

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

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Abstract

Affordances are standardly understood as perceived possibilities for interaction. What is afforded is in turn regarded as dependent on the properties of a body and its environment. 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. Clothing receives passing attention in remarks by Gibson, and some empirical work in ecological psychology uses worn items as experimental manipulations. We argue that the effects of clothing 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 or oppressive nature of some gendered clothing norms. We aim to show that if ecological psychology is to be a general framework for thinking about human perception and activity, then it should consider clothing, because of the differences it can make to what is afforded. It should do so critically because the ways that clothing transforms affordances are sometimes discriminating in 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.

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, p. 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. Clothing can transform human capabilities. Shoes protect feet from various hazards and allow us to be active for longer on otherwise intolerable surfaces. Gloves transform what we can safely or comfortably handle. Other garments 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 important 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 cognitive significance of worn items that aren't overtly computational. Significant works on embodied cognition such as Gallagher (2005) barely mention clothing.

Ecological psychology is distinguished by its commitment to take seriously the capacities and skills of bodies in environments, and by its claim to be “generalizable to all organisms” (Turvey 2019, p. xi). Its central theoretical concept is that of the affordance: a perceived possibility for interaction for a body in a situation. It is 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 ecological psychology has been largely 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* devoted to “Ecological Approaches to Cognition in Sport and Exercise” doesn't include the word “shoe” (Araujo, 2009). Norman, a theorist of design who drew inspiration from Gibson, doesn't link clothing to affordances in *The Design of Everyday Things* (2001) or in *Living with Complexity* (2010). His remarks about clothing in *Emotional Design* (2004) are focused on style and meaning rather than embodied activity.

Here we aim to show that if ecological psychology is to be a general framework for thinking about human perception and activity, then it should consider clothing, and 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* 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.

A frequently quoted gloss by Gibson says that the “*affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill” (Gibson 1979, p. 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, and not independent of the body of the agent itself. There are contending schools of thought about how to understand affordances, partly because of differences in how to understand Gibson's insistence that affordances are directly perceived. Ongoing debate concerns whether affordances are relational or are better characterized as properties of the environment (Turvey et al., 1981; Stoffregen, 2003). Wilkinson and Chemero have argued that the differences are not “empirically consequential” (forthcoming, p. 4) because both approaches motivate the same studies, and claim the same results. Our argument is independent of these differences, and takes as a starting point the shared idea that what is afforded isn't independent of the body and situation, and that perceiving affordances involves embodied activity. Our interest is in what differences clothing can make to what is afforded, over both short and long time scales, rather than the metaphysics affordances.

Ecological psychology and its notion of affordances are valuable to those who care about embodiment and embodied cognition 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, p. 128). When we wear certain clothing, it enables us to change our appearance or capacities, shaping our capacities *as agents*, either supporting 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, p. 41). He noted that clothing allows someone to “change the texture and color of [their] surface, to put on a second skin, as it were” (p. 41). Such a second skin might do more than change texture and color. It might, for example, provide thermal insulation, or pockets. Gibson noted elsewhere in talking about the affordances of fire, that fire is associated with a “gradient of danger” where “warmth becomes injury” (p. 39). Safety gloves used by welders and blacksmiths, are precisely technologies that transform the danger gradients, allowing the clothed human to exploit different affordances. It

is, of course, an empirical question whether the skilled blacksmith perceives different affordances for grasping and handling with her gloves on. Our point here is only that the gloves transform what can be handled. We also don't insist that what is worn be skin-like in becoming a transient part of the body, and are open to thinking of clothing as more tool-like. We highlight Gibson's remarks as a general invitation to think more about clothing and affordances.

We've noted that affordances are perceived possibilities for interaction. 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. Ecological psychologists have already studied phenomena that can be affected by clothing, by using worn items as experimental manipulations. Mark (1987), for example, explored judgements of whether 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, p. 387) on the other hand examined how wearing weighted backpacks designed to displace the center of mass affected affordances for standing on inclined surfaces. Some of these effects could be relatively immediate, like the finding that wearing heavy backpacks is associated with larger estimates of egocentric distance (Proffitt 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 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 (Barratt, 2011 links climbing boots to affordances). These studies weren't investigating clothing and affordances but rather using worn manipulations to study affordance perception. Notice, though, that some clothing has the same effects as the manipulations. High heeled shoes, for example, change height (like the blocks subjects stood on in one study) and displace center of mass (like the backpacks worn in another). Still, they show that there's no question that ecological psychology has the resources to investigate the effects of clothing.

That it can take skill, or require learned habit, to exploit some of the affordances made available by clothing is worth emphasising. 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 features 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 can be further shaped by regularities in how it moves its body, the niches and constraints in which it has developed those regularities, and the embodied skills it has acquired (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). Experience with norms can turn effortful compliance into habit, just as experience with permissible or encouraged activities can develop fluent skills. Climbing shoes make it easier to interact with some features of a cliff, but experience is required to develop the skills and habits that transform how a rock face is perceived. A social norm that climbing isn't appropriate for girls, though, would obstruct girls from acquiring the necessary experience and learning.

We propose that a fruitful way to think about clothing when it changes what a body is capable of is as an *affordance transforming technology* that is sometimes embedded in a system of norms. The wearable technology of clothing is important to ecological psychology in ways that go beyond Gibson's own observations about "second skins". Given that humans are almost invariably clothed, the neglect of clothing by ecological psychology is remarkable. 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, sometimes enough to count as cheating. Yet, as we noted above, a whole special issue of a journal on "Ecological Approaches to Cognition in Sport and Exercise" with fourteen separate contributions doesn't mention shoes *once* (Araujo, 2009). 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 develop three examples showing how clothing can shape the space of affordances in ways both transient and enduring. Although the examples we've used up to now involve beneficial transformations in sport and safety, we're going to focus on cases that restrict or inhibit embodied activity. Making things easier or better doesn't exhaust what there is to say about affordance transformation by wearable items. Sometimes, for example, people wear, or are made to

wear, handcuffs the function of which is to *reduce* available affordances. To use language introduced by Liao & Huebner (2021), we show that clothing can sometimes be an *oppressive* affordance transforming technology. In this paper, we examine how conventional clothing can shape the affordance landscape through a critical feminist lens. Our analysis will be focused on examples of motion-restricting women's clothing and how the material limitations in interaction with systems of gendered norms can change the affordance landscape. Feminist thought provides a wealth of observations and analysis of the embodied character of patriarchal oppression, and pays specific attention to gendered clothing norms. A research programme "generalizable to all organisms" should be able to accommodate feminist expertise on embodied experience. We argue that ecological psychology *can* accommodate these feminist insights, and that the tool for making this possible is recognising clothing as an affordance transforming technology.

2. High Heels and Low Expectations

Early in the 1988 movie 'Working Girl' the protagonist played by Melanie Griffiths wears sneakers during her commute, which involves using public transport and walking on busy New York streets. 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 recent legal victories have made them optional.¹ 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 attracted discussion in the fashion press (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 review the significant negative physical effects of high heels giving most attention to medical literature. Second, we review highlights of how feminist scholarship argues that these negative effects serve patriarchal purposes. Third, we 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.

¹ A ban on mandatory high heels in British Columbia workplaces, for example, was announced in 2017 (BC Government News 2017).

To begin, consider the negative effects of high heels that bear directly on the efficiency and success rates of embodied activity. 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 various kinds of damage to feet, legs and posture (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, lower physical competence on the part of women, including moving more slowly, having a smaller area of surface contact with the ground, being less balanced, less able to carry a load, and taking smaller and more painful steps, 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 visual effects, but included being 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 for patriarchy. 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 endorse Dworkin's entire analysis to be struck by the fact that the conclusions of empirical research on the effects of wearing high heels corroborate many of her key premises.

There is, of course, much more going on with high heels than we've been able to survey. They also change how wearers look to others, and how they feel. High heels, which are neither culturally nor historically universal, and in Europe 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 they 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 all that, high heels are painful and compromise physical effectiveness, and women are far more likely to be expected to wear them in certain settings. Feminists have argued that neither the pain nor the physical restrictions are accidental.

It should be clear why we think that high heels are 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 heels. 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 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, p. 39). That high heels transform gradients 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 also 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 showed that unfamiliar manipulation of eye-height by means of worn 10cm platform blocks 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, finding that walking and free head movements, i.e. embodied experience, were most effective.

Mark's aim, we reiterate, 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 eye-height, judgements of affordances and embodied activity. Nonetheless, *because* high heels change eye-height for standing wearers, his results tell us that experience with moving around in high heels changes perception and judgement about what is afforded, just as the shoes transform the safe or comfortable range of motion and how 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 the direct focus of a fraction of the empirical and theoretical enquiries of ecological psychologists. Whether and how this confirms, complements or corrects feminist analyses are empirical questions. Our aim isn't to prejudge the outcome, but to highlight a specific and promising avenue for investigating an affordance transforming technology.

We have defended two claims here. One is that high heels transform affordances. 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 modestly moving sex of lesser physical accomplishment. This second claim is not unprecedented. Gallagher notes that "clothes impact most immediately how we move, and then how we act and what roles we can play" and that they can "have real physical and social effects and can actually support the norms of institutions" (2021, p. 90-91). Gallagher refers here to the work of McCarroll (2016) who considers how motor control processes can be shaped by clothing and uses the Victorian corset (as represented a theatrical work) as an illustration in ways compatible with our treatment of high heels. We take ourselves to be complementing and extending Gallagher's view that clothes (like institutions) "define an affordance space" (2021, p. 92).²

Our brief discussion has focused mostly on the short-term or current effects of wearing high heels, even though there is medical evidence of longer-term consequences. In the following sections we devote more attention to accumulated effects and habituation as we study two different affordance transforming technologies subject to gender norms.

3. Obligatory Skirts and Bodily Comportment

Here we focus on mandatory skirts or dresses in school uniforms. Not all schools have uniforms at all, of course, and while skirts are *widely* required of girls, they aren't universally demanded. Our

² We are indebted to an anonymous reviewer for drawing our attention to this passage.

interest is in their effects when they are imposed in a gendered way, and in settings where social norms regarding the behavior of women have been shaped by traditions emphasising modesty, docility, and subservience to men. We recognise that not all skirts limit the activity of the wearer, and that skirts have not always been considered feminine clothing. Like high heels, skirts were sometimes worn by men in pre-Victorian European to signal wealth and affluence, as in the iconic representations of Louis XIV and Henry VIII. In various traditions 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 are no more *inherently* masculine or feminine than high heels. We will show how obligatory skirts in the settings we've specified contribute to shaping girls' activities, bodily comportment, and affordance perception.

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 were 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 by injury, 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 restricting 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 feminine presentation. We focus on the norm of modesty, and the specific imperative not to allow underwear to be seen.

This threat of embarrassment has ongoing effects on posture and well-being. Cohen-Woods and Laattooe 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” (2019, p. 4).³ 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, oblige girls to attend deliberately to their positioning, which can distract from 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. 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.

Some schools require a different, sporting, uniform for girls on Physical Exercise (‘PE’) days, including schools that demand skirts 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. Activity by girls was lower in both seasons while wearing formal clothes, and higher on days when they wore shorts or tracksuit pants. The activity of boys, whose formal and sports uniforms both have 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.⁴ The Norrish et al. study showed a significant change in girls’ activity between days when skirts and

³ An anonymous reviewer for this journal suggested that we hadn’t paid enough attention to the consequences of some people having external genitalia. We emphasise that our point isn’t that everyone should sit with their knees together, but rather that everybody should be *equally free to sit with them apart*.

⁴ Again, we are trying to avoid debates about the ontological status of affordances, to focus on how clothing can shape the ways 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 influence *how* affordances are perceived, not *whether* they are. For an excellent overview of why the phenomenology of affordance solicitation is important, see (Dings 2018).

shorts are worn, suggesting an immediate change in their affordance landscape. However, it is also the case that on short timescales, 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 in *any* clothing. As Young describes it: “[t]hrough 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, p. 142).

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 1993). Likewise, de Beauvoir 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 regarding high heels, mandatory skirts 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 that is “generalizable to all organisms”.

The phenomenology of lasting social shaping is examined in Young’s celebrated paper “Throwing Like a Girl” (1980). In Young’s analysis the timidity and uncertainty with which many women approach physical engagement involves a lack of trust in one’s own body and a fear of getting hurt. We suggest that fear of embarrassment can also play a role in how women view and interact with affordances, and that obligatory skirts make this *more* challenging. This 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 giving full attention to embodied interaction. “We feel”

she says “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, p. 144).

Young famously proposes that an *inhibited intentionality* is characteristic 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, p. 146). 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, p. 154).

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 analysis supplements these accounts with concrete ways in which the affordance landscape can be shaped through gendered imposition of affordance transforming clothing. In this case the skirt transforms the task of conforming to modesty ideals in ways that, like high heels, inhibit physical agency. Again, the testimony of children is compelling and incisive. Here is a girl’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 describes the difference she experiences in the affordance landscape when she changes from the conventionally “girls” uniform to the “boys” one. She can comfortably sit on the floor and play sports at recess, just as Rosie (quoted above) experiences the formerly dangerous bar as climbable *when in shorts*.

Historical changes in clothing for competitive sport provide an instructive contrast to 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 work to enhance it, and to remove obstacles to it, including ones connected to clothing. This has eroded some of the most dramatic gendered differences in sporting clothing. In tennis, for example, early 20th century expectations for women competitors included floor-length skirts, petticoats and corsets. The norms were so strong 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). At the first Olympic Games where women competed in fencing the dress code for women included skirts, regarded as uncomfortable and dangerous because blades could reach the legs. 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 patriarchy-free utopia. 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). Women competitors in various sporting codes have recently faced discipline or 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 Russia and Poland made skirts mandatory. Polish coach Leszek Piotrowski said “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). What women wear and how they look remains contested in sport, and in domains where physical effectiveness is *not* a decisive priority, gendered clothing expectations that are impractical, uncomfortable, unsafe and even harmful persist for longer. Our point here is that clothing for competitive sport provides examples of innovations aimed at improving physical effectiveness, some of which have displaced or eroded gendered clothing norms that specifically burdened women.

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, for example, has argued that when habituated through these kinds of restrictive norms, inhibited intentionality can “constrain our perception of possible actions” (2019, 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, p. 140).

4. Affording Independence

Our final example 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.

Pockets are receptacles that move with the body. A compelling statement of the usefulness of pockets is provided by Gilman in a 1914 story. 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). 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, p. 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. 5237). One who has pockets consistently available and is skilled in using the items they contain, gains a regularity in the relationship between the pockets and their contents (wallet, phone, lighter, pocket

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 (for example, how a smoker might reach into a pocket for a lighter at a certain point in the process of preparing to smoke a cigarette). This is important for thinking about how having items regularly available can shape how we perceive possibilities for interaction. Pockets allow quick retrieval of their contents and permit carrying an object without 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, p. 23). And complaints about the inconvenience to women of having fewer pockets, or none, have been aired for over a century. 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 and keen observer of the practical effects of clothing norms, Charlotte Perkins Gilman.⁵ 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 latter 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, p. 40) 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, 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, p. 24). 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 (2021) treatment of 'oppressive things' – physical artefacts that can maintain oppressive structures. 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

⁵ We use this example as historical evidence for our claims while acknowledging and condemning the author's eugenicist beliefs.

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, and Colombetti and Krueger (2014 p. 1165) note how someone used to one, and who leaves it behind, an experience a powerful sense of loss or incompleteness. Even so, 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 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*. We can relate this to Gallagher's conception of autonomy as a matter of the number and quality of an agent's affordances (e.g. Gallagher and Janz 2012), if we recognise clothing as among the ways in which the number and quality of affordances can be shaped, whether in ways that help or hinder.⁶ 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. As

⁶ It would take us too far astray to engage in extended discussion of autonomy here but are indebted to an anonymous reviewer for drawing attention to the relevance of Gallagher's notion of autonomy.

before, empirical study, the conclusions of which we don't prejudge, could corroborate, extend or correct feminist claims here. It would be interesting to know, among other things, whether, and if so how, perception of the "open-ability" of a door varies with whether the key is in hand, in a pocket, or in a bag with other objects, or how having to keep track of a handbag in a busy environment impacted attention, memory and other capacities.

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, phone, 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*. It is obvious that running downstairs in high heels answering a phone while holding a book, and without pockets to hold your keys is challenging. 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 and workplace safety, intense research and development goes into trying to make clothes that support 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 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 wrought by worn technology. Indeed, studies we have already described provide suggestive templates for how this could go. 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 Proffitt et al (2013) used weighted backpacks as a manipulation, and Witt, Proffitt and Epstein (2005) used reach-extending tools. These initial hints show that ecological psychology is within reach of where we're urging it to go.

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 risked exemplifying 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 (2021) discussion of oppressive things, and Timms and Spurrett's account of hostile scaffolding (in press). 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 clothing.

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