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Method& Critique *Frictions and Shifts in RTD*

The Parameters Required to Support a Woman in Motion

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Abstract

'A Measurable Factor Sets the Conditions of its Operation' is an on-going research project and series of publicly exhibited materials originally developed through the Stanley Picker Research Fellowship at Kingston University. This paper outlines the method, process and contextual underpinnings of the project, which aims to rethink the ways in which shoes are designed by shirking traditional approaches. It instead employs an engineering method based on structural parameters, informed by biomechanical factors, required to support a high-heeled foot while in motion. Through continuous critical reflection on the method as it was being developed, I identified areas of study necessary to understand and unpick the gendered connotations of the high-heeled shoe, which in turn informed the artistic framing of the project and additional filmic work. In so doing the work expands on the discourse surrounding high-heeled shoes and the gendering of different disciplines and objects.

Keywords: Research Methodology; Gendering; Shoe types; Cultural Connotations; Contextualising; Identity

Marloes ten Bhömer | Bluepanelshoe

Introduction

Both mass-manufactured and traditionally crafted shoes can be broken down into the following components: The upper, the soles (the inner and outer sole) and the heel. The regimented component construction process, or the method of assembly by which shoes are made, leads to a type of design that may be referred to as 'the sum of its constituent parts'. There are exceptions to the rule, such as mono material footwear, footwear produced though alternative technologies such as rotational moulding, or 3D printing (previously explored through my practice), and there are creative approaches to the traditional methods, since each component can be different/divergent in shape, material or size, as long as they can be attached together. But in essence the time-honoured assembly of a shoe is as follows: The outsole and heel are fixed (glued, stitched, taped, nailed, screwed, direct moulded etc.) to the upper. [4] Because of the rigidity of this process, it makes it difficult to rethink or instigate a complete overhaul of the shoe 'type', and so new shoes are rendered merely as variations on a theme.

It doesn't seem to be in the interest of trend-led fashion to challenge shoe typologies. While much has changed in fashion since 1937, Agnes Brooks Young's central argument from *Fashion has its Laws* still resonates: "We know that fashion outmodes previous styles each year, so there must be a continuous change under way. We know this continuous change must be relatively slow because only the initiated can recognise the differences from one year to the next. Finally, if fashion in dress is a slow continuous change, outmoding each year that which had general acceptance, and substituting for it something slightly different, then there must of necessity always exist a typical expression of fashion, or a typical style, on which the changes are operating." [12]

These 'typical expressions' are constantly, relentlessly, being reinterpreted, recontextualised and re-referenced. One ubiquitous footwear type, the brogue, perfectly illustrates this consistent contextual shifting: The brogue originated around 1580 in the farmlands of Scotland and Ireland and was constructed using perforated, un-tanned leather, allowing water to drain out of the shoe when crossing wet terrain. The shoe has hardly changed in form and material since its inception, but the original function and cultural and physical placing (namely on men in the country) have been relocated completely. Already from the end of the 19th century the brogue was considered a formal business shoe, and from the 1920's it was acceptable wear for women. You would now be laughed at if found trudging through a wet field in a pair.

Footwear types, much like garment types, fall into an array of 'hardened' style categories that remain limiting in both form and as markers of identification. Most shoe styles could even be described as clichéd, and as a result the women that wear them can be perceived to conform to a set of restrictive roles. A primary concern, one which helps to inform the project's aim, is with this limited and limiting scope of identification. While the method of consistently re-referencing and re-contextualising types has produced complexity and nuance within fashion-constructed identities, this approach is not conducive to creating new identities and codes of meaning, and thus broadening what fashion can speak of.

Design Methodology, Research and Testing

A Measurable Factor Sets the Conditions of its Operation is an on-going research project and series of publicly exhibited materials originally developed through the Stanley Picker Research Fellowship (2011-2013) at Kingston University. The initial works were presented in an exhibition at the Stanley Picker Gallery in 2013, under the same title. Displayed throughout the exhibition were artefacts from a series of structural, aesthetic and cultural experiments and outcomes, aimed at expanding the scope of footwear typologies, and the discourse surrounding high-heeled shoes. While the project has broader objectives, for the relevance of this conference I will focus primarily on the process by which I came to develop new footwear typologies. With this in mind, there are two characteristics to the project which might cloud a reading of the research methodology: The process itself presented in the gallery as an artwork, and the framing of the method (and in turn, the process) as a critical reflection on the gendering of different disciplines and objects. As such, some choices made in the rendering of the research, design and production were deliberately shifted towards telling this story in an engaging, convincing and sometimes subversive manner. The process and design choices underpinning the project should therefore be understood in relation to these broader objectives.

Lets begin at the beginning. What is a shoe? More specifically, what is a high-heeled shoe? And even more specifically, what is a high-heeled shoe void of any cultural connation and understood solely as a functional object? My first step was to try to define it, resulting in the following text, presented in the gallery as a wall-based art work titled *Parameters* (2012).

> "A high-heeled shoe is a circumscribed cavity, a support structure, impermanently fixed and positioned around a human foot in plantar flexion (avoiding any direct skin contact with the ground - a relatively solid, straight and level substrate), able to bear dead and dynamic loads restricted to the combined weight of three variables: The wearer, that which the wearer supports, and the shoes themselves, either in stasis or in ambulation."

With this definition in mind, and rejecting the standard, regimented approaches and limiting parameters of the shoe industry as described above, I started from scratch to rethink the method by which shoes are designed. Employing processes drawn from an engineering approach, I set out to design a collection of footwear pieces informed by research into the structural parameters required to support a foot, in a high-heeled position, while in motion. This method purposefully shirks the existing footwear configuration of assembled parts, fashion trends and styles –that which architect and design theorist Christopher Alexander might refer to as "the chosen formal order". [1] Applying an engineering process to the design of footwear, I imagined, could allow me to create radically different shoe typologies. Congruently, such an approach would foreground the perception that high-heeled shoes are a piece of *technology*, and in so doing expose the gendering of different disciplines and objects.

Figure 1. *A Measurable Factor Sets the Conditions of its Operation.* Exhibition shot.
Photo: Ellie Laycock

In defining the shoe, I realised how important the foot actually is. How else can one identify mobile areas of support for the foot, if it isn't considered as the biomechanical entity that it is?! This might seem patently obvious, but in traditional footwear design and manufacturing, movement and anatomy are not explicitly taken into account. Firstly, shoe designers in the field of fashion rely mostly on fashion lasts. [2] These particular lasts are representations of the foot informed to a greater extent by style and trend than anatomy. There even seems to be a contemporary trend towards less anatomically correct lasts for men and women's shoes alike. Second, designers use pattern calculations rather than direct anatomic knowledge when deviating from pattern types to inform where the foot is covered up and where closing systems occur. Third, if and when alternative materials are introduced, they are chosen to continue to function more or less in the same way as the materials they replace, because the type of shoe they serve remains the same.

Through the fellowship, I began an intensive study of the anatomy of the foot and ankle with Nicola Smith Swann and James Brouner from the Sports Science Department at Kingston University. With their assistance, it became clear that a reconsideration -if not a complete redesign- of the last was essential. In collaboration with last manufacturers Spring Line, a custom last, more true to the anatomy of the foot. [8] (fig. 2,3 & 5), was produced, ignoring industry informed standards that have more to do with cost effective manufacturing and fashion shape. Two critical aspects of the last were altered:

a) The bottom of the last (both high-heeled and flat) is straightened out in lateral to medial (side to side) direction. (fig. 2) This is done so that the material of the insole and outsole doesn't require to be pressed in a double curvature, reducing cost and making it possible to work with materials that are less restrictive with regards to malleability.

b) The other change made is the re-instatement of the actual shape of the transverse arch on the last. The material volume this arch requires is slowly shifting on many men and women's fashion lasts.

In order to work on a last using prototyping materials that aren't structurally sound, a frame was made to suspend the last, eliminating any support needed. (fig. 5) The frame also served as a measuring tool, allowing for exact measurements to be taken and inputted into a 3D computer model.

Continuing my collaboration with the faculty at the Sports Science Department, we extended our research to cover the kinematics of the foot and ankle, specifically looking at the high-heeled gait and the impact of shoe inserts in existing shoes. [7] Based on these studies, a mould of the foot was developed denoting areas of sensitivity and insensitivity and areas that bend in ambulant motion (fig. 4). This served the purpose of showing, on a three-dimensional object, some of thefoot support structure's locational requirements.

Figure 2, 3, 4 & 5. Custom Last Development.

Most importantly for the development of the project, kinematic knowledge pertaining to specific biomechanical factors were organised and grouped into the following categories: Forefoot pressure, mid-foot pressure, barefoot ambulant motion, stability and high-heel impact stride. These categories were then addressed as if they were the catalyst for a structural engineering problem, and hypotheses were raised, with the idea that the testing of each hypothesis might produce a new shoe typology. It was via this method that the idea of interlinking areas of support, or footwear 'constellations' was formed. These footwear constellations map out new combinations of foot and ground contact points/areas. By 'contact points/areas' I mean the areas where the object/shoe touches the foot and the areas that touch the floor in ambulant motion or static stance These 'contact points/areas' serve the purpose of

a) keeping the foot in place
b) keeping the foot in its high-heeled position
c) keeping the object/shoe on the foot
d) making contact with the floor

By thinking of footwear as a constellatory entity, the traditional sandwich method by which the upper of a shoe is adhered to the sole can be defied, producing genuinely new opportunities in configuring the shoe. Without this constraint, the contact areas on the foot could exist as separate entities. Each hypothesis supports the generation of a specific grouping and positioning of associated 'contact points/areas', in turn producing new constellations. Once these 'contact points/areas' are literally, physically connected together (in such a way that they support the foot, in a high-heeled position, while in motion), an actual proposal for footwear is developed.

All in all I produced 17 different hypotheses, resulting in 17 design proposals. This procedure is best explained with a detailed example: The hypothesis for this particular footwear constellation *constellation B2* (2013) (fig 7) (fig 8) seeks to enable a similar dorsal-lateral to ventral-medial enveloping motion of the foot as occurs in barefoot ambulation. [3] There are many barefoot gait techniques, especially in the field of athletic running. One well-known technique, the Pose Method, was developed by Nicholas Romanov, a sports scientist in the former Soviet Union. Romanov essentially had three rules: no cushioned shoes, no pushing off from the toes and, most of all, no landing on the heel. [10] However, I based this specific 'constellation' on the biomechanical factors commonly adopted when walking barefoot, known as the Heel Strike Gait. The factors are as follows: 1) Inthis method of barefoot ambulation, the heel strikes on the dorsal-lateral side of the foot and pushes off/propels through the big toe on the ventral-medial side of the foot. 2) The heel bone is situated on the lateral side of the foot. 3) In ambulation, but also in static stance, our two feet, by means of body muscles, allow us to distribute weight and allow us to balance.

Figure 5 White Prototypes & Figure 6 Bluepanelshoe

In response to these factors, my proposition is to position the heel ground contact point on the lateral side of the foot/heel (fig. 7), rather than having it hit the floor directly in the middle under the heel, where it is traditionally placed. Placing the heel on the lateral side might promote inversion or eversion of the foot, which is the movement of the plantar surface or sole of the foot either towards or away from the body sideways over the sagittal plane (which imaginarily cuts the body and foot into left and right parts). In order to prevent this motion, while at the same time keeping the shoe on the foot, an oval shaped construction (fig. 7) is placed around the foot, slanted downwards towards the arch.

The 'constellation contact areas' of each of the 17 different footwear hypotheses as described above were first drawn up as three-dimensional maps in a computer-modelling program and made into limited edition silk-screen prints, titled *Constellations* (2013) (fig. 1). Subsequently the 'constellation contact areas' were extruded outward (fig. 8) and produced as physical pieces. The pieces, rapid prototyped in Nylon, were encased in a vacuum formed polystyrene shell in order to be used as 'testing shoes', exhibited under the title *White Prototypes* (2012-2013) (fig. 1) (fig. 5) (fig. 13). They served the purpose of testing the validity of the new constellations: Could the constellation be worn and walked in? The *White Prototypes* were made to my size, permitting direct body-to-object understanding and allowing me as a designer to understand the expanded possibilities of footwear through direct experience. The *White Prototypes* were additionally analysed at the Sports Science department using pressure mats (fig. 15), and although the functionality of these 'testing shoes' was partially compromised (they were too slippery!), the results from initial tests were promising in relation to the hypotheses. It's important to reiterate that the ultimate purpose of this study is not to produce biomechanically 'better' shoes, but to create a collection of shoes based on divergent shoe configurations. How the defined areas in the configuration are connected obviously takes biomechanics in account, but it isn't the purpose

I produced all the testing shoes, based on the 17 different hypotheses, using the same construction method and in the same material. This set up would have made more sense in a comparative study, but the main aim at this point in the research was to look for more specific answers in relation to each hypothesis. Testing the performativity of several testing shoes relating to one particular hypothesis against each other would make sense. Furthermore, how the constellation of 'contact points/areas' are connected, and with which material and by which construction method, has a huge influence on how the shoe works structurally. With this being said, the testing shoes didn't function fully, and in the next iteration of testing shoes these factors will need to be incorporated. In working with biomechanical factors of the foot, what is also important to note is that a calibration process is needed, as the individual foot requires specific solutions.

As a way of furthering this segment of the research and methodology, I produced the *Bluepanelshoe* (2015) based on the hypothesis detailed above. The work was commissioned for the exhibition *Life on Foot* (2015) at the Design Museum London, and should be seen not as a 'final' shoe design, but as exemplifying the novel opportunities (structurally, functionally, aesthetically) that the method proposes. Even in this text, presenting something even remotely resembling a 'finished' shoe design might prove a distraction. The project's purpose is in the development of an alternative method, and any outcomes are not to be considered 'final'.

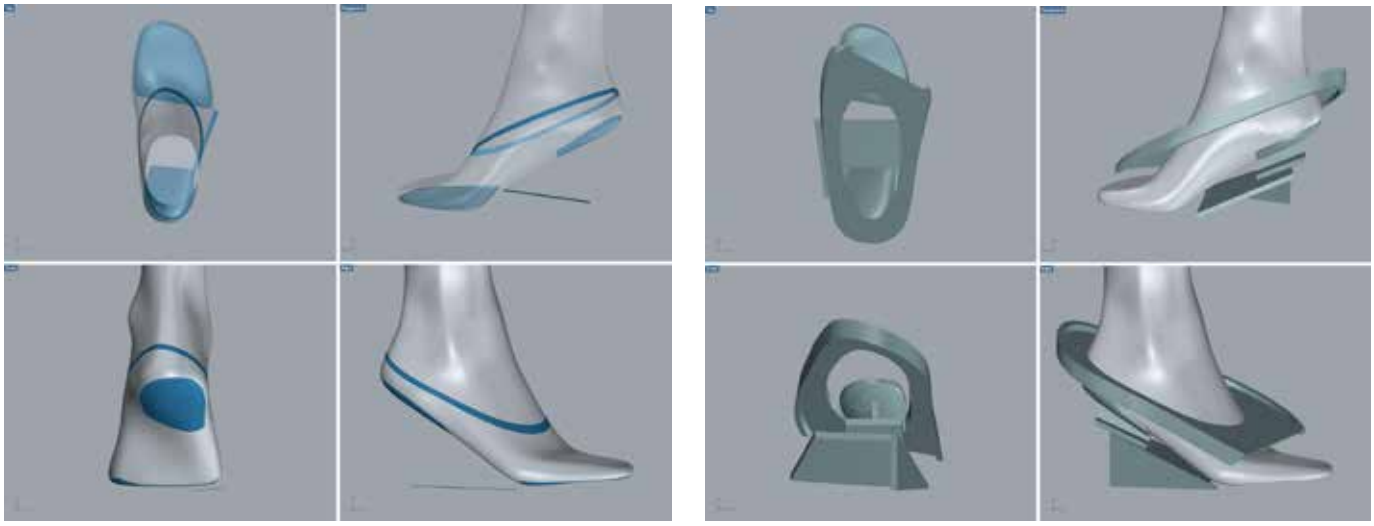

Figure 7 & 8 Computer Model of Constellation B2

The Cultural Connotations of High-Heeled Footwear

Having written about the 'so called' rationalised parameters from which to design the shoe, I would now like to consider the engineering approach from another perspective and talk about the cultural connotations of engineering and technology in relation to fashion and high-heeled footwear. The stiletto heel, made possible through the use of a steel rod in the heel of the shoe (popularised by Roger Vivier in 1954), can and should be considered as a piece of engineering. [11] Yet the 'values' we traditionally associate with engineering and technology -efficiency, rationality and social progress- don't seem to apply to a variety of woman's objects such as the heeled shoe, which is perceived as frivolous.

I will elaborate here on the history of the original coding of heels as male and the subsequent re-appropriations which transform the coding of heels as female. This gendering shift explains why the high-heeled shoe has become associated with frivolity. Dating back to around the 10th century, heels were first worn in Persia for the purpose of added stability for horseback riders in seated and upright position in their stirrups. At the end of the 16th century the first Persian diplomatic mission was sent to Europe, where men adopted the heel "[...] to give their [European men] appearance a virile, masculine edge." [9] In the early 17th century a trend emerged in which women re-appropriated elements of men's dress in order to masculinise their wardrobe. In the late 17th century, the then unisex heel underwent an aesthetic and formal bifurcating shift:

> "Leather-covered heels came to be worn by men at home or formal settings while stacked leather heels were common on men's riding boots and other plain, hardworking footwear. Women's fashion favoured covered heels and although clear formal differences emerged between men's and women's heels—men's grew high and were sturdy while women's tapered to increasingly narrow points—by the middle of the century, the covered heel smacked of refinement, a feature that would eventually damn it in men's fashion." [6] It wasn't until the time of the French revolution, Semmelhack continues to argue, that "[...] heels' roles as gender markers and as status symbols collided. On the one hand, France's post-revolution society emphasized—or, at least, it told itself it emphasized—practicality and reason, and heels, while they are many things, are decidedly impractical. By the time Napoleon crowned himself emperor in 1804, the new ruler made a point of wearing flats. And so heels were relegated to the realm of the impractical, the irrational, the superficial...which is to say, to the realm of the traditionally feminine. And there, ever since, they have remained." [5]

It is important to iterate that the contextual shift of the heel had already taken place when European men appropriated the heel and that the original function of the men's heel had been relocated, while the heel was still located in a men's realm. It is not at this point the heel is deemed frivolous; it is when women adopted them. I therefore argue that the association with the heel as frivolous has more to do with gender associations than the object or the object's function. Continuing on from this, it also seems that the gendering of the object at hand informs the connotations of engineering and not the 'values' we traditionally associate with engineering and technology.

The Stanley Picker Gallery exhibition provided an opportunity to expose how the negative association of high heels with frivolity has historically been propagated. In collaboration with artist Noam To-ran, we focused our research on the depiction of the high-heeled woman through cinematic history and produced two video investigations in response. The first work, *Women in Various States* (2012) (fig. 11, 12 & 14), is a taxonomy of cinematic moments where a high-heeled women's mobility has been compromised. The taxonomy reveals that a high-heeled woman, moving through a multitude of cinematic narratives, is a complex construct, but one designed for, and ultimately sanctioned to, the man-made environment in both its literal and fantastical forms. When a high-heeled woman is placed in alternative settings – namely outside the flat and smooth surfaces of urbanity and sub-urban-ity – or when forced to walk through unique substrates (like sand, mud, etc.), she loses her equilibrium (both physically and culturally) and begins to slip, trip, sink or tumble, thereby transforming her perceived identity. This observation was the catalyst for the second work, titled *Material Compulsion* (2013) (fig. 9 & 10), in which a subject in high heels walks through a variety of substrates, filmed with a high-speed camera.

Figure 9 & 10 Material Compulsion Film Stills

In Conclusion

The method devised to come to new shoe typologies during my tenure as Stanley Picker Fellow at Kingston University, allowed me to produce works that exemplify novel design opportunities (structurally, functionally, aesthetically). It also provided me with the body-to-object and lab-tested knowledge that helped me understand and identify new biomechanical opportunities for the high-heeled shoe within and outside the context of this particular project.

More importantly though, through continuous critical reflection on the method (incorporating sketches, models, tools etc.), I identified areas of study necessary to understand and unpick the fraught gendered connotations of the high-heeled shoe. These further cultural and historical studies helped me identify and expose implicit cultural connotations of the high-heeled shoe and through the framing of the method and additional works such as the two films, make these notions explicit. As such, treating the 'woman in motion' as an engineering problem exposes the high-heeled shoe as a cultural 'problem' while at the same time questioning the connotations of engineering, as they seem informed by the object at hand.

This research project has dramatically opened up the scope of my practice, but out of frustration with the scarcity of critical writing in this field, I took it upon myself to better understand the project and its potential relevance within an academic framework. In an attempt to compress the work's multiple aims within the constraints of an academic paper, I struggled with how to adequately represent the implicit, layered, and questioning aspects of the work. In the current design research climate, the quest for explicit research questions, and linear, established methodologies seem to permeate. Attempting to rigidify design research limits the potentials of projects that purposefully 'wander', 'get lost', or 'get messy', in order to discover a more nuanced and informed critical voice. Such approaches, I feel, expand what design can speak of, and I hope to use the Research Through Design conference to strategise ways that we may resist the status quo and adequately recognise the implicit value of practice-based research.

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Figure 11, 12 & 14 Women in Various States

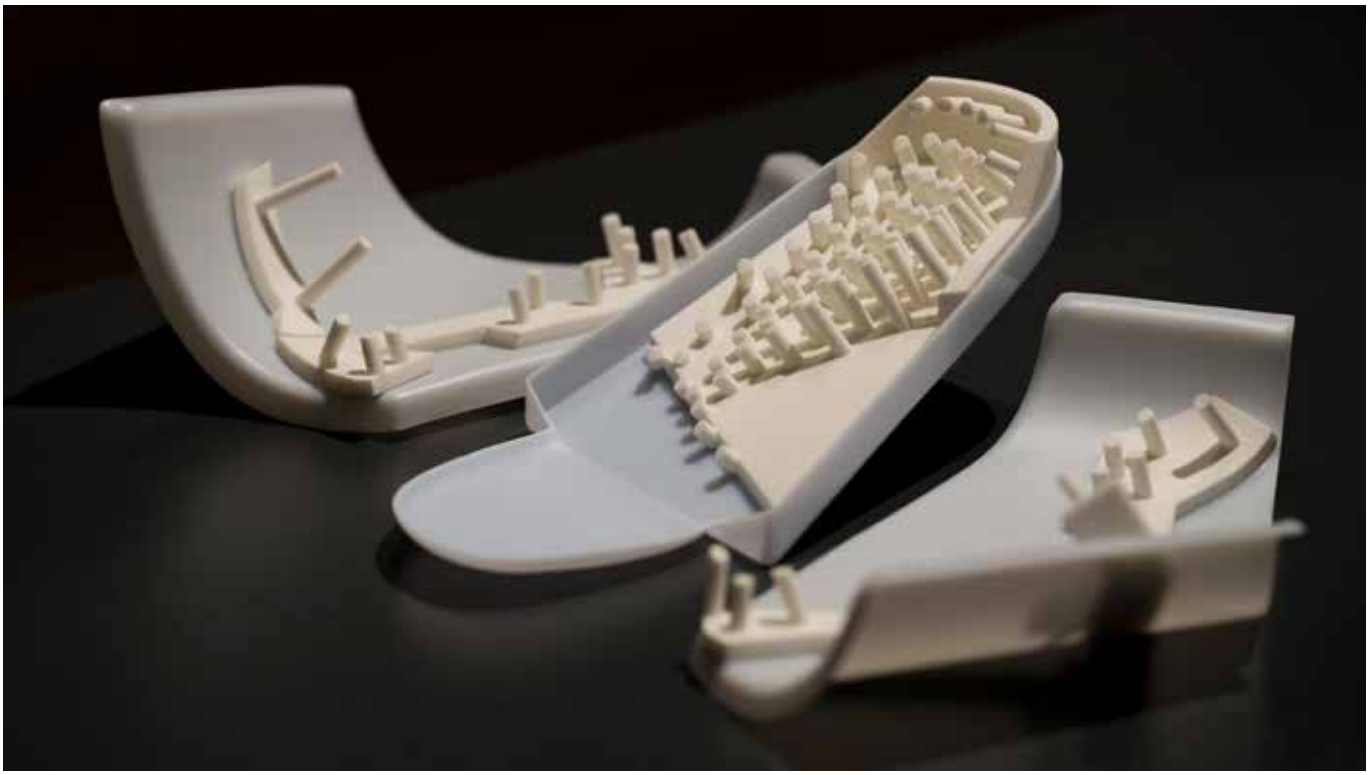

Figure 13 White Prototypes

Figure 15 Pressure Mat Testing

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2. A shoe last is a three dimensional mould used to construct a shoe around.

3. Dorsal relates to the back or posterior of a structure. Lateral is the side of the body or part of the body that is away from the middle. Ventral means that it is closer to the front side of the body. Medial refers to being toward the midline of the body or the median plane.

4. Footwear manufacturing method whereby a sole is moulded and thereby adhered directly onto the upper.

5. Garber, M. (2018). *What High Heels Can Teach About Gendered 'Truths'*. [online] The Atlantic. Available at: https://www.theatlantic.com/entertainment/archive/2018/06/what-high-heels-can-teach-about-gendered-truths/563660/ [Accessed 3 Oct. 2018].

6. Google Cultural Institute. (2018). *Standing TALL: The Curious History of Men in Heels - Google Arts & Culture*. [online] Available at: https://artsandculture.google.com/exhibit/BQJSZR_j5AhtLA [Accessed 15 Aug. 2018].

7. I acknowledge the high-heeled gait effects the rest of the body from pelvic posture, to knees as well, but I am focusing on the foot and ankle as a way of narrowing down possibilities and staying within the realm of footwear's location, as we know it.

8. In the proposed working method, the shape of the shoe would not rely on the shape of the last and thus the shoe would not have an orthopaedic aesthetic despite the last being more anatomically correct.

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