Fashioning Affordances: A Critical Approach to Clothing as an Affordance Transforming Technology

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WORKING DRAFT

Abstract: [122 words]

Affordances are perceived possibilities for interaction. What is afforded is usually understood as dependent on the properties of a body and its environment. But human bodies are nearly ubiquitously clothed, and clothing can change the capabilities of bodies. We argue that when clothing does this, it should be regarded as an affordance transforming technology. Although this idea receives passing attention in remarks by Gibson and empirical work in ecological psychology, we argue that it should be a central topic of investigation. We further show how the notion of clothing as an affordance transforming technology allows ecological psychology to accommodate feminist insights about the restrictive nature of some gendered clothing norms. Not all affordance transformations serve the interests of those wearing the clothing.

Keywords: Affordances, clothing, patriarchy

"I don't want to create painful shoes, but it is not my job to create something comfortable." – Christian Louboutin (in Alexander, 2012).

"Pain is an essential part of the grooming process, and that is not accidental [...] wearing a girdle, learning to walk in high heeled shoes [...] these things *hurt*." – Andrea Dworkin (1974: 115).

1. Clothing as an Affordance Transforming Technology

Human bodies are more regularly clothed than not, and what people wear has multiple often overlapping purposes, including symbolic, aesthetic and practical ones. Some clothing transforms human physical capabilities. Footwear protects feet from a range of hazards, and allows us to be active, or to do so for longer, on otherwise intolerable surfaces. Gloves transform what we can safely or comfortably handle. Other garments can insulate, waterproof, armour, cool, and camouflage, not to mention furnish receptacles that extend carrying capacity, and free up hands. That the human body is typically clothed in ways that transform its capabilities seems like the kind of thing that matters for thinking about human embodiment and cognition. Even so, synoptic works of cognitive science that focus on wearable technology, for example Clark's *Natural Born Cyborgs* (Clark 2003), tend to focus on wearable computational gadgets rather than the possible cognitive significance of worn items that aren't overtly computational.

Ecological psychology is both wary of computational metaphors and distinguished by its commitment to take seriously the capacities and skills of bodies situated within an environment. This makes it a promising framework for thinking about wearable technology, given that the possibilities for human bodies are rarely independent of what they are wearing. Perhaps surprisingly the ecological psychology literature has, for the most part, been silent about clothing, even when the clothing is clearly supposed to make a difference to embodied activity. Sportswear manufacturers, for example, have been engaged in high stakes competitive research and development focused on shoes for over half a century, going back at least to Bill Bowerman's passionate pursuit of weight-reduction for running shoes in the 1960s (Moore 2006). Yet an entire special issue of the International Journal of Sport Psychology in 2009 devoted to 'Ecological Approaches to Cognition in Sport and Exercise' doesn't include the word 'shoe' (see Arauju 2009).

The standard statement of what affordances are, following Gibson, is that the "affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill" (Gibson 1979, 127). This is commonly explained or fleshed out in terms of relationships between the physical properties of the environment and the capacities for action of an organism (Chemero 2003, 2009) or form of life (Rietveld & Kiverstein 2014). In this way of thinking, affordances are not an objective aspect of the environment, but are given in the agent-environment relationship.[1] The agent is the source of activity, and perception is the agentive process of actively discriminating possibilities for interaction in the environment. Here, we examine a selection of ways that clothing can shape action opportunities and affordance perception over both short and long time scales.

[1] There is ongoing debate over whether affordances are indeed relational or whether they are better characterized as properties of the environment (Turvey et al. 1981, Stoffregen 2003). As Wilkinson and Chemero have pointed out, the differences in characterization between relations and properties is not "empirically consequential" (forthcoming, p. 4) as the studies and results would be the same. We have chosen to go with the relational characterization, but what we offer here holds either way (or could with some minor modifications in wording).

There are several aspects of affordance perception important for understanding how clothing can change possibilities for interaction, and thus the affordance landscape. First, ecological psychology and its notion of affordances are valuable to those who care about embodiment precisely because of their focus on what an agent of a particular type, with a particular body, can do, and what can happen to it, in an environment. As Gibson notes in connection with the affordance of 'sitting on': "Knee-high for a child is not the same as knee-high for an adult, so the affordance is relative to the size of the individual" (1979, 120). When we wear certain clothing, it enables us to change our bodily appearance or capacities, shaping us in our capacities *as agents* (scaffolding or constraining our possibilities for action). Gibson himself made passing reference to clothing, suggesting that when being worn "clothing, even more than a tool, is a part of the wearer's body instead of a part of the environment" (1979, p35). He noted that clothing allows the individual to "change the texture and color of [their] surface, to put on a second skin, as it were" (1979, p35-36). But this second skin doesn't only change texture and color. Gibson noted elsewhere in talking about the affordances of fire, that fire is associated with a "gradient of danger" where "warmth becomes injury" (1979, p. 33, see also Heft 1989). Safety gloves used by welders and blacksmiths, are precisely technologies that transform the danger gradients, and so allow the clothed human to exploit different affordances.

This brings us to the second aspect: affordances are directly perceived as possibilities for interaction with the environment. This does not mean that an agent perceives everything they can possibly interact with at any given time, but that in active exploration of the environment they perceive and must select from affordances relevant to their current activity (Spurrett 2018). *How* clothing that makes a difference to possibilities for action transforms affordance perception is an empirical question, but *that* it does so is evident. Anyone who has hesitated approaching a hot pan with ungloved hands, or turned back to fetch sandals before walking on the pavement on a hot day, has in some sense experienced this. And ecological psychologists have studied phenomena that can be affected by clothing, by using worn items as experimental manipulations. So, for example, Mark (1987) explored judgements of whether some steps were climbable, including under manipulations of eye height achieved by having the subjects stand on blocks. Regia-Corte and Wagman (2008, cited in Turvey 2019, p387) on the other hand examined how wearing weighted backpacks designed to displace the center of mass affected affordances for standing on inclined surfaces. Some influences of clothing on affordance perception could be relatively quick, like the finding that wearing heavy backpacks is associated with larger estimates of egocentric distance (Profitt et al, 2003), and that holding a reach-extending tool is associated with smaller estimates of distance to target objects (Witt, Proffitt, & Epstein 2005). Others might require extended experience and practice, for example when learning to see what small bumps and depressions afford support to one practised in the use of climbing boots (Barrett 2011 explicitly links climbing boots to affordances). The first aspect we highlighted was that clothing can become part of the agent in the sense that it is a constitutive embodied element of determining possibilities for interaction with the world. The second, to reiterate, is that what is worn can shape what we judge we can do with our bodies and how we might achieve it.

The fact that some of the changes enabled by clothing need experience to exploit, and also experience to transform perception, bring us to the intertwined third and fourth aspects of affordance perception important for thinking about clothing: bodily comportment, and habituation and skill. The claim that what is afforded is relative to a body, illustrated by how knee-high can differ for adult and child, is not always and simply a statement about the brute physical dimensions of the bodies in question. Bodies are lived and have histories, giving each of them a profile of practiced motions and portfolio of embodied skills. The perception of affordances is certainly shaped by the core needs of the organism (seek good and avoid harm), but this can be further shaped by regularities in the way it moves its body, the kinds of environmental niches and constraints in which it has developed those regularities, and the embodied skills it has acquired over time (Rietveld & Kiverstein 2014). For humans and other social animals, bodies are shaped by the social norms and practices in which they

have developed. This means, first of all, that there are norms of comportment specific to various social settings. Bodies are held differently in a job interview, in the pub after a few drinks with friends, and when sitting on the couch playing video games. Secondly, our bodily comportment is also shaped by norms governing our social position, and in a way that influences what we perceive as possible for interaction. Some of these norms are explicitly gendered ones marking out ranges of acceptable or appropriate embodied activity for girls and boys, or women and men (Young 1980, Brancazio 2019). Growing experience with norms can turn effortful compliance into habit, just as accumulated experience with permissible or encouraged activities can develop fluent skills. We noted that climbing shoes make it easier to interact with some features of a rock face, but climbing experience will develop skills and habits that actually change how a rock face is perceived. On the other hand, a social norm that climbing isn't an acceptable thing for girls to do would obstruct experience and learning by those the norm excludes.

We propose that a fruitful way to think of the practical effects of clothing is as an *affordance transforming technology*. The wearable technology of clothing is of interest and importance to ecological psychology in ways that go beyond Gibson's own observations about 'second skins'. We think that the near total neglect of clothing in ecological psychology is a remarkable omission. One way to make this point is, as we noted in passing above, by reference to sports kit. Sports footwear is, worldwide, a fifty billion dollar industry (2021 figures), producing purportedly tailored gear for many sporting codes. Besides specific shoes for climbing, fencing, basketball, tennis and more, there are variations for different kinds of throwing (e.g. shot-put vs javelin) and types of running (sprints versus marathon, or track versus cross-country). Many sports now have rules about footwear, and there have been various controversies about whether some specific shoe conferred *unfair* advantage. A recent example of this is the Nike Alphafly, effectively banned from some categories of elite competition since 2020. Trainers, competitors, regulators and manufacturers seem to agree that shoes can make a significant difference to what a body can do. Yet as we noted above, a whole special issue of a journal (the *International Journal of Sport Psychology* in 2009) on 'Ecological Approaches to Cognition in Sport and Exercise' with fourteen separate pieces in it doesn't mention shoes *once*. The 800 page *Handbook of Embodied Cognition and Sport Psychology* (Cappuccio 2019) does somewhat better, mentioning shoes in connection with affordances on two occasions.

Here we will demonstrate through several examples that clothing can change the affordance landscape in immediate and long-lasting ways. We don't want to stop with this general point, though. In the paragraphs above we've mostly focused on cases where the affordance transformations provided by clothing are beneficial: allowing safe handling of hot dishes or easier climbing of cliffs. Making things easier or better doesn't exhaust what there is to say about the affordance transformation of wearable items. Sometimes people are made to wear things that reduce available affordances, for example with handcuffs and straightjackets. To use language introduced by Liao & Huebner (2021), we show that clothing can sometimes be an *oppressive* affordance transforming technology.

In the remainder of this paper, we examine how clothing can shape the affordance landscape through a critical feminist lens. Our analysis will be focused on a few examples of motion-restricting women's clothing and how the material limitations can change the affordance landscape. We aim to show that if ecological psychology is to be a general framework for thinking about human perception and activity, then (a) it has to consider clothing, and (b) should do so critically. It should consider clothing because clothing often makes a difference to what is afforded. And it should do so critically because the ways that clothing changes what is afforded, are sometimes discriminating. They're discriminating in the sense that what people are expected to wear and what differences that makes aren't independent of how they're classified in systems of power and oppression.

2. High Heels and Low Expectations

Early in the 1988 movie 'Working Girl' the protagonist heroine played by Melanie Griffiths wears sneakers during her commute, which involves using public transport and being a pedestrian on busy New York pavements. Upon arrival at the office she removes her sneakers and changes into formal shoes with high heels. This is an iconic example of a recurring template in film and television. What these office workers are doing and why is so legible that no dialogue is wasted explaining it: Some shoes are good for moving around in demanding environments, and others are good for the way you're expected to appear. High heels remain obligatory for women in some workplaces, and in others only relatively recent legal victories mean that they are, at least nominally, optional. For example, a ban on mandatory high heels at work in British Columbia was announced in 2017 (BC Government News 2017). And an unwritten requirement that women wear high heels on the red carpet at the Cannes film festival is strong enough that Julia Roberts violating it by removing her heels and proceeding barefoot made headlines in 2016 and receives ongoing discussion in the fashion press (e.g. Le Vine 2016).

We want to develop a more thorough *ecological* treatment of the two uncontroversial points above, that high heels aren't very good for moving around, and that in some environments women are nonetheless expected to wear them. First, we'll review the significant negative physical effects of high heels giving most attention to medical literature. Second, we'll review highlights of how feminist scholarship argues that these negative effectsserve patriarchal purposes. Third, we'll argue that the negative effects can and should be understood by recognising high heels as an affordance transforming technology that is congruent with patriarchy rather than benefitting wearers.

First, then, consider the negative effects of high heels, specifically those that bear directly on the efficiency and success rates of different embodied activities. Some of these effects are widely reported. Wearers have compromised balance because of displaced centre of mass and a reduced surface area contacting the ground. High heels are painful, especially when worn for extended periods, partly because of the increased pressure on a smaller contact surface, and because effects of the transformed (relative to flat shoes) forces on ankles, knees and other body parts extend all the way up to the neck. Wearers take shorter steps on average, move more slowly, and exhibit generally less efficient gait. Some of the factors that compromise balance also compromise maximum braking force. Unsurprisingly wearers experience falls, breaks and sprains with higher frequency than wearers of flat shoes. Prolonged regular wearing is associated with a cluster of kinds of damage to feet, legs and posture (see, among many others, Barnish & Barnish 2016, Cowley et al 2009, Cronin et al 2012, Cronin 2014, Ebbeling et al 1994, Weidemeijer & Otten 2018). It isn't surprising that the bans on mandatory heels in workplaces have been motivated, to a significant extent, by occupational health and safety considerations (e.g. WorkSafeBC Evidence-Based Practice Group & Martin 2017).

Feminist scholars are well aware of these and other effects of high heels. Andrea Dworkin (1974), for example, makes brief remarks on high heels in the context of a longer examination of the practice of footbinding, making the crucial observation that the physical mutilation of footbinding "*did not emphasize the differences between men and women – it created them*" (1974, p. 103, emphasis in original). That is, that lower physical competence, including moving more slowly, having a smaller area of surface contact with the ground, being less balanced, and taking smaller and more painful steps, on the part of women was not a prior fact encountered in the world and enshrined in patriarchy, but something that had to be *produced and maintained,* whether by means of footbinding or imposing high heeled shoes. Dworkin grouped high heels with other tools and practices forming a "technology of beauty" (Dworkin, 1974, p.114) the purpose of which was not exhausted by its superficial effects, but included that much of it, including high heels, are uncomfortable or painful. At the start of this paper we quote noted footwear designer and high heel specialist Christian Louboutin suggesting that the pain of wearing the shoes he designs isn't his intention, but a regrettable by-product of achieving his aesthetic objectives. Louboutin may be correct about his own state of mind, but Dworkin's contention is that the pain is non-accidental, and functional. In her view standards of beauty serve to "describe in precise terms the relationship that an individual will have to her own body. They prescribe her mobility,

spontaneity, posture, gait, the uses to which she can put her body. *They define precisely the dimensions of her physical freedom*." (Dworkin, 1974, p.113, emphasis in original.) Dworkin also observes that a key, and she thinks non-accidental, effect of the pain and physical restriction is to force "women to be a sex of lesser accomplishment" (Dworkin, 1974, p.116). You don't have to think that Dworkin's entire analysis is correct to be struck by the fact that the conclusions of empirical research on the effects of wearing high heels confirm many of her key premises.

There is much more going on with high heels than we've been able to survey here. In addition to what we've mentioned regarding pain, injuries, balance and more, they change how wearers look to others, and how they feel. High heels were originally a male fashion item, adopted in imitation of shoes worn by cavalry officers (Thompson Ford 2021, p. 140). Some wearers report enjoying the gain in height, or the change in how their legs look, or how others relate to them. High heels, precisely because they are impractical, can signal status by expressing the wearer's indifference to manual effort. We don't deny these complications and are not aiming for a comprehensive treatment. Irrespective of those other considerations, high heels are painful and compromise physical effectiveness, and are far more likely to be expected on women in certain roles than anyone else. Feminists have argued that neither the pain nor the physical restrictions are accidental.

It should be clear from the considerations raised above why we think that high heels should be regarded as an affordance transforming technology. The question whether some slope affords standing, or some interval affords stepping over, or a suitcase affords carrying, will sometimes depend not only on the body of the subject or what they may want to stand on, step over or carry, but whether the subject is wearing high heeled shoes or not. This is precisely what the office workers who leave their homes with two pairs of shoes illustrate: that the cost of the high heels is too high to be borne on their commute where they are relatively free from pressure to wear them. What the environment provides or furnishes a body, for good or ill, isn't independent of what the body is wearing,.

Gibson, as we noted above, referred to a 'gradient of danger' in connection with fire (Gibson 1979, p33). That high heels impose a different gradient of danger is clear from the injury data. The less balanced person, constrained to take smaller steps, will correctly perceive larger intervals as not being safely traversable. The heels impose, we could say, a 'gradient of pain' discouraging motion in general, and some motions specifically. The transformation to the distribution of what is comfortable or painful, difficult or easy, safe or risky, make real differences in how wearers experience their affordance landscape. Some differences will be noticed quickly, some require experience, and prolonged use will both habituate perception and embodied activity, as well as having longer term physical consequences on joints, tendons, muscles.

The thought that high shoes might transform affordances is not wholly unfamiliar to ecological psychology. As we noted above, Mark (1987) studied judgments of whether surfaces afford "sitting on" or steps afforded "climbing on", arguing that information in the optic array was scaled to the perceiver's eye-height, as well as being highly accurate. He also showed that unfamiliar manipulation of eye-height by means of worn 10cm platform blocks both predicted errors in whether a surface afforded sitting or climbing. A modest amount of experience with the platform blocks allowed subjects to recover high accuracy. Further work in Mark (1990) sought to clarify what kinds of experience with the blocks facilitated accurate rescaling, and found that walking and free head movements, that is embodied experience, were most effective.

Mark's aim wasn't to investigate clothing generally, let alone high heels specifically, from an ecological perspective. The platform blocks were an experimental manipulation in a suite of experiments investigating relations between judgements of affordances and embodied activity. Nonetheless, because high heels change eye-height for standing wearers, his results do tell us that experience with moving around in high heels will change perception and judgement about what is afforded, at the same time as the physical properties of the shoes transform one's safe or comfortable range of motion and the ways in which wearers are able to interact with the environment. Similarly,

high heels displace the wearer's centre of mass, which ecological psychologists have manipulated by means of weighted backpacks (Regia-Corte & Wagman 2008). Rather than worn items that transform affordances being a rare experimental manipulation, we'd like to see them becoming a central focus of a fraction of the empirical and theoretical enquiries of ecological psychologists.

We have defended two claims here . One is that high heels transform affordances at all. The other is that recognising this allows ecological psychology to accommodate established critical feminist points about the harm done by imposing high heels. The second claim depends on the convergence between *how* high heels impose physical restrictions, and the patriarchal requirement that there be a sex of lesser physical accomplishment. Our brief discussion here has focused mostly on the short term or current effects of wearing high heels, even though there is medical evidence about longer term consequences. In the following sections we'll devote more attention to accumulated effects and processes of habituation as we review two different affordance transforming technologies.

3. Obligatory Skirts and Bodily Comportment

Here we shift our focus to mandatory skirts or dresses in school uniforms. It is important that not all skirts or dresses function to limit the activity of the wearer, and that skirts have not always been considered feminine clothing. Like heels, skirts were sometimes worn by men in the European pre-Victorian era to signal wealth and affluence, for example in the iconic representations of Louis XIV and Henry VIII. In various traditions and cultures men's skirts are standard everyday wear (e.g. Fiji), formal attire (e.g. Scotland, Niger), religious attire (e.g. Shinto priests), or clothing for battle (e.g. Samurai armour). Skirts, that is, aren't *inherently* masculine or feminine, any more than high heels. We're interested in contemporary cases where they are made selectively obligatory for women and girls.

We focus strictly on compulsory skirts and dresses for school girls, where social norms regarding the behavior of women have been shaped by traditions that emphasise modesty, docility, and subservience to men. Our analysis of these skirts is concerned with the way that uniforms play a role in shaping girls' activities, bodily comportment, and affordance perception. School uniform skirts are usually box or circle pleat styles, though we sometimes find pencil skirts in senior school years. We maintain that there are two broad ways in which skirts are affordance transforming, a direct route and an indirect one. In the direct case skirts make a difference to what is physically possible or convenient. Consider the testimony of Rosie, a seven year old at a school where girls are required to wear skirts:

> "When I was 5 and in kindergarten, I stepped on the hem of my dress while climbing on play equipment and smashed my face into a metal bar. I said to mum, "I can't climb on that bar any more mummy". She said, "Why don't you wear shorts?" And I have for 2 years now, and have no problems playing on the climbing things. … I think all girls should be able to wear shorts because then they can do soccer and climb and kick and do cartwheels. I think girls should wear shorts because then they can do lots of things!" (Rosie, 7) (Girls Uniform Agenda undated b)

The skirt that can get trapped under foot leading to accident and injury while engaged in physical play is directly and vividly affordance transforming. Rosie learned quickly what activities were punished, and if switching to shorts hadn't been an option she'd have held back from some forms of physical play. Similarly, a pencil skirt that restricts the movement of the legs will inhibit or prevent running, climbing, and other activities. Many skirts, though, are short enough that they don't get snagged and loose enough that they don't directly restrict movement. This brings us to the indirect route to transforming affordances. Here the key issue is selecting between forms of physical action given *both* the physical properties of skirts, and the felt obligation to conform to some norm of

appearance. We'll focus on the norm of modestly demanded of girls and women, and the specific imperative not to allow underwear to be seen.

This threat of embarrassment has an ongoing effect on posture and well-being. Cohen-Woods and Laattooe (2019) explain that "the best sitting posture is an upright back with knees slightly apart–a position usually adopted by men (wearing shorts and trousers); girls and women tend to sit with knees together or crossed" (p. 4). They link this difference in comportment to girls not wanting to risk showing their underwear, a finding congruent with research showing that women tend to take up less space with their bodies, folding their arms and crossing their legs in 'closed' rather than 'open' positions (Vrugt & Luyerink 2000). They also point out that some stationary activities–such as sitting cross-legged–make girls feel like they have to overly attend to their positioning, which can distract from their lessons and social engagement. We say that the route to affordance transformation here is indirect because the skirt doesn't inhibit physical movement in the same way as the high heel. A bench or step affords sitting in the best posture just as much to the child in trousers and the one in the skirt next to them. What the skirt does, given the modesty norms, is introduce a *penalty* for adopting that posture, and impose an ongoing demand to select between socially acceptable and unacceptable forms of action based on how much they risk letting others see their underwear. This affects the acceptability of almost every action or form of that action including sitting, running, jumping, climbing, and bending to pick something up.

At some schools it is common to require a different, sporting, uniform for girls on Physical Exercise ('PE') days, including schools that demand skrits on non-PE days, and shorts or tracksuit pants on PE days. This creates a useful natural experiment. Norrish et al. (2012) used a combination of pedometers and self-reports to record the physical activity engaged in by pupils on days of wearing formal uniforms (dresses) versus days of wearing sport uniforms (which include shorts) for both summer and winter uniform variants. Physical activity by girls was lower in both seasons while wearing formal clothes, and higher on days when they wore shorts or tracksuit pants. The physical activity of boys, whose formal and sports uniforms both include shorts or trousers, showed no change. This is very striking: among the same children, with the same social relationships, and in the same familiar environment, the day to day difference between skirts and pants is associated with reduced average physical activity among those wearing skirts (Norrish et al. 2012).

Again, we can distinguish short and long term effects here. As with the change from sneakers to heels (or vice-versa) for the skilled wearer, the change in the way affordances are perceived, or their solicitation (Rietveld 2012, Dreyfus & Kelly 2007), is sometimes immediate.[2] The Norrish et al. study showed a significant change in girls' activity between days when formal attire (dresses/skirts) and sports attire (shorts) are worn, which shows that there is an immediate change in their affordance landscape. However, it is also the case that on short time-scales, self-consciousness or embarrassment following failure to satisfy the norm can drive deliberate selection of less comfortable postures, such as sitting with knees close together, and rejection of physically possible and enjoyable activities like climbing. The accumulation of such discipline over time can lead to cultivating or otherwise acquiring habits of comportment that satisfy the patriarchal norms of modesty and docility. At the same time refraining from some activities means leaving large regions of embodied skill space unexplored, so that even if the imposition was removed, a significant degree of conformity might remain. Having to wear a skirt for many years in school, that is, can habituate one to act *as though* a skirt is being worn. We think this is one of the many contributors to the well-documented closed or minimizing postures of women

[2] Again here, we are trying to avoid debates about the ontological status of affordances, as our priority is in making the case that clothing can shape the ways that affordances are perceived. So, for example, one might think rather that the affordances of the environment are all perceived, but with varying valence depending on how they offer one the means to achieve their goals at a particular time (Gibson 1982, p. 410). Our point is that clothing and footwear are intertwined with how affordances are perceived, not whether they are perceived. For an excellent overview of why the phenomenology of affordance solicitation is important, see (Dings 2017).

in *any* clothing. As Young describes it: "[t]hough we now wear pants more than we used to and consequently do not have to restrict our sitting postures because of dress, women still tend to sit with their legs relatively close together and their arms across their bodies" (Young 1980/2005 p. 32).

Happel (2013) and other feminist researchers have pointed to the ways that cisnormativity in school uniforms contribute to regulation processes that line up with other means of constructing a gender binary (Butler 1991). Likewise, de Beauvior has argued that a "feminine essence" is not expressed by girls but imposed upon girls through "education and custom" (1974, p. xxxv) . School uniforms and the restriction of movement have wide-reaching effects, as they have "implications for how girls are treated, viewed, and, most importantly here, for how they are able to move. Skirts restrict movement in real ways; wearers must negotiate how they sit, how they play, and how quickly they move. Skirt-wearing, consciously and unconsciously, imposes considerations of modesty and immodesty, in ways that trousers do not" (Happel 2013, p. 95). From an early age, girls are taught to constantly attend to the ways they can hold and move their bodies in order to avoid deviating from social expectations. As we argued in regards to high heels, skirts are used to materially create and maintain femininity. And this can involve reinforcing norms of modesty that habituate girls into being overly attuned to how they are being perceived by others. Much of this has been discussed in feminist literature on the male gaze (for a review, see Tyner and Ogle 2009), and should not be out of the purview of an account of cognition and perception.

The phenomenological aspects of lasting social shaping are made clear in Young's celebrated paper "Throwing Like a Girl" (1980). In Young's analysis the timidity and uncertainty with which a large number of women approach physical engagement involves a lack of trust in one's own body and a fear of getting hurt. We would also like to suggest that fear of embarrassment through immodesty or lack of grace can also play a role in how women view and interact with affordances, and that obligatory skirts make this *more* challenging. This further supports Young's point that having been shaped to pay close and consistent attention to one's own body is itself a hindrance that keeps women from being able to give full attention to the interaction itself. As she says: "We feel as though we must have our attention directed upon our bodies to make sure they are doing what we wish them to do, rather than paying attention to what we want to do through our bodies." (Young 1980/2005 p. 34).

Young famously proposes that an *inhibited intentionality* is one modality of feminine comportment and motility. This draws from Merleau-Ponty's conception of the "I can" of experience as being the bodily orientation toward action (Merleau-Ponty 1962). Young proposes that feminine comportment involves a withholding of full bodily commitment to the "I can" of orientation toward action, "which simultaneously reaches toward a projected end with an "I can" and withholds its full bodily commitment to that end in a self-imposed "I cannot."" (Young 1980/2005 p. 36). We see this experience implemented materially with the mandatory wearing of skirts. A girl at risk of showing her underclothes learns to see herself from the outside, monitoring her visibility so that she is not violating standards of modesty. She learns to limit her movement in accordance, paying a deliberate motor control tax on sitting, getting up and down, bending over, etc. And she learns to experience her own movement, her embodied relation to the world, as "the potential object of another subject's intentions and manipulations, rather than as a living manifestation of action and intention" (Young 1980/2005 p. 44).

Current thinking about gender and its relation to affordance perception has focused for the most part on the ways that social norms are expressed and maintained in interaction with others (e.g. McHale et al. 2003, Brancazio 2019, McClelland & Sliwa 2022). Our examples here supplement these accounts with tangible and material ways in which the affordance landscape can be shaped through social impositions of gendered clothing norms. In this particular case the skirt transforms the task of conforming to modest norms in ways that, like high heels, encourage diminished physical agency. Again, the testimony of children is compelling and incisive. Here is nine-year old Anouk's response to the question "What can you do wearing shorts that you couldn't or wouldn't do in a school dress?":

> "I can run around more. I can cool myself down easier on hot days. I can climb around the playground. I can sit cross legged on the floor a lot more easily and comfortably, and I can play my favourite sports, like cricket and footy. In grade one I played footy at lunchtimes, but it got too hard in my dress, so I stopped. I'm glad I can play footy this footy season at school!" (Anouk, 9) (Girls Uniform Agenda undated a)

Anouk's experience shows the drastic change in the affordance landscape when she changes from the girls uniform to the boys uniform. She can comfortably sit on the floor and play sports at recess. Likewise, Rosie expresses that the bar that she feels she cannot climb on due to risk of injury is climbable *when in shorts*.

Historical changes in clothing for competitive sport provides an instructive contrast to the world of school uniforms. Most competitive sports impose strict separation between women and men, and often mark this with differences in expected attire. Even so, in competitive sport *physical effectiveness* is at a premium, and trainers, countries and the manufacturers of clothing as well as athletes themselves compete with each other to enhance it, and to remove obstacles to it, including ones connected to clothing. This has helped erode some of the most dramatic gendered differences in sporting clothing. So in tennis, for example, early 20th century expectations for women competitors included floor length skirts and petticoats as well as corsets. So strong were the expectations that Suzanne Lenglen was called 'indecent' for appearing at Wimbledon in 1919 wearing a calf-length skirt, and neither petticoat nor corset (Chrisman-Campbell 2019). Three decades later, Gertude Moran's appearance at Wimbledon in a mid-thigh tennis dress that sometimes allowed glimpses of her underwear caused a sensation, and was described by the committee of the All England Lawn Tennis and Croquet Club as "bringing vulgarity and sin into tennis" (Williams 2013). Similarly, at the first Olympic Games where women competed in fencing, starting in 1924, the dress code for women included skirts, regarded as uncomfortable and dangerous because blades could reach the legs. Men standardly competed in breeches. The first woman to compete in breeches was Judy Guinness in 1932. Breeches closed below the knee subsequently became mandatory for all fencing competitors (Fare 2019).

We are not claiming that competitive sport is a utopia free from patriarchy or any other kind of discrimination. As Chambers notes, in women's bodybuilding competition, contestants in the 'figure' category are both required to be less muscular than in other categories, and to wear high heels (Chambers 2022, Chapter 1). And women competitors in various sporting codes have faced discipline or courted controversy for *not* wearing gear that focused attention on their appearance. In 2021 the Norwegian Women's beach handball team was fined for wearing shorts instead of bikini bottoms. In that same year, it was widely regarded as newsworthy that the German women's gymnastics teams opted to wear full body garments instead of standard bikini cut leotards in protest against 'sexualization'. A particularly illuminating example comes from the introduction of women's boxing into the Olympics. Most teams opted to allow women to wear the clothing of their choice, but two teams, Russia and Poland, made skirts mandatory. When asked about it, the Polish coach Leszek Piotrowski stated "By wearing skirts, in my opinion, it gives a good impression, a womanly impression. Wearing shorts is not a good way for women boxers to dress" (Brennan 2011, Ingan and Kovacs 2012). So how women are expected or encouraged to dress for appearance remains contested. In addition, in domains where physical effectiveness is *not* a decisive priority, gendered clothing expectations that are impractical, uncomfortable, unsafe and even harmful can and do persist for longer. Our point is more restricted: clothing for competitive sport provides plenty of examples of innovations aimed at improving physical effectiveness, and some of those examples have displaced or eroded gendered clothing norms that specifically burdened women. Some of those changes make sense if we see skirts as an affordance transforming technology.

Differences in bodily comportment have been discussed in the literature on ecological psychology and the sociality of affordances. For example, Costall notes that "...there are striking cultural differences in the manner of walking, sitting, or ways of carrying things (e.g. on the head rather than in our arms). The fact, then, that our activity is itself socialized extends the issue of socializing affordances well beyond the limits of artifacts" (Costall 1995, p. 473). The socialization of affordances and the relation between gender norms of bodily comportment and perception has received some recent attention. Brancazio (2019), for example, has argued that when habituated through these kinds of restrictive norms, inhibited intentionality can "constrain our perception of possible actions" (p. 13). This section has served to show how enforcement of gender binaries through mandatory skirts/dresses and resultant habituation can contribute to shaping the affordance landscape in myriad ways, from actual physical restriction to fear of embarrassment to accentuating self-consciousness to broader social compulsion to enact "femininity" as "a set of structures and conditions that delimit the typical *situation* of being a woman in a particular society" (Young 1980/2005 p. 31). Mandatory skirt wearing for girls is one more example of how clothing can be an affordance transforming technology used to enforce and habituate gender norms.

4. Affording Independence

Our final case study is the provision of sewn-in pockets. As before, we defend a set of connected claims: Pockets have positive practical consequences that make them affordance transforming technologies. Clothing made for men is typically, and has long been, more extensively provided with pockets than clothing for women. Again, this has not escaped feminist attention. The recognition of pockets as affordance transformers allows this critical perspective to be accommodated by ecological psychology. [3]

Pockets are receptacles that move with the body. A compelling statement of the usefulness of pockets is provided by Gilman in a 1914 work of fiction. In one passage the narrator rhapsodises about the delight of having pockets, contemplates the many pockets forming part of their regular clothes, and the varied contents of these pockets (pen, cigar case, keys, money, notebook). In a formulation wonderfully apt for our purposes, they realise "the armoured assurance of having all those things at hand, instantly get-at-able, ready to meet emergencies' (Gilman 1914, quoted in Burman & Fennetaux 2019, p24)[4]. Calling the things in pockets 'get-at-able' is vividly suggestive of Gibson's regular use of similar idioms such as 'climb-on-able' to refer to affordances (Gibson 1979, 120).

We noted above that Gibson counted clothing as a kind of skin, and potentially relevant to ecological psychology. Clothing with pockets makes wearers into beings whose skin includes containers. These allow things to be carried without being handled, and brought to hand if and when needed. How having items readily available can change the affordance space might be best understood through Bruineberg et al's (2019) concept of general ecological information. Building on Chemero's (2009) work on non-lawful regularities, they define general ecological information as "any regularity in the ecological niche between aspects of the environment, x and y, such that the occurrence of aspect x makes the occurrence of aspect y likely" (Bruineberg et al. 2019, p. 7). For one who has pockets consistently available and is skilled in using the items they contain, there would be a regularity in the relationship between the pocket itself and the pocket's contents (a wallet, a phone, a lighter, a Swiss

[3] A different consideration sometimes offered is that proper functional pockets would interfere with the imperative to display the body shape of the wearer. If this is correct, it might explain but certainly doesn't justify (and hardly undermines the feminist criticism). But it's also an unimpressive argument because inadequate provision of pockets for women was widespread long before closely fitting clothing for women was common.

[4] We use this example as historical evidence for our claims while acknowledging and condemning the author's eugenicist beliefs.

Army knife). Non-lawful regularities are not only important for understanding how affordances relate to each other. It is non-lawful regularities between affordances that enable us to anticipate, to plan ahead, and to shift from one activity to the next when undertaking short-term and longer-term activities (e.g. I generally reach into my pocket for my lighter when I am at a certain point in my process of having a cigarette). This is important for thinking about how having items regularly available can shape how we perceive possibilities for interaction, as pockets both allow quick retrieval of their contents and make it the case that carrying an object doesn't mean giving up on other deployments of the hands. Clothing for men in Europe has provided extensive sewn in pockets for several centuries (Burman & Fennetaux 2019, p23). And complaints about the inconvenience to women of having fewer pockets or none have been aired for over a century. In New York in 1910, for example, early suffragettes used a tailors' association event to promote a 'Suffragette Suit' distinguished among other things by having 'plenty of pockets' (New York Times, 1910). The astute 1914 observations about the convenience of pockets that we quoted above are from a work of speculative fiction called 'If I Were a Man' by utopian feminist Charlotte Perkins Gilman. Over a century later there are still periodic initiatives to promote clothing for office environments that provide women with pockets, including the 'Leslie Suit' by Holdette, and the 'Parity Pockets' project (Suman 2018). The Parity Pockets project responds to a persisting complaint that some garments - for example denim jeans, are made for women with fake or non-functional pockets, which Suman (2018, p40) calls a 'daily affront' for 'roughly half the population'.

Women not being provided with pockets a century and more ago was often linked to their being denied some of the things that would go inside the pockets. So Gilman, in the story quoted from above, while imagining being a man for a day, dwells specifically on some pockets containing money, and "all at once with a deep rushing sense of power and pride, she felt what she had never felt before in her life - the possession of money, of her own earned money - hers to give or withhold; not to beg for, tease for, wheedle for - hers" (Gilman 1914, quoted in Burman & Fennetaux 2019, p24). So pockets are affordance transforming, and their uneven provision aligned with patriarchy. There's a superficial difference between this case and our earlier examples. High heels and skirts have negative effects on their wearers, whereas pockets are beneficial. But in both cases the gendered norms about the distribution of an affordance transforming technology is congruent with patriarchy.

Our thinking here has been guided by Liao and Huebner's (2020) treatment of 'oppressive things' – physical artefacts that can maintain oppressive structures. Liao and Huebner argue that a material thing is oppressive when it is 'congruent' with an oppressive system, and spell out three conditions for congruence:

> "First, physical things must be *biased in the same direction* as other manifestations of an oppressive system. Second, they must be *causally embedded* in the respective oppressive system. Third, these causal connections must be *bi-directional*: racist things must be more than mere products of racist psychological processes and racist social structures; they must also guide and constrain racist psychological processes and racist social structures." (2020, p9 – online first PDF)

The affordance transforming technologies represented by some clothing fit this framework. While there is at least a growing agreement that social conventions and practices specify a large majority of human affordances (Costall 1995, Rietveld & Kiverstein 2014), the example of pockets demonstrates how the oppressive structures in our social realm exist in the everyday material reality of one's affordance space. Where women are expected not to have power or freedom, they are not provisioned with ready access to tools that afford empowerment. And, recursively, women who are not provided with affordances that empower them will be impeded in forming goals or intentions that involve acting independently (Brancazio 2019).

Bags are often a fall back portable container, but Gilman (again) this time writing in 1905 was both clear that 'a bag is not a pocket' and correct about why: "If your bag be small and holds but a few things it is of little use: if it be large and holds many things there is much trouble in finding the article wanted. Pockets, in the masculine sense, are trim, flat, vertical pouches, keeping their shape and place so that the accustomed hand can fly to them instinctively" (Gilman 1905). Her observation about the 'accustomed hand' is astute. Having many pockets allows organisation in ways that bags don't, and experience with that organisation makes available a kind of unthinking fluency in bringing the wallet, or key, or mobile phone to hand. It is clear what practical injustice is being diagnosed here. Again, the world of sport provides a striking contrast. Rock climbers, for example, typically have a kind of pocket in the form of a worn pouch of chalk dust (to reduce the effect of sweat on hand grip). These pouches are useful, and their provision is insensitive to gender.

Early on in this paper we noted the commonly quoted gloss of affordances by Gibson as what the environment "provides or furnishes, either for good or ill" (Gibson 1979, 127). One argument we've been making is that clothing is often an affordance transforming technology. Another is that the transformations, like affordances themselves, can be *for good or ill*. Less is afforded to the subject with fewer pockets, and the differences are congruent with patriarchy. Being deprived of pockets is being burdened with encumbered hands, and either lacking important items or tasked with keeping track of a bag, and with greater search and handling time. Just as high heels create and maintain differences in mobility and physical freedom, so the lack of pockets burdens attention — by taking away the 'armoured assurance' Gilman diagnosed — and also burdens physical action because of the transfers and additional operations required to deploy the hands. If we recognise pockets as one of the ways clothing can be an affordance transforming technology, then we can also consider how being denied pockets changes the affordance landscape and disadvantages some in achieving everyday tasks by stifling transitions between affordances.

5. Conclusion

Consider, now, a *combination* of the cases we've examined. On one side imagine a trousered person with pockets and relatively flat shoes. On the other side, a person in high heels wearing a pocketless pencil skirt. They both face the task of getting out of their car, walking up the steps to the bookstore carrying their wallet, cellphone, and car keys. In the bookstore they must locate and buy a copy of *The Ecological Approach to Visual Perception*, answering their phone on the way out, and then run to their car when the call reminds them of an urgent errand. The practical demands of these quotidian tasks are very different *because of the clothing*. That running down stairs in high heels answering a phone while holding a book, and without pockets to hold your keys, is challenging is a fairly banal observation. But we've argued that these difficulties, like the conveniences of pockets, can and should be understood by thinking of clothing as an affordance transforming technology. And these are not isolated or unusual phenomena. As we've noted, humans are near ubiquitously clothed, and often the clothes are intended to change what is comfortable, or possible, or convenient. In some settings, such as competitive sport, intense research and development goes into trying to make clothes that support and augment specific embodied activities. We have shown here why, rather than worn affordance transformers being a very occasional experimental manipulation in ecological psychology, as they currently are, clothing like heels and skirts and fittings like pockets should be a mainstream target of investigation. Ecological psychology is already willing to be sensitive to ongoing differences between bodies, such as the relative size of children and adults. We don't think it is an excessive step to extend this to include relatively transient changes brought by worn technology. Indeed, studies we have already described provide suggestive templates for how this could go. So judgements of whether steps are climbable could be studied in both naïve and experienced subjects wearing high heels, along the lines of Mark (1987). Studies of whether inclines afforded standing could be studied where the

displacement of centre of mass was due to high heels rather than weighted backpacks, along the lines of Regia-Corte and Wagman (2008). Judgements of egocentric distance to a locked door could be studied where the contrast was whether the key was in a dedicated pocket, or in a bag with other objects, where Profitt et al (2013) used weighted backpacks as a manipulation, and Witt, Proffitt and Epstein (2005) used reach-extending tools.

Again, we note it would have been possible for us to argue for consideration of clothing as an affordance transforming technology in an optimistic way, focused on the benefit. Look, we could have said, at how these shoes help rock climbers, and these ones help runners, and these gloves help welders, and so forth. Had we done that, we'd have illustrated what Jesper Aagaard (2020) has usefully called the 'dogma of harmony' in 4E cognition, glossed as the 'over-idealized' presumption that "all entities are presumed to cooperate and collaborate" (Aagaard 2020, p1). Various recent papers have argued against this including Slaby's (2016) argument that some environments can scaffold exploitative emotion, and Liao and Huebner's (2020) discussion of oppressive things. In various ways these and other authors are showing how theories about the ways that cognition can be situated, extended, embodied, distributed, etc., can and should accommodate cases of conflict, harm, exploitation and oppression. The provision of affordances in physical environments can likewise undoubtedly be unjust or oppressive, for example when ableist design specifically and avoidably impedes access to people with some disabilities (Imrie 1998).

If ecological psychology is to be a general framework for thinking about human perception and activity, then it has to consider clothing, and do so *critically*. We can see that some norms about who wears what distribute affordance transformation in ways biased in the same direction and patriarchal norms, including Dworkin's point about restricting physical freedom (1974), and creating persons of *lesser physical accomplishment*. The examples here show that immediate changes in how we can interact with the environment can have significant downstream effects, especially with prolonged use, through changes in bodily comportment and other kinds of habituation. In taking onboard the idea of affordance transforming technologies, we hope ecological psychology can incorporate and perhaps even extend existing feminist and other insights about the effects of some kinds of clothing.

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