC

'Then the person (is) turning to the left-hand side…'

(190b) *afege* *vāt̊* *farāt-aṣ̊* *e*^{n}*berī=gen̊* *mīhā* *kurumattu* *gaha*

I.GEN left.hand side-DAT turn.IN.CVB=SUC person front.LOC tree

'…turning to my left-hand side, the tree (is) at the person's front.'

AJ1:

(191) *ōkē*

OK

'OK.'

HA5:

(192a)	*den̊*	*mīhā*	*afege*	*kanāt̊*	*farāt-aṣ̊*	*e^{n}berī=gen̊*
	then	person	I.GEN	right.hand	side-DAT	turn.IN.CVB=SUC

‘Then the person (is) turning to my right-hand side…’

(192b)	*mīhā-ge*	*kanāt̊*	*farātu*	*gaha*
	person-GEN	right.hand	side.LOC	tree

‘…the tree (is) on the right-hand side of the person.’

AJ1:

(193) *ōkē*

OK

‘OK.’

HA5:

(194a)	*den̊*	...	*mīhā*	*maṣ̊*	*kurumatu*	*jahai=gen̊*
	then		person	I.DAT	front	hit.CVB=SUC

‘Then…the person (is) facing me…’

(194b)	*mīhā-ge*	*kanāt̊*	*farātu*	*gaha*
	person-GEN	right.hand	side.LOC	tree

‘…the tree (is) on the right-hand side of the person.’

AJ1:

(195) *ōkē*

OK

‘OK.’

Route Description game

File name: DIV_RD_LD_20131129_2_4_MT1_MA3_W

Metadata: Laamu Dhanbidhoo; 2013-11-29; outdoors near lagoon shore; facing west (towards lagoon); director: MT1 (53-year-old man, civil servant and former sailor, primary education, speaks some English and Hindi, has lived in Malé for a few years and Sri Lanka, India and Pakistan for short periods); matcher: MA3 (48-year-old man, fisherman, primary education, has lived in Malé for ten years and Lhaviyani Atoll for ten years, speaks some English).

MT1:

(196) *sṭārṭ?*

start

'Start?'

MA3:

(197) *ãã*

yes

'Yes.'

MT1:

(198)	*ãã*	*mihāru*	*mi=danī*	*i^{n}gē ?*
	yes	now	DEM1=go.PRES.PROG	TAG

'Yes, now I'm going, OK?'

MA3:

(199) *hmm*

yeah

'Yeah.'

MT1:

(200)	*kon̊*	*hen-ek̊*	*kam̊*	*i^{n}gē*	*ta ?*
	which	way-INDF	COMP	TAG	Q

'Do you know which way?'

MA3:

(201) *kon̊ hen-ek̊ dān̊ vū ?*

which way-INDF go.INF be.PST.3

'Which way (do I) have to go?'

MT1:

(202) *mihāru āde dekon-aṣ̊*

now come.IMP south-DAT

'Now come to the south.'

MA3:

(203) *hmm*

yeah

'Yeah.'

MT1:

(204) *ma e=nagā in̊ dekon-aṣ̊ malu-ge mi=farāt-un̊*

I DEM3=take.CVB sit.PST.PTCP south-DAT flower-GEN DEM1=side-ABL

'By this side of the flower to the south which I have taken.'

MA3:

(205) *vāt̊ farāt-un̊*

left.hand side-ABL

'By the left-hand side.'

MT1:

(206) *ãã*

yes

'Yes.'

MA3:

(207) *hmm*

yeah

‘Yeah.’

(208)	*vāt̊*	*farātu*	*irun̊ ?*
	left.hand	side.LOC	east.ABL

‘By the east of the (one on the) left-hand side?’

MT1:

(209)	*ãã*	*irun̊*
	yes	east.ABL

‘Yes, by the east.’

MA3:

(210) *hmm*

yeah

‘Yeah.’

MT1:

(211)	*dan̊*	*got-aṣ̊*	*goho*	*ekkala*	*hāl=ā*
	go.INF	way-DAT	go.IMP	that	rooster=CONJ

rī^{n}dū	*gēyā*	*dēterein̊*
yellow	house.COM	between.ABL

‘Go straight, between that rooster and the yellow house.’

MA3:

(212) *haruga^{n}ḍu*

ladder

‘The ladder?’

(213)	*hmm*
	yeah
	‘Yeah.’

MT1:

(214)	*haruga^{n}ḍu*	*matin̊*
	ladder.GEN	top.ABL
	‘Over the ladder.’	

MA3:

(215)	*kon˚*	*haruga^{n}ḍu=ē ?*
	which	ladder=QUOT
	‘Which ladder?’	

MT1:

(216)	*mi*	*...*	*mī^{n}da*	*uturu*	*farātu*	*in̊*
	FILL		DEM1.sit.PRES.PTCP	north	side.LOC	sit.PST.PTCP
	‘Um, here there's (a ladder) which is on the north side.’					

MA3:

(217)	*hmm*
	yeah
	‘Yeah.’

MT1:

(218)	*fābai=gen̊*	*mi=danī*	*mihāru*
	descend.CVB=SUC	DEM1=go.PRES.PROG	now
	‘I'm going now by coming down.’		

MA3:

(219)	*hmm*	*bēr-aṣ̊*	*hmm*
	yeah	outside-DAT	yeah
	‘Yeah, to the outside, yeah.’		

MT1:

(220) *bēr-aṣ̊* *fābai=gen̊* *gos*
outside-DAT descend.CVB=SUC go.IMP
'After coming down to the outside, go…'

haruga^{n}*ḍu* *koḷ-un̊* *aḷā=ha*
ladder.GEN end-ABL pass.CVB=SUC
'…by passing by the end of the ladder.'

MA3:

(221) *hmm*
yeah
'Yeah.'

MT1:

(222) *ais* ... *gē* *terē*
come.CVB house.GEN inside.LOC
'After coming…at the inside of the house…'

MA3:

(223) *rī*^{n}*dū* *kulai-ge* *geyā* ... *rat̊* *kulai-ge* *gē* ...
yellow colour-GEN house.COM red colour-GEN house.GEN

geyā *dēterein̊ ?*
house.COM between.ABL
'…between the yellow-coloured house ... and the red-coloured house?'

MT1:

(224a) *rī*^{n}*dū* *kula* ... *rat̊* *kulai-ge* *gē* ...
yellow colour red colour-GEN house.GEN
'The yellow-colour…red-coloured house's…'

(224b)	*rat̊*	*kulai-ge*	*gē*	*uturun̊*	*mi=hirī*
	red	colour-GEN	house.GEN	north.ABL	DEM1=stand.PST.FOC

‘…by the north of the red-coloured house, here is…’

(224c)	*anek̊*	*dekunu*	*farātu*	*mi=hirī*	*gē*
	FILL	south	side.LOC	DEM1=stand.PST.FOC	house.LOC

‘…um, on the south side, this (man) is at the house.’

MA3:

(225) *hmm*

yeah

‘Yeah.’

MT1:

(226)	*nukume=gen̊*	*bēr-aṣ̊*	*vejje*	*bēr-aṣ̊*	*vejje*
	exit.CVB=SUC	outside-DAT	become.PERF.3	outside-DAT	become.PERF.3

‘After coming out (of the house), (he) went out, (he) went out.’

MA3:

(227) *hmm*

yeah

‘Yeah.’

MT1:

(228) *nimunī*

finish.PST.FOC

‘Finished.’