



# Clothing Inventions as Acts of Citizenship? The Politics of Material Participation, Wearable Technologies, and Women Patentees in Late Victorian Britain

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## Abstract

This article is about clothing inventions, material participation, and acts of citizenship. I explore how pioneering Victorian women at the turn of the last century inventively responded via clothing to restrictions to their (physical and ideological) freedom of movement. While the bicycle is typically celebrated as a primary vehicle of women's emancipation at that time, I argue that inventive forms of clothing, such as convertible cycling skirts, also helped women make claims to rights and privileges otherwise legally denied to their sex. I ask: Do clothing inventions create possibilities to act differently? Can they be thought of as wearable technology, and in what ways do they (and their invention) enact political concerns? Might convertible cycling skirts be considered "acts of citizenship?" Throughout,

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I mobilize concepts of multiplicity, in-betweenness, and ambiguity to make a case for the relevance of clothing research for science and technology studies.

### **Keywords**

citizenship, clothing, gender, invention, patents, participation

A cycling craze swept Britain in the late nineteenth century.<sup>1</sup> While the middle-and-upper classes were quick to adopt this new leisure activity, it was socially and sartorially challenging for women. Conventional fashions in the form of long skirts and petticoats flapped dangerously near wheels and caught in pedals. Wearing more “rational dress,”<sup>2</sup> such as swapping skirts for bloomers, made cycling safer and more comfortable. However, because clothing was a primary symbol of the status quo, this exposed wearers to different kinds of harm. Early women cyclists were criticized as masculine and assumed to be “New Women” who held socially progressive and emancipatory views, even if they weren’t politically active.<sup>3</sup> It was not uncommon for abuse and rocks to be hurled at those who dared to challenge conventional ideas of how women should be in and move through public space. As Gordon (2001) writes, “With notions of gender so deeply embedded in clothing, changes in styles portended changes in the social structure” (p. 27).

The 1890s was also a time marked by patent fever in Britain. The bicycle was the source of much inventive attention, with over 20 percent of patents attributed to cycling in some form.<sup>4</sup> Although the vast majority of patents were by men, early cycling clothing is one of the rare fields where women inventors made themselves present.<sup>5</sup> Solving cycling’s “dress problem” was so mobilizing that it became a key driver for women’s entry into the world of patenting. The volume of their inventive activities in the mid-1890s rendered them statistically relevant (in English Patent Reports), marking out new territory in what had previously been a masculine domain.<sup>6</sup>

A popular type of inventive cycling clothing of this time focused on *convertibility*. Inventors ambitiously aimed to “provide a skirt proper to wear when either on or off the machine.”<sup>7</sup> Using a variety of clever mechanisms sewn into skirts, wearers could switch between walking and cycling as needed. These designs were popular. They permitted safer and more comfortable cycling and, because the wearer could conceal her cycling intentions away from the bicycle, went some way to minimizing the potential for

harassment and abuse. “With these various forms of convertibility,” write Helvenston Gray and Peteu (2005), “inventors searched for ways to easily transform the female cyclist, chameleon-like, back into her former self when dismounted” (p. 31). While convertible costumes weren’t for everyone, even Lady Florence Harberton, a leading English dress reformer and women’s rights campaigner saw a use for them. “[I]t is an invention whereby the Rational Dress can be made into an ordinary looking skirt at once” and “though I don’t want it myself, it might be convenient for anyone paying calls who wants to leave their cycle and walk about” (The Buckman Papers 1898).

There are abundant studies about the history of the bicycle and its technical trajectory. We know a lot about what we have cycled over the last century and far less about what we have worn to ride bicycles. And even less about the women who took material matters into their own hands. Women are more often historically narrated as being passively caught up in waves of technological change, as symbols of social upheaval, not catalysts of it. Or, alternatively, they’re not written about at all. In this article, with its focus on cycle clothing patents and related archives, I tell stories of pioneering Victorian women who inventively responded to restrictions to their (physical and ideological) freedom of movement. While the bicycle is typically celebrated as a primary vehicle of women’s emancipation, I aim to argue that inventive forms of clothing, such as convertible cycling skirts, also helped women make claims to rights and privileges of their sex that otherwise would have been legally denied.

To do this I approach clothing inventions via material participation and citizenship studies (Isin and Neilson 2008; Marres and Lezaun 2011; Marres 2015; Hildebrant et al. 2019). I build on research that expands understandings of political engagement beyond formal legal and informational status to include a wider variety of material and embodied understandings. I ask: Do clothing inventions create possibilities to act differently? Can they be thought of as wearable technology? In what ways do they (and their invention) enact political concerns? Can convertible cycling skirts be considered “acts of citizenship?”

## **Political Acts, Performances, and Participation**

I locate my argument in research that explores material and civic participation via objects and practices that enable, organize, and unsettle political engagements and interactions (Latour and Weibel 2005; Hawkins 2011; Marres 2015). As Marres (2015) suggests, turning attention to “participation,

as if things mattered” is a way of “letting things in” and opens up the possibility that nonhuman entities might transform understandings of social and political life (p. 1). This approach is concerned with what mundane things make possible, as in inspire, catalyze, or coalesce in those around them, in relation to specific concerns. It is, as Marres and Lezaun (2011) explain, “an investigation that queries how objects, devices, settings and materials, not just subjects, acquire explicit capacities that are themselves the object of public struggle and contestation, and serve to enact distinctive ideals of citizenship and participation” (p. 491).

Expanded scholarship in citizenship studies also seeks to bring civic concerns and political participation closer to everyday life. Conventionally, citizenship refers to a state of belonging, linked to place, rights, and top-down power. It defines individuals in relation to their political and legal status, borders and boundaries—where you are born or live—and relationship to governing bodies. While obviously important, national activities such as voting and citizenship tests can feel far from everyday concerns and practices. Over a decade ago, Isin and Neilson’s (2008) “acts of citizenship” drew attention to how people socially, spatially, sexually, and economically “do” and “make” citizenship on a lived daily basis in terms of claiming space, interrupting order, expanding possibilities, or otherwise engaging in and attempting to shape social and political worlds. Since then, acts of citizenship have been explored through social and digital media, public demonstrations, Do-It-Yourself community engagement, citizen-sensing projects, and protest, among others (Castañeda 2013; Ratto and Boler 2014; Gabrys 2017). Notably, this work does not seek to replace conventional understandings of citizenship but rather to add texture and layers. As many have argued, citizenship has always been “an essentially contested concept” (Lister 2003, 2).

Public performativity is key to these literatures. While the performance of participation is a well-studied area, Marres (2015) notes the “pervasiveness of material participation as a distinctive form of public action” has largely gone “undocumented in most official academic and public accounts” (p. 6). She argues, “it is the task of social and political studies to recover the material dimension of participation, and to testify to its normative significance” (p. 8). The version of citizenship “that exists on paper is an expression of inert or passive rights, yet citizenship rights (and responsibilities) are brought into being only when performed,” argues Isin (2019, 50). He suggests that certain citizenship rights “would disappear if not performed” and “also that such struggles require performing rights that may not exist” (p. 50). They are made and sustained through

performance. Critically, he notes that acts of citizenship are not only for citizens. “[N]on-citizens can also perform citizenship” (p. 50). Teasing acts of citizenship from conventional understandings expands to include activities like gorilla gardening, volunteering, donating blood, and protesting. Acts of citizenship might also involve *not* doing something, which may or may not involve obeying the law.

Clothing fits in these expanded parameters. As Crane (2000) argues, “Changes in clothing, and the discourses surrounding clothing indicate shifts in social relationships and tensions between different social groups that present themselves in different ways in public space” (p. 3). Extinction Rebellion T-shirts and Pussy Hats are recent examples, but clothes have long been used as political tools when people are denied a voice. Tickner (1987) demonstrates how suffrage campaigners at the turn of the last century used clothes, accessories, and their bodies to render visible some of the struggles they faced. Protestors expressed emancipatory desires on banners, sashes, and brooches to capture public imagination and claim streets. Critically, their contributions were not just “a footnote or an illustration to the ‘real’ political history going on elsewhere, but an integral part of the fabric of social conflict” complete with “its own power to shape thought, focus debates and stimulate action” (Tickner 1987, ix). Similarly, Parkins (2002) notes how the colors purple, white, and green played critical public roles in the suffrage movement. “Through the use of fashion and specific colours,” she explains, “the suffragettes forged a public identity for themselves in the public spaces of the city” and pushed their message “into the sphere of political communication” (p. 99). The political timelessness of these colors was evidenced at the 2021 US inauguration where Kamala Harris, Hilary Clinton, and Michelle Obama all wore purple hues. Yet, despite these notable exceptions, it is surprising that clothing, with its potential to enact and embody political concerns, has not generated much attention in relation to material participation and citizenship.

A core aim of this article is to explore convertible cycling skirts as acts of citizenship. Given the above broad definition, what then is not an act of citizenship? Although voting and being conscripted into the military, for example, might be seen as acts of citizenship, Isin (2013) makes the distinction that “active citizens” are those who follow “scripted acts,” while “activist citizens engage in writing scripts” (p. 41). The point here is “not to decide in advance what an act is but to explore how it is enacted,” because “an act can only be described through its performance and enactment” (Isin and Saward 2013, 25). Critically, for this article, it means we need to pay

attention to what clothing inventors and wearers show and tell us about the sociopolitical acts imagined and made possible with and in their designs.

## **Patents, Data, and Methods**

Although predominantly found in legal contexts, patents have attracted interdisciplinary attention. Researchers have explored famous patentees and controversial patented artifacts (Schwartz-Cowan 1997; Helvenston Gray and Peteu 2005; Swanson 2011), patent systems and innovation processes (Zorina Khan 2000, 2005; Cochoy and Soutjis 2020; Cochoy 2021), and indigenous histories (Foster 2017), among others. The reason for all this interest? Further to legal data, clothing patents hold social and technical stories. “If there were no such thing as a patent,” writes Schwartz-Cowan (1997), “we would not know very much about inventors” (p. 120). Patentees describe issues and provide detailed responses. This makes them valuable problem-making and problem-solving devices. Usefully, they tell us not only about their inventions but also about themselves and imagined users. This means patents can reveal the interests and anxieties of different people at different times as well as related materials, processes, and contexts of use.

Patent archives are also valuable for their breadth of data. While not all inventions are patented, of course, patent archives provide systematic means to find and examine lesser-known stories of marginalized or under-represented groups. This might seem counter-intuitive, given that patent archives are also vast colonial, gendered, and classed projects. Yet, as Zorina Khan (2000) argues, they can fill gaps in other data sources, such as where “the paucity of relevant data in an era when women were rendered ‘invisible’ by legal and social conventions” (p. 163). This means that patent data can counter persistent ideas that women were not eager and active participants in technological advancement. “Patent records are inherently useful in this regard because they provide a continuous source of information about market-related activities of women,” which “allow us to trace variation in female market participation across regions and sectors” (Zorina Khan 2000, 163). This wider perspective can reveal alternate practices that expand accounts and understandings of political participation and help us get beyond “heroes, big men, important organisations or major projects” (Law 1991, 12). Of course, the quality and nature of patent data vary over time, place, and application. But even when they prove to be “bad” “vehicles of social and moral concerns” as Cochoy (2021) found, patents nevertheless provide valuable records of the past upon which alternative future imaginings are possible (p. 21).

## *Data Collection*

The European patent archive, with free access to over 120 million global patent documents, is a primary source of invention data (see <https://worldwide.espacenet.com>). Since 2016, digitized archives spanning vast international collections has enabled detailed searching, categorization, and analysis of big data sets. This article examines a subset of publicly available clothing patents. As mentioned, women's patenting activities accelerated in Victorian Britain during the cycling craze. Skirts are my focus as they were the key site of the "dress problem." The corpus for this analysis includes eighty-six inventions for new or improvements to women's skirts for the purposes of cycling that were patented in Britain from 1890 to 1900.<sup>8</sup> Out of these, thirty-two were for convertible cycling skirts. Women submitted close to half.<sup>9</sup> While most inventors of this period came from England, there were also patents from inventors residing in Australia, Canada, France, Germany, Ireland, New Zealand, Scotland, and the United States.

## *Methods*

A mixed-methods approach was used to analyze the subset of thirty-two convertible cycling skirt patents. I closely read the text and illustrations and coded data to identify emerging patterns and themes (Charmaz 2014). My research extended beyond patents to a wider range of related archival sources. Acts of citizenship, as Isin and Neilson (2008) explain, "disrupt habitus, create new possibilities, claim rights and impose obligations in emotionally charged tones; pose their claims in enduring and creative expressions; and, most of all, are the actual moments that shift established practices, status and order" (p. 10). Piecing together a broader understanding of inventors' lives, motivations, and associations was essential to better understand their inventions. It is, however, notoriously difficult to trace ordinary women's lives from this period, so less-standard sources were enrolled to get at what Sheller (2012) has called "the embodied, spatial and affective aspects that escape archival record" (p. 5).

To thicken the data, I combined patent analysis with data from the Census, Electoral Register, Land Register, Marriage, Birth and Death Records, periodicals and newspapers, personal correspondence, and, where possible, contact with extended family. I also "interviewed" inventors through their clothing inventions (Jungnickel 2018). Few cycle garments of this period still exist, and no English convertible designs have been located (as yet); and even if available, there would be limits to access.

Furthering the idea of “letting things in” to the research, my team and I reconstructed a collection of convertible cycling skirts, following the instructions provided in patents, which added more data. In the following section, I focus on specific inventors to elucidate key themes in the corpus and explore how their inventions might be seen as “providing alternatives, possible sources for the development of new kinds of practices, narratives about belonging to and participating in society” (Holston 1995, 48).

## **What Can Historic Clothing Patents Tell Us About Citizenship and Participation?**

First, why seek a patent for a creation? While the subject of much larger discussion, it is useful to reflect on what inventors gained from legally claiming ideas in public. The boom in patenting in 1890s Britain arose from intersecting factors a decade earlier. Startled by advancements in competing countries, politicians began to link successful inventions with nation-building. They believed inventors could help Britain forge a reputation in “the great race” (The Times 1881, 6). The subsequent 1883 Patent Reform Act lowered costs and barriers to entry to encourage a broader range of inventors and inventions. These shifts corresponded with vast changes in machinery and industry, travelers’ tales of new worlds, increase in media that fueled the public imagination, and, of course, the popularity of cycling. It worked.<sup>10</sup> Patenting boomed in Britain. Successful inventors “were celebrated in print and from the pulpit . . . Newspapers quoted their opinions; popular magazines recounted their exploits; huge crowds turned out to hear them lecture; artists clamored for the right to paint their portraits” (Schwartz-Cowan 1997, 124). Patenting was especially appealing to women whose life courses were largely mapped out. Many wanted to be and do more.

What did they invent? As mentioned, the surge in women patenting was primarily triggered by the desire to cycle. Convertible cycle wear is the focus of this article but they invented a vast range of clothing in the form of bloomers and knickerbockers, capes, leggings, garters, spats, hats, and gloves, among others. Focusing on convertible cycling inventions reveals dynamic layers and tensions. They offered choices and held possibilities. They were designed to help women do things they otherwise were not encouraged to do. As we will see, they did not replace one identity with another, but rather added more. In the following sections, I mobilize concepts of multiplicity, in-betweenness, and ambiguity to make a case for clothing’s significance to the study of material and civic participation.

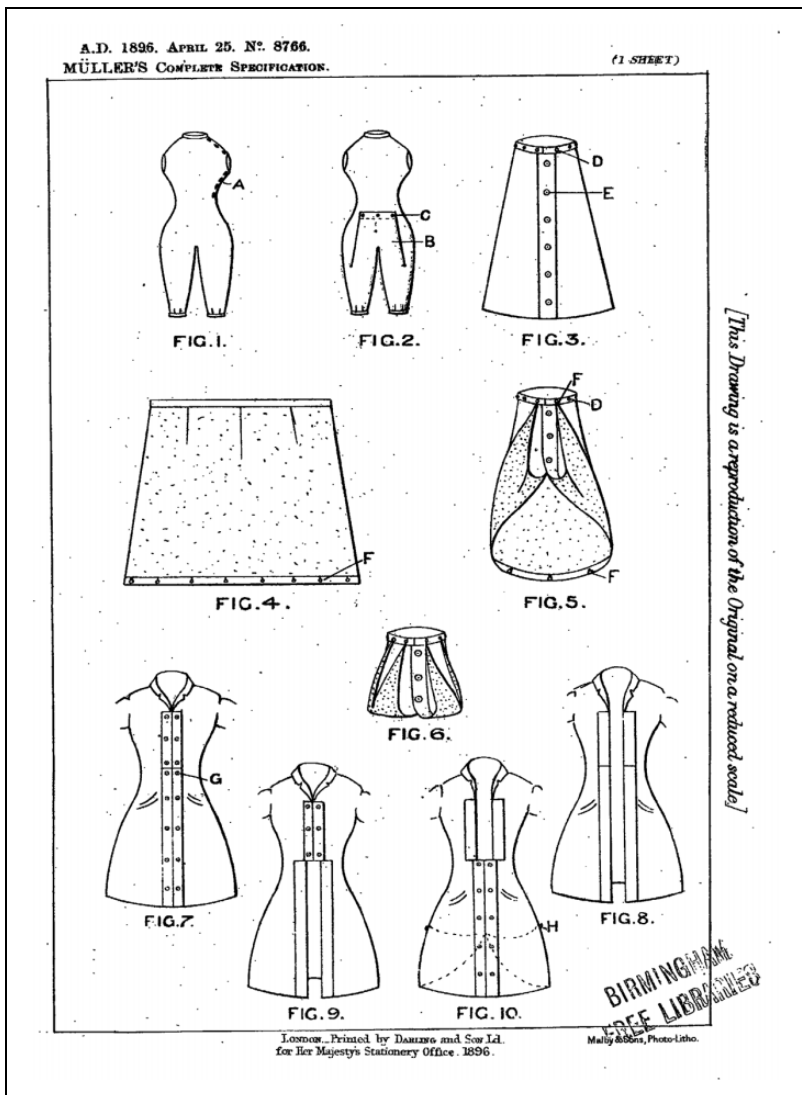


## *Multiple Citizens*

Frances Henriette Müller was a well-known women's rights activist, originally from Chile and residing in Maidenhead, England, who campaigned tirelessly for women's education, equal pay for equal work, the vote, reproductive health services, and more. She traveled frequently through Europe, India, and America to give lectures about women's rights. She set up her own newspaper, citing the lack of women's voices on important issues. She was even arrested for refusing to pay tax (due to lack of political representation).<sup>11</sup> Throughout her life, Müller challenged patriarchal systems on many platforms; in public lectures, writings, protest, and, it turns out, in clothing as well.

Much like her multifaceted approach to suffrage, Müller's (1896) patent for "Improvements in Ladies' Garments for Cycling and other Purposes" did not address a single issue. It responded to three (Figure 1). She invented a cycling suit that appears conservative on the outside, not dissimilar to modest, middle-class fashions of the time. Attired in a tailored knee-length coat and long A-length skirt, the wearer would not have looked out of place standing at a podium delivering a public lecture. Yet, the garment's surface concealed something else. The coat front featured modular sections that could be buttoned back in different formations; "closed at the waist" or "closed below the waist only" (Müller 1896). The A-line skirt was differently convertible. It could be hoisted up via a series of buttons and loops sewn into the hem and waistband. Müller even took on the much-discussed discomfort of women's underwear by combining two items, knickerbocker and blouse, into a single piece. It included a buttoned back opening for the wearer to easily relieve herself without having to undress. The cycling suit could be worn together or as separates. Much like her political approach, Müller designed self-determination into the invention by making sure each "part is quite independent of the other."

The idea that multiplicity and flexibility can yield cohesion and strength is a familiar one in STS. Mol's (2002) classic research on atherosclerosis demonstrated how a complicated disease was made coherent in an assemblage of diverse and often fragmented representations and practices. Far from diffusing or weakening, it demonstrates how multiplicity can make things stronger and more resilient. Reflecting on Mol's work in relation to citizenship, Netz et al. (2019) argue: "The multiplicity approach opens up the possibility for a detailed comparison of differing practices of (un)doing categories of difference," and this in turn "enables us to identify implicated



**Figure 1.** Frances Henrietta Müller's (1896) Pat. No. 8766: *Improvement in Ladies' Garments for Cycling and Other Purposes*, May 30 (accessed at Espacenet, the European Patent Office, [www.epo.org](http://www.epo.org)).

actors and fields that are not in the spotlight but nevertheless important sites for potential change” (p. 647).

Müller’s invention was multiple and flexible on every layer. It could be made, assembled, and interpreted in a range of configurations for diverse wearers and activities, some of which were accepted and expected, while others were considered radical and offensive. What must it have been like to wear a garment that contained such a range of expressions and relations? “If bodies are multiple,” argue Netz et al. (2019), “they can be different and other worlds are possible” (p. 646). Unsurprisingly, Müller’s (1896) invention does even more.

The whole suit forms a knickerbocker costume with all its conveniences, yet which may be wholly or partially disguised at the will of the wearer, and admits of freedom in riding a diamond frame machine if desired, with facility for the return to more ordinary costume if wished at resting places, by releasing the looped-up skirt.

Diamond frame bikes were conventionally viewed as men’s machines. They were fast, light, high-end machines as a result of advancements made for the male racing industry that trickled-down into the consumer market. (While some women raced, they faced even more hostility and ridicule than everyday cyclists.) Women’s bicycles were adapted with step-through or open frames to minimize the dangers of cumbersome skirts. They were heavy and hard to ride. Many derided the market decision to fix the bicycle, rather fixing “the dress problem,” with some even declaring: “An open frame is only an apology for a bicycle” (Wheeler 1898, 83). Müller’s invention offered the freedom for women to ride men’s machines. Was she suggesting they access men’s associated rights and privileges? Was she claiming even more ways for women to carve out independent mobile identities in public? From what we know of her life and pursuits, it seems likely.

Like many women’s rights activists, Müller also had a proclivity for pockets. Pockets have attracted the attention of many feminist scholars because they point to roles and responsibilities, indicating privileges and power (or lack thereof). Burman and Fennetaux (2019) argue that pockets “open new and arresting ways of looking at women’s lives in the past” (p. 15). Most notably, they provide means to carry property—a radical act for women who for so long have themselves been regarded as property. While men have historically enjoyed many pockets, sewn in and on display, women have not. In fact, “[t]ailors created additional pockets to keep abreast of developments in the implements a man might think essential to

his place in the world” (Burman and Fennetaux 2019, 26). Women’s pockets have had to be creatively added and adapted and are more often concealed. Unsurprisingly, enduring pocket problems have inspired inventors for centuries. They are a familiar feature of women’s cycle wear patents in the late nineteenth century.

Müller understood this. Her commitment to women’s suffrage is further rendered visible in a plethora of pockets she suggests the wearer consider. She lists five and encourages more. Her patent also notes similarities to a “Fishwife” skirt. This made more sense when we reconstructed it (see Jungnickel 2018, 205). A fishwife skirt is full, double-layered garment worn by Scottish fishing women in the nineteenth century. Wearers caught their skirt layers up at the waist to keep them out of dirt. This folding action created coveted pocket-like spaces. Hoisting the hem of Müller’s skirt up to the waist has a similar effect. In some ways, the entire garment is a series of multiscaled pockets.

Müller was a public figure, writer, gentlewoman, traveler, inventor, publisher, and protestor with a criminal record. She mixed with the likes of famous American activists, Susan B. Anthony and Elizabeth Cady Stanton, who described her as a “fearless, aggressive and self-centred” person who “claimed her rights when infringed upon” and “carries her theory into practice” (Cady Stanton, Joslyn Gage, and Anthony 1886, 950). Yet, like all women of this period, Müller (2019) lacked rights equal to those held by (or granted to) men. Isin argues, “performing citizenship always involves a citizenship-as-yet-to-come” (p. 52). It involves claiming something otherwise not given. Convertible, pocket-filled, three-piece cycling garments like Müller’s equipped women to do multiple things when and where they felt safe to do so. They could give public lectures, walk about or cycle. They could ride women’s or men’s velocipedes. They could fill their pockets and free their hands. Furthermore, they could “wholly or partially disguise” their intentions. Rather than doing things with rights, Isin writes about “doing rights with things” (p. 52). For Müller, whose life was dedicated to all forms of women’s emancipation from the domestic sphere to the public pulpit, this invention furnished wearers with more than just a garment to cycle safely. It enabled ordinary women to experience extraordinary freedoms.

### *Multiple and In-between Citizens*

Isin (2019) writes about how “citizenship is performed or played in the gaps or tensions between and among different senses of citizenship” (p. 51). We see this in Ibáñez Martín and de Laet’s (2018) research into domestic

cooking oils. Here, people “enact” different kinds of citizens in relation to the mundane practice of oil disposal—down the sink, at the recycling center, or remade into soap. These identities, like practices, are not singular or fixed. Different kinds of citizenship are moving, unsettled, complicated, changing, and made with things in practice. “Citizens, then,” they argue, “‘are’ neither just good or bad; they are either, or both, or something in-between” (p. 714). In-betweenness is a useful lens for examining how wearers of convertible cycling skirts were inhabiting public space and populating debates with multiplicity and variation.

New forms of cycle wear in late nineteenth-century Britain were popular and controversial and regularly filled newspaper columns. There was an appetite for new ideas and inventions buoyed by the boom in cycling and patents and the surging women’s rights movement. An invention that garnered a lot of public attention was patented by Alice Bygrave in 1895 (Figures 2 and 3). Her convertible skirt was commercialized and distributed by Jaegar, the English fashion house, who used it to front their cycling range and sold it across England and Scotland (Figure 3). Bygrave took it to America and it made its way to Australia. Her unique response to the “dress problem” was a hit because it featured a dual pulley system sewn into the front and rear skirt seams. It combined her interest in cycling, sewing, and time pieces, having been raised in a busy watch-and-clock making shop in Chelsea, West London. To operate the skirt, the wearer pulls on waxed cords concealed at the waist, threaded through stitched channels, and attached to weights sewn in the hem. As we discovered when reconstructing it, the “Bygrave ‘Quick Change’ cycling skirt” was exactly that (*The Queen, the Lady’s Newspaper* 1896a, 595). Much like the cogs and gears of a watch, the hidden mechanisms work together to gather material up and out of the wheels and reverse quickly back to an ordinary skirt.

Bygrave regularly demonstrated her invention to fascinated crowds. “The skirt may thus become a pair of knee bloomers, or be allowed to hang loose like a divided skirt,” one journalist noted, “and when worn amid ‘the busy haunts of men’ it appears as a plain, ordinary skirt, with never a suspicion of masculinity about it” (*San Francisco Chronicle* 1896, 8). Another heralded it as a “happy solution to the vexed question of ladies’ wheeling dress,” because it “hits the golden mean between the ordinary and the rational, giving to the rider all the comfort of the latter, and the additional ease of knowing that in a moment it can be resolved into a perfectly ordinary skirt” (*The Queen, the Lady’s Newspaper* 1896a, 595). There were more imagined uses of the costume: “By a system of cords worked through openings near the waistline it can be made to fill three different varieties of



**Figure 2.** Alice Bygrave's (1895) Pat. 17,145: *Improvements in Ladies Cycling Skirts*, December 6 (accessed at Espacenet, the European Patent Office, [www.epo.org](http://www.epo.org)).

long-felt wants of the bicycle woman.” These included a straight walking skirt, a slightly raised skirt for use on a woman’s step-through frame, and a full conversion to cycle a diamond frame bicycle “with all the grace and utility of a masculine wheelman” (St. Louis Post Dispatch 1896, 22). Another suggested its dual use “for either cycling or mountaineering” (The Lady Cyclist 1896, 49). Bygrave’s invention clearly captured the public imagination. While some reviewers stressed its discreet feminine allure, others boldly claimed the masculine freedoms it offered women. Convertible skirts provided not only clothing to ride safely, and a quick change in times of social danger, but also a range of alternate discourses and imaginaries to navigate an expanded range of social, political, and physical landscapes.

The Pease sisters provide another illustrative example. Self-identifying as Gentlewomen from Yorkshire, Mary Elizabeth and Sarah Anne’s patent responds to multiple desires to embrace change while minimizing exposure and threat of harassment. They explain, “The rational dress now greatly adopted by lady cyclists has one or two objections, inasmuch that when the lady is dismounted her lower garments and figure are too much exposed” (Pease and Anne 1895). Their invention is also convertible, but the skirt

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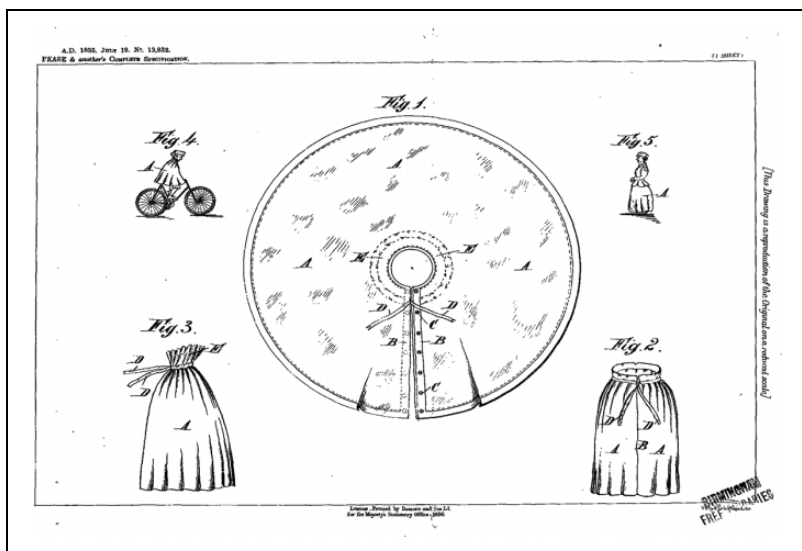
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Figure 3. Jaeger advertisement for the Bygrave "Convertible" Skirt, *The Lady Cyclist* (1896, March), p. 1 (accessed at the National Cycling Archives, Warwick University, UK).



**Figure 4.** Mary Elizabeth and Sarah Anne Pease's (1895) Pat. No. 13,832: *Improved Skirt, available also as a Cape for Lady Cyclists*, April 11 (accessed at Espacenet, the European Patent Office, [www.epo.org](http://www.epo.org)).

comes completely away from the body (Figure 4). Perhaps reflecting their young age, twenty-three and twenty-four, it is one of the more radical designs of the period.

The sisters' invention is a skirt that transforms into a cape via a specially designed wide waistband that gathers into a dramatic high ruche collar around the neck. Using a ribbon, the skirt/cape could also be bundled up and affixed to handlebars. This invention enabled the wearer to try out a range of outfits and associated identities: skirt or no skirt, closed or open cape, or no skirt/cape at all. This style was targeted at cyclists who wanted to cycle safely, yet were concerned with looking too much like a progressive "New Woman" at the wrong time or place. Perhaps it appealed to those who had suffered harassment and wanted a backup plan. With this invention, you didn't have to risk one identity or suffer another. You could occupy both via something in-between. The skirt/cape combination was popular at the time. While we can't track the use of this exact invention, a firsthand account of a similar design by Kitty Buckman, aged twenty-three, helps us imagine its use:



Minnie came from Harborough part of the way by train the rest cycling, she got in late for she as quite done up by the heat. K.W and self wore no skirts on Sunday, some friends of hers came to tea and she wanted them to get used to the costume. It was jolly wandering around the woods without a skirt and Minnie wished she had her costume. But she wore a skirt because of going by train and did not bring a coat. (The Buckman Papers 1897)

Buckman and her friends were keen cyclists and, fortunately for us over a hundred years later, ardent letter writers. This excerpt provides a glimpse of women trying out and getting “used to the costume” away from prying eyes. This could be an example in practice of Hildebrandt et al. (2019) “fake it ‘til you make it” (p. 7). They explain, “to perform citizenship and to act as citizen includes a certain dimension of ‘fake it ‘til you make it’ when claiming, enacting or presupposing a right that has yet to gain legal apparatus” (p.5). They stress this is not a case of binaries; of being or not being a citizen, “because performing citizenship outside of given systems also generates forms of representation” and “a chance to create the scene and the actor in the action itself in an ‘Act of Citizenship’, as Isin defines it” (p.6). For Kitty and her friends, their new convertible cycling and walking outfits enabled them to try out new forms of material and political participation on their own terms.

### *Multiple, In-between, and Ambiguous Citizens*

New ways of being in and moving through public space offered expansive possibilities. It also came with consequences. Early women cyclists were often harassed when onlookers struggled to situate them in terms of how women of their class were meant to dress, act, and move in public. To some, they appeared to be abandoning “natural” gender relations or their role in the family and society more broadly. Crane (2000) explains, “The dominant point of view allowed for no ambiguity about sexual identification and no possibility for evolution or change in the prescribed behaviours and attitudes of each gender” (p. 112). This view was fueled by media opinion, which, as Simpson (2001) notes, seemed to flip between dichotomous positions of women cyclists as either “respectable or disreputable” and in doing so tried to “make tidy an untidy situation” (p. 56). Yet, ambiguous and untidy they were. These unusually attired mobile women were enacting new political expressions that did not fit conventional norms or codes. A glimpse of the kinds of harassment women tolerated is captured in this letter-to-the-editor: “What females who adopt the semi-masculine costume have really to put up with I had no idea till the other night, when as I was

walking home, I was passed by two girls who were thus attired, and they were being assailed by such a torrent of foul and obscene language” (Bicycle News and Sport and Play 1895, 10).

Ambiguity also played a role in patent infrastructures. For those fortunate enough to successfully patent their ideas, how their inventions were recorded remains relevant to their long-term legacy (or lack thereof). Women inventors and their convertible cycle skirts were difficult to place by those in power. Despite evidence to the contrary, women inventors struggled for legitimacy. Even at the peak of patenting fever, recognition was elusive: “It is one of those numerous generalisations about feminine capacity which are accepted without much consideration—that women are not inventors. Imitators, both clever and ingenious, they are freely allowed to be, creators never” (*The Queen, The Lady’s Newspaper* 1896b, 104). The belittlement of women’s invention was a multi-pronged attack, as Zorina Khan (2005) notes, “By denigrating household work and the inventions of household articles, the women’s movement likely contributed to the notion that women were not technologically adept” (p. 128).

The mis/categorization of clothing inventions exacerbated issues. During the cycling boom, mechanical devices (or technologies for cycling with) were collated under *Velocipedes* in annual patent abridgements. These included frames, wheels, tires, chains, saddles, and the like. Cycling clothes (or technologies for cycling in) were separated into clothing categories. Their impact became diffused. It is not easy to find women’s cycle clothing inventions even when you know they are there. Researchers have to piece together fragmented data within disparate categories.

This taxonomy mattered at the time, because analysts, journalists, and politicians used official records of cycling inventions to show and tell stories about national and international inventiveness. The data fueled and sustained public frenzy for ideas and in turn could signal success or failure. While the bicycle was the primary motivator for women’s entry into the world of patenting, the bulk of their activity was oriented around cycling’s “dress problem,” and, as such, they struggled to gain the recognition given to other (male) inventors. Although only one of many similar accounts, “one is left with a strong sense that the industrial revolution is primarily a men’s story” (Dublin 1994, cited in Zorina Khan 2005, 129).

And it still matters. The privileging of masculine hardware over more feminine *softwear* aligns with historical undervaluing of clothes and clothes makers. Many researchers have identified the neglected dimensions of gendered labor in political economies of clothing (Tickner 1987; Burman 1999). Tailors (male), for instance, were far earlier recognized as a profession, gaining

legitimacy and subsequent rights and higher salaries than (female) dress-makers. Similar parallels can be found in contemporary discourse on “wearable technologies,” which currently almost entirely account for “high-tech” and “smart” electronic and digital devices worn on bodies (such as watches and fitness trackers). This taxonomy continues to separate technology from clothing, and yet clothing is, and has always been, a wearable technology. The privileging of some advancements over others, and especially ones that map onto historical gender biases, can also be explored in relation to public acts and performances of citizenship. As Bowker and Star (2000) have argued, categorization matters. How we name and order things has social, moral, and political consequences. It shapes what is considered valuable and important at the time, how we remember the past, and how we imagine futures.

## **Wearable Acts of Participation and Citizenship**

The end of the nineteenth century was a radical time of sociopolitical and technological change. While much was articulated in verbal and printed communication, it was also materialized and performed on and with differently clothed bodies. The popularity of the bicycle in late Victorian society generated a very public opportunity to question, challenge, and shape women’s rights. As a result, new forms of clothing to enable women to cycle was never simply a case of making minor adaptations to existing fashions but rather involved much larger social and moral debates about women’s participation in public life. Crane (2000) has written about women’s clothing as valuable sites of “nonverbal resistance” (p. 99). Alternative dress styles, she argues, “attracted increasing numbers of women” and played a critical role “in bringing about change in attitudes that were essential preconditions for structure the nineteenth century” (p. 128).

In this article, I experimented with “letting things in,” in the form of convertible cycle skirts, to explore lesser-known enactments of political concerns and resistance to conventional norms in late Victorian Britain. I drew attention to “mundane, everyday ‘low-tech’ artefacts and their ability to generate or firm up novel forms of citizenship” (Marres and Lezaun 2011, 491-92). In this case, clothes are both ordinary and extraordinary. In the late nineteenth century, they were highly valuable, long-lasting, and limited; a person’s wardrobe was shaped according to vocation, class, gender, and birthplace. What people wore in public revealed a great deal about their life and firmly located them in the social spectrum. Convertible cycling skirts queered conventional understandings on many levels and, in the process, opened up possibilities for wearers to act differently.

Studying convertible cycling skirts revealed a plethora of distinctly material forms of political participation. I have discussed a few; from new ways to experience public space (for Kitty and the Pease sisters), to media and business opportunities (for Bygrave) and expanding emancipatory action (for Müller and Harberton). Yet, despite the evidence, convertible cycling skirts aren't easy to pin down. They're full of contradictions and tensions. They weren't as dramatic as suffrage activists' fierce public protests, and far less valued than bicycle designs. They were promoted widely, yet deliberately hidden in plain sight. Journalists waxed lyrical about them, yet patent clerks struggled to categorize them. Despite the commercial success of some inventions, they barely figure in cycling or technology accounts.

Yet it is precisely because convertible cycle skirts did not fit with conventional norms and behaviors that make them interesting. Inventors and their supporters were not waiting to be granted equal rights but were claiming them via the making, wearing, and commercialization of new forms of clothing. The many multiple, in-between, and ambiguous possibilities of convertible cycling skirts did not fix wearers into a single form or way of being or moving. Rather, they gave wearers physical and ideological freedoms to make things up as they went along. They could assemble garments in their own way and wear them converted or unconverted. They could try out a range of men's and women's machines, at different times, and in new places. They could fake-it-till-they-made-it and in the process "constitute themselves as citizens" (Isin and Neilson 2008, 2).

What I hope to have conveyed in this article is how paying attention to the extraordinary lives of ordinary things, in this case of clothing, can reveal alternate and lesser-known acts and performances of citizenship. Convertible cycling skirt inventors rendered women's concerns visible, in hidden mechanisms, concealed buttons and cords, and the potential for conversion. They made their desires and anxieties relevant in patent statistics. And wearers physically made use of them, reconfiguring public engagement in different relations and contexts. These inventions unsettled and expanded ideas and practices around citizenship then and they raise questions now. As Schwartz-Cowan (1997) reminds, "the absence of a female perspective in the available histories of technology was a function of the historians who write them and not of the historical reality" (p. 120). The fact that they remain largely unknown today should prompt us to ask what else don't we know, how we might expand definitions of wearable technologies, and why some acts of citizenship matter more than others.


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## Notes

1. Early cycling was very popular with women. “Cycle historian Ross Petty has estimated that there were at least several million women cyclists worldwide in 1896, and suggests that their numbers ranged from a third to half of all cyclists” (Kinsey 2011, 1122).
2. Dress Reformers campaigned for rational dress over irrational fashion to help women and men lead more active lives unencumbered by restrictive clothing.
3. Suffrage campaigners were seeking, among other things, voting rights, equal pay for equal work, personal ownership of property, and earnings and custody of children.
4. According to the Fourteenth Report of The Comptroller General of Patents, Designs, and Trade Marks, with Appendices for the Year 1896, Annual Report: Presented to Both Houses of Parliament by Command Her Majesty, London (accessed at The British Library, UK).
5. Another field where women inventors have been present is feminine hygiene products (Cochoy 2021).
6. Women’s patenting was remarked upon for the first time in The Twelfth Report of The Comptroller General of Patents, Designs, and Trade Marks, with Appendices for the Year (1894), Annual Report: “Of the 25,386 applications received in the year 1894, 501 or two per cent were made by women, about 100 being inventions connected with articles of dress” (p. 3). Women’s patenting activities increased in 1895, and again it was noted: “Five hundred and ninety-one, or 2.3 percent of the total number of applications, were made by women during the year; about 184 being for inventions connected with articles of dress” (p. 5)

- (The Thirteenth Report of the Comptroller General of Patents, Designs, and Trade Marks 1895, 3).
7. Although a regular phrasing in many patents, this comes from Bygrave (1895).
  8. See the full corpus at Jungnickel (2018, 259-70).
  9. The gender identity of inventors was indicated in their patents.
  10. An 180 percent increase in patents was attributed to the 1883 Patent Reform Act (The Second Report of The Comptroller General of Patents, Designs, and Trade Marks 1884). Applications grew through the following decade. They leapt again in 1896, when they totaled 30,194 (The Fourteenth Report of The Comptroller General of Patents, Designs, and Trade Marks 1896)
  11. Much of Müller's life is documented in "The Women's Herald: The Women's Penny Paper," published from 1888 to 1893, which she founded and edited.

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