

Bodies and Technoscience. Practices, Imaginaries and Materiality

Simone Arnaldi
Stefano Crabu
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In our contemporary technology-driven societies, every aspect of life connected to our bodies — such as birth, reproduction, sexuality, gender, and aging — is profoundly influenced by technoscientific advances. The body is no longer a fixed entity but a dynamic battleground, constantly reshaped by technologies.

This compelling book delves into the evolving interface between human bodies and technoscience, exploring themes like technoscientific imaginaries, the cyborg concept, bodily transformations through technologies, datification, and biomedicalization. Approaching these topics from a Science and Technology Studies (STS) perspective, the book poses essential questions about the relationship between technology and the body: What are the consequences of our increasingly mutable physicality? What analytical frameworks can we use to study this ever-changing, hybrid body? How does STS help us understand the material and discursive construction of corporeality through technoscience? And how do our bodies, in turn, help shape the very nature of technoscience?

This book is of interest for scholars and students in Science and Technology Studies (STS), Sociology of the Body, and Social Theory, offering fresh insights into the crucial interplay between scientific knowledge, technology, and bodily experience. It invites readers to reconsider the essential questions regarding the interplay between technoscience and corporeality.

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6. Sizing Bodies and Making “Others”: Standardising and Appropriating Apparel

CHRIS HESSELBEIN, PAOLO VOLONTÉ

INTRODUCTION

Technoscientific studies of the body often focus on emerging technologies and how these reconfigure social roles as well as our bodies in terms of their perceptions, abilities, and experiences. Prosthetic and medical devices as well as reproductive, computational, and biotechnologies as much problematise the boundary between the natural and the hybrid body as they reinscribe existing social structures (Haraway 1991; Martin 1987; Treichler et al. 1998). Studies of technology from the perspective of gender and race, in particular, have noted how gendered and racial divisions of labour and social inequality play out on the level of everyday life through domestic objects, urban infrastructures, and computational technologies (Benjamin 2019; Cowan 1983; Wajcman 1991, 2004). One category of technology that has not yet received much attention in technoscientific studies of the body, however, is that of clothing, which is surprising considering the inseparability of body and clothes in the clothes-body complex (Klepp 2011) as well as the crucial role clothes play in naturalising the body and social identity.

In contemporary societies, the relationship between clothing and the body as well as the experience of wearing clothing are strongly informed by standardised manufacturing processes and the categories of inclusion and exclusion that underpin these processes of

production. Anyone who has ever gone in search of a pair of jeans, for example, knows that finding one's "size" does not necessarily result in finding one's "fit". In mass manufacture, clothes are prototyped by the pattern maker on an "abstract" body (Corrigan 1997: 64) – that is, on a fit model's body and a mannequin – which is theoretically representative of all possible customer bodies. As might be expected, the use of this impersonal body has led to a gradual splitting of clothes from actual bodies because now clothes "encounter" the body only after they have been manufactured. The results of these standardised manufacturing processes, namely the clothes that are eventually presented to and bought by consumers, embody or "materialise" the sociotechnical decisions and considerations that underpin such production processes. However, these are not necessarily the same considerations that consumers might have, and particularly for those who have "non-standard" bodies. In other words, the problem of finding apparel that fits is considerably more difficult for those whose bodies are more divergent than standardised production processes have taken into account.

In this chapter we will focus on the role of technology and mass production in the normalisation of the female body within the fashion system and in the resulting exclusion of bodies or body parts that do not fit on the basis of seemingly "objective" reasons. By means of two case studies of apparel production that lead to the naturalisation of "other" categories of bodies, we show not only how technologies standardise the female body, delimit its variability, and therefore "other" a significant number of women on the basis of "technical constraints", but also how women attempt to negotiate or work around such constraints and exclusions.

Our first case study focuses on the exclusion of fat bodies¹ in the mass production and standardisation of clothes in the fashion industry. The sizing system employed in the production of clothing strives to find a balance between two challenges, namely the variability of consumers' bodies as well as the complexity and costs of producing and distributing clothing for all possible body sizes. However, the abstractions and generalisations that manufacturers rely on are inherently imprecise and ill-suited to many bodies, particularly when attempting to move beyond a certain size threshold. We will show that the development of the sizing technique incorporates the normalisation of thinness as an essential characteristic of female beauty and fashionable bodies, and the resulting exclusion of fat bodies from the domain of fashion.

Our second case study focuses on the standardised sizing and manufacturing systems used in women's footwear production. Similar to the previous case study, footwear producers face a dual challenge in finding an economically optimal solution to a wide variety of bodies and feet. In contrast to the previous case, standardised and mass-manufactured

¹ In many languages, "fat" has a negative connotation, which means that people often resort to a wide range of euphemisms when referring to fat bodies. However, using such euphemisms only confirms and reinforces the fat stigma. Therefore, we will here use "fat" and "fatness" in their neutral, merely descriptive, and stigma-free meaning.

women's footwear results not in the exclusion of entire bodies but instead of body parts, namely small and irregular or otherwise non-standard feet belonging to adults. Finding appropriate women's shoes is therefore an everyday challenge for those women who wish to wear fashionable, professional or "feminine" footwear². We will show that these challenges are negotiated and circumvented through a variety of appropriation techniques and tinkering practices that consumers use to adapt and make their shoes "work" for the idiosyncrasies of their particular feet and bodies. The composition of the two case studies illustrates in a complementary way how standardised forms of production result in a situation in which apparel is rarely, or only poorly, suited to most bodies, and that women are often required either to modify their apparel or their bodies.

The two case studies were conducted separately by the two authors at different times and places. The study of the exclusion of fat bodies in the mass production of fashionable clothes is mainly based on secondary data and analysis of media content (texts and images). The study of the standardised sizing and manufacturing systems used in women's footwear was carried out through in-depth interviews and ethnographic observations in New York City during 2016-2019.

BODIES, CLOTHES, AND SOCIOTECHNICAL STANDARDS

According to Cavallaro and Warwick, «it is dress that has time and again been assigned the responsibility of transforming the incomplete body into a complete cultural package» (Cavallaro and Warwick 1998: 3). Although we are used to talking about dress and the body as two different and separate entities, the body in social life is a dressed body (Entwistle, [2000]2015: 6), and only exceptionally appears "undressed" or "naked". Dressing is therefore one of the primary ways of making bodies appropriate and acceptable to social situations in such a way that they can "fit in" according to their assigned roles and expectations. Consequently, bodies that are not dressed according to perceived role or identity are seen as transgressive, inappropriate, and out of place. Jennifer Craik observed that clothes «are activated by the wearing of them just as bodies are actualised by the clothes they wear» (Craik 1993: 16). The human body, therefore, and particularly the body as a social entity, is always an assemblage of flesh and matter, nature and technology, human and non-human elements (Haraway 1991). Fashion scholars have highlighted this relationship as a clothes-body complex, fashion-body-hybrid, body-clothes assemblage, or as dressed embodiment (see Klepp 2011; Haller 2015; Ruggerone 2017; Hesselbein 2021a).

One of the primary cultural functions of the clothes-body complex is to structure, differentiate, and maintain forms of social identity, such as gender, class, ethnicity, and sexuality. For example, as Elizabeth Wilson notes, «fashion is obsessed with gender, [it]

² The inverse is the case for, among others, drag queens and trans* women, who often struggle to find women's shoes that fit their larger-than-standardised-for feet.

defines and redefines the gender boundary» (Wilson, [1985]2003: 117). Clothing is often used both to highlight and to obscure bodily differences between men and women as well as other groups. In doing so, it not only draws attention to such bodily differences, but it also imbues these differences with social meaning. Clothes separate individuals in terms of their appearance but at the same time draw them together into common categories. Even though clothing is often viewed as an individual and voluntary choice or expression of identity, especially in a Euro-American context, it can also be considered a tool of de-differentiation, homogenisation, and disciplining in which there is relatively little room for choice. Michel Foucault made it clear that fashion, as a practice of disciplining bodies, is a fundamental tool of power in today's societies, where power produces its effects not only through censorship and repression, but also through the stimulation of desire. By imposing an ideal of beauty that is far from real bodies and substantially unattainable, fashion subjects especially women to constraints based on self-monitoring and adaptation to a construct of "normality". This is a new mode to cope with power, he writes, «which presents itself no longer in the form of control by repression but that of control by stimulation. "Get undressed – but be slim, good-looking, tanned!"» (Foucault, [1975]1980: 57).

The fraught character of "choice" is all the more apparent when certain groups and bodies are excluded from being granted the ability to choose. This is the case for bodies for which no, or very little, apparel is being produced, as they are too distant from the standards established by the industrial production system and therefore cannot be accommodated by the main tool of such standardisation, that is, the sizing system: fat, tall, short, curved, pregnant bodies, etc.

Clothes are therefore one of the most effective means of drawing and redrawing, and naturalising, the boundaries between biological and social categories of differences, and for example, making bodies appear as "masculine" or "feminine". The important role of clothing in structuring and naturalising gender roles, often to the detriment of women, has caused early feminist analyses to be relatively hostile towards fashion. That is to say, fashion and femininity were considered as instruments of oppression through which women were turned into passive and sexualised objects of the male gaze (Brownmiller 1984). More recent feminist appraisals of fashion have signalled a change in that they have more positively re-evaluated fashion as providing avenues for self-expression, creativity, and pleasure (Evans and Thornton 1989; Wilson, [1985]2003). Indeed, from this perspective, the process of continuously changing one's appearance through clothing can be seen as liberatory insofar as it "denaturalises" the body and highlights its malleability. The high heel – often seen as the epitome of femininity – nicely captures this ambiguity. On the one hand, high heels are derided for being frivolous, impeding, and harmful, on the other, they are praised as a potent symbol of sexual independence, female empowerment, and professional success. The transformational quality of high heels for enacting and subverting "natural" gender roles is further underscored by their popular use among drag queens and trans* women.

Fashion is, of course, not only a highly effective means of gender differentiation, but also a powerful technique for assigning various social roles as well as defining certain categories of “others”. An important aspect to the normalisation and naturalisation of certain bodies is the exclusion of “other” body categories, which by nature of their exclusion highlight the normality of those categories and bodies that are “naturally” included. Every naturalisation involves the creation of classes of unnatural occurrences, that is, exemplars of diversity with respect to the standard. And very often this construction of diversity brings with it the exclusion of what is non-conform in the spectrum of opportunities reserved for what is conform. The exclusion of certain categories of “others” has been most notable in fashion runway shows where, now still, people of colour, people with disabilities, and fat people are only occasionally allowed to participate as exceptions that confirm the rule. However, this is just the tip of the iceberg. The exclusion takes also place at a much earlier stage, namely during design and manufacture as well as through processes of technical standardisation and mass production. In the next section we will demonstrate how this is the case for fat bodies.

Sociotechnical standards are a crucial yet relatively invisible and taken-for-granted means of streamlining procedures, regulating behaviours, and coordinating complex infrastructures, people, and things (Lampland and Star 2009). As such, standards are often nested inside one another, interlocked with other standards that are found across organisations, countries, or technical systems, relative to certain communities of practice, and therefore «distributed unevenly across the sociotechnical landscape» (*Ivi*: 5). Classification systems, moreover, always have “residual” or “other” categories assigned to those things, objects, or people that do not fit (Bowker and Star 1999). A classification cannot comprise of everything; one size never fits all. In other words, standards always codify, embody, prescribe certain values and ethics, often with great consequences for those whose identity, body, or practice does not “fit” well with such standards. Those that remain outside of such systems help us see the boundaries of classifications and standards as well as the ethics and values that these embody or ignore. The exclusion of these residual categories is frequently presented as justified because their inclusion would decrease the efficiency of the sociotechnical system for those already included. Unlimited diversity and inclusion, in short, is never seen as a practical or economical option. Such exclusions eventually become normalised, particularly when they are embedded in bodies, practices, or technologies, and thus reproduced on the level of production and consumption as well as broader cultural discourse (see Bordo 1993; Volonté 2019; Hamraie 2016; Roulstone et al. 2017). In other words, examining standards of apparel production and the clothes they produce, which fit some bodies but certainly not other bodies, highlights whose bodies and identities are presented as natural or normal and whose are not.

Classification system and standards are not, however, simply passively accepted and incorporated by all. Perhaps the most notable examples of this are the success of the women’s rights movement against the standard “male” body in medical research, and

the relative success of the disability rights movement in changing the standards used in design and construction by architects and urban planners so that people with mobility impairments are no longer (or at least less often) excluded (see Epstein 2009; Hamraie 2016). Similarly, in fashion, runways have become significantly more diverse in terms of the variety of bodies that are allowed to model clothes, and high heels are no longer an official part of women's professional dress codes in many countries.

In the following sections we will discuss the consequences that standardised production processes have within the fashion system, with its fundamental need for classification, and what this involves for those with non-standard bodies and body parts, that is in particular, for those with fat bodies and small feet. How does manufacturing technology give rise to the exclusion of certain consumers such as fat women from the range of clothing opportunities offered by the fashion system? How might consumers interact with the classifications and standards that are built into production techniques as well as embedded in items of apparel such as women's footwear, and how do they adapt shoes that do not fit well so that they work better for their particular feet?

STANDARDISING WOMEN'S CLOTHING

Historical research has shown that there is a link between the rise of the thin ideal in fashion and the industrialisation of clothing production (Wissinger 2015: 108-140). The transition from custom-made to ready-made clothing necessitated the standardisation of sizes, and this has resulted in a reversal of the relationship between dress and the body. Clothes are no longer adapted to the bodies that wear them, instead bodies are required to adapt to the standardised dimensions of clothes manufactured and retailed by the fashion industry. The technique of standardisation has made it possible to consider clothing as a self-sufficient artifact that is separated from the concreteness of the personal body, an independent object that is available for mass consumption by a number of body types (Bertola 2014: 117-121).

A sizing system is designed with the intention of offering the best fit for purchasers of ready-made clothes, thus «providing enough variation to accommodate all customers but limiting the number of sizes for efficiency of production and distribution» (Ashdown 2014: 17). The smaller the number of sizes, the lower the accommodation rate of customers. The larger the number of sizes, the higher the manufacture and retail costs and the complexity of the purchasing process. The goal of a sizing system is to identify the best balance between these two opposing needs. The efficiency of the sizing system originates from a specific technique called size grading (Moore et al. 2001). Size grading reduces the need to repeat body measurements for each size because measurements for larger-size garments are obtained through incremental changes to the base size. The processes that inform the size grading algorithm generally have a proportional characteristic, that is,

they reproduce the shape of the base pattern by proportionally enlarging all of its parts.

However, the enormous reduction in costs made possible by this technique results in a concomitant reduction in the variability of garment sizes and shapes. The range of available sizes will only fit customers whose bodies might be different from the fit model in overall body dimensions but that are identical in body proportion. Ashdown describes the system as follows, «Different companies have fit models of different proportions; therefore each company provides [a] good fit for those customers whose body shape most resembles their fit model» (Ashdown 2014: 27).

This makes clear how the sizing system reconstructs the unity of the clothes-body complex by adapting the body to clothes, and not vice versa. In principle, sizing should be a tool for making garments fit bodies. In practice, it ends up “manufacturing” bodies that adapt to clothes. Inadvertently, it is not the consumer who chooses the brand, but the brand that chooses the consumer. Each brand constructs its own audience by deselecting (“othering”) certain bodies.

The general outcome of the standardisation and marginalisation processes employed by the sizing system is even more powerful if we consider those who are regularly unable to find the right fit while purchasing clothes, such as fat women and women of ethnic groups with non-Caucasian body morphologies (Bougourd 2007: 108). In fact, the size grading technique produces not just standardisation, but a standardisation that favors slim as opposed to average body sizes. The technology that lies at the basis of the mass production of apparel results in a constraint that excludes fat bodies from fashion. Size grading can only be extended to larger bodies up to a certain size, as shape and size differences between bodies belonging to a range of slim sizes are more likely to conform to similar proportions than bodies that are above a certain weight. Let us quote a pattern maker:

We know pretty well what a [US] size 6 woman will look like if she edges up to a 10; her bust line might increase an inch. But if a woman goes from a size 16 to a 20, you just can't say with any certainty how her dimensions will change. [...] You'll have some people who gain weight entirely in their trunk, some people who will gain it in their hips. [...] There are so many variables; you never win. (Kathleen Fasanella, quoted in Bellafante 2010)

For the apparel industry this means that, up to (US) size twelve, proportional size grading enables a large proportion of the population to be accommodated. However, the accommodation rate falls steeply beyond size twelve because then most of the variation is typically found outside the proportions of the original model: more on the hips, bottom, bust or belly (Boorady 2014). Size grading below the size-twelve threshold, especially when it has been automated and digitised, is quick, profitable and effective. Larger sizes require the creation of a dedicated pattern for each specific size and body shape, which makes it much more complicated and harder to standardise the mass production of clothing for these groups.

As a result, a significant proportion of apparel created by the fashion industry is never manufactured for average and overweight bodies. Very few items offered by brands participating in, for instance, Paris Fashion Week are retailed in sizes larger than twelve (Volonté 2021: 148). The fashion industry restricted itself during the process of industrialisation to a limited range of body sizes through its own technological development. The culture of slenderness is difficult to fathom if we disregard its hybrid character as a combination of symbolic values and material constraints. The thin ideal did not appear out of nowhere and induce the fashion industry to limit itself to slim sizes. Rather, the thin ideal evolved alongside a system of industrial production that was technologically discouraged from producing large sizes, and therefore developed practices that were technically within its possibilities.

However, technology is not independent of social processes but embedded in and informed by such processes, as technological innovations and cultural values are mutually co-produced (Jasanoff 2004). Like all technologies, size grading incorporates the needs, expectations, beliefs, habits, and idiosyncrasies of various relevant social groups (Bijker 1995). The fact that there is an upper threshold for the applicability of this technique – above which it becomes inefficient – is not an incidental consequence of how it was developed, but an inherent condition of the fact that it was developed in the first place. The threshold is a central aspect of the technique because it is a major part of its development; it is both one of the reasons the technique was adopted and one of the reasons for its success. The crucial point is that the size grading technique was able to establish itself only because it adequately responded as a whole, including the intrinsic technical “limits”, to the needs of various relevant social groups. The exclusion of large sizes did not occur after an “objective” design and implementation process but was a condition for this technology to develop.

The technique of size grading informed – through its material process of clothing manufacture (e.g., the physical machinery and its performance, forms of master patterns, size of dummies and models, algorithm-based rules, etc.) – the standardisation of garment shapes and sizes, the consequent standardisation of clothes-body complexes, and, accordingly, the decision to sacrifice the capacity to accommodate fat bodies to the efficiency of the production process. Sizing is a powerful instrument for the normalisation of bodies as it places bodies within a hierarchical system of classification that actually excludes individuals on one end of the continuum, ipso facto stigmatising their bodies as substandard.

NEGOTIATING WOMEN'S FOOTWEAR

Fat women frequently indicate having great difficulty in finding clothes that meet their needs. They feel excluded from the fashion system, as they are often forced to resort to

unfashionable multi-brand stores and clothes that cover rather than enhance the body. Yet, protest and complaint, or the creation of so-called fat fashion brands, are not the only ways that “othered” people can negotiate the standardisation of bodies in fashion. We now turn to the case of high-heeled shoes to discuss how consumers experience and negotiate the relationship between non-standard feet and standardised footwear.

Similar to apparel production, the transition from custom-made or self-made footwear to mass-produced shoes necessitated the standardisation of sizing and manufacturing techniques. Earlier, relatively loose definitions and measurements of length³ eventually became codified into more accurate and specified systems of sizes for feet and footwear that were determined with standardised measurement devices, such as the Ritz Stick and the Brannock Device (Morgan 2016). However, there remains today a high degree of variability in shoe sizes – as well as in clothes sizes – across and within countries and between (and even within) brands. There are several major shoe sizing systems that differ in what they measure (i.e., the foot, the shoe, or the “last”), what unit of measurement they use (i.e., sizes correspond to different intervals of measurement, which results in different increments between “half” and “full” sizes), and where they start measuring from (different systems “place” or “start” with measuring 0 or 1 in different locations, which means size can be proportional either to the foot or the shoe). This complexity is further exacerbated by differences between conversion tables, which create overlaps and gaps between sizing systems, and by the fact that only few systems take the width or girth of feet into account even though these are just as crucial determinants for insuring fit and comfort as length.

Footwear’s range of sizes is based on the most common sizes and shapes of feet in a consumer population as well as the differences between regions and genders (Jurca et al. 2019). An essential part in the manufacture of shoes is the last, which is a human-foot shaped form on which shoes are constructed and that therefore is the primary determinant of the size and inner shape of a shoe. Shoes and lasts are initially developed in one size and width, namely the “sample size”. Similar to clothing manufacture, a complete size range of shoes is developed by means of grading, that is, by scaling up (or down) from the sample size to develop other sizes and widths (Luximon 2013). Scaling factors are defined by means of grading tables that are well defined for each sizing system by the International Organisation for Standardisation, but it is unclear on what data these grading tables are based on, and furthermore, they have not been updated in decades. What is more, grading tables only provide scaling factors for width and girth, which means that these scaling factors are kept constant across entire size ranges even though there are several other significant variances in feet, such as instep height as well as forefoot and heel width, that would ideally be considered (Jurca et al. 2019). The failure to accommodate

³ Interestingly, many common measurements that are still in use today are based on the lengths of body parts or bodily actions, and particularly on the parts and actions of the lower body. For example, both the “foot” and the “step” or “stride” have been used across multiple eras, cultures, and countries to standardise units for measuring length.

for such variances is particularly pernicious in the case of high heels, which are comparatively complex not only in their construction, but also their wearing because they angle one's foot and often have smaller toe boxes⁴.

The diversity and complexity of sizing systems and the implications these have for manufacturing processes, which are generally more determined by economic costs and benefits than the actual needs of customers, result, once again, in a situation in which bodies are either forced to conform to apparel that poorly approximates their size and shape or are otherwise excluded. Because currently almost all commercially available high heels are mass-produced, most shoes do not fit perfectly even if they are one's "normal" shoe size. The potential consequences of ill-fitting footwear, particularly high heels, are not only discomfort and social embarrassment, but also long-term foot deformity and acute trauma (Branthwaite and Chockalingam 2019). In other words, feet that fall outside of the standards used in footwear manufacture are forced to bear the consequences imposed by industrial mass-production.

Consumers who cannot afford the considerable cost of a bespoke high heel must therefore make do with off-the-rack shoes and adapt them to the singularities of their own feet or vice versa. The abundance of brands to choose from, combined with uncertainty about what is suitable for one's feet (given the ever-changing nature of the interactions between foot and shoe) often leads consumers to believe that their feet are unusual, different, or abnormal in some way (Curwen and Park 2014). Because of such bodily differences and the variance in shoe sizes and designs, each pair of shoes run the risk of rubbing one's foot the wrong way. The results of such friction can be painful, so it is hardly surprising that high-heel consumers go to great lengths to avoid such pain. The problem of fit and the risk of painful friction lead many people to modify their shoes and feet to keep adverse effects to a minimum. In short, standardised and mass-produced high heels do not simply work, that is to say, they are negotiated and made to work by consumers, and often with tenacious creativity and resourcefulness.

The remainder of this section provides two examples of how high-heel wearing women experience the encounter between standardised footwear and non-conforming feet, and what techniques women might resort to in order to improve the encounter between body and shoe⁵.

In order to minimise the risk of buying uncomfortable and painful high heels, women often resort to a variety of testing and "breaking in" mechanisms either during the moment of buying high heels or right after. Such strategies go some way in allowing consumers to

⁴ The high heel is relational: its definition not only varies according to context and wearer, but also depends on the wearer's intention and physical ability. One person might find a pair of high heels immobilising, while another wearer might find them laughably easy to walk in.

⁵ The interview accounts introduced in this section are based on research conducted by one of the authors during their dissertation fieldwork in New York City during 2016-2019. For more on the strategies and techniques that are employed in high-heel wearing, see Hesselbein 2021b.

ascertain, and to some extent ameliorate, the relationship between mass-produced shoes and the particularities of their feet. More importantly, to correct the perceived mismatch between the particularities of their feet and standardised shoes, wearers frequently resort to a variety of “fixes” or “hacks” to address the idiosyncrasies of their feet and to improve wearing comfort. Many women who wear high heels anticipate some degree of discomfort and take precautions, such as applying bandages to their feet before going out. But some shoes – and some feet – are more complicated. One interviewee, a dance instructor with particularly high foot arches, likes to wear open-toed shoes. The commonly available gel inserts are not high enough to support her arches; insoles, which are larger and more supportive, are unwieldy and too large for the shoes that she likes to wear. To provide her arches with more support, she places a folded sanitary pad on the arches of shoes in which she needs more support, and tapes it down to ensure that it stays in place.

Minor adaptations to shoes and feet are a common way for high-heel wearers to negotiate and “correct” the gap that exists between their shoes and their feet. Most adaptations to high heels focus either on increasing the padding or cushioning below the foot or on decreasing the pressure and friction caused by shoes that are too slippery or snug. High-heel wearers frequently alleviate or even prevent painful friction by using baby or talcum powder, anti-blister sticks, candle wax, and even roll-on deodorant.

Although most footwear adaptations are designed to remedy problems caused by shoes that are too tight, sometimes the opposite is true, and wearers must modify shoes that are too loose. Women with relatively small feet, for example, are often forced to buy shoes that are too large, because only children’s shoes are available in their size. Similarly, feet that are unequal in size or an in-between size or wider than average will need to be accommodated in some way (people with these issues often opt for shoes that are a size larger than called for by the length of their feet).

Another interviewee – a senior operations manager with a short stature and a particularly youthful demeanour – often wears shoes that are too big. Most of the shoes in her size are children’s shoes, which, needless to say, she refuses to wear. She goes to great lengths to assert her maturity and authority in the workplace, and she considers high heels an essential part of her fashion arsenal. As a result, she must often wear shoes that are too large. This complicates walking, because high heels already require a degree of skill, even without a heightened chance of their falling off. She wears large, full-sized insoles in most of her shoes, and when possible, socks too, but even this is sometimes not enough to fill the additional space. Certain makes of shoes, such as D’Orsay or slingback heels and sandals, make it hard to use insoles, or to hide them from view. This problem calls for other solutions. On the day of our interview, she showed me how she had stuffed a sock into the toe box of her shoe: «I’ve tried using cotton balls and newspapers before, but they squish and become flat very quickly. I usually stuff two sockettes into the front of my shoe, which works perfectly». For her, socks are not only an item of clothing; they are also a means of adapting adult-sized shoes to her diminutive feet.

Standardised sizing and manufacturing techniques in footwear production, and the classificatory systems and grading scales that inform these techniques, can be a problem for anybody with feet that do not conform or “fit” into these systems. However, the problem is exacerbated for women with smaller than average feet who wish, or who might even be required, to wear feminine footwear, such as high heels. This issue is particularly difficult for them because high heels are often thought to be the most appropriate footwear for a range of social events as well as for the performance of professionalism and authority in workplaces. However, although standardised sizing and classification systems can be exclusionary to those who have non-standard feet, consumers can, and frequently do, rely on a range of creative adaptations and hacks that allow them to adapt and appropriate such mass-produced items to their own specific needs.

CONCLUSIONS

This chapter has discussed the role of fashion in the normalisation of female body shapes and sizes by leveraging three of the key interventions that Science and Technology Studies has to offer to the study of technoscience: first, to make visible the co-construction of sociality and materiality, second, to denaturalise the implicit political and ethical aspects of this process, and third, to show how things might therefore be constructed otherwise either by manufacturers or users/wearers. By applying this approach to the study of two mundane technologies – clothing and footwear – we sought to highlight how methodological tools and concepts that are usually applied to complex sociotechnical systems and computational technologies can fruitfully be expanded to include objects that are not usually thought of as technology but that nonetheless play a similar role in naturalising certain bodies and social norms.

The size grading technique is an indispensable tool for the mass production and manufacture of both clothing and footwear. But this technique has two important implications for the social perception of the human body: its shape and size are standardised in line with the goods sold by apparel companies; the standardised shape and size of the body are further normalised through a production system that favours manufacturing needs rather than consumer needs. As a consequence, the fashion system employs a classification of human bodies that involves the categorisation of “normal” and “abnormal” bodies, and that posits “abnormal” bodies as being in need of correction, adjustment, and realignment with supposed normality.

We have discussed the marginalisation of fat bodies in the fashion system to show that the current normalisation of the female body – as young and slender – is mediated by the incorporation of the thin ideal in the size grading technique. That is to say, the materiality, obduracy and efficiency of manufacturing technologies contribute to the creation and maintenance of categories of “other” bodies that are not deemed to be beautiful, desira-

ble, or cool. Further, we have highlighted how people with relatively “normal” as well as “abnormal” feet can be hindered, and to some extent even excluded, from wearing a type of shoe that many deem essential to the performance of feminine desirability, professionalism, and authority. Having a body that falls outside of standardised modes of production does not, however, need to prevent one from wearing high heels necessarily. High-heel wearers can successfully negotiate their “otherness” and avoid being marginalised by standards of mass production by employing a range of mundane techniques and “hacks”. Both cases, in other words, highlight how the co-construction of body and technology can result in the creation and naturalisation of the human “natural” body, and exclusion of certain “other” bodies. The case of footwear adaptations shows, however, the extent in which the power and obduracy of standardised mass-production techniques can be subverted and appropriated, and therefore that sociotechnical “things” can be otherwise.

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