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Cultural influences on perception of disability and disabled people: A comparison of opinions from students in the United Kingdom (UK) Pakistan (PAK) about a generic wheelchair using a semantic differential scale

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Abstract

Assistive Technology (AT) product use occurs within a socio-cultural setting. The growth internationally in the AT product market suggests that designers need to be aware of the influences that diverse cultures may have on the societal perception of an AT product through its semantic attributes. The study aimed to evaluate the visual interaction with an AT product by young adults from Pakistan, a collectivist society, and the United Kingdom (UK), an individualist society. A paper-based questionnaire survey was carried out with 281 first-year undergraduate students from the UK and Pakistan to evaluate their perception towards the visual representation of a generic conventional wheelchair image. A semantics differential (SD) scale method was used involving a seven-point bipolar SD scale incorporating sixteen pairs of adjectives defining functional, meaning, and usability attributes of the product. The mean (M) and standard deviation (sd) values were obtained for each pair of adjectives and compared between both groups by employing appropriate parametric tests. The results show that having a diverse cultural background did not appear to have overtly influenced the meanings ascribed to the generic manual wheelchair, which was unexpected. The University 'Internationalist' environment may have influenced the results. Some minor but critical differences were found for some pairs of adjectives (bulky-compact, heavy-light), having p-value less than 0.05 ($p < 0.05$) that related to previous experience of wheelchairs and/or their use. Further studies are planned to investigate and validate outcomes with other student and non-student groups.

Keywords: Assistive Technologies, Communication, Diverse Cultures, Semantics, Visual Interaction, Visual Product Semantics, Wheelchair

INTRODUCTION

The motivation for this study is that one of the authors had been working as an industrial and graphic designer for ten years and a University lecturer for eight years in Pakistan. This led to the belief that artefacts are significant not just in terms of functionality, but also attributes, meaning and values, communicated through semantics and cultural coding. These features of visual language acquire more meaning and importance within the domain of Assistive Technology (AT) products. Assistive technologies are the devices that provide technology-based assistance, intended to compensate for or alleviate an injury, impairment or illness, or to replace a physical function [1,2]. This AT market sector is ignored by mainstream industry and design in Pakistan, resulting in a potential loss to the Pakistan economy [3]. The semantic attributes presented in AT products could be used to reframe an individual's or societal group's perception towards these products and the larger issue of their perception of disability. A further factor that motivates the research is that there is a dearth of research relating to semantics associated to the AT products, particularly when considering diverse socio-cultural environments [4–6].

In such diverse environments, culture acts as an independent variable when considering meaning and value systems that are altered by the social changes. Culture may be considered as a dynamic process that forms dialectic and integrates new meanings, while reshaping convention [7]. Therefore, culture influences on how individuals' form an opinion and respond to the information provided [8].

In literature, there are currently more than 300 definitions for the term *culture*, presented in many ways by different researchers [9–11]. According to Williams [12], culture is one of the most difficult word in the English language to explain precisely.

Many authorities consider culture as a broad concept, manipulating people's behaviour within a larger group [9]. Albeit, Ripat *et al.* [6] state:

“..culture refers to the beliefs, values, meanings and actions that shape the lives of a collective of people, influencing the ways people think, live and act, also these beliefs, values and ways of understanding are socially constructed and specific to the culture in which they are found..” [6,p.88]

From this perspective, on an individual level, culture influences the way information is retrieved, processed, interpreted and mediated by the receiver or a person.

Culture is an extensive concept to investigate, but one way to study it is by dividing diverse cultural values into individualism and collectivism [9,13]. By incorporating socio-cultural processes experts from cultural psychology have reported differences between collectivist (Asian) and individualist (Western) societies relating to perception and cognition. [for details and reviews see; ,14–19]. Based on their societal structure, Asian social groups are engaged in complex relationships with other members, shared values system, interdependent self-construal's, and thus exhibit group harmony. In this way, individuals from Asia see their behaviour relative to the others' thoughts, attitudes, actions and feelings [13–16,18,20]. Western social groups are relatively independent self-construal, demonstrate personal autonomy and self-reliance with less complex inter-relations than their Asian counterparts [14–17,20]. Their behaviours result from their own internal attitudes and feelings rather than stemming from other group members [14,20]. Individualism has been argued to be a dominant feature of Western societies, with Asian societies categorised as predominantly collectivist [13,15–18,20]. The two societies are different in terms of their formation of societal structures, which appear to lead to the development of distinct thinking (cognitive) styles.

Recent studies addressing cultural differences based on diverse cognitive styles of individuals from collectivist and individualist societies have provided some insights. By integrating socio-cultural aspects, Masuda *et al.* [15] postulates that there are two distinct cognitive styles: analytical and holistic. The analytical approach is typically for members of individualist (Westerns) societies who focus on (semantically appropriate) objects and their salient features rather than on the contextual information in a provided visual scene [15,17,18]. In contrast, the holistic approach is associated with individuals from an Asian societies, who mostly focus on the contextual information and the relationship between the visual scene and object(s) [15,17,21]. When viewing the visual stimulus and giving or assigning meaning, the differences of distinct cognitive styles become more relevant.

Culture also shapes the way people think about their own self and perceive others, and/or relationship of the two [14,19]. Corresponding to their dominant societal value, interdependent self-construal, individuals within the Asian (collectivist) society perceive an individual “not as separate from the social context but as more connected and less differentiated from others” [14]. They tend to focus on shared values systems, the opinion of others within their group and how their self-presentation appears to the rest of their society [19]. Individuals from a western society (individualist), hold a dominant independent self-construal that “involves a conception of the self as an autonomous, independent person” [14]. The interdependent or independent self-construal is more meaningful when considering a person who is disabled, and the AT products they use in daily living, and associated stigma within their societal group.

Stigma is a term used to describe a strong feeling of disapproval about something within a society and of which an individual is made to feel ashamed. Once the individual’s self-presentation does not matches with the anticipated societal norms,

this differentiate the individual or a group (disabled), causes disruption within social interactions [22]. A phenomenon labelled as stigma, an attribution assigned to an individual, when they are considered discredited or inapt in relation to social expectation due to some of their attributes [23,24]. It has its origins in the Greek word referring to a mark branded into the skin of criminals, slaves or traitors as morally polluted and to be avoided in public places [25]. The writings of disability activists and everyday observation suggest this ancient description of stigma can still be seen to be applied to people with disabilities in modern societies. When an individual has been tagged with stigma, the associated products inevitably inherit the negative connotations [26]. In this way the stigma, which is a socially constructed phenomenon [22,23], is shifted on to the associated AT products, often resulting in abandonment of those devices [27].

The World Health Organization (WHO) has stated that over one billion people (10% of world population) are estimated to have some sort of disability [28]. Meanwhile, changes in the world demographics indicates the rapid increase in number of elderly and people with disabilities [5,29] resulting in an increase in global demand for AT products. With an Annual Compound Growth Rate (CAGR) of 7% of the global Disabled and Elderly Assistive Technology (DEAT) market is anticipated to reach \$46,360.0 million by 2025, [30]. Internationally, wheelchairs are arguably the most frequently use AT product, which support the users to engage and participate in their community [31–33]. Currently, the global wheelchair market is growing and predicted to reach approximately \$6.1 billion by 2022 [34,35]. Thus, the number of elderly/people with disabilities and associated demand for AT products has been rapidly growing.

The rise of internet sales suggests the image presented online of any given product or service is critical to the consumer's understanding of that product. The

increased global market for AT products, such as a wheelchair, suggests the importance of understanding the product semantics (the meanings given or attributed to them in diverse cultures). There appears to be few published studies into the semantics given to the AT product related to the perceived product's values or meanings. The literature suggests there is a need to determine AT product meanings across different cultures [6] not only from users, but also non-users viewpoints [22,36]. There does not appear to be any published research related to the efficacy of a visual semantic representation of an AT product from non-user perspective. Understanding the visual semantics, the meaning, of the form of a manual wheelchair from non-users perspective may be beneficial to designers and manufacturers; towards the development of a product that best meets the user as well as societal expectations in the global markets [4]. Therefore, understanding the current perceptions of wider society (non-users) towards AT products from different cultures would appear to be essential.

This study has utilized a cultural lens to inspect and compare individual opinions and perceptions of the visual language (meanings) of an AT product, which has been argued as a vital aspect towards socially acceptable AT design [6,37]. Referring to the communicative component of the AT product, Shinohara *et al.* [22] suggests that socially acceptable AT product helps to improve social misperception of those products, an approach referred as *Design for Social Acceptance* (DSA). It is essential for AT product designers to be aware of societal norms, beliefs and values of what societal members expect (positivity/negativity) from AT products in terms of their semantic attributions. Similarly, how do those meanings fit into the particular socio-cultural environment [6]. The study offers a perspective that goes beyond the functional aspects of AT product, towards prioritizing social context in which the product will be used [22]. Additionally, this approach will be helpful in determining social stigma

(negativity) associated with the AT product, which in this case is a manual wheelchair.

Investigating a social group's perception of the AT product semantics could be imperative to inform those involved in AT product development to produce the products that best meet the needs not only of users, but also the society around them [6].

This study describes the perception of non-users towards disability and disabled people through the vehicle of a visually represented generic manual wheelchair. This parallels with the application of a more influential social model of disability [38,39], rather than medical model, which enables the authors to investigate disability by encompassing socio-cultural processes. Furthermore, through a cultural-psychology lens, societal perception of semantics given or ascribed to an AT product [manual wheelchair] has been compared between a collectivist (Pakistan) and individualist (United Kingdom) society. Socio-cultural constructs coupled with a marketing perspective have been used to develop theoretical framework. The aim of this study is to test an assertion that first-year undergraduate students from different cultural backgrounds would associate different values to a given image of a wheelchair and associated users of this AT product. To test this hypothesis, a Semantic Differential (SD) scale method is applied. The results and the efficacy of using an SD scale method have been discussed. The verb 'ascribed' used here in the context to indicate the assigned meanings, credits, attributes and features given by the person to a product based on their perception of it. Terminology and definitions associated with semantics and product semantics are described to provide a contextual framework within which the outcomes of the study may be viewed.

Product Semantics and Assistive Technology

A product performs practical function as well as communicative functions [40,41]. The communication theory within the domain of product design assumes communication as

a process between the designer and end-users, through several tangible or intangible attributes of the product [42]. In this way, a product becomes a physical representation through which designer intended message is communicated [42–44]. An artefact's communicative attributes are important in an offline marketplace that offers wide range of similar products in terms of functionality, quality and price. For this kind of market, a designer's attention is increasingly focused on visual characteristics of the products, as their functionality are often taken for granted [42]. Likewise, in recent global online marketplace, it is essential but no longer enough to offer just good functioning product. In visual product evaluation during online marketing, artefact semantics, ascribed meaning, plays an imperative role and provides a differential advantage [45]. Users from different cultures interpreting a product's semantics through visual interaction may employ different preferences and bias. Therefore, an effective design demands consideration of cultural variations in the visual interpretation of an artefact. Also, it should have design element(s) that accommodate the approaches, viewers of different cultures will take in during their interpretation [46]. Albeit, these views are more valid in purchase practice, when considering user's perspective of their opinion of semantics, ascribed with AT products.

To understand the impact of culture on social interaction, the literature regarding artefact and cultural meaning of objects has been reviewed. Material culture refers to an approach through which individuals derive cultural meaning, values, and associations from tangible artefacts [47,48]. Cultural meanings ascribed to the artefacts continually unfold during an interaction and rely on the context within which they are understood [49,50]. Distinctive cultural settings may give or assign different a meaning to the artefact, such as societal values and beliefs systems or doctrine that are likely to result in a changed in meaning(s) associated with the product [51].

Pape *et al.* [36] reported that investigating the meanings and significance of AT products were imperative determinant affecting its use or abandonment. Furthermore, they [36] revealed that the cultural and psychosocial issues serve as a stimulus in shaping ‘individualized’ meanings given or assigned to AT products. Ripat *et al.* [6] have conducted research that investigates the importance of culture in relation to the concept of disability and meanings of the AT products. In their exploration, Ripat *et al.* [6] present several purposes of AT products and emphasize that each purpose is culturally defined, which needs further investigation. Considering the culturally defined meanings of AT products, the manual wheelchair may be seen as the most widely used AT product across many communities and its function of assisting mobility commonly understood. In this context, it is important to check the semantics, the meanings, of a wheelchair image in diverse cultures such as individualists and collectivist societies.

The meaning of artefacts, often termed as product semantics, has been extensively studied through a variety of objects. In the early eighties, Klaus Krippendorff and Reinhardt Butter stated product semantics as;

“the study of the symbolic qualities of man-made objects in the context of their use and the application of this knowledge to industrial design” [52,p.4].

From this definition, it would appear the ascribed meaning, and associated value or status, of a product are always within the cultural context in which a product may be used [53]. Semantics offers the designer an opportunity to communicate attributes of social and cultural functionality beyond physical function or cost of the product. Also, designers may use product semantics as a driver to improve interaction between the user and artefact/product [41,52,54–56].

Online sales are becoming an essential part of international trade, with AT products being part of this relatively recent trend. Online sales currently limit the user to

visual interaction with a product [57]. The lack of physical interaction between the buyer and seller may influence their interaction [58]. However, during this limited interaction one major component that contributes towards a product's successful purchase is visual product semantics [45].

From sociological perspective, given evidence supports the need to study cultural differences between collectivist and individualist societies. As Ripat *et al.*, [6] state that people who live in individualist societies (such as the UK) are characterised as gaining mastery, control, self-sufficiency and predominantly independence. Whereas, people from collectivist societies are more focused on developing social relationships, community, sense of belonging and interdependence [59,60]. Furthermore, Norman [61] points out that in the individuals of collectivist societies (Japan), prefer the aesthetics and beauty of products rather than usability when compared to individualist societies (Israel). Considering those differences between value systems of both societies, it can be hypothesised that there exists the significant difference of the opinion of members from individualist (UK) and collectivist (PAK) societies towards product semantics given to the manual wheelchair. The proposed research elicits insights about cultural differences (if any) between the individualist (UK) and collectivist (PAK), their societal views towards meaning ascribed to the visual representation of manual wheelchair. From this objective, the study gain insights into the perception of these two groups towards disability and disabled people. A survey using a questionnaire coupled with a semantic differential scale was used to probe the semantic qualities of the product form, within the context of a university in the UK and Pakistan.

Semantic Differentiation (SD) scale

The Semantic Differentiation (SD) scale is frequently used method to measure product semantics, significance, connotative or symbolic meaning, and even the attitude of

individuals towards other individuals or the objects [62–65]. Originally, proposed by Osgood [63], this method measures individual's perception of concept(s), typically on a seven-point bipolar rating scale [64,65]. The semantic attributes of subjects are presented by pairs of antonymous adjectives which lie at the polar ends of SD scale [65,66]. Participant's perception about the concept(s) are quantified on the scale, usually one (1) to seven (7), in relation to the two adjectives. Corresponding responses with higher ordered numbers reflect positive dimension and vice versa, where middle value (4) represents the neutral position [64,65,67].

In SD scale, Osgood [68] presented factorial analysis based on three domains; evaluation, potency and activity, that were confirmed by previous pan-cultural studies [68–70]. Evaluation relates to goodness or badness, morality, utility; potency to magnitude, social power, strength, expansiveness; activity relates to speed, animation and spontaneity [70]. The SD scale typically focuses on three meaning dimensions that were found recurrent in attitudes that individuals used to appraise given words and/or sentences [4].

The scale was originally developed for use in psychology-based studies but was rapidly adopted by other disciplines. For example, in consumer behaviour studies many marketing surveys adopt the SD scale method to appraise their products or services [65]. The method can also be used to determine social attitudes through the bipolar perimeters of a semantic space (antonymous adjectives) [65]. Researchers have employed this method to study specific product's element including styles, shapes, colours and other related attributes. Alcántara *et al.* [71] compiled many applications of the SD scale including; facades, telephones, doors, office chairs, car interiors and applied their SD scale to footwear design. Hsu *et al.* [72], applied an SD scale when conducting a telephone-based study comparing the perception of a product form with a

group of designers and users. Petiot *et al.* [66] presents a general approach to assess product semantics, and exploits SD scale to inspect semantic attributes of the concept (table glasses). Aros *et al.* [73] integrates factorial dimension in SD scale to study social group perception of the concept (educational equipment). The SD scale was found to be a valid and reliable tool to address and inspect product semantics [71]. The outcomes obtained through explorations employing SD have been used to help designers, analyse and evaluate consumer behaviour, leading to the synthesise of more precisely targeted products [73].

Recently published literature has demonstrated the potential of the SD scale to explore an individuals' perception towards an AT product and associated users. Davis *et al.* [74], conducted a comparative study between African Americans and Caucasian, to explore the impact of using AT product [hearing aid] on the social group (female opinion about male) perception. The authors used the SD scale and concluded that females of both regions responded differently towards males when wearing their assistive devices [74]. The knowledge and attitude of public health educators towards assistive technologies has also been evaluated through the use of the SD scale method [75]. Some studies founded to adjust the SD scale in accordance to inspect their particular research interest. In an image-based exploration, Fellinghauer *et al.* [76] investigated the perception of able-bodied participants towards a wheelchair user in term of six dimensions (*communicability, competence, attractiveness, intelligence, industriousness and popularity*). By developing a similar method called, 'Photo Elicitation Semantic Differential (PESD)' scale, the researchers' expanded the SD scale method into an effective and reliable instrument for evaluating social perception of disability [76]. Lanutti *et al.* [4] applied SD scale to investigate the influence of gender on the user's perception towards the significance of their manual wheelchair. The

authors found differences between the male and female wheelchair users; male perceptions about their wheelchair were more positive than those of the females [4]. In order to investigate the influence of stigma ascribed to a manual wheelchair, Carneiro *et al.* [77] employed SD scale within a virtual environment experiment. The study did not find any substantial differences for aesthetic and emotional variables when considering diverse contexts or communication formats [77].

The studies cited have successfully used the SD scale method to analyse individual's perception of assistive technologies and their attitude towards people living with disability with able-bodied as well as disabled participants. This validated the application of an SD scale method for this study.

METHOD

This preliminary study utilized cross-cultural surveys with the UK and Pakistan respondents based on SD method and aimed to compare their responses that might lead to significant differences towards meanings ascribed to the wheelchair.

The desk-based survey was conducted in Higher Education Institutions (HEI) in Pakistan and the United Kingdom. Ethical protocols were followed throughout this study and ethical approval was given by the two Institutions involved and consent given by all participants [78]. The questionnaire was organized into three sections: basic demographic questions followed by a pilot SD scale, indicating adjectives relating to attributes of envisioned user of the manual wheelchair. The second section comprised of sixteen (16) pairs of antonymous adjectives, placed on a seven-point bipolar scale that defines 'positive' and 'negative' dimension of the product. The third section was designed to inspect personal evaluation of participants of using a manual wheelchair for themselves.

In order to measure semantic attributes of a wheelchair through SD scale, this research adopted semantic differential scale as outlined by Lanutti *et al.* [4] with added adjectives. For this SD scale sixteen pairs of adjectives were loaded on three well-defined factors, viz.; the evaluation, activity and potency as proposed by Osgood *et al.* [63]. As the resulted dimensions (evaluation, activity and potency) may be named accordingly, but the factor naming is always a personal decision; therefore, more suggestive expressions were used for this study. The first factor, evaluation, received the name “function”, as it expressed more functional attributes of the wheelchair. The second dimension, potency, was named “social value” including adjectives which described social association of respondents with the product such as desirable-undesirable, outdated-modern etc. The third factor, activity, altered to “usability”, being described by adjectives such as complicated, difficult-to-use, and effective. The chosen pair of adjectives with their factorial tagging are represented in figure 1.

[Figure 1 here]

To evoke the participant’s response towards the semantics of the product, a wide-range of images of manual wheelchairs were reviewed. This provided the authors with comprehensive evidence of current practices (online selling) available in both United Kingdom and Pakistan societies. The basic visual of the product (manual/attendant wheelchair) was carefully specified, to be applicable and understood within both societies, with minimal bias through communication of other features such as performance. The visual stimulus was intended to be as neutral as possible with respect to culture and socio-economic status. This was achieved by reducing visual variables, (detail of wheelchair user, background information), thereby, focusing attention on the wheelchair product. This also eliminated a range of issues associated with other influences such as user age, gender, clothing/style; and, environment,

(indoor, outdoor, hospital, domestic, cultural centre), that would have been found to be notably different in both countries. With an intention to provide a visual reference for scale and proportion of product, a gender ambiguous outline of an attendant was used.

A consensus of visual attributes of commercially available manual wheelchairs were combined within the generic wheelchair product and presented on a plain white background. The generic image was non-coloured, using grey tones to define contours and three-dimensional form. Krippendorff [79], referred to semantics as a study of symbolic qualities of product *form*, hence, constraining authors use of colours, materials, texture. The three-quarter view chosen to represent the wheelchair combines the “front”, “side”, and “top” views of an object, is often used in computer vision studies [80].

[Figure 2. Here]

The survey was conducted with first-year undergraduate students (N=281) from Loughborough University (England, UK) and University of Engineering and Technology (Punjab, Pakistan). The selection of students as sample provided dual benefits for this research. Each university comprised of students from various regions of the country that makes an easy access to participants representing different regions. Secondly, the university students understood a common language (English), which could have been an additional barrier between two diverse cultures. A potential bias was that a university environment may have an impact on the student’s home life beliefs, which may influence or alters the cultural values of the students. To minimise this potential bias, a cohort of first-year, first semester undergraduates were identified as having been least influenced by a university environment. The narrow age range was also seen as helpful for this initial study, to further reduce variables, such as age or age-related impairment.

In both case of the UK and Pakistan surveys, respondents were provided with a set of papers including; participants' information sheet, informed consent form and questionnaire in sequence. Prior to data collection, participants read the conditions described in the information sheet and signed informed consent form that had been approved by the ethics committee of both universities [78]. In addition to the participants' information sheet, verbal instructions were also briefly provided in classroom where the survey was conducted. The participants were informed about the purpose of the survey and explanation about the basic structure of the questionnaire. In the paper-based questionnaire, participant's responses were elicited by semantic profile (visual) followed by the semantic scale. The respondents were advised that they could take appropriate time to mark their response on the scale, but that a spontaneous and intuitive response were recommended.

A description of each participant's socio-economic or demographic profile was not an objective of the study, but this personal data was intended to provide a basis for comparing sub-groups to which participants belonged. In last section of survey, questions were asked about the participant's experience of interacting with wheelchairs. This was to see if there was a bias of preferences due to having previous experience of this form of AT product.

All questionnaires were screened, with incomplete or inaccurately completed surveys were excluded. Inaccuracies were considered for responses with two or more missing SD scale answers. Also, the participants with nationality other than the UK or Pakistan were excluded from the analysis.

The questionnaire data were imported into the spreadsheet complied in Microsoft Excel 2010 and processed using the Statistical Package for the Social

Scientist (SPSS) software (IBM Corp., Armonk, USA.). The overall mean (M) and standard deviation (sd) values of both groups were statistically analysed.

The statistical tests Shapiro-Wilk and Independent t-test were used, as advised by a statistician. Although, the violation of normality assumption should not create major problems when sample size is large enough ($n > 30$) [81], yet the reliability tests were done to ensure appropriate selection from parametric and non-parametric tests. The Shapiro-Wilk and independent t- test were performed on response values for both data groups (16 times in each SD scale). Shapiro-Wilk assessed the normality of the responses from questionnaire data. An independent t-test was used to compare mean values of each adjective from one group to another. The results were considered as statistically significant if the significance or reliability value (p-value) was less than 0.05 ($p < 0.05$). Graphical representations of the results were produced using Adobe Illustrator CS6 computer program.

Descriptive statistics tests were performed by using Microsoft Excel software to obtain minimum (Min), maximum (Max), standard deviation (sd) and mean (M) values.

RESULTS

The complete dataset collected from this study can be accessed via Figshare [82]. 281 questionnaires were collected from the participants. After exclusion of incomplete and or inaccurate responses a total of 228 (81.14%, 114 questionnaires from each group) were included in the analysis.

Most of the respondents from the UK were male (66%) in comparison to female (34%), while in Pakistan this ratio was inverted, where the female (68%) were greater than male (32%). Participants from both groups were of similar age. The UK respondent's age range was between 18 to 25 years old (average 18.7) and age of

participants from Pakistan was between 18 to 22 years old (average 18.6).

[Table 1. Here]

As a part of participant's demographic information, the UK respondents were from different cities across England. There were no students from Scotland, Wales or Northern Ireland. Respondents in Pakistan were all from various regions of Punjab. In response to the question regarding religious practice, all respondents from Pakistan marked 'Islam' as their practicing religion. Most of the UK participants appeared not to practice or follow any religion (73%). Following this, Christianity was cited as the practicing religion for rest of the participants in the UK (27%). For both groups all participants were the able-bodied; no participants in this study were reported as a permanent wheelchair user and most respondents had never used a wheelchair for themselves. However, some respondents were found to have had previous experience of using a wheelchair (4% in the UK and 5% from Pakistan). 43% of participants from Pakistan had stated that they had helped a wheelchair user; this percentage was 23% in the UK.

From responses of SD scale representing the product attributes, descriptive statistics, minimum (Min), maximum (Max), mean (M) and standard deviation (sd) values, were obtained and presented in table 2.

[Table 2. here]

Overall, for both cultural groups (Pakistan and UK), a contrary response was noted in some pair of adjectives indicating the functional attributes of the wheelchair. Participants from the UK perceived the product as 'light'; the respondents from Pakistan, perceived the product as heavy. The pairs of adjectives such as light-heavy, dynamic-static, compact-bulky, indicated similar differences. Furthermore, the

independent t-test in factorial category (functional aspects), adjective small-large, also represented statistical differences (where $p < 0.000$). Figure 3 exhibits the pairs of adjectives with shaded areas, where statistical differences were found. Reference to the neutral value (4) the graphical representation (Figure 3) showed the difference exists with greater and lesser degree of variation between the responses of both groups.

[Figure 3. here]

For most of the adjectives in the factor group, indicating the social value or meanings of the wheelchair, statistical differences were discovered from independent t-test. Considering the mid-value as neutral position, responses of both groups for adjectives were found to have differences to a greater or lesser extent. For example, the adjective desirable–undesirable the UK respondents considered the wheelchair to be undesirable with as greater strength as that of the participants from the other group. Though showing statistical differences, almost all variables in this category followed a similar trend. For pair of adjectives signifying the usability facets of the product, no statistical difference was noted. Figure 3; represent a comparison of mean (M) and standard deviation (sd) of both groups. Even though, there were statistical significance differences, having p-value less than 0.05, the nature of differences did not suggest totally conflicting responses. Overall, the independent t-test was performed, resulting p-value 0.615 ($p > 0.05$). Although minor conflicting differences were noted for some pair of adjectives, but the reliability value for overall groups suggests and supports that no statistical difference exists between responses of both groups.

Figure 4 shows comparative analysis of overall responses with their corresponding reliability values. The pair of adjectives having reliability value less than 0.05 presents statistically significant differences, those of indicated by shaded rectangles in Figure 4. Again, rather than contrasting responses of both groups, for most

of the adjectives statistical differences were found to greater or lesser degree of variation. However, two pair of adjectives (heavy–light, bulky–compact) found to have contradictory responses between both cultural groups. Based on these two variables the overall findings cannot be generalised, but these contrary responses suggest that studies (incorporating more adjectives showing functional attributes) are required to investigate this concern further.

[Figure 4. here]

Corresponding to the numbers of male (N=111) and female (N=117) respondents, the data was analysed to ensure that the response data would reflect any variation based on the gender. This concern was noted by Lanutti *et al.* [4] who suggests investigating gender-related differences towards the symbolic meaning ascribed to the manual wheelchair image by non-users [4]. In results for adjectives related to functional characteristics of the wheelchair, statistically, no significance differences were found between the response of male and female. This suggests the appropriate level of understanding of participants regarding functions of the wheelchair.

Participant's gender did not appear to influence the perception of an individual when considering the functional attributes of the wheelchair. There were some interesting outcomes regarding social value and meanings of the product. In pairs of adjectives related to social aspects, males more negativity rated the wheelchair when compared with females. This occurred for the pair of adjectives titled 'outdated–modern', 'beautiful–disgusting', 'stylish-unstylish', (Figure 5). These findings do not match with the outcomes of the study conducted by Lanutti *et al.*[4] that attributed the male perception is more positive than female for practical and symbolic functions of the wheelchair. However, in their study, gender of both groups were wheelchair users [4].

This may have influenced the finding of that study, as the user perspective towards the wheelchair was probably developed by incorporating many other socio-cultural and/or environmental factors. In terms of social value and meanings of the product, Table 3 presents M and sd values based on the gender of participants.

[Table 3. Here]

It can be concluded that the functional aspects of the product viewed had no difference in response related to the gender. However, the associated meanings of the product, related to disability and disabled people, variations were found based on gender responses. The shaded pair of adjectives in Figure 5 represents those statistical differences.

[Figure 5. here]

In addition to the comparison based on the gender, participants in this study were generally adults with limited age groups (18-22). For this preliminary study, a total of ten (10) participants (UK=04, PK=06) responded to have previous experience of using manual wheelchair for themselves. Previous experience of interacting with product may have an important impact in the formation of perception about the wheelchair, disability and people living with a disability [83]. Their responses were compared to ten (10) randomly selected participants having no experience of using the wheelchair. The following table (Table 4) shows the M and sd values having obtained from responses of those groups.

[Table 4. Here]

With regards to adjectives representing practical aspects of the AT product, one adjective (light–heavy) was found to have notable difference between the responses in these two groups. However, the independent t-test for majority of adjectives showing

the meaning and usability of product were discovered to have low reliability for differences statistically (compiled in Figure 6). Additionally, the responses given by participants with previous experience suggests their positive perception as compared to participants with no experience of interacting with product. Cook and Polgar support that previous experience influence the formation of perception and says that;

“Past experiences influence meaning and perception of a current situation. A person comes into a situation with an established “lens” forecasting his expectations in that situation.” [83,p.65]

Differences were highlighted between the participant’s responses of those having previous experience compared to those who never interacted with the product. However, the small size of the sub-sample of participants with previous experience restricted the generalization and statistical validation of the findings. Further investigation is necessary to test and generalise these results with larger sample size and different age groups.

[Figure 6. Here]

DISCUSSION:

This study brought up some underlying questions and interesting insights. To analyse the semantics, the meaning, of a manual wheelchair, two diverse cultural groups were chosen to represent collectivist (Pakistan) and individualist (United Kingdom) societies. By utilizing the seven-point bipolar Semantic Differential (SD) scale, questions were asked of participants perception of the product [manual wheelchair]. Based on the methodology, corresponding qualitative and quantitative data results were produced. Those findings were categorized into various themes (adjectives defining functional, social value and usability element of the product, associated positivity _ negativity,

male _ female, participants having previous experience compare to those with no experience of using wheelchair), on which statistical assessments were performed to further validate the findings. Overall, no substantial differences were noted between the responses in both cultural groups. However, there were minor variations for some pairs of adjectives indicating functional attribution of the product (light–heavy, dynamic–static, compact–bulky). These trivial differences indicate the underlying issues that needs to be addressed with larger sample population in future studies.

This study of two social groups' perception towards disability and people with a disability, through the vehicle of an image of a manual wheelchair, has provided an inconclusive result. The evidence does not enable the authors to explore in more detail the reasons for minor differences noted, but it reveals that the meaning ascribed to the wheelchair as perceived by the non-users depends on many factors, where gender being one having significance.

This initial study using mixed methodology brings some limitations. The contentious concern of selecting appropriate adjective to use in SD, which may influence the results, remains an important consideration. In particular there is some uncertainty in the results for some pair of adjectives, for instance, expensive to inexpensive, is on some continuum. While, the SD scale technique has some merits, it challenges and expands the dimensionality of selecting appropriate adjectives for the subjects. The integration of Principal Component Analysis (PCA), a procedure to reduce dimensionality of semantic space (highly correlated adjectives and underlying dimensions are revealed), could be an effective approach to deliver relatively more appropriate adjectives [57,63,64,66,68,76,84,85]. However, the sample size was too small to attempt PCA into this first study.

The generalisability of these results is subject to certain limitations. Firstly, the population considered for this study belongs to university students, which does not necessarily represent the entire culture or society. Secondly, a key aspect of this study was to determine cultural influences on the individual's perception, which may be impacted/altered by the university environment. To minimize those potential biases, a large number of new cohort, first-year undergraduate students, representing various region of societies, were considered. Likewise, compared to other students, the new cohort of students were identified as having been least influenced by the university environment. Lastly, the limited age range of participants (18-22 years old) shortfalls to generalize the findings. This consideration (age) may influence the individual's perception of the product, as elder members may exhibit relatively more embedded socio-cultural values compare to young people. This can be addressed by incorporating the participants of different age groups from both societies. Moreover, a larger sample population could permit a more encompassing inspection of individual's viewpoint of semantics attribution, to be compared between both cultural groups.

Variations between male and female responses, and those with previous experience of interacting with a manual wheelchair, did not overtly influence the preferences of the participants. It was not possible to investigate how gender and previous experiences influenced the formation of perception towards AT product further because the sample size was too small. Again, with a small sample size, caution must be applied, as the findings might not be transferable to the entire population.

A further larger online survey will be accomplished with wide-ranging population of both cultural groups, by incorporating proposals to improve SD scale. Additional areas for future research may include; investigating the processes involved in the formation of individuals' perception, when attending the visual representation of a

manual wheelchair. Further explorations inspecting the viewing behaviour of participants may also prove to be advantageous. For instance, when viewing the visual representation of a manual wheelchair, did the participants prefer to look at the specific components of the product, or, they rely on their intuition when assigning meaning to the artefact? Comparing the viewing pattern of individuals from both cultural groups may be insightful to understand their visual behaviour. Moreover, considering various age ranges of members from both societies about their perception towards semantic attribution of an AT product may prove useful. Future research may also explore, when assigning semantic attributions to the AT products, differences/similarities are observed among students compare to the social members opinions. Finally, studies may include supplemental questions regarding AT product user group's perception compare to the non-users, of semantic attribution, from the viewpoint of pan-cultural intervention.

CONCLUSION

The aim of this research was to evaluate the perception of an able-bodied group from culturally diverse (Pakistan and United Kingdom) countries towards semantics ascribed to a visually presented generic manual wheelchair. The first section of paper-based survey indicates, that there was no notable difference of the preference between the participants of both cultural groups towards the envisaged user of the manual wheelchair. In both cultural groups, respondents perceived the envisioned user of the manual wheelchair to be old, disabled, dependent, shy, and incompetent. The second section of the survey revealed that the semantic comprehension was relatively different for the participants of both cultural groups. Statistical differences were noted for majority of adjectives indicating the functional and social attribute of the product (bulky-compact, heavy-light, outdated-modern, desirable-undesirable, beautiful-disgusting, stylish-unstylish etc.). Unfortunately, the significant value (p) of

independent t-test for overall groups was remained ($p=0.615$), supporting a null hypothesis and indicating no reliable difference exist between the responses of both groups. Minor conflicting responses in the opinions from both cultural groups were found, which might indicate the underlying issues that would be more explicit in non-university-based cohorts.

This study indicates that diverse cultural backgrounds are not as substantial for the meanings ascribed to the manual wheelchair during visual interaction, particularly for able-bodied University-based adults. However, the result provides some small, but critical differences of individual perception suggesting an awareness of cultural cognitive styles may be important for product adaptation in a global market. Moreover, based on those differences and to generalize the findings of the research, it is important to conduct more studies on larger scale within different society. Whilst a ‘null hypothesis was achieved; the study suggests that it is worth conducting the survey with new cohort of students from a different collectivist and individualist society to determine the extent to which a consistent view is obtained. An interesting outcome from university-based cohorts is that a university environment would appear to encourage an International normalization of views and doctrines of its members. The collegiate and ethical standards of the environment of most universities across the world would appear to influence the staff and students towards a similar viewpoint; in effect creating an ‘Culturally internationalized bubble’ within any society in which the university is based. If a national or regional societal response is required, researchers must look to non-university participants.

The study appears to have in-directly indicated the influence universities have on a society and internationalism, as the many thousands of students trained within these Institutions leave to work within national and regional societies.

The authors welcome further discussion and debate on this topic and collaboration internationally in undertaking further studies.

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Implications for Rehabilitation

The semantic attributes of assistive technologies highlight a number of aspects that have implications for those involved in Assistive Technology (AT) product development, manufacturing and marketing.

- For online sales, the AT products rely on the web page image to communicate the purpose and attributes of the product. There are limited explorations related to the semantic/communicative attributes of AT product presented in images, as perceived by individuals from diverse cultural backgrounds.
- The knowledge towards semantic meaning ascribed to the AT product is important to investigate to provide a perspective that goes beyond practical functions of the AT product towards the communicative function.
- Information of comprehending semantics and significance of the AT product from a social (non-users) viewpoint may benefit manufacturers in the development of AT products that best meet the societal needs, preferences and expectations.
- A model of best practice, with a focus on semantic manipulation will offer Industrial Designers (ID) internationally with the suitable process and tools to reframe perceptions of disability and enhance acceptance of AT products not only for users, but also for the society around them.

Factor	Adjective	Opposites
Evaluation/Functional	Weak	Strong
	Light	Heavy
	Dynamic	Static
	Compact	Bulky
	Small	Large
Potency/Social Value	Expensive	Inexpensive
	Outdated	Modern
	Desirable	Undesirable
	Beautiful	Disgusting
	Standard	Customised
	Stylish	Unstylish
	Negative	Positive
	Including	Excluding
Activity/Usability	Complicated	Simple
	Difficult to use	Easy to use
	Effective	Ineffective

Figure 1: Adjectives with factorial category for SD scale representing product meaning

Figure 2: Semantics profile (left) and the semantics space with 3D axes proposed by Osgood (adopted from: Aros & Aros, 2009)

Figure 3: Comparison of M and sd values of responses for Pakistan and UK

Figure 4: Illustration comparing mean values (SD scale evaluating semantics of product)

Figure 5: Comparison of responses M values based on gender (having difference between male and female responses)

Figure 6: Comparison of responses having previous experience of using wheelchair and those without any experience

Table 1: summary of basic and demographic profile of respondents

Basic Information	United Kingdom	Pakistan
Total participants	114	114
Male	75	36
Female	39	78
Age limit	18 to 25	18 to 22
Average age	18.7	18.6
Participants demographic Information		
	England	Punjab
Participants (with practicing religion)	31	114
Participants (with no religion)	83	0

Table 2: descriptive statistics of both groups for SD scale evaluating semantics of product.

About the product (Pak)					About the Individual (UK)			
Min	Mean	Max	sd	Pair of Adjective	Min	Mean	Max	sd
1	4.30	7	2.09	Weak/ Strong	1	4.3	7	1.5
1	4.35	7	2.15	Complicated/ Simple	1	4.25	7	1.5
1	4.09	7	1.7	Expensive/ Inexpensive	1	3.99	7	1.4
1	3.99	7	1.83	Outdated/ Modern	1	2.67	7	1.38
1	4.51	7	1.97	Difficult to use/Easy to use	1	4.03	7	1.66
1	3.92	7	1.89	Light/ Heavy	1	4.75	7	1.44
1	3.52	7	1.81	Dynamic/Static	1	4.26	7	1.48
1	4.68	7	2.01	Desirable/ Undesirable	1	5.95	7	1.23
1	3.67	7	1.81	Compact/Bulky	1	5.24	7	1.38
1	3.28	7	1.82	Effective/ Ineffective	1	3.11	7	1.33
1	4.54	7	1.67	Small/ Large	1	5.18	7	1.01
1	4.33	7	1.58	Beautiful/ Disgusting	1	5.04	7	1.12
1	3.57	7	1.64	Standard/ Customised	1	2.21	7	1.46
1	4.40	7	1.65	Stylish / Unstylish	1	5.73	7	1.21
1	4.41	7	1.9	Negative/ Positive	1	3.42	7	1.23
1	3.96	7	1.42	Including/ Excluding	1	4.23	7	1.42

Table 3: Comparison of M and sd values of responses based on gender

Pair of adjectives	Response from male		Response from female	
	<i>Mean (M)</i>	sd	<i>Mean (M)</i>	sd
Out-dated/ Modern	<i>3.01</i>	1.65	<i>3.63</i>	1.78
Standard/ Customised	<i>2.57</i>	1.69	<i>3.20</i>	1.64
Stylish / Unstylish	<i>5.28</i>	1.60	<i>4.86</i>	1.56
Negative/ Positive	<i>3.60</i>	1.56	<i>4.21</i>	1.73

Table 4: Comparison of responses based on previous experience of the wheelchair

Pair of adjectives	Response from having previous experience of using wheelchair		Response from having no previous experience of using wheelchair	
	<i>Mean (M)</i>	sd	<i>Mean (M)</i>	sd
Light/ Heavy	<i>4.50</i>	1.65	<i>6.00</i>	0.94
Small/ Large	<i>4.10</i>	1.97	<i>5.10</i>	1.10
Out-dated/ Modern	<i>4.10</i>	2.02	<i>3.90</i>	2.33
Desirable/ Undesirable	<i>4.60</i>	2.17	<i>5.20</i>	1.62
Stylish / Unstylish	<i>4.40</i>	1.65	<i>5.00</i>	1.25
Complicated/ Simple	<i>3.90</i>	2.13	<i>5.00</i>	1.70
Difficult to use/Easy to use	<i>4.40</i>	2.01	<i>3.80</i>	1.75
Effective/ Ineffective	<i>3.70</i>	2.11	<i>2.50</i>	1.08