Fashion, the body and technology: 
tracing early 20th century techno-utopian ideas, aesthetics and 
impulses in 21st century wearable technology

Madeleine King

Bachelor of Fine Arts (Visual Arts), 
Queensland University of Technology

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Abstract

‘Wearable technology’, or the use of specialist technology in garments, is promoted by the electronics industry as the next frontier of fashion. However the story of wearable technology’s relationship with fashion begins neither with the development of miniaturised computers in the 1970s nor with sophisticated ‘smart textiles’ of the twenty-first century, despite what much of the rhetoric suggests. This study examines wearable technology against a longer history of fashion, highlighted by the influential techno-sartorial experiments of a group of early twentieth century avant-gardes including Italian Futurists Giacomo Balla and F.T. Marinetti, Russian Constructivists Varvara Stepanova and Liubov Popova, and Paris-based Cubist, Sonia Delaunay.

Through the interdisciplinary framework of fashion studies, the thesis provides a fuller picture of wearable technology framed by the idea of utopia. Using comparative analysis, and applying the theoretical formulations of Fredric Jameson, Louis Marin and Michael Carter, the thesis traces the appearance of three techno-utopian themes from their origins in the machine age experiments of Balla, Marinetti, Stepanova, Popova and Delaunay to their twenty-first century reappearance in a dozen wearable technology projects. By exploring the central thesis that contemporary wearable technology resurrects the techno-utopian ideas and expressions of the early twentieth century, the study concludes that the abiding utopian impetus to embed technology in the aesthetics (prints, silhouettes, and fabrication) and functionality of fashion is to unify subject, society and environment under a totalising technological order.

Keywords
wearable technology; fashion; the body; technology; utopia; techno-utopia; machine aesthetics; the cyborg
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Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signed

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Date

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Chapter 1: Introduction

In the past decade the term *wearable technology* has been used to describe the confluence of dress and technology in the twenty-first century. Though the term remains nebulous as it continues to evolve, wearable technology can refer to three related things. Most commonly it is understood as a material product, specifically a garment or accessory worn on the body that is inspired by, created through, or enhanced by digital or electronic technologies. Second, it can refer to a category of creative praxis, encompassing the diverse range of scientific and creative processes undertaken by the artists, fashion designers, technologists and hobbyists who make the products of wearable technology. Finally it is an emerging subject of scholarship that connects multi-disciplinary research and discourse on the intersection of the body, dress and technology.

While the neologism may be only a decade old, wearable technology as a twenty-first century product, praxis and theoretical subject marks the timely collision of two otherwise discrete historical moments. The first is the cultural history of twentieth century *technologised fashions*, encompassing the overlapping history of worn technology in modern and contemporary art. Because the twenty-first century term *wearable technology* typically connotes the use of electronic or digital technology, this thesis applies my own term *technologised fashion* to designate pre-information-age garments that are lucidly derived from or inspired by mechanical or analogue technologies. The second moment is a commercial history of post-1970s wearable computing, comprised of a series of technological developments funded primarily by corporate bodies and universities. At the dawn of the new millennium – the meeting point of these two histories – wearable technology is predominantly understood as a global hybrid practice of scientific, commercial and creative endeavours.

In 2011 the idea that technology can be incorporated into everyday dress is no longer a rarefied vision, as it was for the early twentieth century art and design vanguard (who, in the wake of industrialisation, imagined futuristic attire enhanced by the aesthetics, functionality and perceived symbolic values of nascent mechanical
technologies), nor is it the science-fiction fantasy of computer engineers (who conceived wearable technology as the inexorable direction of developments in ubiquitous and miniaturised computing and electronics). Instead, speculation, enthusiasm and debate on the anticipated ubiquity of wearable technology in contemporary dress are had at all corners, engaging futurologists, cultural theorists and electronic media theorists, as well as the practicing scientists, artists and designers at the forefront of wearable technology research and development. Accordingly, in the twenty-first century the relationship between the body, dress and technology has become a concern for a wide-ranging spectrum of commercial, cultural and academic disciplines.

However despite the increasingly mainstream profile of wearable technology, the subject remains at the margins of fashion discourse. In fact, the idea that wearable technology will inevitably be absorbed into the popular imaginary of contemporary fashion is one exalted by cultural and media theorists far more than by fashion scholars. To date only three key fashion publications have attempted to address wearable technology directly: Suzanne Lee’s *Fashioning the Future: Tomorrow's Wardrobe* (2005), Bradley Quinn’s *Techno Fashion* (2002) and Andrew Bolton’s *The Supermodern Wardrobe* (2002). However, as I argue in my literature review (Chapter 3), these guides to the eminent material and intellectual issues at the axis of technology and contemporary fashion, being wide-ranging in scope, make limited critical and analytical contributions. In all, neither the field of wearable technology, nor the field of fashion draw benefit from this reduced picture of wearable technology.

1.1 Aims & significance of the study

Prompted by this inadequate scholarly context, where there are very few insights provided by fashion scholars despite widespread interest and speculation on wearable technology as a new frontier of fashion culture, the primary aim of this study is to situate the contemporary practice of wearable technology in relation to historical instances of technologised fashion. Specifically, this study traces a genealogical line
between the early twenty-first century phenomenon of wearable technology and the influential experiments of a group of early twentieth century avant-gardes who also explored and exalted the coming together of fashion, technology and the body.

In contextualising the past decade of wearable technology within fashion’s modern history, this study aims to contribute to and expand on the scholarly context for wearable technology. To inform the contemporary hybrid practices of wearable technology, I have used the interdisciplinary framework of fashion studies, which combines philosophical, sociological and aesthetic insights to navigate the discursive of art, design, commodity culture, gender and the body. Regardless of fashion studies’ limitations – namely, that its perspectives on technological issues are narrow, and more generally, that as a young area of scholarship, fashion studies lacks authority in many areas with which it engages (philosophy, psychology and sociology, for example) – its expertise in the areas of design history and aesthetics makes for a fresh and complementary perspective to the insights already offered to the wearable technology field by electronic media discourse (which draws most heavily from the post-1970 commercial history of wearable computing). Therefore, one of the key aims of this research project is to bring a fashion historical perspective to what is often mistakenly considered to be a recent phenomenon born purely of material technological advances, in order to provide a fuller historical and theoretical picture of the field.

My study builds upon and expands a critical observation made by contemporary fashion scholar, Caroline Evans – a theorist who is credited for her skilled analysis of the visual and material culture of fashion through the multiple critical lenses of philosophy, sociology, psychoanalysis, aesthetics, and art history. On the subject of technology in contemporary fashion, discussed in Fashion at the Edge: Spectacle, Modernity and Deathliness (2003), Evans provides a fleeting, but poignant insight: she argues that contemporary fashion and textile designs that are inspired by new technologies repeatedly recall the ambitions of early twentieth century avant-gardes who rejected the past in favour of a future imagined as a techno-utopia (2003, 275). In other words, Evans suggests that the idea of techno-utopia (an ideal place or
society achieved through technological progress) has resurfaced in contemporary technologised fashions, echoing the early twentieth century experiments of the modernist avant-garde.

Evans’ insight is compelling for two reasons. First, experiments in modern fashion by the early twentieth-century avant-garde, despite their historical standing as the progenitors of technological ideas, materials, and aesthetics in dress, are unjustly overlooked as antecedents for contemporary wearable technology. Second, Evans’ revelation points to the relationship between technologised fashion and future ideation: the way that technological attire, almost always conceived for an imagined future, reveals an abiding utopian aspiration. Taking up Evan’s observation, this project examines utopia, and specifically the idea of the techno-utopia, as the key corresponding feature of early twentieth century technologised fashion and twenty-first century wearable technology. Using utopia as the focus of comparison, this study teases out some underlying formal and conceptual similarities between a specific group of works from the early twentieth century avant-garde and another group comprised of early twentieth-first century experiments in wearable technology.

My central thesis is that twenty-first century wearable technology resurrects (although often unknowingly) a series of futuristic sartorial ideas developed in the early part of the twentieth century by a disparate group that includes Italian Futurists Filippo Tommaso Marinetti and Giacomo Balla, Russian Constructivists Liubov Popova and Varvara Stepanova, and Paris-based Cubist Sonia Delaunay. On the sum of similarities, I argue that in comparative ways both machine-age technologised fashion and information-age wearable technology have explored the coming together of fashion, the body and technology as a techno-utopian project.

Before I expand on my project’s design and research questions, I will explain my decision to explore the technologised fashion of early twentieth century at the exclusion of other periods. The most notable of these exclusions is the technologised fashion movement of the 1960s, led by the techno-utopian visions of Rudi Gernreich, Paco Rabanne, Pierre Cardin and André Courrêges. With the techno-utopian
imaginary of this period overtaken by a fixation on the USA-USSR space-race, 1960s technologised fashions routinely present the body as vulnerable and in need of technological protection against the strange and potentially harmful conditions of lunar or inter-planetary exploration. While this period provides an ideologically fascinating context for questions of the body, technology and utopia in a popularised form, I have instead chosen in this study to focus on the more varied and experimental work of the early twentieth-century avant-gardes.

My decision to focus on these works has a double rationale. First, the early twentieth century was a particularly formative time for technologised fashion and the development of the techno-utopian impulse in clothing design. In particular mass-industrialisation and the subsequent ‘democratisation’ of fashion caused modern fashion to become synonymous with notions of totalising change as well as social and cultural progress, thus providing a rich context for the development of utopian ideas around the union of technology and dress. Second, the work of the avant-gardes that I examine aligns more closely with the sensibility of experimentation and individualised artistic practice that currently constitutes the cultural forms of wearable technology.

1.2 Research design & research questions

My comparative analysis of twenty-first century wearable technology and early twentieth century technologised fashion is structured around the appearance of three techno-utopian themes: one, the urge to use technology to optimise the body; two, the conviction that technologised fashion can help perfect society by engineering either collectivism or individualism; and three, the imperative to converge the body with its technological environment. These themes umbrella a range of techno-utopian ideas, impulses and aesthetics that are common to the examples from each era. Using this framework, I look beyond practical and opportunistic rationales for using technology in fashion, to explore how it is aspirational, experimental, optimistic, moral, theoretical, ideological, teleological and prognosticative, and above all, fundamentally utopian.
While the priority of this study is to highlight the similarities between the historical and contemporary examples under analysis, in the discussion in Chapter 5 I propose some key reasons for contemporary wearable technology’s resurrection of twentieth century utopian ideas. I suggest that in both historical and contemporary instances, the impetus to embed technology in the aesthetics (prints, silhouettes, and fabrication) and functionality of fashion is to unify subject, society and environment under a singular technological order. I also argue that the sustained novelty of technology makes it amenable to the project of perfecting both fashion and the future.

My study also highlights some of the key differences between the periods under analysis, and attempts to make some preliminary links between such differences and the broader questions this study asks, such as: Does the transition from analogue mechanical technology to digital electronic technology, along with the transition from industrial to post-industrial society, have more than just material implications for the development of technologised fashion? Could wearable technology’s reliance on both materiality and the body account for its affinity with analogue and mechanical issues of the early twentieth century? And, in the context of wearable technology, does new media make anything new (and if so, how)? These questions expand the more focused research question that guides the design of the study: Can the idea of utopia that framed the coming-together of technology, the body and fashion in the early-part of the twentieth century have meaning and integrity in the information age, despite its seeming anachronism?

1.3 Methodology & interpretive paradigm

I have approached this research project from the field of fashion studies, adopting a multi-method and interdisciplinary approach that draws strongly on art history to inform the contemporary hybrid practices of wearable technology. As mentioned, my use of the fashion framework to assemble the plural, diverse and disconnected
discourses attributed to wearable technology constitutes a scholarly contribution to the study of wearable technology.

My use of the multiple method approach, combining textual analysis, comparative studies and visual analysis, is broadly characteristic of qualitative research (Denzin & Lincoln 2000, 5). Specifically, this qualitative research approach is comprised of the primary study of cultural texts and productions (Denzin & Lincoln 2000, 3), such as documentation of original artworks and garments, as well as theoretical and historical texts and other cultural artefacts (such as art manifestos).

The analytical framework employed in the project draws on the theoretical formulations of Fredric Jameson, Louis Marin and Michael Carter, whose work could be termed critical theory, philosophy and art/fashion history, respectively. In addition, a number of texts examined are inextricable from their own situated interpretive paradigm – for example, feminism is a central paradigm to a number of theories relating to fashion and concepts of the body. My approach therefore broadly follows that of the theoretical *bricoleur* (Denzin & Lincoln 2000, 6), a qualitative researcher who synthesises plural interpretive paradigms.

As the rigorous comparative analysis of technologised fashion from the early twentieth century and the early twenty-first century is unprecedented in both wearable technology and fashion literature, my methodology draws on a related precedent set by cultural theorist, Greil Marcus’ *Lipstick Traces: a Secret History of the Twentieth Century* (2001). In this critical text, Marcus combines cultural studies and art history to mine the histories of three distinct moments of twentieth century art and popular culture. He suggests that a ‘secret history’ that connects Paris-based intellectuals of the 1920s and 1950s with the 1970s British punk group, the Sex Pistols lies in range of cultural texts and artefacts, thus permitting Marcus to compellingly recast the 1970s counter-cultural revolt popularised by the Sex Pistols as the successful relaunch of the Dadaist’s and Situationist’s critique of modern society (2001, 18). His combined use of textual and visual analysis, comparative studies and philosophy enables Marcus to overcome institutional and disciplinary
boundaries (or indeed, indifference) that had prevented meaningful connections to be established between these three historical moments. In lieu of an existing or disciplinary-specific framework, he meticulously fits together the fragments of primary and secondary data, by way of theoretical *bricolage*, to provide a fuller picture of the popular 1970s punk movement. Following Marcus, my study design has been necessarily interdisciplinary and carefully improvised to synthesise the wide range of texts that contribute to the fuller picture of wearable technology.

1.4 Chapter summary

Chapter Two provides an overview of three constitutive concepts for this study: technology, the body and utopia. After addressing the two historically-specific understandings of technology applied in this thesis, I cover pertinent discourses relating to the literal and metaphorical convergence of the body and technology since industrialisation. Cultural theorist Tim Armstrong and historian Jeffrey Schnapp provide the machine age context for the idea of technology as a bodily prosthesis, and they together demonstrate that technology has had utopian as well as dystopian implications for modern conceptions of the body and the self. Armstrong describes the complexity of technology’s relationship with the body in modernity (in that it offered a glimpse of a perfect body whilst revealing the body’s inadequacies), and describes how the avant-garde entertained the idea of a technological prosthesis or a technological self. Schnapp likens modern artificial fabrics to the technological prosthesis, compensating not just for the body’s inadequacies, but also those of a deficient consciousness, humanity, social order, meaning, and spirituality.

Subsequently, I examine the key tenets of posthumanism, a theory that is contemporaneous with wearable technology. Specifically, I follow the shifting connotations of the technological prosthesis in light of the postmodern rejection of humanist narratives (colonialism, centred subjectivity and rationalism), and in light of technological change (e.g. the virtual realm and artificial intelligence). I provide a précis of Donna Haraway, N. Katherine Hayles and Maria Fernandez’s descriptions of the posthuman cyborg as a metaphorical hybrid being that rejects the primacy of
our biological form in an attempt to prevent human markers of difference from negating a universalist utopia.

To define the scope and meaning of utopia, I turn to semiotician Louis Marin and his contemporary, cultural theorist Fredric Jameson, who trace the broad cultural, political and philosophical etymology of the term, beginning with its debut and satirical appearance in Thomas More’s 1516 novel *Utopia*, and culminating with its problematic and contended position in the wake of communism’s collapse and the onset of the so-called ‘end of ideologies’ known as postmodernism. After affirming that utopia has continued relevance and meaning in the twenty-first century as a means to imagine change, I examine the peculiarities of utopia’s relationship with technology, the body and fashion by way of the lucid analysis provided by art and fashion historian, Michael Carter. Fashion is discussed as a vital device for the narration and reification of utopia; a material form that provides utopian fantasy a lifeline to the real in order to gratify the ultimate purpose of the utopian imaginary: critiquing the present.

The literature review of Chapter Three examines a small second wave of cultural literature relating to the subject of wearable technology. Noting that none of the relevant literature specifically addresses the relationship between utopian ideas and wearable technology, the literature review focuses on two other major themes that relate to the focus of my study: wearable technology’s significance as a practice of art and fashion and its engagement with ideas of the body. The disciplinary-specific meanings of wearable technology put forward by Susan Elizabeth Ryan and Sarah Kettley are reviewed, as is the notion that wearable technology expresses contemporary forms and ideas of embodiment, as argued by Anne Cranny-Francis and Ryan.

Chapter Four locates a historical context for wearable technology in the avant-garde of the early part of the early twentieth century, examining, as mentioned, the sartorial activities of Russian Constructivists Liubov Popova and Varvara Stepanova, Italian Futurists Filippo Tommaso Marinetti and Giacomo Balla, and Paris-based Cubist
Sonia Delaunay, through the lens of utopia. Despite some rifts in socio-political context, these examples are unified by their approach to fashion as a platform for techno-utopian ideas inspired by the potential for the convergence of the body and the machine in industrial modernity. Marinetti and Balla’s ideas for a techno-utopia are guided by a narrative of fascist nationalism and imperialism, however, they celebrate technologised fashion’s individualistic as much as its egalitarian and collectivistic qualities. In the Futurist utopian imaginary, fashion is not just a narrative vehicle, but more importantly, the unification of the machine and the body as an immortal ‘second skin’. In their quest for egalitarianism, collectivism, a productive and competitive Soviet industry, and a socialist commodity object that can transform the body, the self and the everyday, the example of Popova and Stepanova illustrates how utopia in modernity was often allied with political ideology. Conversely, Delaunay positions the progressive bourgeoisie and the modern woman as the central figures of an individualistic techno-utopia. Despite the aesthetic and ideological differences in each of these avant-garde examples, utopia is elicited through the harmony of modernist machine aesthetics, the body, fashion and technology.

My central thesis is engaged in Chapter Five, through an analysis of how contemporary wearable technology resurrects the modern avant-garde’s ideas of a techno-utopia. I examine twelve wearable technology projects that, while technically and formally varied, share a common utopian impulse. My comparative analysis of contemporary wearable technology with the historical examples discussed in Chapter Four draws on three key utopian themes that are common to both: the technological optimisation of the body, converging the body with its technological environment and ameliorating society through collectivism or individualism. After highlighting the similarities in how the idea of utopia has manifested in technologised fashion of the two periods, I conclude with some reflections on how the context of the twenty-first century has led to some subtle variations in the way the utopian impulse manifests.
Chapter 2: Conceptual framework

In this chapter I detail the major concepts that underpin my study of early twenty-first century wearable technology and early twentieth century technologised fashion. These foundational concepts are: technology, the body and utopia. To begin, I explain my historically-specific understanding of the term technology. I also outline my approach to periodising the contiguous temporal contexts of this study as the machine-age and the information-age, and discuss the technological ideas and aesthetics I explore as common to these technological eras. Following this discussion, I explore key theories that relate to the body’s notional and literal convergence with technology. This includes the machine-age idea of the machine-body hybrid and the information-age theory of the posthuman or cyborg. Finally I examine the idea of utopia. I cover the utopian ideas, aesthetics and values that framed the coming together of the body, technology and fashion in the early part of the twentieth century, and suggest how this history bears upon the information-age context of wearable technology.

2.1 Technology

Entwined with the development of miniature and portable electronics, the twenty-first century term wearable technology almost always implies digital or computational technology. Indeed, in most definitions, wearable technology translates as wearable electronics. In light of this entrenched association, this study uses the complementary term technologised fashion to describe garments derived from or inspired by mechanical or analogue technologies. In effect, the terms wearable technology and technologised fashion are used to represent two phases of the same basic project – namely the conscious and conspicuous application of technology in the ideas, aesthetics, fabrication or production of garments. In delineating these terms I am therefore identifying two historically specific understandings of technology.
The first is a modernist idea of technology, which is informed by innovations in mechanical, electrical, communication and transportation technologies, new materials (iron, steel etc.), mass production processes and consumer mechanical appliances developed during the Second Industrial Revolution. The period term *machine-age* captures the economic, cultural and social influence of this late Industrial Age period, particularly the period between World War I and World War II. Without question, the many features of the machine-age – automated mass-production, the affordability of print, the skyscraper-lined cityscape, the automobile, communications technologies, textiles manufacture – had significant influence on the development of artistic modernism, and profoundly shaped the ideas, aesthetics and execution of the work of the Cubists, Italian Futurists and Russian Constructivists under analysis in Chapter 4 of this thesis.

My second understanding of the term technology takes in much later innovations in digital, electronic and computational technologies of the 1970s onwards. A globalised and information technologies driven industry is the dominant characteristic of this latter *information-age* technological context, in contrast to the mechanical industry that is the context for the machine age. The widespread use of consumer electronics, personal computers and virtual interfaces, such as the internet, also significantly contributes to the economic, social and cultural qualities of this technological period. The ideas, aesthetics and execution of twenty-first century wearable technology is greatly informed by the social and cultural context of pervasive information technologies – the virtual and online world of social interactions, the convergence of technology and biology, the speed of global communications, and the widespread use of personal computers and various other ubiquitous domestic information technologies.

Appreciating that in the past thirty years the push towards making a vast range of technologies smaller, compact and more portable has had considerable influence on how technological hardware can now be embedded in garments, it is plain that the cumbersome mechanical technologies of the early part of the twentieth century were highly restricted in their actual wearability. Although examples of electrified
technologies embedded in garments (such as large battery-powered heating systems) did exist in the early part of the twentieth century, technology was more commonly embedded through mechanically produced or re-produced textile designs, whose aesthetic derived considerably from machines made of moving parts⁠⁠¹.

By way of contrast, the advances made in the miniaturisation of electronics over the past two decades have meant that highly expanded technological functionality no longer precludes wearability. As a result, wearable technology is both evocative and demonstrative of the discretion and intimacy that pervasively characterises twenty-first century electronic and digital technologies. The technologies and materials that constitute wearable technology – including smart fabrics or e-textiles, nanotechnology, biotechnology, mobile-, wireless- and Bluetooth-technologies, sensors, LEDs, shape-changing polymers – are light and diminutive whilst having a diverse range of capabilities. For example, conductive metallic thread discretely enmeshed in a fabric weave can enable a ‘live’ garment to send impulses to innumerable electronic devices either embedded in or external to the garment. Thus the expanded functionality of technology is central to the contemporary idea of wearable technology.

**Interpretive conflicts: machine age/ information age**

While the period terms ‘machine-age’ and ‘information age’ are helpful in illuminating some of the key differences in life, culture and industry in the early twentieth century and the early-twenty-first century, they are also problematic. Chiefly, the terms erroneously suggest a definitive break or succession between the two periods along technological, economic, cultural and social lines. For example, to use the term ‘information age’ is to imply the death of mechanical industry, when plainly this is not so. The dilemmas with using ‘information age’ and ‘machine age’

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¹ Quinn (2002,4) discusses the Vogue fashion event presented at the 1939 world fair, New York, in which designers made predictions for fashion of the year 2000. A Pathétone newsreel of the event shows that amongst these inventive designs were an electrified belt, to regulate body temperature, an electric headlight, and a suit fitted with a radio and telephone (Eve, A.D 2000! 2008).
are consistent with using any other period term, such as ‘modernity’ and ‘postmodernity’. Venn and Featherstone’s critique of modernity underscores how “in its making of difference, the discourse of modernity has reconstructed a view of preceding periods and a sense of its own coherence that simply does not accord with the historical reality” (2006, 459) – and the same can be said for information age/machine age discourse. Fundamentally, activities and visions that do not fit the cohering narrative of modernity, or for that matter the machine-age or information age, are overlooked and thus the narrative of these periods become confirmed by ever-narrowing accounts of history. Whilst being complicit in the use of these problematic period terms, the aim of this study is to highlight similarities in cultural activities that might otherwise be regarded as emblematic of the technological differences between the machine age and information age. In this sense, I contribute to a broader conversation around the issue of temporal, cultural and technological periodization.

Finally, a word on the politics of technology. While this thesis makes some mention of the profusion and ubiquity of technology in the twenty-first century, I am mindful this is a reality enjoyed predominantly by the First World. I acknowledge that the reality of the ‘digital divide’ – the political, social and economic division between the technological haves and have-nots – dispenses with media theory’s early rhetoric of utopian universalism, or the idea that “anyone in the world had only to be connected to be ‘free’” (Fernandez 1999, 59). This study is careful to avoid universalist assumptions surrounding technology, particularly in light of the connections that post-colonial media theorist Maria Fernandez has made between the information-age ‘crusade’ of technological connectivity and colonial attitudes. As Fernandez crystallises, media theorists who were ebullient about the early wave of domestic computing were ultimately “knowingly or unknowingly doing public relations work for digital corporations”, by “representing electronic technologies, especially the computer, as either value-free or inherently liberatory” (1999, 59). Despite this critique the problematic predictions made by electronic media theory of the 1980s and 1990s have continued influence in wearable technology literature. On the brink of many exciting new technological developments in wearable technology, cultural
texts can become the mouthpiece for the ethically questionable work of corporations (whether unwittingly or consciously). Implicitly, my thesis adopts Fernandez’s critical lens to avoid representing wearable technology as inherently innocuous, universally accessible, or virtuous.

2.2 The Body and Technology

This section provides an overview of ideas of body-technology hybridity that have inspired early twentieth century technologised fashion and wearable technology of the early twenty-first century. Discussed first is the relationship between modern artificial textiles and the nineteenth century idea of a body-machine hybrid. I then examine the late twentieth century idea of technological hybridity – posthumanism – and the way the associated metaphor of the ‘cyborg’ has informed twenty-first century approaches to the body and technology in wearable technology.

The technological instruments for seeing, writing and speaking that gained prominence in the industrialised context of the nineteenth century (telescopes, typewriters, telephones, for example), set up a symbolically interdependent relationship between the body, mind and machine in early modernity (Coleman & Fraser 2011, 5-6). Having paradoxical implications for the modern humanist subject, technological prostheses enhance the perceived ‘natural’ and ‘essential’ qualities of the (masculine) body (power, speed, energy and dynamism), whilst undermining the body’s own efficacy. Or as Armstrong puts it, the prosthesis represents positively the “mechanical extension” of the body, and negatively the body’s “systemic subordination” to the machine (Armstrong 1998, 78-101); to illustrate, while sight is extended by the telescope so too is deficient sight corrected by spectacles (Armstrong 1998, 77). Thus, in extending the capabilities of the body, technology serves to symbolically undermine the body’s inherent condition.

Positioned as a ‘second skin’, the new materials and textiles of the early part of the twentieth century became identified with “modern forms of embodiment” (Schnapp 1997, 191). Symbolically, the much-hyped imperishable quality of artificial textiles
implies the immortalisation of the wearer. Indeed, as Schnapp proposes, a secular sense of the spiritual is imbued in modern artificial materials, rendering the rayon-clad body, for example, as incorruptible to the effects of time – a technological version of the Christian idea of glorified bodies (1997, 191). But in supplementing the deficiencies of the mortal body, modern artificial textiles can also be considered to compensate the body for a lack, and as Schnapp extrapolates, stand in for an incomplete consciousness, social order or meaning (Schnapp 1997, 191).

The increasing bodily intervention of technology in the latter half of the twentieth century (including plastic surgery, IVF, and a range of technological implants and prosthetics), has much further distorted and problematized the idea of a ‘natural’ body. Additionally, the information-age emphasis on information and virtuality, which ultimately privileges mind over matter, has further weakened the status of the naturalistic body as the paramount vessel for subjectivity and identity. This shifting technological context underscores the development of ‘posthuman’ theory in the late twentieth century.

Haraway’s radical feminist manifesto ‘A Manifesto for Cyborgs: Science, Technology, and Socialist-Feminism in the Late Twentieth Century’ (first published in 1985, but republished to greater acclaim in 1991) has become the most frequently cited document of posthuman theory. It reads as a polemic challenging the language and narrative of Western science that implies that women are somehow anterior or other to technology (though this gendered context has been overlooked in many subsequent appropriations). Subverting the masculine archetype of the cyborg that dominates popular science fiction (e.g. *The Terminator*), Haraway imagines a neutral, non-gender-specific technological body that liberates the subject from the pejorative quality of ‘femaleness’ inscribed in the biological body.

Looking beyond the gendered purview of Haraway’s cyborg² Fernandez summarises the posthuman view of the cyborg as representative of the “increasing irrelevance of

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² Early examples of cyborgs, imagined before the term entered popular parlance, were described by electronic media theorists Marshall McLuhan, Jack Burnham and cyberneticist Norbert Weiner
flesh” (1999, 60). On balance, however, posthumanism is quite varied in its thinking on the fleshted body. For some, the body’s physical integration with the machine is only a hypothetical state, for others, it is a contemporary reality. In some descriptions, the body is considered to be completely surpassed by its mechanisation (beyond the transitory state of ‘transhumanism’) causing the flesh to become perfunctory “meat or only nostalgia”, according to posthumanist writer William Gibson (Fernandez 1999, 62).

Consistent with this position, N. Katherine Hayles’ How We Came To Be Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics (1999) makes a case that intelligent machines of the late twentieth century have made the status of human corporeality and consciousness equivocal. Her frequently cited notion of the posthuman body is: first, informational over material; second, part of a much bigger evolutionary picture where consciousness is a secondary process; third, a prosthesis, able to be integrated with any other (technological) prosthesis; and, finally, convergent with intelligent machines (1999, 2-3). From this standpoint, Hayles persuades that technology’s contemporary occupation of the body is not a foreign invasion, but rather a harmonious, even utopian, merger. In theory, with the boundaries between body and machine symbolically ruptured, the emphasis is on fluidity and convergence as opposed to otherness and alienation.

Thus, for twenty-first century wearable technology, the cyborg body provides the utopian blueprint of boundless embodied experience in the information age — untrammelled by the biological limits of gender, age and decay. Indeed, Haraway imagines her cyborg future explicitly in “the utopian tradition”, as a “world without gender, which is perhaps a world without genesis, but also maybe a world without end” (1991, 150).

dating back to the 1950s and 1960s, as hybrids of machines and humans, or as humans in the process of virtualisation (Fernandez 1999, 62).
Wearable technology literature is, in the main, complicit in a process of advocating and normalising the hybridised techno-body, adopting the ideas of Hayles and Haraway in particular to defend the cyborgian premise of wearable technology. However, as this thesis asserts, machine-age ideas of machine-body hybridity also provide relevant insights to wearable technology’s approach to the body. In fact, the early twentieth century notion of a deficient and decaying natural body that could be perfected by technology might be considered to have intensified in posthumanism, with the idea that technology must either ameliorate or surpass the expiring natural body.

2.3 Utopia

Fashion and utopia have an intertwined history; as philosopher Karen Hanson (1990, 109) observes, perfecting fashion has been a key concern in utopian literature, and the utopian imaginary at large, since the debut of Thomas More's *Utopia*³ (1516). I confine my task in this section to exploring specifically how utopia, technology and fashion have aligned at the dawn of the twentieth and twenty-first centuries. To do this I take a historical approach, drawing on Michael Carter’s analysis of techno-utopian ideas and aesthetics in early modern fashion. I also discuss the theoretical hazards I’ve encountered tracing twentieth century utopian tendencies in twenty-first century wearable technology, given utopia’s pejorative meaning in the contemporary context. Adopting the theoretical formulations of Fredric Jameson and Louis Marin, I assert the relevance of twentieth century utopian ideas in relation to the twenty-first century context of wearable technology, without derogatory affect.

³ Richard Martin has rightly argued that “never has there been a Utopian wish or realisation without serious consideration of clothing” (Martin in Carter 1997, 80). To be sure, the instances where fashion has been dismissed – promoting instead nudity or uniformity – have also indicated a careful consideration of clothing. However, the class structure historically reinforced by dress has caused fashion to appear at odds with utopian values, and as a consequence, many utopian movements have adopted an anti-fashion uniformity, repressing variation in style in order to appear “beyond the injustices and irrationalities of class and poverty” (Carter 1997, 80). As the unisex suits of the Chinese Cultural Revolution demonstrate, a conspicuous lack of concern with fashion translates as “dedication to the cause” (Carter 1997, 81).
Understanding utopia in the twenty-first century

Thomas More’s narrative, *Utopia* (1516) describes a satirical world that birthed the enduring notion of utopia as a fantasy, nonsense and joke, as well as an ongoing literary tradition, but the surprising legacy of More’s sixteenth century book was that its central idea of an imaginary perfect place defined by an equally ideal political and social system has since been taken on in earnest. More contrived the word *utopia* from the Greek, *outopia*, comprised of ‘ou’ (no) and ‘topos’ (place) (Marin 1993, 407). While in modernity utopia was primarily pursued as the ideal political and social system described in More’s fiction, the semantics of *no-place* has become the lynch-pin of a semiotic revision of utopia devised by theorists including Louis Marin, Fredric Jameson and Jean Baudrillard (see Baudrillard, 2006). Specifically, the concept of no-place has been re-asserted in order to recoup the meaning of utopia from its ostensibly corrupted usage in the totalitarian political programmes of modernity.

Critical theorist Fredric Jameson has discussed the social, cultural and political implications of utopia in a postmodern context over a number of publications, forming a critical consideration in his seminal *Postmodernism, or, the Cultural Logic of Late Capitalism* (1991), with a focus on utopian discourse and methodology characterising more recent works such as *Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions* (2005) and 'The Politics of Utopia' (2004). French semiotician, philosopher and art historian Louis Marin, like Jameson, considers postmodernity to be a critical period for the re-examination of More’s utopia. In ‘Frontiers of Utopia: Past and Present’ (1993) Marin evaluates the central metaphors of More’s novel (travel, the new world), and provides a parallel lexical history of the words *utopia, frontier* and *horizon* from the 16th century onwards.

Utopia is, as More’s novel illustrated, the tension between the opposing forces of “totality and infinity, limit and transcendence, closure and liberty”, where the satisfaction of our desires and happiness is tempered by the laws and boundaries required for “harmonious functioning” (Marin 1993, 404). Together, the contrasting
notions of frontier and horizon define utopia: they name the desire for boundless expansion and the need to define boundaries; the idea of infinitude and the extreme limits of both the gaze and the imagination. In this sense, utopia, both as the island in More’s novel, and as the modern abstract concept, is “the figure of the horizon” (Marin 1993, 412) – suggestive of a boundless expanse, yet framed within the boundaries of our perceptual limits.

As an alternative metonym for utopia, Marin offers the French word *lisière*, which he describes as the ‘fringe of an edge’ whose limits are unknown – in effect a gap, a ‘no-man’s land’, a “wild or an undetermined space” that is neither affirmative nor negative (Marin 1993, 410). In this sense, the transliteration of utopia as ‘no-place’ does not define a place that is fictional or non-existent, but rather, an abstract, in-between place that is simultaneously “everywhere and nowhere” (Marin 1993, 413); a referent indicating “the ‘other’ of any place” (Marin 1993, 411).

The collapse of communism, and with it, the postmodern notion of the ‘end of ideologies’, forms a critical context for the analysis of utopia in the contemporary era. Both Marin and Jameson are at pains to point out that the political and ideological representation of utopia have been a twentieth century perversion (the representation of utopia might be considered the secular version of false idolatry), inevitably emphasising closure rather than liberty through the creation of “absurd and bloody frontiers” (Marin 1993, 406). Indeed, as Jameson makes clear, to be labelled utopian in the contemporary political sphere is as undesirable for the left as it is for the right, as on the left, utopia is “code word” for socialism and communism, and on the right utopia “has become synonymous with ‘totalitarianism’, or, in effect, with Stalinism” (Jameson 2004, 35). Marin’s pithy recantation of the relationship between politics and utopia reiterates this fact: “Utopia as ideology is a totality; and when political power seizes it, it becomes a totalitarian whole” (1993, 413).

Yet despite our knowledge of the failures of utopian representations, the utopian impulse is interminable; like a mirage, utopia will forever hold an illusionary seduction. Jameson, acknowledging this fact, fashions a useful pathway for utopian
thinking. In his view, utopia has enduring relevance as a means to ideate change, or more accurately, he describes utopia as “crucial test of what is left of our capacity to imagine change at all” (1991, xvi). Describing utopia as “barely audible messages from a future that may never come into being” (Jameson 2004, 44), Jameson argues that our future success is contingent on our ability to achieve utopian thinking (as opposed to utopian representations).

Some qualification is needed here, as the ideation of change is not always utopian, just as fantasy, futurism, totalitarianism and avant-gardism, although closely related concepts, are not simply interchangeable with the term utopia. British art historian, Paul Woods (2006), in a lecture on utopia given at the Tate Modern most succinctly highlights the prevailing misappropriation of utopia. Most significant to this study, and the study of modern art more broadly, is utopia’s erroneous conflation with the avant-garde. The problem is made clear by Woods’ provision of contrasting definitions: the avant-garde suggests scientific and rational problem-solving, as well as leadership for the future, whereas utopia is the imaginary solution to a real problem⁴ (2006). The historical examples discussed in this thesis relate to three modern avant-garde movements – Italian Futurism, Russian Constructivism and Cubism – and I argue that an exploration of utopia is central to each example, and definitely not inconsistent with their vanguard objectives. For example, the Russian Constructivists under analysis, Varvara Stepanova and Liubov Popova, manage to synthesise the scientific rationalism that underscored their approach to aesthetics, the pragmatism of their response to the industrial objectives of the Soviet New Economic Policy, their abidance to political and nationalist narratives, and their own utopian ideas on how machine-imbued fashion could somehow fundamentally transform society and the people within it). While utopia and the avant-garde, as Woods concedes, are not mutually exclusive – on the contrary, many examples in history point to how they have been closely linked – it is important to remember that

⁴ Woods speculates that utopia has become a misnomer for avant-garde, since the latter term has fallen into disrepute with feminist and postmodernist scholars due to its association with the patriarchy, militarism, and over-determined rationalism (2006).
the avant-garde have traditionally sought to distance themselves from ideas that could be dismissed as fantasy or illusion (Woods 2006).

That being said, intent is not always the best qualifier of the utopian impulse, as Jameson has made clear. He distinguishes between utopian programs and utopian impulses – the former being the explicit configuration of utopia into an ideological schema, and the latter being a covert desire revealed only in allegorical forms (Jameson 2010, 25). On this issue, my task in this thesis is not necessarily to distinguish for the reader which are utopian programs and which are utopian impulses, but to ensure my definition of utopia is inclusive of both the explicit and covert forms.

**The axis of utopia, technology and the body in modern fashion: Michael Carter**

Amongst his broader discussion of utopian ideas and aesthetics in modern culture, art and fashion historian Michael Carter astutely elucidates the connection between utopia, fashion and technology in *Putting a Face on Things: Studies in Imaginary Materials* (1997). I have applied to the contemporary context of wearable technology Carter’s (1997) insight that fashion has historically served as a successful narrative platform for the development and communication of the techno-utopian imaginary. Understanding how and why the machine aesthetic became the dominant motif of early twentieth century utopian fashion is invaluable to understanding the appearance of techno-utopian themes in contemporary wearable technology.

Carter examines how dress for the future was conceived in the twentieth century, breaking his analysis down in to three areas: utopianism, political dress reform movements, and science-fiction. He makes the point that these three areas overlap, and moreover become indistinguishable (Carter 1997, 76), which in my view, makes the project of perfecting dress for the future appear inevitably utopian. Indeed, his analysis demonstrates how a concern with perfecting dress is in most cases equivalent with or embedded in utopian designs on social perfection.
To paraphrase Carter, modern visual traditions, such as art and fashion, adapted the same persuasive narrative devices of “story and picture” from the utopian literary genre, in order to fulfil utopian social and political aspirations in the imaginative realm (1997, 77). Between the two world wars, technological motifs pervaded utopian narratives in both literary and visual traditions, just as the influence of the machine permeated modernist culture more broadly. Indeed, as Carter remarks, the modern aesthetic ideal of functionalism “colonised our imaginations” (Carter 1997, 82) and inevitably dominated the early twentieth century conceptions of the future. Thus, the harmonics of clean, standardised, streamlined, geometric forms eclipsed the rambling, libidinal decadence and sumptuousness of (pre-machine) Art Nouveau utopian aesthetics. It was widely agreed, from science-fiction to bourgeois fashion, that the inhabitants of an ideal future would resemble the symmetry and functionalism of the machine (Carter 1997, 81-82). Carter surmises that at the turn of the twentieth century "Art Nouveau never made it into the future as, one by one, the visions of the aesthetic utopians were submerged beneath a wave of techno-futurism" (1997, 82).

With a coherent and discernable form, machine inspired fashion was a positive counterpoint to the ‘generalised’ and ‘abstract’ cipher that was the utopian anti-fashion movement (Carter 1997, 81-82). The machine-inspired fashion of the 1920s onwards asserts its equivalence with modernity, in a way that the backward-looking anti-fashion utopian movements could not. The narrative success of machine-inspired fashion was its clear and positive allegiance to techno-utopian goals of productivity, collectivism, order, rationality and efficiency (Carter 1997, 83). The utopian futuristic dress imagined in science-fiction suggested that “by the wise deployment of technology, [inhabitants of the future] have been able to temper the dysfunctionalities which afflict us in our here and now” (Carter 1997, 87-89). Dressing the body of today in the technological attire of tomorrow is thus a gesture of utopian wish-fulfilment.

While the techno-utopian view sees the natural body as anathema to mechanical perfection, Carter identifies varying levels to which techno-utopian fashion seeks to
exaggerate, sublimate or erase the human “emotional substructure” (Carter 1997, 89). His categories of ‘machinic utopianism’ in dress, the Robotoid, the Rationally Functional, and the Decadent, describe three different attitudes to balancing the qualities of human and machine\(^5\). At one extreme (the Robotoid) beauty, pleasure and libido are entirely supplanted by mechanisation, expressed through uniformity, monochromatic palettes, and a-sexual equivalence in men’s and women’s attire, while at the other extreme (the Decadent), dress overcompensates for fear of mechanical subordination, and attempts to reproduce a camp archetype of human essence and aesthetic decadence, expressed through a dissonant and perverse melange of colours, patterns and organic forms (Carter 1997, 89-90). Down the middle path (the Rationally Functional), human integrity is balanced with technology, and having realised a “rational, fully functional social order” inhabitants of this perfected future are contented with a standardised, undistinctive form of dress (Carter 1997, 87-89).

In sum, while fetishistic attitudes toward the machine pervaded the popular utopian imaginary of the interwar period, techno-utopian aesthetics are also revealed in a throw-back to the decadent, organic and chaotic forms of Art Nouveau. Thus the key tension of modern utopian technologised fashions lies in the balance between preserving authentic human impulses (the libidinal and the aesthetic) and embracing the rational and efficient order of the mechanical. In utopian technologised fashion both the biological and the mechanical are inevitably reduced to crude symbolic representation: clean geometric lines, repetitive patterns and monochromatic palettes evoke sublimation to mechanical order and chaos, decadence and dissonance suggest the defiance of the natural world. It is the simplicity of this symbolic representation, however, that makes techno-utopian dress such an effective narrative platform.

Having provided an overview of the key concepts that relate to this study – the idea of the body and technology in modernist and posthuman discourses and the idea of

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\(^5\) I apply Carter’s Robotoid, Rationally Functional and Decadent classifications to my analysis of historical and contemporary works in Chapters 4 and 5.
utopia through the lenses of art and fashion theory, semiotics and critical theory – I now proceed to review eminent scholarly literature on the subject of wearable technology. The literature review will survey key critical positions – namely how wearable technology has been critiqued as a dimension of art and fashion history, theory and practice, and how wearable technology is positioned in contemporary debates about the body and technology (such as the posthuman discourse discussed in this section).
Chapter 3: Literature Review

3.1 Introduction & Context

Wearable technology has enjoyed much greater scholarly attention in the past ten years, owing primarily to strides in technological development that has widened both commercial and cultural interest. The literature that has emerged on wearable technology in this last decade is broad-ranging in scope, examining the applications for technological developments across a number of extant and speculative areas, including the far-reaching sectors of space-travel, warfare, health, computing and the arts. In light of this breadth, I have identified three major categories to help narrow and define the literature: commercial literature and first- and second-wave cultural literature.

This study defines wearable technology as a garment that is technological in constitution (comprised in part by mechanics, electronics or digital media), or that results from a noteworthy process of technological production. For the purposes of this study I have designated wearable technology as a cultural form – one that deals primarily with the convergence of the body, technology and dress in the hybrid context of fashion and art – rather than as the generalised material outcome of wearable electronics. Due to the project’s scope, I have excluded discussions of stand-alone mobile and hand-held technologies (hand-held cameras or mobile phones for example), or wristwatches, spectacles and other accessories that have been elsewhere examined as examples of wearable technology.

Before I go on to discuss the cultural context that frames wearable technology in first- and second-wave cultural literature, I would like to first acknowledge and tease out the industry focus that dominates much of the literature. The largest volume of literature resides in the commercial category. Contributing to this category are commercially authored works, most comprehensive of which is Philips Design's *New Nomads: An Exploration of Wearable Electronics by Philips* (Eves, D. et al. 2000); popular commentaries in mainstream media; and a UK government study 'Making a
visible difference: electronics 2015’ (2005). This combined literature examines the commercial implications of wearable technology for industries and sectors that include information and communications technology (ICT), health, sports and gaming, entertainment (music, film, gaming and televisual entertainment), and commercial fashion. While commercial literature has asserted some intellectual arguments about wearable technology’s cultural significance, it is largely without critical depth or contextual authority.

Wearable technology’s commercial appeal for the computing, electronics and media industries is also used to contextualise the field in the cultural category of literature, even where commercial focus is absent. For example, cultural commentator, David Smith blithely observes that "the economic potential of wearable technology is enormous" (2007, 2) while electronic media theorist, Susan Elizabeth Ryan more assuredly predicts a 25% per annum growth for smart fabrics and interactive textiles industries⁶ (Ryan 2009a, 309). Government research also attests to the predicted commercial impact of the field: a frequently cited 2005 UK government report discusses, amongst other technological innovations, wearable technology's potential to harness low-cost technologies and transform a range of products from health monitoring devices to the colours and patterns of young people's clothes⁷ (Smith 2007, 2).

The dominant cultural narrative of wearable technology largely overlooks the context of fashion to focus instead on the relationship between the broader sphere of media and culture and wearable technology’s recent material origins (since the early 1980s) out of the electronics, computing and media industries. In this narrative, the objective is to show the mutual influences between cultural forms and commercial scientific research and development. Such overlaps are embodied in the well-told story of MIT researcher Steve Mann (see figure 1), who in the 1980s made a number of seminal technical and conceptual contributions to the contemporary idea of

⁶As of 2008 (Ryan 2009a, 309)

⁷Reported by the DTI Electronics Innovation and Growth Team, 2005 'Making a visible difference: electronics 2015'
wearable technology. The popular wearable technology mythology of Mann as the first ‘real cyborg’ – a metaphorical hybrid form connoting the convergence of wearable technologies with Mann’s own body – charts a path from the cultural narrative (the idea of the cyborg set up in science fiction film and literature since the 1970s), into commercial narrative (the development and marketing of cyborg-inspired wearable computers), and finally, via cultural commentary, back into the cultural narrative (Mann-as-cyborg reinterpreted as primary inspiration for creative, non-commercial experiments in wearable technology). Similarly, concepts such as ‘ubiquitous computing’ or ‘pervasive computing’, which were introduced in the 1990s by computer and electronics companies to conceptualise and market shifting trends in the development and consumer usage of computers, have since helped to form the cultural narrative on wearable technology, by prompting a creative imaginary around how the body and the self might be shaped by the inexorable presence of computers (see Seymour 2008, 19).

Figure 1 Steve Mann and his wearable computing devices, 1980 - 1998.

Over thirty years, Mann has worn his own miniature computers on a daily basis, a practice which has earned his reputation as a wearable computing pioneer and ‘real life cyborg’ (Mann 2003, 20)
In this way, the first-wave of cultural literature on wearable technology draws on the ideas and technological developments raised by the commercial literature. There are four publications in this first-wave cultural category: Bradley Quinn’s *Techno Fashion* (2002), Andrew Bolton’s *The Supermodern Wardrobe* (2002), Suzanne Lee’s *Fashioning the Future: Tomorrow’s Wardrobe* (2005) and Sabine Seymour’s *Fashionable Technology* (2008). This group of cultural texts have addressed both commercial and non-commercial projects in order to examine the major technological developments, creative works, cultural context and theoretical concepts that relate to wearable technology. They are the first publications to exclusively document the emerging cultural applications of wearable technology, and assert the field’s connections with fashion, art, cultural theory and electronic media theory with scholarly authority.

Quinn’s *Techno Fashion* and Bolton’s *Supermodern Wardrobe*, published in 2002, were the first to emerge in this first-wave of cultural literature. Bolton traces the use of wearable technology in contemporary fashion and art, examining the work of Yeohle, Simon Thorogood, Hussein Chalayan and Lucy Orta, amongst other artists and fashion designers. He asserts the thesis that the aesthetics of hyper-functionality and futurism in technological garments of the early 21st century demonstrates a cultural desire to equip the body for the contemporary conditions of ‘supermodern’ excess. Quinn’s book propelled Bolton’s argument by opening it up for comment from the fashion industry. His interviews with designers and fashion houses offer some valuable insights as to how the fashion industry measures the influence of wearable technology in equivocal terms. Lee’s *Fashioning the Future* follows in 2005, positioned as the first major publication to orient wearable technology within the cultural narrative of twentieth century fashion. Her particular historical focus is the impact of the USA-USSR Space Race on the development of textile technologies and the futuristic space aesthetic in the quintessential 1960s designs of Pierre Cardin, André Courrèges, Rudi Gernreich and Paco Rabanne. Seymour’s *Fashionable Technology* (2008) is the most recent book to emerge on wearable technology, providing an extensive, but superficial, manual of the research, products, and creative
activities and practitioners that have been connected with wearable technology to date, to help orient the reader within the field.

A second-wave of cultural literature has advanced the theoretical arguments established by the first-wave in the more rigorous scholarly context of peer-reviewed journal articles. This group of writings continues the first-wave’s objectives to profile the cultural products of wearable technology as well as their makers, and to develop an aesthetic and philosophical discourse that engages art, fashion, cultural and electronic media theory. The scope of the second-wave is ostensibly larger than the first, as it situates wearable technology in a broader frame of social, political, cultural and environmental influence. This literature review will now move to examine the recent literature from this last category.

Specifically, I discuss the work of three academic authors, Susan Elizabeth Ryan, Sarah Kettley and Anne Cranny-Francis, who each make critical assessments of wearable technology’s significance, primarily as a form of cultural expression and discourse, but also as an instrument of social, political and environmental change. Ryan is an American cultural theorist and curator who critically examines wearable technology through the combined lenses of fashion, art and electronic media theory in three key articles: ‘What is Wearable Technology Art?’ (2008a), ‘Re-Visioning the Interface: Technological Fashion as Critical Media’ (2009a) and ‘Social Fabrics: Wearable + Media + Interconnectivity’ (2009b). Kettley is a wearable technology practitioner, electronic interface designer and researcher who discusses the axis of technology, craft and critical discourse in the article ‘Crafts Praxis for Critical Wearables Design’ (2006). Cranny-Francis is a theorist of gender and cultural studies who discusses wearable technology’s historical association with metaphors of embodiment in her article ‘From Extension to Engagement: Mapping the Imaginary of Wearable Technology’ (2008).

Outside of this group of articles, there is an extremely limited selection of cultural discourse relating to wearable technology. In light of this, these authors have had to establish a contextual framework as the foundation for critical discussion. To do
this, they have argued that wearable technology bears significant linkages with the aesthetic and theoretical traditions of art, fashion and craft, and thus the sum of the reviewed literature is the realisation of wearable technology as a subject of cultural discourse. Major contributions have been made through the documentation of original works, critical analysis of emerging practices, and establishment of a theoretical context. Without an extant theoretical framework or appropriate lexicon to draw from, theorists have had to develop the field’s legitimacy and currency as a genuine cultural movement (Ryan 2008b, 5-6). Theorists are thus both burdened and liberated by the field’s lack of established parameters; on the one hand, there is freedom to provide one’s own definitions and versions of events, but on the other, it is almost obligatory to do so. In light of these constraints, the literature under analysis has managed to define, document, anthologise, position, elevate and normalise the terms and practices of wearable technology.

However, despite these achievements, my research project demonstrates a blind-spot in the literature. The idea of utopia, which as Carter makes lucid, has historically surrounded the union of technology, body and garment, is not directly addressed by any of the literature. It is my contention, however, that much of the discourse implicitly draws on a poetics of utopia. By making the link between utopia and wearable technology explicit, my research extends and complements current understandings.

I will examine the literature in two stages to examine key theoretical concepts and themes that underpin my research. First, I show how the literature treats wearable technology as an emergent, yet legitimate, subset of art, design and craft, in order to establish how wearable technology is understood in a cultural context, and how it has been validated as a subject of scholarly research. I then look at how the body plays out as a central metaphor for wearable technology; the body is not only regarded as a crucial site but also intractable signifier in this field. My review, staged in this way, reveals the common impetus for theorists to establish the legitimacy of the field and build its currency as a new cultural study of the body.
3.2 Wearable technology as an emergent, yet legitimate, subset of art, fashion design and craft practice.

Generically, wearable technology is defined as an interdisciplinary field with a wide range of cultural and technological applications that culminate around the body. Nuanced definitions tend to contextualise wearable technology within one (or sometimes more) of three key disciplinary frameworks: fashion, craft and art. As fields that are considered to be most closely related to wearable technology, they offer the potential to equip the discourse with a borrowed language and theoretical framework. This section will first examine the generic definition for wearable technology as an interdisciplinary cultural practice, and then hone in on the more specific definitions supplied using the languages of fashion, craft and art.

The scope and diversity of both cultural and non-cultural disciplines engaged in wearable technology is reportedly vast. According to Smith, contributing disciplines range from “materials science, through computer engineering to textile design” (2007, 1). Cranny-Francis & Hawkins add fashion design, performance studies, architecture, cultural studies and medicine to the list, but do not confine their definition to just these fields (2008, 267). They argue that the scope of multidisciplinary engagement with wearable technology is limitless, as “any field with consequences for human embodiment is potentially affected by the development of wearables”, which they assert extends to “virtually every field of human creativity, innovation and thought” (Cranny-Francis & Hawkins 2008, 267).

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9 Ryan adds that practices are necessarily scattered across the globe, too, with research and development taking place at: “Extra-Soft (XS) Labs and the Hexagram Institute at Concordia University in Toronto; Saint Martins College, University of the Arts, London; the Australia Network for Art and Technology (ANAT)’s ReSkin Wearable Technology Lab; Am-I-Able Network for Mobile, Responsive Environments (a collaboration between several institutions in Canada); the University of Art and Design at Helsinki; Studio 505, New York; V-2 Labs in Rotterdam; and International Fashion Machines, Seattle” (2008b, 5)
The consensus that *wearable technology* is the appropriate term for a diverse range of practices that engage dress and technology is generally unchallenged. In fact, only one author – design theorist Stephen Thompson – has questioned whether the term befits its meaning. In ‘Mind the gap: technology as soma’ (2007), Thompson argues that the term wearable technology reduces our perception of technology to the material quality of its construction, and causes us to fixate on what he sees as the redundant adjective of *wearable* (2007, 39). He claims that we wear technology just as we wear “tools, wear the heat of fire, wear networks, vehicles and clothes”, which should logically preclude the use of *wearable* as a meaningful qualifier. He further argues that ‘good design’ should aim to render the unique qualities of the body and technology as “coextensive”, rather than contra-distinct, so that the technology’s functionality, rather than its materiality, is made the object of focus (2007, 40). Accordingly, Thompson calls firmly for a new critical language to remove the material connotations of technology, and depart from the rigid concept of the body as a contrasting organic form (2007, 39).

While Thompson has sought to stimulate discussion on the appropriateness of the term, his article has failed to further the debate. Nonetheless, the meaning of *wearable technology* is yet to be pinned down, and thus his argument to re-evaluate the term may be heeded eventually. Cranny-Francis has noted changes in the term’s cultural connotations since the 1980s. She suggests that in the 1980s and 1990s, the term *wearable technology* was most commonly associated with Virtual Reality applications, the wearable computing device *du jour* (2008, 365). In the past decade, the rising mainstream profile of ‘smart fabrics’ developments has generated a recent shift in the meaning of wearable technology. The technology’s association with textiles rather than computer hardware has meant that wearable technology is now more popularly identified with fashion. Ryan has introduced a number of alternative terms, such as *wearable technology art* and *technological fashion*, that

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10 Cranny-Francis cites this article in her bibliography of ‘From extension to engagement’ (2008), but it is not discussed. Murphy, E. & A. Pirhonen (332, 2008) quote Thompson as a segue to a discussion of the role of the user, but do not examine his argument on the inappropriateness of the term *wearable technology*. 
imply a disciplinary specificity. However, there is currently no literature that consolidates and defines the range of terminology for wearable technology. As such, I will consider the meaning of each term within the situated context provided by each author.

**Wearable technology in art, fashion and media theory: Susan Elizabeth Ryan**

Susan Elizabeth Ryan is a cultural theorist who has written about wearable technology through the combined lenses of art, fashion and media theory. Ryan’s inquiries into wearable technology, articulated in four key texts, consistently assert wearable technology as an emergent framework for wearable art (see Ryan 2008a, 2008b, 2009a and 2009b), which she presents a product of both art and fashion. I will examine the definitions Ryan gives for wearable technology in ‘What is Wearable Technology Art?’ (2008a), ‘Re-Visioning the Interface: Technological Fashion as Critical Media’ (2009a) and ‘Social Fabrics: Wearable + Media + Interconnectivity’ (2009b).

Ryan's 2008 essay, ‘What is Wearable Technology Art?’, contextualises wearable technology within the twin histories of art and fashion, however, her most compelling history lies in fashion. She charts, from the 1990s onwards, the instances of fashion taking on the functionality and aesthetics of technology as evidence of wearable technology’s contemporary development. According to Ryan, wearable technology in 1990s fashion occurs across three contexts: the runway, the lab and the museum. She cites Thierry Mugler’s circuit board prints on jackets in 1991, and Walter Van Beirendonck's LED T-shirts from his 1997 ‘Avatar’ collection as runway examples; Margaret Orth’s breakthrough methods for sewing electronic circuits into textiles at MIT Media Lab; and, finally, the sanctioning of wearable technology in the art museum at the Pompidou Centre's 1997 ‘Smart Clothes Fashion Show’ (Ryan 2008a, 3). Ryan identifies the key literature that followed in the wake of these developments as Bradley Quinn’s *Techno-Fashion* (2002), Suzanne Lee’s *Fashioning the Future: Tomorrow's Wardrobe* (2004), and Sabine Seymour’s *Fashionable Technology: The Intersection of Design, Fashion, Science and*
Technology (published in 2008, after Ryan’s article) (Ryan 2008a, 3). However, she also points to a number of gaps in this vanguard of wearable technology literature: “none of these texts pull together the disparate threads of wearable technology, nor do they address the aesthetic potential or social dynamics of the new practices”\(^\text{11}\) (2008a, 3). Rather, Ryan contends that “the most promising ideas were put forth by certain practitioners themselves” (2008a, 3).

Accordingly, her view is that practice-led research is driving the innovations and discoveries in the wearable technology field, by offering theoretical developments and candid reflections on practice within the context of fashion. She highlights the work of former MIT Media Lab Masters student Elise Co as “among the first technicians to articulate and explore the ramifications of wearable technology for human expression in the context of garments and fashion” (2008a, 3). Co’s research project which sought to “expand the vocabulary of fashion” (Co in Ryan 2008a, 3), suggests that computing can extend the garment’s potential as expressions of embodiment.

In ‘Re-Visioning the Interface: Technological Fashion as Critical Media’ (2009a) Ryan asserts that the majority of wearable technology practitioners are “acutely aware of the history of clothing as the intellectual context for their work” (2009a, 311), however, she identifies that some practitioners, such as Berzowska, are cynical of the intentions of the commercial clothing companies that have taken to wearable technology. Berzowska argues that commercial clothing companies, along with military groups, seek mainstream success for wearable computing applications, such as wearable health monitoring and surveillance technologies, and that their focus on financial gain is overwhelming design developments that could address “personal, social and cultural needs” (in Ryan 2009a, 312). Berzowska offers a critical perspective to other wearable technology designers, urging that “we need to step back and ask why we want our fabrics to be electronic” (2009a, 312), in order to consider material, form and product within a critical design framework.

\(^{11}\) At the time of writing, this is the only published critique of wearable technology literature
Taking cues from Berzowska’s critique, Ryan explores a range of theories to illuminate both the problems and possibilities inherent in the alliance of fashion and wearable technology. To begin with, she cites sociologist Gilles Lipovetsky’s theory of the ‘consummate’ era of fashion, to suggest that fashion has become perfectly inescapable in collective life (Ryan 2009a, 311). In Lipovetsky’s view, the mass expansion of fashion – and its system of perpetual novelty – is not necessarily a malign function of capitalism, but rather an ideal and “quintessential element in the life of individuals functioning in societies” (Ryan 2009a, 312). However, without greatly expanding on Lipovetsky’s views, she presents a contrasting thesis that fashion’s ubiquity renders it as a mechanism of societal control on a mass scale. In presenting two contradictory critiques, she sets up fashion as an uneasy theoretical paradigm for wearable technology.

Ryan’s hypothesis that the scale of fashion’s ubiquity is commensurate with its potential for control is modelled around the idea of continental philosopher, Gilles Deleuze, that ubiquitous technology creates insidious systems of societal control. She explains that Deleuze’s notion of a ‘control society’ essentially extends Michel Foucault’s idea of the ‘disciplinary society’ – the broadly influential disciplinary power structures of public institutions (schools, hospitals and prisons) described in Discipline and Punish (1975) – for the context of the information age (Ryan 2009a, 312). Specifically, Deleuze has accounted for the changed nature of the institution, the crucial framework for Foucault’s critique, and accordingly examines how controlling structures have manifested in the unenclosed and nomadic realms of the digital age, in which systems that rely on data, such as the internet, remain “ruled by codes and [are] susceptible to protological control” (Ryan 2009a, 312). Put simply, Deleuze’s ‘control society’ may operate outside of disciplinary institutions, but it still fundamentally relies on the mechanisms of societal control that Foucault described.

Ryan expands this theory (albeit briefly) to highlight her own concerns that dress has become highly vulnerable to the same systems of control that rule any technology. She argues that because clothing is “our primary interface to our environment and
transmits and receives emotions, experiences, and meanings” (Ryan 2009a, 312) it poses as strong a threat as a ubiquitous vehicle of control as does technology. Putting aside the simplicity of Ryan’s conceptualisation of fashion (namely her notion that clothing acts as a kind of transmitting/receiving device), her idea that wearable technology may be doubly at risk of becoming a mechanism of societal control warrants further consideration. It is true that wearable technology takes on the features and systems of fashion, as well as those of a variety of data-based technological applications that are the crux of Deleuze’s criticism.

To balance the contrasting views of technological fashion as either controlling or individualising, suggested via the theories of Deleuze and Lipovetsky respectively, Ryan suggests that wearable technology should serve as a critique of both fashion and technology’s increasing ubiquity. She asserts that in referencing the history of both garments and technology, wearable technology should perform a self-reflexive critique, just as fashion has been wont to do historically (Ryan 2009a, 312). Ryan’s argument suggests that acknowledging the dual contexts of technology and fashion confers an inherent criticality on wearable technology.

While Ryan sees fashion as an appropriate, yet problematic, context for wearable technology, she also has proposed one of the few arguments for wearable technology as cognate with contemporary art practice in ‘Social Fabrics: Wearable + Media + Interconnectivity’ (2009b). The advantage of drawing wearable technology into art discourse is that, unlike fashion and, to a lesser extent, craft, art is an established domain of aesthetic philosophy and as such, has the potential to bring a well-established formal language to the study of wearable technology. Ryan’s article discusses an eponymous exhibition, (curated by the author along with colleague Patrick Lichty), as a means to explore some themes, histories and common approaches to wearable technology practice.

She argues that wearable technology art (her term) exhibits a series of tendencies that conform to contemporary art practice, thus making it distinct from the commercial and scientific practices of wearable technology, and lists the three
following attributes as the key qualifiers: “[it is] worn on the body, it exists in the complex multidimensional realities of contemporary social discourse (often simultaneously on-line and off) and it engages with a world transformed by varieties of ‘media’” (Ryan 2009b, 115).

What I glean from Ryan’s classification of wearable technology art is that it engages technology as a subject for contemporary art practice; the fact that it uses technology as medium is not an incidental condition, but rather a meaningful and critical subtext. Accordingly, the practitioner of wearable technology art engages technological networks as a feature of ‘contemporary social discourse’, rather than as a perfunctory tool for disseminating content.

Ryan argues that wearable technology’s emergence in contemporary art occurred in spite of, not because of, its origins in technology industries and academic media theory (2009b, 115). She further asserts that artists display opposing intentions to those using wearable technology for commercial ends. An example is provided: while corporations such as Microsoft seek to make wearable technology invisible and ubiquitous, wearable technology art will “make connections with the palpable, the fantastic, the self-consciously mechanistic and the intractably organic aspects of the body as dynamic interface” (2009b, 115). In other words, art’s trained response is to expose, scrutinise and interrogate the medium of technology.

Ryan identifies three categories of approaches to wearable technology art-making emerging from her own sample group of exhibiting artists. There are practices that a) encourage socialisation, b) visualise data, which may include the indexing of factors both internal and external to the wearer (bodily functions, environmental quality etc.) and/or c) perform social critique (Ryan 2009b, 116). On top of this, Ryan notes, wearable technology is able to run a parallel commentary on the centrality of digital media and fashion to contemporary life (2009b, 115). Critique, therefore, is at the very centre of these works, and according to Ryan, the choice to use technology represents the engagement of a sophisticated language of cultural signification. She argues that the works presented in the ‘Social Fabrics: Wearable +
Media + Interconnectivity’ exhibition “enlarge the conceptual potential of wearable media in specific ways”, demonstrating “convergences between individual expression and statement-making on the one hand and the nature of ‘network society’ on the other” (Ryan 2009b, 115). In Ryan's view, implicit in the choice to make wearable technology art is a desire for cultural critique on the ‘network society’, or the contemporary reality of life amongst advanced information and communications technologies.

Wearable technology in craft: Sarah Kettley

Wearable technology practitioner and theorist, Sarah Kettley has contextualised wearable technology as a critical craft practice in ‘Crafts Praxis for Critical Wearables Design’ (2006). Drawing on contemporary design literature, the article discusses craft as a social, cultural and political intervention into the everyday, and as such, an ideal critical context for wearable technology.

Kettley’s particular interest in wearable technology is its role as an instrument of social engagement. Her research centres around a ‘friendship group’ of retirement-age women who have participated in the author’s controlled experiments to make jewellery using networked technology (a project called ‘Speckled’ jewellery). Interviews with her subjects reveal a variety of attitudes towards the use of new technology amongst more traditional jewellery materials and practices, including ambivalence and concern about “a loss of original expression”, as well as excitement for “technology’s affordance of new ranges of expression” (2006, 8). In addition to these responses, Kettley enthuses about the “exciting and mature approach to technologies by craft researchers”, within the academic circles of recent conferences (2006, 8), reflecting a discourse that engages technical and intellectual interests in technology’s potential for craft.

Kettley is critical, however, about how the field of wearable technology has emphasised technological innovation over material, form, process and concept (2006, 5). She cautions that many examples of wearable technology have failed to address
the aesthetic, ethical and practical issues of wearability such as the potential “lack of intimacy between artefact and wearer, [and] the ‘social weight’ of covert interfaces” (2006, 6). Also highlighted is the pervasive perception that wearable technology practitioners are “unthinking in their appropriation of both garment and jewellery form” (Kettley 2006, 6). In light of this, Kettley argues that craft could provide both a critical framework and language for wearable technology practice that would help to overcome these underdeveloped areas of practice. Above all, Kettley argues for an appreciation of contemporary craft’s leading example in addressing artefact, material and social meaning in perpetuity, and craft’s use as a template for wearable technology to achieve “social complexity in design” (2006, 13).

3.3 Wearable technology and contemporary notions of embodiment

In this section I first examine Cranny-Francis’ article ‘From Extension to Engagement: Mapping the Imaginary of Wearable Technology’ (2008), which comprehensively traces how bodily metaphors have been used in the discussion and development of wearable technologies since the early 1980s. I then return to the work of Ryan to examine her key text, ‘Re-Visioning the Interface: Technological Fashion as Critical Media’ (2009a), which describes the way wearable technology has approached the concept of the body with alternate sensitivity and insensitivity to its symbolic meaning.

Considering wearable technology in its broadest terms, Cranny-Francis begins with the pioneering apparatuses of early Virtual Reality (VR) and describes how these and developments since have been both imagined and coded through metaphorical associations. Framing the author’s analysis of the history and cultural context of wearable technology are her key metaphors: extension, prosthetic, augmentation, and engagement. With much of the discussion centring on the trope of the cyborg or hybrid technological being, Cranny-Francis launches a feminist critique that is familiar to posthuman theory. Using the term ‘erotics’ to explore the gendered nature of technology, Cranny-Francis argues that an erotics has always been present
in wearable technology, emerging in early VR wearables as a masculinist eros of power (Cranny-Francis 2008, 366)

In introducing her work, Cranny-Francis hypothesises that metaphor has been engaged to conceptualise and imagine the potential for wearable technology, but also to naturalise the fantastic or threatening ideas of wearable technology into the everyday; she aims to show how this process of normalising technology’s integration with the body is a crucial role for wearable technology as a cultural form. Cranny-Francis introduces her use of French feminist philosopher Michèle Le Dœuff’s notion of ‘the imaginary’ or ‘thinking-in-images’, which provides a narrative structure to knowledge forms, taking also from Elizabeth Grosz’s idea that the imaginary is used politically and intellectually to cover over “founding assumptions” (Cranny-Francis 2008, 364). According to Cranny-Francis, Le Dœuff renders the imaginary as an enabling device that can take knowledge outside of established ideas and frameworks and into “new experiences and new capabilities” (Cranny-Francis 2008, 364).

The history of the extension metaphor in technology is launched from the early “wearable, not comfortable” technologies that were no more than crude electrical appendages, and concludes with the more fluid and comfortable technologies that have characterised wearable technology in the twenty-first century (Cranny-Francis 2008, 366-367). The author discusses the metaphor of extension as denoting both physical and perceptual enhancement, as well as phallic erotics. In discussing the prosthetic metaphor, Cranny-Francis describes how science-fiction scenarios such as those of Neuromancer and Star Trek have had genuine influence on the ways the prosthetic enhancements of wearable technology are inserted, implanted or appended to the body (2008, 367). Furthermore, she explains that these fictions constitute the ‘imaginary’ that has helped drive the innovation of early wearable technologies, which in 1980s were crudely conceived as the hard-shelled hats and gloves of Virtual Reality, to land new technical possibilities for connecting the body with a technological prosthesis – e.g. Neuromancer (1984) suggested that the body could be neglected entirely under the virtual seduction of cyberspace, while Star Trek (‘The
N. Borg’s (1990) proposed the insertion of technological prosthesis under the skin. These examples point to the possibility that the cultural and imaginative domains have driven scientific experimentation.

Culminating in the figure of the cyborg, Cranny-Francis argues that prosthetic enhancement prompts a ‘complex’ of fears and desires that “require an effort of the imaginary to accommodate” (2008, 370). Inherent in the prosthetic enhancement metaphor is a threat to human agency. As an ‘effort of the imaginary’, many cinematic and literary fictional scenarios have considered technological enhancement to mean that body and mind have been relinquished to the machine. Cranny-Francis discusses a culture of fear particular to the late 1980s and early 1990s, where pop cultural narratives frequently imagine “the dread of being fundamentally changed, indeed invaded, by technology” and “the invasion of western society by a series of viral vectors, biological and technological, including AIDS, (fears of) Ebola, IT viruses transmitted by email” (2008, 368). Central to many of these fictions is the power of the human (western male) rational mind to overcome the imminent threat of technological invasion.

Cranny Francis’ next metaphor, augmentation, by contrast highlights the deficiency of our natural corporeal form (2008, 371). Using both the science-fiction film The Matrix, and theorist Viseu to illustrate her point, she argues that augmentation is the submission of the failed body to a technological overhaul. Engagement is the final metaphor, and in a much softer way it acknowledges technology as artifice, but “neither rejects nor colonizes it” (Cranny-Francis 2008, 374). Sensitive to the body’s ability to both integrate and stand apart from technology, engagement aims to create a new and more palatable hybrid form, operating in an humanistic and tactile manner that Cranny-Francis describes as ‘sensuous’ (Cranny-Francis 2008, 374).

As interpreted by Cranny-Francis, the imaginary has been articulated most significantly in posthumanism’s hybrid or cyborg figure (2008, 365). Influenced by philosopher Andy Clark’s theories on interfaces, Cranny-Francis believes that the body’s relationship with the “material culture of technology” is fluid and dynamic.
enough to resist its absolute intrusion, with the mind remaining a plastic and embodied agent (2008, 377). Cranny-Francis concludes that Clark’s ideas are compelling enough for us to accept that technology is no threat to the natural human body or human subject. Indeed, she asserts that the intrusion of technology is only remarkable because we are yet to naturalise it (2008, 378). Thus, Cranny-Francis stresses the cultural role of wearable technology in constructing a narrative that can naturalise technology’s advanced relationship with the body.

Dealing with two trends in wearable technology’s approach towards the body and technology (one described as positivist - an instrumentalist approach, the other being critical practice that highlights inherent social and ethical dilemmas), Ryan makes some key observations through the analysis of a handful of wearable technology projects. Complementing Cranny-Francis’ cyborg metaphors, she treats the critical approach as one influenced by the moral fables of science fiction and the positivist as one entrenched purely in the material issues of technology.

Indeed, the positivist designer idealises the functionality of technology to the extent that both the body and dress are seen to detract from the design. As the name suggests, positivist design follows the traditions of the scientific method, with the added implication that it constitutes an extreme or fundamentalist view of science. In seeking minimalism and standardisation (Ryan 2009a, 307), contemporary positivist design is compared to various historical anti-fashion movements which elevated the body’s natural state as the purest form (2009a, 307-308). Accordingly, positivist wearable technology dismisses the “clothes’ cultural connotations” in favour of the natural form, which Ryan likens to the purely functional role of clothing in the utopian sartorial project of Russian Constructivism (2009a, 308). Unfortunately for the positivist designer, the body remains an omnipresent counterforce, and thus Ryan describes the challenge of wearable technology as having to resolve “awkward, clumsy, and prohibitive problems of hardware vs. body” (2009a, 308). While purist positivist examples such as Tachi’s Invisibility Cloak (which takes a reductivist approach to both the garment and body by making them disappear – a trick of video camouflage described further in Chapter 5) can
assert uncompromising principles on both dress and the body, the clumsiness of the technological hardware often betrays the ideology. However, Ryan suggests that smart-fabrics, which can change shape, be stretchable and comfortable, are making the ‘problem’ of the body a lot easier to address (2009a, 308). So while the positivist designer may dismiss the garment in favour of the functionality of technology, the success of their ideology is contingent on technology’s seamless integration into dress, thus making the vanishing interface of smart textiles a significant milestone for positivist design.

Ryan also highlights that many wearable technology designers are in fact primarily concerned with affecting the mind, rather than the body. She cites Philips as making strides towards developing emotionally responsive wearable technology, and at this stage, the experiments reveal the role of the garment in their research to be rather incidental. Philips’ 2007 SKIN project simply set out to change garment pattern and colour in accordance with sweat inducing emotional responses such as “stress, fear, or arousal” (2009a, 308-309). Ryan condemns their approach to measuring, predicting and manipulating human emotions as “modernist and techno-futurist”, hinting that they lack the sophistication to interpret the data with the subtle analytical tools that it would seem to demand (2009a, 308-309).

Whilst Philips is denounced by Ryan as positivist, a similar use of nanotechnologies for the protection of both body and mind can be found in the critical examples of Glitterati, a nanotech fashion line protecting wearers from airborne allergens and pollutants by design student Olivia Ong and fibre scientist Juan Hinestroza (a project discussed in detail in Chapter 5) and the automated aromatherapy experiments of Scentsory Design (again, discussed in Chapter 5) (Ryan 2009a, 309). Another dubious critical example is Heidi Kumao’s Posture Generator, a leather corset that triggers an automated lecture “demanding a return to correct and adopt perfect (vampish) posture” when the wearer slouches (Ryan 2009a, 310). Each of these examples, and there are many others discussed, are treated by Ryan as acutely sensitive to the cultural meanings of both the body and dress, despite the similarities
they bear with Philips’ attempt to interpret and control (in the case of Posture Generator, punitively) the wearer’s body and expressed emotions.

Ryan problematises the positivist technological bodily intervention by drawing on the pertinent theoretical formulations of media theorist, Geert Lovink. Specifically, she raises Lovink’s argument against the vanishing interface, which he asserts makes the body and human agency vulnerable to control (in Ryan 2009a, 312). In the case of wearable technology, Lovink’s theory is a cautionary warning for the invisible interfaces of nanotechnology and smart textiles. Accordingly, Ryan urgently appeals for a careful consideration of how we “incorporate the new technologies seamlessly into our practice of dress”, with the import that the “body itself and our corporeal existence are at stake” (2009a, 313). Whilst her concerns regarding wearable technology’s symbolic and physiological treatment of the body parallel those of Cranny-Francis, this rather anxious plea for a critical, rather than positivist, approach contrasts with Cranny-Francis’ relaxed resignation to the seemingly interminable process of technological bodily intervention.

Having established how wearable technology is understood in a broad cultural context and within the frames of fashion, craft and art in part one of the literature review, and elucidating the central metaphors of this study through the concept of the body in part two, I will now go on to argue how the idea of utopia connects the historical contexts of early twentieth century technologised fashion and early twenty-first century wearable technology. In the coming chapter, I analyse examples of technologised fashions from the early part of the twentieth century to assert the significance of techno-utopian ideation to the synthesis of the body, technology and dress.
Chapter 4: Historical Context

This chapter will illustrate how the idea of utopia was integral to the early twentieth century avant-garde project of technologised fashion by way of three key modernist sartorial projects – namely the textile design of Russian Constructivists Liubov Popova and Varvara Stepanova; the experiments and manifestos for dress of the Italian Futurists Filippo Tommaso Marinetti and Giacomo Balla; and the more bourgeois fashion sensibilities of Cubist Sonia Delaunay. While these three groups of artists acted independently of one another and across vastly different socio-political contexts, they each invariably imagined the future as a technological utopia, using dress as both instrument and narrative vehicle for ideas of how the body, self and society would be transformed by advanced industrial modernity. In the context of this study, the work of these key progenitors of the “avant-garde’s abiding interest in the domain of clothing design as a site for fashioning a new humankind” (Schnapp 1997, 239) acts as an important historical backdrop against which my investigation into wearable technology of the current era is given a genealogical perspective. In developing and applying this historical lens to the study of utopian ideas in wearable technology, I will develop my central argument, namely that twenty-first century wearable technology resurrects these modern avant-garde conceptions and representations of techno-utopia.

I’d like to briefly contextualise this discussion by noting how the interlinking of significant social, technological and sartorial changes in modernity inspired the avant-garde’s techno-utopian thinking around the union of fashion, the body and technology. Importantly, early twentieth century fashion was implicated in a number of large-scale technological and social shifts, including: the mass-production of textiles (seeding the idea and means for fashion’s democratisation, and subsequently, changes to established class norms), auto-transport (demanding freedom of movement in women’s fashion, as well as enabling the spread of modern fashions), communication technologies (creating the rapid and mass dissemination of new fashion styles), and central heating (demanding lightness and breathability,
particularly in women’s fashion). The early twentieth century avant-garde idea of utopian self- and social-transformation led by technological fashion thus sprung from the established relationship between technological, sartorial and social change in modernity.

This thesis is supported by art historian Jeffrey T. Schnapp, who, in his introduction to Filippo Tommaso Marinetti’s ‘Wrapping the World in Italrayon’, identifies amongst other artists Giacomo Balla, Sonia Delaunay and Varvara Stepanova (he fails to mention Liubov Popova and F.T. Marinetti, but they are implied), as avant-gardes who viewed the remodelling of fashion through technology’s intervention into process, material, and aesthetics as instrumental in conceiving the new body, self and society of modernity (1997, 239-240). Providing two categories of avant-garde sartorial experimentation as the “repatterning of fabrics” and the “recontouring of garments”, he describes how the replacement of pre-modern or classical styles with “brightly colored, hard-edged, abstract geometries” marked “a new rapport of intimacy between the surface of the wearer’s body and the new century’s machine-dominated context” (1997, 239-240). In this way, the use of a technological aesthetic in fashion served as a “utopian or mythic” narrative that asserted that the modern body, and by extension, the modern self had new requirements that could be met through the function of technology in fashion (such as “hygiene, lightness, elasticity, breathability”) as well as the symbols of technology in fashion (“for the outfits to suggest movement, classlessness, agility, speed and flight”) (1997, 239-240). On the back of modern technological, sartorial, and social changes, the early twentieth century avant-garde saw that fashion could communicate a clear association between technology (aesthetics, symbols and functionality) and the utopian transformation of each the body, self and society. The following discussion will narrow in on three key utopian ambitions that support the avant-gardes’ pursuit of a technological fashion: one, the premise of technological body-optimisation, two, the impulse to converge the body with its technological landscape, and three, the

notion that either utopian collectivism or utopian individualism imbued in technological fashion would emancipate both the self and society.

4.1 Filippo Tommaso Marinetti & Giacomo Balla

Over eight manifestoes published between 1915 and 1933, a group of Italian Futurists that included Filippo Tommaso Marinetti and Giacomo Balla as central figures, disseminated their call for a complete revolutionary overhaul of both men’s and women’s clothing, as part of their dogmatic pursuit to reconstruct “the universe” by way of poetry, art, design and public spectacle (Braun 1995, 34). Whilst culture, industry, politics and society at large constituted the broad focus of the Italian Futurists’ spirited revolt, the body and technology took supreme roles as the agents and measures of utopian change. The body, seen as inextricable from notions of selfhood and society, represented the extreme states of the dystopian present (weakness and deathliness) and the prophesised utopian future (power, novelty and immortality), while technology was charged with the values, aesthetics and functionality considered to be antithetical and superior to the decaying natural world.

In the utopian imaginaries of Marinetti and Balla, fashion’s union of technology, the body and Futurist aesthetics would transform the stagnating and dysfunctional present into a future of unbridled power, collectivism, egalitarianism, dynamism and perpetual innovation. My analysis of their ideas for technological body-optimisation, the body’s convergence with the Italian Futurist city, and fashion-led collectivism put forward in Marinetti’s poems and manifestos for Futurist fashion and Balla’s fashion designs and illustrations is informed by three key theorists: Cinzia Sartini Blum, a cultural theorist specialising in Italian modernism, and art historians, Emily Braun and Jeffrey T. Schnapp.

Broadly, the Italian Futurists’ machine-aesthetic, applied in painting, sculpture, architecture, literature, music and fashion, was inspired by the changes brought about by industrialisation, the vibrancy of the modern city and the impact of machines on the modern consciousness; an idea of beauty that is adversative to pre-industrial and
pre-modern humanist poetics (Marinetti in Schnapp 1997, 208). The Futurist painterly convention, for example, describes the beauty of the machine’s motion, speed and energy via the repetition of geometric forms, the use of contrasting and garish colour, and the formal principles of Analytic Cubism. Futurist fashion, especially as quintessentially represented by Giacomo Balla (see figure 2), takes largely from this established style in the use of colour, pattern and graphical composition to reflect mechanical movement and dynamism.

In rhetorical form, the Italian Futurists’ plans for a machine-imbued-fashion transcends material limitations to describe the body’s physical convergence with

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13 Many examples of Balla’s garments and fashion sketches simply extend his painterly studies of mechanical speed to a three dimensional form of the body (Costache 1994, 186).
technological apparatuses\textsuperscript{14}, lyricising the ceaseless buzzing energy of the machine, and its capacity to agitate, to “stun, to upset, to annoy” (Braun 1995, 35). In the Futurist imaginary, the disruptive qualities of the machine prevent the imperfect present-time from ever settling into the despised orders of tradition, stagnation, or decay. Unsurprisingly, their mandates for dress reform invariably urge that fashion represent the machine’s exuberant and hostile extremes: its symbols of productivity, progress, dynamism, superabundance, warfare, aggression and power.

Connecting subjectivity to corporeality, the Italian Futurists considered fashion, as an interface between the body and technology, to be instrumental in the construction of the idealised technological self. Over the first three decades of the Italian Futurists’ formation, numerous manifestos, sketches and prototypes for men’s and women’s fashion imagined how a combination of modern synthetic fabrics, the Futurist machine aesthetic and a series of worn technologies (triggering a spectacle of lights, sounds, colours and explosive transformations) could act as a second skin; a conduit between technology and the living subject\textsuperscript{15}. Accordingly, fashion is prominent in the Futurists’ prevailing myth of the “regenerating union between man and machine” (Blum 1996, 88) in which the power of the machine is transferred to the subject, and vice versa. In this myth, the utopian future and rhetorically dystopian present are allegorised as the respectively virtuous and wretched qualities of the gendered body; the masculine body is commensurate with the emblems of technological power (having the fast, agile and powerful qualities of the automobile or the aeroplane for example), and antithetically, the feminine body is tantamount to nature, weakness.

\textsuperscript{14} Volt sought to create “illusionistic sarcastic sonorous noisy homicidal explosive outfits; outfits that lunge, shock, transmute, armed with springs, stingers, camera lenses, electrical current, spotlights, spouting perfumes, fireworks” (in Schnapp 1997, 200-201).

\textsuperscript{15} Rhetorically, the Futurists’ ideas were highly fanciful (calling for the clothing to arm the body with explosives, fireworks, pneumatic mechanical devices, disappearing tricks and instantaneous transformations), while their textiles and garments produced as both sketches and wearable items were comparatively sober, exploring primarily the use of man-made materials, such as Rayon, and dynamic machine aesthetics.
tradition and decay (Blum 1996, 88). Accordingly, the female body is rejected as constituting a lack, and the masculine body is modelled on the machine that stands in supremely as the “new inspiring muse, aesthetic model, and object of desire - a narcissistic object … mirroring man's ambition for supernatural power”¹⁶ (Blum 1996, 88). The promise of the technologised fashion is to reify the Futurist body ideal of a masculine human-machine complex.

In the early part of the twentieth century, the arrival of new artificial fabrics, such as Rayon, signalled to Marinetti the imminence of the human body’s technological redemption (Rayon, the plant-derived synthetic had already helped to redeem Italy’s ailing natural landscape). Dissatisfied that machine aesthetics and freedom of movement alone would fulfil “modern clothing’s revolutionary promise” Marinetti demanded that artificial fabrics “become the living prolongations of living beings - in his own words the ‘tender elastic equivalent[s] to the human epidermis’” in order to materialise the Futurist fantasy of a technological ‘second skin’ (Schnapp 1997, 240). In Marinetti’s view, garments made from artificial fabric are an imperishable edition of the human body’s skin; in effect, a mimesis of the human subject that does not terminate with its host, but rather, abides in a perpetual state of perfection after the natural/original body has expired. It is not clear whether or not in Marinetti’s view the superhuman second skin would overcome the biological self as the supreme and rightful occupant of the Futurist techno-utopia or if in fact it would serve to memorialise and regenerate its decaying host. I sense that the Futurists’ lust for the

¹⁶ Paradoxically, the masculine traits the Futurists attributed to the machine – its aggressive qualities in particular – they also sought to transfer to the modern woman, to enable her to “take on the icons of modern warfare and transportation: machine guns, airplanes, submarines” (Braun, 1995, p37). As Braun explains, while the Futurists fervently rejected femininity as anterior and diametrically opposed to both the machine and modernity, for a period, both the Futurists and the fascist state were surprisingly supportive towards the feminist movement as it undermined traditionalism, and demonstrated recognition of the wartime effort of women on the home front (ibid).
technological self was such that it need not simply extrapolate and redeem human qualities, but rather, supersede them entirely.

Futurist poetry prophesised that under fascism, the pursuit of fashion (as well as literature and art), which had been formerly monopolised by the aristocratic and bourgeois classes, would be reclaimed as a tool “for the forging of a true mass society” (Schnapp 1997, 220). In this view, the masses would be fundamentally transformed by their interaction with the machine and automated production (such as the industrial manufacture of artificial textiles), creating what Marinetti called a “proletariat of geniuses” (in Schnapp 1997, 209). In the Futurist utopian imaginary, the virtuous effects of increased access to culture (such as the democratic and everyday culture of fashion), education and the transformative dynamics of the machine would make their society hyperbolically intelligent, creative, productive, immortal, collective and classless.

The industrial innovation of mass-fashion was leveraged by the Futurists to create a unique model of collectivism that simultaneously promoted individualism, freedom of expression and the Futurists’ anarchic sensibilities. Departing from the rigid uniformity that is often associated with the factory of industry and the utopian ideal of the organised collective, both Balla and Marinetti (along with other Italian Futurists, such as Volt) anticipated “the modern fashion phenomenon” (Braun 1995, 38) as part of their collectivist vision, exalting the potential for cheap mass-produced fabrics to enable the mass participation in rapid seasonal style change. Not only did industrial modernity’s democratisation of fashion align with the Futurist’s egalitarian ideology, it also systematised their dogmatic pursuit of cultural novelty or “speed, dynamism and ceaseless innovation” (Braun 1995, 34). The planned obsolescence of new fashion styles further satisfied the Futurist utopian ideology by increasing production (the rationale of economic stimulation that framed Mussolini’s demand in 1930 for a new national style in fashion and other applied arts).
The regular style changes afforded by cheap, industrially produced fabrics would also make the Italian body *en masse* mirror the dynamic change of the urban and industrial scene, in contrast to the dominant bourgeois “stuffy sartorial and social conventions” (Braun 1997, 35) that bore no relationship to pervasive state of mechanical change. Confirming their anarchic sensibility, the Italian Futurists conceived the bodied occupants of their utopia as blending harmoniously with the mechanical environment through aesthetic non-conformity, an idea best unpacked via the example of the *Antineutral Suit* (a men’s fashion described by F.T. Marinetti in his manifesto *Il Vestito Antineutrale*, and devised into material form by Giacomo Balla – see figure 3).

*Figure 3* Giacomo Balla, Antineutral Suit, wool and cloth (c. 1920)
To mimic the exhaustive transfigurations of the idealised industrial landscape, and the inherently Futuristic flux of women’s fashion styles, Marinetti and Balla demanded that the optimised male body be appropriately “clad in ‘aggressive’, ‘agile’, ‘dynamic’, ‘rapidly changeable’, ‘bright’ garb with ‘muscular’ polychrome hues” (Schnapp 1997, 199)\(^\text{17}\). The garment’s variability, dynamism and ‘anti-neutrality’ forged a sense of congruity between the body and the techno-utopian surrounds. Along similar lines, Balla also envisioned transformable clothing that, with the push of a button, could transform style, colour or fit, and incorporate “mechanical trimmings, tricks, disappearance of individuals” (Balla in Braun 1995, 35) to make the technological self even better adapted with its hyper-changeable environment. In this paradoxical way, the transmutable nature of each the body, society, culture and environment epitomised the Futurist idea of harmony—the logic being that instability inverted the dystopian orders of stagnation, degeneration and decay.

\[\text{Figure 4} \text{ Fortunato Depero & F.T. Marinetti in Depero’s Futurist vests (1924)}\]

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\(^{17}\) Balla's suit was indeed bright and dynamic in colour, but in one incarnation it signalled their fierce nationalist pride by taking on the colours of the Italian flag for a patriotic public demonstration.
The Italian Futurists’ hyperbolic and narcissistic attitude towards the unification of the body, technology and fashion made their utopia a libidinal and decadent rather than uniform, austere or rational one. In decadence, their utopian ideal of a collective, egalitarian and superabundant society was pursued through the garish and anarchic self-expression of the machine-clad individual. Led by a vital urge, the Futurist’s idea of a technologically-optimised body was consumed by vain projections of masculinity and immortality. However, the flamboyance of the Futurist utopian fashion project was underscored by ideological sobriety: the imaginary redemption and regeneration of Italy’s present-time dysfunction characterised by deathliness, traditionalism, the dominance of bourgeois culture and the backwardness of national industry. Through the technological reformation of dress, Marinetti and Balla pursued an imaginary future absolute and exhausting in its newness, complete with radically revised corporeal, subjective, cultural, and social norms that would bring Italy in step with the speed and efficacy of the modern technological revolution.

4.2 Liubov Popova & Varvara Stepanova

In this section I analyse the sartorial activities of Russian Constructivist artists Liubov Popova and Varvara Stepanova between 1923 and 1924 to elucidate how their work at this time triangulated the body, fashion and the machine to build and articulate the Constructivist ideation of utopia. I apprehend their idea of utopia as a primarily political one, centred on the notion of a productive, egalitarian, socialist state that is made dynamic via the modern and revolutionary qualities of the machine. I examine how the artists transferred this idea of utopia into fashion by impregnating the symbolic and practical functions of the machine in their textile and clothing designs in order to create a socialist commodity object that would transform both the consumer and everyday life under modern Soviet Russia.

My argument draws on a chapter of Imagine No Possessions: The Socialist Objects of Russian Constructivism (2005), by art historian Christina Kiaer, entitled ‘The Constructivist Flapper Dress’, which analyses the artists’ work during their time at
First State Cotton-Printing Factory\textsuperscript{18}. Most significantly in the context of this study, Kiaer reveals that Popova and Stepanova transformed the capitalist commodity of fashion into a utopian socialist object that would transform the body, self and society through the imbued qualities of mechanical mass-production.

Popova and Stepanova worked at the First State Cotton-Printing Factory in Moscow for only a year, making it a short experience that registered both success and disappointment. Embodying the idealised qualities of the Constructivist-Productivist artist-engineer\textsuperscript{19}, the artists managed to attain complete access and input into all areas of design and technical production, including the factory’s chemistry laboratories (Kiaer 2005, 104), so that they could engage holistically and practically in the

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure5.jpg}
\caption{Varvara Stepanova using a compass to create a design for textiles. Photo by Alexandr Rodchenko (1924)}
\end{figure}

\textsuperscript{18} Kiaer’s is the only significant analysis to emerge on the subject of Popova and Stepanova’s pursuits in fashion and textile design since Natalia Adaskina’s 1987 article, ‘Constructivist Fabrics and Dress Design’ (which I also refer to).

\textsuperscript{19} The artist-engineer teamed her/his skills (‘qualifications’) as a modernist artist with new found technical expertise in industrial mass-production (Kiaer 2005, 95).
processes of industrial production (Kiaer 2005, 94), and in turn, help reinvigorate the ailing Soviet industry. The artists’ achievements at the factory marked them as the only Russian Constructivists to realise their socialist objective of having their utilitarian designs mass-produced and distributed around the Soviet Union (Kiaer 2005, 89), thus making their project a success in terms of the ideological goals of Productivism. However, the ultimate disappointment of the project lay with Soviet industry’s inability to match the Constructivist’s utopian rhetoric of technical innovation, progress and transparency, as the struggling factory operation could not meet the demand for updated resources and drastic change amongst more immediate financial concerns in the wake of the Communist revolution.

The machine aesthetic invoked by Stepanova and Popova’s textile designs attempted to imbue the symbolic qualities of the machine – speed, dynamism, progress, transformation – in the socialist body it clothed, under the utopian program of Constructivism. Their reductive geometric patterned designs resolved various compromises with the process of industrial mass-production20, the limitations of which were revered by the artists because it made the material product reminiscent of the machine that had produced it and exemplified the Constructivist ideal of transparency: the visible connection between the mechanics of the thing and its form and purpose (Kiaer 2005, 90). Furthermore, their response to the limitations of the factory highlighted their ability as Productivists to synthesise their artistic sensibilities—the aesthetic principles of Constructivism, the idea that craft and artistic drawing “in the context of industry is obsolete” (Kiaer 2005, 98), the representation of mechanical form and movement and the scientific rationalisation of form—with the collectivist objective of creating egalitarian fashion through mass-production (Adaskina 1987, 151).

20 Their machine aesthetic was thus devised in part as a response to the factory's print rollers and antiquated conveyor systems, which demanded simplicity in their pattern designs and limited use of colours, ultimately permitting few variations on their distinctive ball and stripe motif (Kiaer 2005, 101).
Popova and Stepanova consciously viewed the factory process as having imbued their “everyday objects with the dynamic qualities derived from technological modes of construction” (Kiaer 2005, 104). The visible trace of mechanical production indelibly marked in the surface qualities of the textile designs continued the object’s relationship with the machine after it had departed the dynamic scene of its construction and had entered the everyday. Notionally, the object would henceforth transfer the dynamism of the machine onto the socialist wearer/consumer. To this extent, the aesthetics of mechanical process figured as a central device of utopian self-transformation, drawing the idealised dynamism of the technological environment into the constitution of the socialist self.

Collectivism, and thus social organisation, was the central impetus of Stepanova and Popova’s utopian fashion experiment, guided by the idea that the machine’s aesthetic manifestation in the everyday object of dress would mobilise the consumer into an active participant of socialist collectivism. In the wake of mass-production, Walter Benjamin hypothesised in his *Arcades Project* (1927-1940) that modern fashion could be capable of removing, rather than sustaining, class hierarchies because industry had made it cheap, accessible, and thus democratic (in Kiaer 2005, 135). But although Benjamin’s notion of a democratic fashion (and others like it) was pursued with great commitment by Popova and Stepanova, the artists found it
difficult to reconcile the utopian egalitarianism of Constructivism with the fashion industry’s significant contribution to capitalist consumerism, class inequalities and the exploitation of the proletariat. While Stepanova wanted to create a radically different paradigm for fashion guided by the idea that socialism would “destroy fashion” as the perpetuation of a capitalist system (Kiaer 2005, 111), Popova saw an opportunity in fashion to redeem “the new material forms of modernity in order to engender a utopian future... [to] stop fashion’s eternal cycle of repetition and reawaken its utopian promise as a force of social change” (Kiaer 2005, 135)

Working under the economic objectives of both the First State Cotton-Printing factory and Productivism under the Soviet Union's New Economic Policy (NEP) (Kiaer 2005, 107), Popova attempted to harmonise the collectivist socialist object with the irrationality of consumer desire (Kiaer 2005, 130). Whereas Stepanova maintained that the rational premise of socialism alone would overcome the individual’s fetish for capitalistic fashion, Popova believed that appealing to the vagaries of modern consumer desire was necessary in order to properly reroute socialist tastes towards the collectivist fashion object.

As Kaier argues, Popova’s creation of a Constructivist Flapper Dress (see figure 7) exemplifies her attempt to synthesise the capitalist and socialist object for the utopian project of collectivism via the use of machine aesthetic. Having a standardised form for mass-production that was imbued with the machine via her geometric textile designs, the dress met the Constructivist fashion agenda of egalitarianism, collectivism, utilitarianism, athleticism and productivity, whilst the simple additions of belt ties played up a seductive feminine silhouette.
Figure 7 Liubov Popova, design for a window display (1924)
Popova constructed accompanying advertorial window displays to create a ‘wish image’ in the dress, drawing comparison between the machine aesthetics of the dress and that of the modern automobile in order to stimulate associations with car’s connotative symbols of modernity, wealth and progress (the connotations of the modern automobile being the same in Soviet Russia as they were in capitalist America) (Kiaer 1997, 137). The marketing of the machine-imbued dress as an object of capitalistic desire, however, could be rationalised within Popova’s utopian program via the principles of Constructivism (transparency, dynamism, Productivism) and her socialist ideological framework (particularly Marx’s assertion that human energy and imagination have peaked in industrial production).

Figure 8 Varvara Stepanova, sports uniform designs published in Constructivist journal Lef (1923)

With none of Popova’s concessions to capitalism, Stepanova’s machine aesthetic garb displayed the singular intention of fulfilling the Constructivist sartorial mandate of prozodezhda, to optimise the socialist body for its collective and productive functions in work, exercise and relaxation (Adaskina 1987, 147). Theatrical
costumes and sportswear produced by Stepanova in the same period as her time at the First State Cotton-Printing factory highlight how she idealised the fashioned body as a sexless and disciplined mimesis of the machine. The costumes she created for ‘An Evening of the Book’ in 1924 (a performance at the Academy of Communist Education), for example, were uniform, androgynous and unisex, and were designed, when the performers were lined up, to create a continuous pattern across each body (see figure 9). Kiaer argues that these costumes suggest a “direct connection between Stepanova’s optical designs and the futurist, mechanistic vision of the human body as a disciplined collective machine that is so often attributed to Constructivism” (Kiaer 2005, 114). Stepanova’s deployment of both textile designs and costume in the same manner, to the same ends, presents a totalising interpretation of the Constructivist idea of the technological self a singular human/machine entity charged with productive and collective duty.

Figure 9 Varvara Stepanova, costumes for ‘An Evening of the Book’ (1924)
The textile designs produced at the First State Cotton-Printing factory, Popova’s Constructivist Flapper Dress and Stepanova’s *prozodezhda* costumes cumulatively represent the artists’ impulse to make fashion the transformative utopian interface between the machine, the body and by extension, the self. Fashion, which imbued the aesthetics, symbols and functionality of the machine in the everyday, both communicated and reified their utopian ambitions of egalitarianism, collectivism, Productivism and the creation of an active form of consumption. The machine, invoked in fashion through aesthetic representation and the transparency of the mechanical process of construction and production (both the artists’ self-mechanised process and those imposed by the factory), was perceived by the artists as inherently transformative, having the potential to optimise the body as a productive and disciplined being, to draw the body into its dynamic technological environment, and to perpetually remind the wearer of her collectivist duty. In this way, Popova and Stepanova’s utopian project was ultimately faithful to their socialist ideology, with fashion recruited to perfect the body, self and society in the image of the machine: rational, dynamic and organised.

### 4.3 Sonia Delaunay

In this final historical example I examine the work of Sonia Delaunay, a Ukrainian migrant based in Paris for the majority of her career, who sought a relational fluidity between life, the body, consciousness, the mechanical environment, art, fashion, poetry and objects of the everyday. The activities she undertook in her inextricably linked art and fashion practices have been described as conforming to two styles: Orphic Cubism (or Orphism), which specifically designates the work of both Sonia and her husband, Robert Delaunay, for its emphasis on colour and abstraction within the cubist oeuvre (Gronberg 2003, 120), and Simultaneity. The term Simultaneity, which is also often linked to the Delaunays, was contested and shared with a number of avant-garde movements including the Italian Futurists, however what Delaunay devised for fashion was a distinctive Simultaneous aesthetic that mapped onto the body “manifestations of modernity: the vibrancy of the modern city, the impact of
new technologies (in communication, transport, lighting) and mass media on the experience of time and space” (Gronberg 2003, 120). Whilst sharing a similar impulse with the Italian Futurists and Russian Constructivists to make fashion reflect the machine’s transformation of both the practicalities and symbolism of modern life and consciousness, Delaunay was alone in targeting her utopian ideals at the tastes of the female bourgeois consumer. I will be discussing Delaunay’s Simultaneous designs for women’s dresses, as well as her matching designs for automobiles, produced in the period that immediately followed the launch of her commercially produced textiles business in 1924, to examine how her Simultaneous aesthetic created a utopian narrative for a radically modern bourgeois life.

Figure 10 Sonia Delaunay, Simultaneous dresses and accessories (1925)
Relying heavily on colour rhythms, created primarily through the almost scientific application of contrasting colours and the repetition of flat, vibrant geometric forms, Simultaneity lyricised and induced the dynamism, vitality and ceaseless movement of the machine (Rendell 1983, 36). Playing up associations with change, transformation and progress, Delaunay’s Simultaneous aesthetic attempted to synthesise the interlocked movements and simultaneous processes of both kinetic machinery and the human brain (Rendell 1983, 36). By linking the motions, at least on a purely aesthetic level, of mechanics and consciousness, Delaunay not only optimistically embraced technology’s permeation of all facets of modern existence, but also drew equivalence between body, machine and self. While both the Simultaneous aesthetic and Delaunay’s practice more broadly was almost indiscriminate in locating congruity and synchronicity in all forms, in fashion, Delaunay used Simultaneity to express the specific utopian harmony of the modern subject and its technological environment. In applying the technique of Simultaneity to the body, Delaunay tried to confer upon her subject a sense of mobility and freedom that reflected the concurrency of modern technological transformation.

Sonia Delaunay’s commercial success in fashion was widely maligned by other avant-gardes, as was her commitment to the decorative arts, however her critics “failed to take into account the changing relationship between art and life since Cubism” that had blurred the distinction between the practical decorative object and contemplative art object (Rendell 1983, 38). Expressing the beauty that animated the modern everyday was consistent with Delaunay’s artistic goals and in fact Gronberg argues that her commercial business can be interpreted as an avant-garde strategy to leverage fashion and female consumerism as the “performative sphere for the enactment of new modernities” (Gronberg 2003, 115). In other words, Delaunay saw the tastes and choices of the individual consumer as a form of self-determined liberation, particularly for the modern female subject, as new fashions heralded the freedom to create the social, behavioural and aesthetic norms of one’s own modern experience. Accordingly, Buckberrough, a fashion theorist and art historian who has analysed Delaunay’s simultaneous fashion under the title ‘Delaunay Design:
Aesthetics, Immigration and the New Woman’ (1995), argues that Delaunay's design aesthetic was “an avant-garde gesture toward changing the bourgeoisie”, that empowered the individual to determine the progressive bourgeois identity (1995, 55).

In this way, the example of Delaunay marks a significant ideological shift away from the collective, classless utopianism of the Italian Futurists and the Russian Constructivists. This may be explained by the two streams of utopian ideals that Carter describes were the norm prior to the 1920s: the first was collective over individual (akin to a “rationalised factory” that was pursued by the Constructivist-Productivists, wherein the value of the individual lay only in its contribution to the productive collective), while the second aimed to construct an authentic individualism through utopia, by prioritising aesthetic and sexual needs (Carter 1997, 79-80). Carter explains that the latter ‘aesthetic’ utopian vision pursued the individual’s "transformation and eventual realisation at a 'higher' level of development” (Carter 1997, 79-80). In this view, utopian society – conceived as a harmonious whole made up of contrasting expressive individual components (much like Delaunay’s Simultaneous aesthetic) – is itself radically improved by the fulfilment of the individual’s potential.

The modern automobile is a significant emblem of Delaunay’s Simultaneous utopian project, having a highly symbolic relationship with notions of individualism and modern female emancipation, as well as representing the interlinking of technological and social progress. Expanding her project of Simultaneous aesthetics to include ‘Simultaneous Cars’ (1925 to 1928), which were often Citroëns painted and upholstered in Simultaneous geometric patterns to match her textile designs, Delaunay aesthetically and symbolically hybridised the body and modern machine (see figure 11). Her rhythmic patterns served to mechanise the body with the aesthetics of movement, speed, and geometric repetition, whilst anthropomorphising the car through an aesthetic process of domestication and personalisation. The body and car’s shared aesthetic served to level their relationship, as though the lens of Simultaneity reveals that they were always harmonious in form.

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A fashion illustration for the cover of *Vogue* in 1925 by French fashion illustrator, Georges Lepape, emphasises the utopian impulse behind Delaunay’s Simultaneous car (see figure 12). Rendered in Lepape’s idiosyncratic Art Deco style, the female subject of the composition, wearing a Simultaneous dress, goggles, hat and a no-nonsense expression, leans against her Simultaneous car and drapes her hand over its bonnet, presenting herself as a confident extension of the machine. In contrast to the way the female body is so often juxtaposed against the car to highlight an apparent duality between femininity and the machine, this image plays the reverse: the modern woman and modern machine are almost indistinguishable. As evoked by Lepape, both the car and woman proudly wear matching designs, to stress not only the aesthetic nature of their relationship, but also the symbols of progress and movement that Delaunay sought to mirror in both figures; in the woman, the car’s qualities of movement and speed translate into autonomy and freedom. In this way, Lepape’s drawing reinforces the intractability of the female subject in Delaunay’s techno-utopian narrative. Having aesthetic and symbolic equivalence with the car, the new bourgeois woman is imbued with the modern machine’s inherent teleology, making her a central dynamic agent of a liberated and progressive utopian society.

Figure 11 Sonia Delaunay, Simultaneous designs worn by model and Citroën (1925)
Figure 12 Georges Lepape, cover for British Vogue featuring Sonia Delaunay's Simultaneous fashion and Simultaneous car (1925)
The idea that Simultaneous patterns can converge the female subject with her mechanical environment can be seen not only in Lepape’s drawing, but also in photographs showing Simultaneous women appearing to dissolve completely into an array of Simultaneous motifs found in Simultaneous cars (as in figure 11), elaborate backdrops of Delaunay’s fabric designs, as well as the avant-garde technological iconography of Robert Delaunay’s paintings displaying the coveted modern symbols of the aeroplane and the Eiffel Tower (Gronberg 2003, 110). Delaunay’s intention for Simultaneous fashion was thus to embed the subject into a self-determined fantasy of technological modernity comprised of both the real spaces of industrial change (such as the modern city), as well as personalised impressions of technological spaces (such as those created by both Delaunay and her husband).

Aesthetically harmonising the female body with the emblems and environments of technological change, Delaunay’s Simultaneous fashions ascended the modern bourgeois woman into a radical modernity. The totalising rhythmic patterns of Delaunay’s textiles, fashions, cars, paintings and decorative objects serve to fluidly connect multiple spaces, forms and times simultaneously, to bridge the real present with an immanent utopia revealed through the aesthetics and imagination of Simultaneity. For the female subject, the limitless horizons signalled by Simultaneous fashion directly invert the limitations (immobility, dependency, servitude, oppression, and materiality) to which pre-modern fashion had condemned both body and mind. For the human subject more broadly, Delaunay’s Simultaneity celebrates the rhythm between the kinetic and dynamic processes of the machine, and those of the human brain.

**Conclusion: technologised fashion of the early part of the twentieth century**

The sartorial activities of the early-twentieth century artistic avant-garde that includes prominently Marinetti, Balla, Popova, Stepanova and Delaunay, anticipated that technology could bring the body in step with modernity through its *functional* and *symbolic* qualities of movement, speed and efficiency, which represented the teleological notion of progress in economic, social, political and cultural terms.
However, the mechanical achievements of modernity represented only a stepping-stone towards the attainment of a utopian ideal society; the rhetoric of these artists suggests that the full utopian promise of the body’s convergence with the machine were yet to be realised.

The modernist history of avant-garde utopias, such as those proposed by the Cubists, Russian Constructivists and Italian Futurists, demonstrate an abiding consideration of dress as alternately a marker of oppression and emancipation. For Marinetti and Balla, the anarchic individualism of dress served to liberate the Futurist body from the stuffiness of bourgeois tradition. On the other hand, for Delaunay, it was this individualist quality of dress that supported the right of the progressive new bourgeois woman to participate in building avant-garde ideas of utopia. Uneasily, in the context of Russian Constructivism, dress treads a fine line between being read as a democratising object of new socialist consumption, and as an oppressor of the proletariat.

Carter’s (1997) idea that fashion has been implicated as an engineer of social change in utopian movements is supported by art historian Christine Kiaer in relation to the Russian Constructivists. She claims that fashion is the “locus of the wish-image that must be redeemed in the new material forms of modernity in order to engender a utopian future” (2005, 135). Accordingly, Popova and Stepanova experimented with fashion as a demonstrative remodelling of material consumption under socialism that would redirect the consumer to collectivist tastes, rather than lure it into individualist commodity desire. Fashion was seen to transfer the dynamic qualities of the machine, generated through the processes of industrial production and a Constructivist machine-aesthetic, onto the socialist body, and by virtue of its energy, break the cycle of capitalist consumer torpor.

The fashion experiments of the Italian Futurists similarly sought to capture the dynamic energy of the machine and transfer it to the body. Furthermore, they shared the Russian Constructivists’ pursuit of collectivism achieved by the democratic industry of mass-fashion. Through manifestoes, poetry and garment designs,
Marinetti and Balla devised a Futurist fashion that would assume the seemingly immortal and powerful qualities of the machine as a ‘second skin’, in order to counteract the body’s immanent decay. Their ideas for a utopian fashion were aligned with the political programs of Fascist Italy, which pursued a nationalistic commitment to industrial achievement, and economic, cultural and military dominance over Western Europe.

In a contrasting manner, Sonia Delaunay refashioned the modern female body around an aesthetic that signalled the movement and dynamism of the machine in order to reflect a socially, culturally and politically progressive, but wholly individualistic utopia. Her Simultaneous aesthetic sought to reconfigure modern bourgeois life and consciousness based on the speed, mobility and emancipation offered by new technology, using the modern consumer spectacle as her platform. Although the collectivist pursuits of the Italian Futurists and Russian Constructivists, under Fascism and Communism respectively, may conform to the popular, but erroneous, metonymy of utopia and totalitarianism, Delaunay’s example of an individualist aesthetic utopia operating in the bourgeois realm of haute Parisian female consumerism demonstrates that utopianism is more accurately organised around a totality of idea, rather than political program.

The cumulative effort of these modern avant-gardes, despite their differences in socio-political context, is to make fashion the narrative vehicle of a utopia which takes as its core the advanced convergence of the body and machine. Specifically, their utopian ideas serve to both critique and overturn the problems and limitations of past and present-times. Their reflections on how the body and, with it, notions of self-hood, have been, and can be further transformed by industrial modernity provides an important historical lens for my study of wearable technology in the information age. By understanding how utopian ideas have proliferated around the meeting of the body, technology and dress in modernity, I have provided a genealogical framework for elucidating techno-utopian themes, ideas, impulses and aesthetics in twenty-first century wearable technology. I will now move to exploring how the modern utopian ideas of collective and individual emancipation, the
optimisation of the body, and the integration of the body with the technological environment are resurrected in wearable technology.
Chapter 5: Contemporary Context & Discussion

The task of this chapter is to identify, characterise, and account for how the early twentieth century techno-utopian impulse presents itself in twenty-first century wearable technology. Analysing twelve examples from a broad cross-section of wearable technology practice (domestic and professional, collaborative and independent), I trace the appearance of the three techno-utopian themes I have attributed to twentieth century technologised fashion – the technological optimisation of the body, merging the body with the technological environment, and ameliorating society through collectivism or individualism. Structuring my analysis in this way, I show that these quintessentially machine age techno-utopian ideas and ambitions for fashion abide in contemporary wearable technology, and thus elucidate my central thesis, namely that early twenty-first century wearable technology resurrects early twentieth century conceptions and expressions of techno-utopian technologised fashion.

The range of twenty-first century examples discussed are various in form, scale, technical sophistication and budget, though they are bound by their imaginative and sometimes conceptual approach to wearable technology, wherein communicating ideas on the body and technology take precedence in the design. In contrast to the resolved artistic and rhetorical projects discussed in the preceding chapter, the contemporary examples are treated as ‘prototypes’ that signal a broader trend, and are not approached as significant works in the artist’s/designer’s oeuvre. Though also not selected for their finesse, the contemporary examples share something of the sensibility of experimentation and, predominately, the mode of individualised artistic practice displayed by the early twentieth century avant-garde under analysis in the previous chapter.

The profile of the independent and interdisciplinary wearable technology practitioner is highly characteristic of the field. Bleeding the parameters of scientific laboratories and creative studios, wearable technology practitioners often work collaboratively to share skills and knowledge from the disciplines of art, design and science.
Under analysis is the work of XS Labs – a collaborative design studio based in Montreal that specialises in electronic textiles and wearable technology. Through the interdisciplinary context of art and design their work presents a self-reflexive critique on the intersection of technology, fashion and art.

Sharing this critical and cultural focus is the independent collaborative practice of Laura Beloff, Erich Berger and Martin Pilchmair (based between Finland and Austria) who combine backgrounds in computing, industrial design and electronic media art. Austrian student collaborators from Kunstuniversität in Linz, Ebru Kurbak, Ricardo Nascimento and Fabiana Shizue, have a similar alignment towards the context of electronic media art, with both groups presenting their work primarily through museum exhibitions.

Operating an independent design laboratory Scentsory Design that straddles the fields of fashion, art and health, London-based artist and designer Jenny Tillotson is also a Senior Research Fellow at the Innovation Centre at Central Saint Martins College of Art & Design. She, like a number of other designers under analysis, explore the intersection of technology and fashion through studio-based research.

Also operating in this fashion context is Ying Gao, a Montreal-based fashion designer who uses technology as part of her conceptual approach to design. Similarly, Stephanie Sandstrom is a Dutch fashion designer who has experimented with technology amongst other non-traditional media as part of her conceptual fashion practice. Both Sandstrom and Gao are fashion trained and consider their work to stand alongside the broader context of contemporary fashion. Likewise, New York based Cornell University students Olivia Ong and Juan Hinestroza pair their respective backgrounds in fashion design and fibre science to bridge studio and laboratory based research in the field of fashion and technology.

Working in an exclusively scientific laboratory context, and thus standing apart from the aforementioned practitioners, Professor Susumu Tachi is a mathematical engineer and physicist from Japan, who works in robotics and augmented/virtual reality.
applications. However while his work might be considered to be a more traditional scientific endeavour, his experimental and conceptual approach to wearable technology resonates with the other interdisciplinary practices under analysis.

Explicitly and implicitly underpinning the ensuing comparative analysis are theories and concepts relating to technology, the body and utopia that form my conceptual framework (Chapter 2). Namely these are the machine-age idea of the technological prosthesis, and its positive and negative implications for the body; Donna Haraway and N. Katherine Hayles’ utopian metaphor of the information-age cyborg; Louis Marin and Fredric Jameson’s formulation of utopia in the cultural and political context of the late twentieth and early twenty-first centuries; and finally, Michael Carter’s idea of the techno-utopian aesthetic in early twentieth century fashion, in particular, his three techno-utopian categories of the Rationally Functional, the Robotoid and the Decadent.

In the discussion that follows my analysis of contemporary works, I revisit these ideas to suggest why twenty-first century wearable technology resurrects a range of early twentieth century techno-utopian ideas, aesthetics and impulses.

5.1 Technological optimisation of the body

Jenny Tillotson's Smart Second Skin (which in name alone encapsulates the Italian Futurists’ ideal of a technological second skin), and her related project Scentsory Design, invoke the Futurist and Constructivist notion of a body/machine complex by synthesising and technologically enhancing the body’s own circulatory system. Similarly, Olivia Ong and Juan Hinestroza’s Glitterati line creates a protective interface between the vulnerable body and the escalating environmental threat of technology. In these examples, the Italian Futurists’ idea of countering the body’s decay is resurrected, with wearable technology revisiting the notion that the hybrid techno-body can adopt the superior qualities of the modern machine: agility, power, dynamism, efficiency and indestructibility.
Jenny Tillotson’s *Scentsory Design* (2005) and *SmartSecondSkin* (2004) (see figure 17) are a series of garments that sense the body’s various emotional states and respond with an ‘aura’ of therapeutic chemical aromas (Seymour 2008, 95). The design delivers therapeutic scents through a series of vein-like channels that are modelled on the body’s own circulatory system (Seymour 2008, 96). By addressing emotions that are either involuntary or dormant, the project asserts that psychotherapy is best administered through an automated technological system (Ryan 2009a, 309). Indeed, the artificial system is active before the body shows visible signs of stress or illness, and therefore notionally stands in for the body’s natural warning signs as well as its in-built coping mechanisms. Inadvertently, in protecting the body, Tillotson’s automated scent therapies overwhelm the body’s ability to protect itself and effectively render the internal rebalancing process of the body redundant. Thus the extreme techno-utopian assertion of this work is that the functionality and rationality of technology qualifies it as a caretaker and moreover, a stand-in for both body and mind.
In a similar mode of automated defence Olivia Ong and Juan Hinestroza’s *Glitterati* (2007) line of wearable technology uses nanotechnology to destroy airborne allergens and pollutants before they reach the wearer’s body (Ryan 2009a, 309) (see figure 18). Their project thus dramatises the accepted function of the garment as a protective interface between the wearer and its environment. However, the garment’s ability to provide short-term artificial preservation from allergens and pollutants puts the body’s natural immunity in a state of decline (Ryan 2009a, 309), and subsequently, the garments build long-term user-dependency. Like Tillotson, Ong and Hinestroza sublimate the body’s natural functioning to a technological prosthesis imagined as higher-functioning. This suggests that the body has failed to protect itself sufficiently against the technological environment, necessitating technology’s superior role in interpreting and acting upon the body’s warning signals. In their utopian scenario, technology measures out correct responses to both emotional and physiological corporeal threats, maintaining a perfect equilibrium.

*Figure 14* Olivia Ong and Juan Hinestroza, *Glitterati* (2007)
Again using wearable technology as tool of bodily defence, Ebru Kurbak, Ricardo Nascimento and Fabiana Shizue’s *Taiknam Hat* (2007-2008) provides an immediate and conspicuous response to the imperceptible threats of radio wave signals and electromagnetic pollution in the wearer’s surrounding environment (Seymour 2008, 49) (see figure 19). The hat, covered in matching black feathers, becomes excited by the ambient wave signals and raises its feathers to imitate a bird’s stress-response (Seymour 2008, 49). In so doing, it dramatically prefigures the human body’s own potential stress.

![Figure 15 Ebru Kurbak, Ricardo Nascimento and Fabiana Shizue, Taiknam Hat (2007-2008)](image)

In much the same manner, Stephanie Sandstrom’s *EPA Dress* (2008), which responds to air pollutants by crumpling up, makes immediately apparent the more subtle signals of environmental pollution (see figure 20). Both warn and prepare the body by creating a conspicuous spectacle from an inconspicuous menace. Simultaneously, the projects act as a kind of technological placard for the agitator of the future – something the Futurists had only imagined.
Figure 16 Stephanie Sandstrom, *EPA Dress* (2008)
Figure 17 Joanna Berzowska and Di Mainstone/ XS Labs, *Skorpions* (2007)
Operating more as companions or competitors, than protective instruments, Joanna Berzowska and Di Mainstone’s *Skorpions* (XS Labs, 2007), are a series of garments that use a kinetic electronic system to move autonomously, at times exposing the body and becoming “poeticized garment malfunctions” (Ryan 2009a, 310) (see figure 21). By imperilling the wearer through unpredictable movements, the garments exert a form of control over their embodied subject. Effectively *Skorpions* counters the rational robot ideal by using unpredictability as a simulation of (playful and malicious) human intentionality and individuality (see Seymour 2008, 57).

Wearable technology need not necessarily be aligned with the aims of the body, but rather serve, as *Skorpions* demonstrates, to constrict, control, and even supersede the body. This treatment refutes the primacy of the natural body and elevates the technological prosthesis as a competitive agent to humanity. Although seemingly dystopian, the technological destruction of humanity is as pious a scenario as the one of the technological preservation and enhancement, in that the total cleansing of our current reality creates a pure foundation for a techno-utopian future. Moreover, XS Lab’s idea of an aggressive, competitive technological self is strongly aligned with the Futurists’ rejection of the inferior, passive biological self as anathema to mechanical humanity’s utopian potential.

5.2 Converging the body with its technological environment

As the following section reveals, environmental concerns are not simply about protecting the vulnerable natural body against the technological pollution of the future; they are as much about situating the body within a technological eco-system, in which the body converges with its technological environment. Joanna Berzowska’s *The Leeches* (2004) typifies the notion of a technological eco-system that harmonises technology and biology by constructing a relationship between the body and the speculative phenomenon of digital parasites (see figure 22). The dress acts as a power-distribution substrate so that three-dimensional silicone modules, resembling oversized leeches, are lit up in red LED light (Seymour 2008, 60).
As the designer intended, the leeches present a science-fiction scenario in which parasites could attach to the electrified body to drain its power (Seymour 2008, 60), thus proposing an electrified eco-system in which there may be a chain of benefactors to the hybridised cyborg body. In the equilibrium of Berzowska’s techno-utopia, the parasitic fulfilment of the leeches transforms them into adornment, thus balancing the exchange with the host body.

Susumu Tachi’s *Invisibility Cloak* (2003) harnesses technology’s ability to fully converge the body with its technological environment (see figure 23). Tachi has pioneered a form of technological camouflage, achieved when a video capture of the environment to the rear of the wearer is projected on the garment front (Lee 2005, 89). Effectively, the cloak reduces the body into an analytical schema capable of aggregating with any environment, and in the process exemplifies performance artist Stelarc’s idea that technological prosthesis as a posthuman strategy is about “erasure, rather than affirmation - an obsession no longer with self but an analysis of structure” 89
On the other hand, the utopian impulse to dissolve the body so completely into its physical environment parallels Sonia Delaunay’s purely aesthetic camouflage manoeuvre of blending the body into the mechanical environment. The strategy offers the body transcendence of material limitations through entry into the no-place between the frontiers of humans and machines.

All of the contemporary wearable technology projects under analysis embrace the potential of wearable technology to generate feedback between the body and other subjects, the natural environment and technological systems. The utopian rationale for developing this feedback response is to conceptualise the body as governed by a singular technological order that controls in totality the living creatures, plants and minerals of the natural universe, as well as artificial matter, and the single most important signifier of the information age: data. It is the utopian idea of a technological eco-system, where advanced cybernetics restores the ‘natural’ order or balance.

Figure 19 Susumu Tachi, *Invisibility Cloak* (2003)
This ideal of a singular technological order suggests that technology simply hasn’t
gone far enough and that the dysfunctionalities of the present are caused by the
inharmonious relationship between nature and technology (as artifice). The
imaginary techno-utopian solution is to create harmony by blurring the boundaries
between body and technology, ecosystem and cybernetic system, society and online
network.

The desire to harmonise the seeming contrasts of the natural body and the artificial
(machine-age or information age) city-scape is thus the utopian urge “to abolish the
sheer jumble of things and events in the present and reform them into a patterned
regularity” (Carter 1997, 79). Carter also reminds us that utopia is not defined by a
particular aesthetic or content – he gives the evocative examples of ‘crystalline
architecture’ and ‘streamlined body suits’ – but rather it is the desire to “impart both
social forms and material things a coherent, all-embracing style” (Carter 1997, 79).
Through illusory and functional convergence, wearable technology attempts to re-
order the totality of the present in a similar manner to the way the Russian
Constructivists, Italian Futurists, and Cubists imposed unifying aesthetic strategies to
objects, subjects, time and space. The shared underlying principle, though expressed
in different ways, is to impose order and congruity through technological aesthetics,
concepts and systems.

5.3 Ameliorating society through technology-led collectivism or individualism

Techno-utopias imagined by twenty-first century wearable technology, like their
early twentieth century counterparts, continue to be framed around the organisation
of society according to either collectivist or individualist ideologies. In both contexts
the dynamics of social exchange are seen as contingent on technological change,
with social media, online communications and the virtual realm forming key
considerations for how a utopian society might function in the information age. Of
the contemporary projects under analysis, the majority see information age
communication technologies as having the potential to radically ameliorate social
functioning. Many projects see the virtual world as a boundless and self-organising space governed by the democratic rule of autonomous individuals, rather than by the ‘failed’ political programs of the present. Others however perceive the realm of the virtual society as a fragmented and unstable space that compromises the social order of physical world and take a nostalgic view of pre-virtual society. Their mandate is to explore the potential of wearable technology to bring online society into line with their collectivist utopian social values through transparency and imposed order.

Ostensibly of this latter category, Despina Papadopoulos’ *embrace-me* (2007) is a set of navy hooded jumpers wired with conductive fibre, sensors, LED lights and audio which culminate as a twinkling display of lights on the jumper back accompanied by a soundtrack of heartbeats cued by an affectionate squeeze between two wearers (see figure 13). The sound of heartbeats and the artificial glow on the jumper back synthesise the body’s natural romantic response, as though in Papadopoulos’ vision of the future, the embodied experience of an embrace has become a distant memory. Placed outside the wearer's field of vision, the visual display triggered by the embrace is designed to communicate with onlookers, not the wearer, making the garment a spectacle of instructive display; the lights and sounds activated through touch are positive signals that educate the virtualised citizen on the benefits of physical contact. It would seem that the project expresses anxieties around the
bodiless zone of virtual society, however this project could equally be interpreted as
displaying a desire to impart a regimented techno-utopian order over the social chaos
inherent in contemporary human romance, intimacy and reproduction.

A techno-aesthetic reward is similarly provided by XS Labs’ *Constellation Dresses*
(2004) as a means to engineer physical, rather than virtual, social contact (see figure
14). Worn collectively in pairs or groups, the dresses feature embedded LED lights
that resemble a stellar constellation when two or more wearers make contact
(through the use of conductive metal snaps), thus causing the bodies of the collective
to symbolically and literally ‘complete the circuit’. *Constellation Dresses* is said to
encourage playfulness and creativity within the interacting collective (Seymour
2008, 61), and indeed, the more coordinated the collaborating team, the more

Figure 21 Constellation Dresses, XS Labs (2004)
rewarding the twinkling light spectacle. The metaphor of technological energy transfer exalts the dynamism and harmony of collective society, resurrecting the tropes of machine energy invoked by the collectivist technologised fashions of the Italian Futurists and Russian Constructivists. Certainly the project evokes the early twentieth century idea of a social body united aesthetically, physically and notionally through the symbols and aesthetics of the machine, as put forward by Stepanova’s 1924 athletic costumes for ‘An Evening of the Book’ (see figure 9). The subtle difference is that participants of *Constellation Dresses* do not so much form a disciplined collectivist machine, as a disciplined electronic network. The connotations of the latter form are of autonomous individual entities operating within a self-organising (computational, not political) system. Here, collectivism is construed through the determination of the individual.

Figure 22 Laura Beloff, Erich Berger, and Martin Pichlmair, *Seven Mile Boots* (2003)

Evoking the pejorative totalitarian connotations of collectivism, Laura Beloff, Erich Berger, and Martin Pilchmair’s *Seven Mile Boots* (2003) suggest that social disorder is a characteristic dysfunction of the information age, thus permitting technological surveillance for the maintenance of utopian social order (see figure 15). Triggered
by walking, the boots tune in to internet audio chat-rooms, broadcasting their spoken conversations into the immediate environment, albeit without the knowledge of the chat-room participants (Ryan 2009a, 311). In so doing, the boots invigilate the online society, and transform the ordinary citizen into an agent of societal control. However, the makers refer to their subject in nostalgic terms, as a “cosmopolitan flâneur of hybrid space” (Seymour 2008, 125), implying the harmonious convergence of virtual and physical space in the twenty-first century.

Optimistically, the wearer of Seven Mile Boots configures the simultaneous connection between the chatter of urban life and that of online conversation as a relevant and dynamic form of social togetherness in the information age. The apparently sinister, or even dystopian, inflection of this scenario (the moment totality becomes totalitarianism) is that the connection contrived between the virtual and the physical relies on perpetual surveillance and the forced social transparency of online communication.

Another project that uses wearable technology to implore the individual to invigilate online activity is Ying Gao’s Index of Indifference (2006), however the focus of her project is the political, rather than social, behaviour of the virtual realm (see figure 16). Index of Indifference is a garment installation designed to overturn the neutral political attitudes of online poll respondents (Seymour 2008, 34). Over four weeks, Gao used a software program to compile the frequency of ‘indifferent’ responses to online opinion surveys, and in correspondence with the data, she remodelled ten men’s shirts. The data input was not arbitrary or chance-based, but rather, it was used intentionally to address the subject matter of political apathy generated and displayed by online communities (Seymour 2008, 34).
By visualising the computer data as sartorial modification, apathy and ambivalence towards a range of cultural, economic and political issues raised by online surveys manifested as a concrete form with material implications. Over the course of the project, the pattern of the standard men’s shirts changed dramatically: pleats were moved or exaggerated, collar and sleeve lengths fluctuated, and the entire garment expanded and then became considerably diminished in form. As a result, the aesthetic representation of change and transformation symbolically inverted the flat-line neutrality of responses to create a sense of turmoil. Exploiting the transmutable and manipulative qualities of data visualisation through wearable technology, Gao attempts to counter the perceived social ill of apathy driven by the anonymity of online society. Her techno-utopian political strategy is that of the Italian Futurist’s ideas for the Antineutral Suit (1914), realised faithfully as the counter-neutral spectacle of dynamic sartorial modification.

![Figure 23 Ying Gao, Index of Indifference (2006)](image)

In each of these examples, technological change confers both opportunities and threats for creating and maintaining social harmony. To counter the threat of social and political disorder, technological surveillance and agitation is used by Seven Mile
Boots and Index of Indifference to reinforce collectivist ideals. On the other hand, a new metaphor for collectivism is offered as the ‘network’, shifting the machine age focus of egalitarianism through democratic access to machine-produced fashion (imbued with the dynamic, rational and collectivist qualities of the machine), towards a more literal connection between fashion consumers. Wearers of embrace-me and Constellation Dresses, for example, are brought together to complete an electrical circuit, and thus notionally form a technological social body. Theirs is not a rigid, conformist notion of collectivism, but rather can be understood as a self-organising collective system akin to the Italian Futurist’s anarchistic ideas of expressive, free individuals coming together under some kind of hierarchy-free network, sharing also Delaunay’s utopian individualist idea of self-determination through consumerism.

Above all, these contemporary collectivist projects reveal a classically utopian assumption about technology; like their early twentieth century counterparts, Constellation Dresses, embrace-me, Seven Mile Boots and Index of Indifference assert that a garment inspired by or imbued with technology has the capacity to transform society and the people within it.

5.5 Discussion

The mechanical symbols and aesthetics of early twentieth century technologised fashion, expressed quintessentially as geometric patterns and optical rhythms that induce the speed and dynamic energy of the machine age, have mostly been supplanted in the twenty-first century by a subtly different technological aesthetic. While the machine age symbols of smokestacks, high-rise-lined cityscapes and moving machinery of the earlier period have not disappeared, the succeeding information age technological motifs of computer chips and the outer hardware of computers and virtual reality began to form a contemporary technological aesthetic in the fashion and wearable technology of the 1980s and 1990s (see Ryan 2008a, 4 and Cranny-Francis 2008, 365). In the present moment however, the prevailing technological principles are ambience, ubiquity and invisibility, making these early information age representations already outmoded.
As Jameson has noted, the information age, compared against the machine age, seems bereft of its own symbols (Jameson 1991, 36-37). He observes that the emblematic technologies of the information age are:

“machines of reproduction rather than of production, and they make very different demands on our capacity for aesthetic representation than did the relatively mimetic idolatry of the older machinery of the futurist moment, of some older speed-and-energy sculpture” (Jameson 1991, 36 – 37).

In stark contrast to early twenty-first century avant-garde’s overarching aesthetic concern with making technologised fashion in the image of the machine, commercial information-age wearable technology seeks primarily to achieve a seamless or invisible technological interface and a neutral technological aesthetic (or perhaps anti-aesthetic) (see Seymour 2008, 19 and Ryan 2009a, 307). However, as mentioned in Chapter 3, Ryan has presented two reasons this may not necessarily translate to wearable technology in the cultural realm. First, with the exception of some smart textiles and nanotechnologies, many wearable technologies are still quite conspicuous (Ryan 2009a, 308). Second, artists may wish to use conspicuous technology to critique the commercial rationale and ethical implications of the invisible interface (Ryan 2009a, 310).

In fact, in contemporary wearable technology, many artists and designers choose to highlight, rather than supress, the binary oppositions of technology and biology. In what appears to be a throwback to humanist ideas, the symbolic dichotomy of the body and technology is expressed in the same terms in both contemporary wearable technology and machine age technologised fashion: the body is, in the main, representative of nature, decay and (feminine) weakness whilst technology is equated

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21 Indeed, Thompson’s (2007, 39) call for wearable technology to dismiss the material connotations of technology and reject rigid ideas of the body as a contrasting organic form would support my argument that the dichotomy of technology and the body are not aesthetically or conceptually reconciled in contemporary wearable technology.
with (masculine) archetypes of power, agility, dynamism, rationalism, order and efficiency. It may be that popular culture has trumped the influence of Haraway and Hayles, who subvert the popular masculinist assumptions of science, technology and the cyborg body in their calls for fluidity, rather than affinity or difference, between the body and technology\textsuperscript{22}; as Cranny-Francis (2008) has pointed out, essentialist notions of the body and technology have dominated the cultural imaginary of wearable technology since the 1980s, transmitted through popular science fiction representations in film and literature.

Similarly, tensions between a subordinate or dominant relationship between the body and the machine are represented as much in twenty-first century techno-utopian fashions as they were in the early twentieth century examples analysed in Chapter 4. Accordingly, Carter’s (1997) characterisations of the hybrid machine-body ‘types’ that dominated science fiction and techno-utopian fashion in the early twentieth century have continued relevance as interpretive models for twenty-first century representations of the hybrid body. Indeed, given the evidence that in contemporary wearable technology human and technological qualities are reduced to motifs and simple traits or essences, it is a worthy exercise to discuss the examples of wearable technology analysed in this chapter against Carter’s (1997) Robotoid, Rationally Functional, and Decadent mechanical hybrid categories, as introduced in Chapter Two.

The Decadent mutants of wearable technology, like their twentieth century counterparts, dispense with the techno-functionalism of uniformity and instead sumptuously adorn the hybrid body with camp distillations of biological qualities to insist that the body has not been entirely sublimated to the machine. A return to nature, as the paradisiacal Garden of Eden model of utopia, is an ironic reference point for these futuristic Decadent forms. I would consider as prime examples of this tendency: the Taiknam Hat, whose adornment is the highly stylised emulation of a

\textsuperscript{22} Not to mention the preceding influence of Delaunay and Popova’s ideas of the female subject as empowered extension of machine as well as Stepanova’s embrace of the potentially androgynous female/machine hybrid.
stressed bird’s erect feathers; *Scentsory Design/Smart Second Skin*, which elaborately reproduces the body’s circulatory and nervous systems in a pastiche of the body’s functioning; *Leeches*, in which a technological appropriation of the idea and form of nature’s parasites decorate the body; and finally, *Skorpions* whose asymmetry in fetishized organic form and irrational ‘personality’ parodies the libidinal subject. Though others (such as *Glitterati*) display a similarly reductivist approach to biology and subjectivity, these particular examples adorn the body with the essence of human, animal or plant in its most exaggerated and decadent form.

At the other end of the techno-utopian spectrum are the Robotoid examples of *Invisibility Cloak, embrace-me, and Constellation Dresses*, which evoke the “nightmare of a technicist rationality run wild, in which humans become machines and machines approximate to humans, thereby obliterating all the marks of difference between the organic and the metallic” (Carter 1997, 89). Indeed, in its attempt to erase the human subject, Tachi’s *Invisibility Cloak* is the most extreme spectre of the early twentieth century Robotoid. *embrace-me* and *Constellation Dresses* demonstrate the Robotoid compensatory response, going to “great lengths to stress their humanness, to show that at their most profound level they have a beneficent, almost archaic emotional substructure where love, altruism and democracy hold sway” (Carter 1997, 89), through stylised gestures of human sensuality and a spectacle of collectivist social interactions. However in the latter examples, their uniformity belies a truly individualistic human ‘emotional substructure’.

While the Rationally Functional tendency (a more contented state of techno-utopian arrival – an attitude typified by Delaunay’s celebration of individual difference), might resonate in *EPA Dress, 7 Mile Boots, Glitterati, and Index of Indifference*, the Decadent or mutant sensibility undoubtedly overwhelms wearable technology of the early twenty-first century. And this throw-back to the rambling art nouveau style over the rational order of the machine suggests a key symbolic divergence from early
twenty-first century techno-utopian wearable aesthetics. It would seem that the mutant organic forms pervading contemporary wearable technology attempt to counter the technological destruction of nature and tradition. The competition of intelligent machines, technological pollution (such as the perceived health threat of electromagnetism), social and political atrophy, and the technological violation of the fleshed body are all threats brought about by the unchecked technological progress of the information age. In all, the problems wearable technology seeks to address are exaggerated versions of problems we currently face – climate change, the virtualisation of social contact, the biological and existential consequences of technology’s intrusion into the body, and more generalised social and political dysfunction.

Where early twentieth century technologised fashion was experimental and optimistic in exploring the utopian possibilities of a technological future, the contemporary manifestations are comparatively reactionary, narrowed by the impetus to respond to the seemingly dystopian trajectory of current technological progress. While many of the perceived limitations and threats that early-twentieth century technologised fashion sought to overturn (such as decay, weakness, irrationality, disorder, inefficiency) continue to feature in contemporary wearable technology, the particular modernist avant-garde anxiety that a pre-modern state will return to halt the cultural, social, political and economic progress promised of technology does not fuel the contemporary utopian impulse. In what is the twilight of modern industrialisation, the more ready threat is that of radical technological change. Put simply, the optimism of technological change has become supplanted by

23 In the early twentieth century, the use of organic decorative forms would have signalled an allegiance with the elite, wealthy consumer, rather than with the egalitarian notion of a cheap, accessible and functional mass-produced object. It must be said that twenty-first century wearable technology is undemocratic from a consumption perspective, as in the main, the technologies used confer a prohibitive expense to the average consumer. For example, while *embrace-me* is marketed as a prêt-à-porter street fashion, its price is above what the mass-consumer would want to pay – up to US$600 per pair (Studio5050 2008). Many other wearable technology projects are developed as limited-release prototypes, with consumption considered either a secondary or unaccounted priority.
contemporary technological anxiety. The Decadent thus represents the desire to reassert some traditional and natural motifs in a bleakly technological scene.

Theorists Ryan (2009b), Kettley (2006), and Cranny-Francis (2008) are at pains to highlight the complexity they see as characterising many designers’ and artists’ approaches to creating hybrid forms in wearable technology. Cranny-Francis argues that the best metaphor for the relationship between the body and technology is a tactile one “that acknowledges the intense sensory nature/pleasure of that engagement” (2008, 378). Of the most sophisticated wearable technology theory and practice observed by Cranny-Francis, a distinction is made between:

“a hybrid or cyborg figure in which the technology has been elided or subsumed by the human (or, in nightmare scenarios, has taken over the human) and one in which the human-technology interaction is perceptible, self-conscious, negotiative, knowing - a source of pleasure, creativity, and of increased self-knowledge, as well of new knowledge” (Cranny-Francis 2008, 378).

Ryan echoes this sentiment in saying that critical wearable technology art will “make connections with the palpable, the fantastic, the self-consciously mechanistic and the intractably organic aspects of the body as dynamic interface” (2009b, 115). Similarly, Kettley calls for sophisticated knowledge of intimacy, wearability and “social complexity” in wearable technology (2006, 6-13). Though these are salient assessments of what sophisticated human-technology hybridity in wearable technology should be like, the appearance of the Robotoid, Rationally Functional and

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24 Additionally, traditional cultural forms are no longer seen as antithetical to technology-led cultural progress as they were for the Constructivists (a sentiment epitomised by their mantra that craft is obsolete in the mechanical age). Kettley (2006) demonstrates how traditional craft processes might be harmonised and used to enhance technological ones. However, this notion is to some extent prefigured by Delaunay’s harmonisation of machine aesthetics with the traditional ethnic designs of Eastern Europe.
Decadent techno-utopian forms, which tend to order and simplify human and technological qualities rather than register their mutual complexity, suggest that this may be wishful theoretical projection.

At the turn of the millennium, after the collapse of communism and other “epistemological certainties in the West”, fashion, Evans asserts, has played a significant role in making images and meaning (encompassing both anxieties and ideals) of a period in which “ideas about the self seem to be unstable, or rapidly shifting” (2003, 5). The hyper-speed of technological development has significantly contributed to the mechanics of change and destabilisation in the information age, and Evans observes that at the end of the twentieth century, fashion was presented by a number of designers as an allegory of the volatile conditions of contemporary existence; they drew from past episodes of industrial life to illustrate anxieties and concerns over the present climate of post-industrialisation (Evans 2003, 9-10).

As mentioned, wearable technology at the dawn of the twenty-first century continues the mood of fashion in the late twentieth century as a reaction to the relentless speed of technological development that has intensified the metaphors of equivocalness, perpetual change and planned obsolescence. In this context, wearable technology indicates that millenarian presentiment has not given way to optimism about the future, but rather that the continued uncertainty of technological and environmental change has protracted the late-twentieth century sense of foreboding captured by contemporary fashion. Wearable technology thus interprets the contingency of contemporary existence, described by Evans, through the combined lenses of the change-catalyst (technology) and the meaning-maker (fashion). In the face of uncertainty, utopia manifests as a future in which fashion and technology coalesce to produce positive and meaningful, rather than alienating, change.

That the modernist utopian project of perfecting clothing for an imagined future is an ongoing one is an idea is sustained in part by the perpetual novelty of the fashion system, and the perpetual novelty of technological development, and with it, sustained (if repressed or overlooked) notions of teleological progress. While
fashion may recycle the past, technology of our current period continues to make genuinely new developments, making it a blind-spot for wearable technology theorists and practitioners who subscribe to the postmodern rejection of teleology. Thus technophilia continues to broadly frame the utopian imaginaries of wearable technology as it did for the avant-garde of the early twentieth century, even if paradoxically technology is now presented as the solution to the problem of technology.

The appearance of utopia in wearable technology is both anachronistic and poignant, a conundrum symptomatic of the complex and uneasy way that utopia has more broadly manifested in the present period (see Woods: 2006, Marin: 1993 and Jameson: 1991; 2004; 2005; 2010). While we can consider utopia to be a slippery and timeworn term, disputed as a place, a no-place, an idea, an ideology, a social or political system, or a literary tradition, the theoretical evaluations of Jameson and Marin make salient what utopia can and cannot be, given the lessons learnt after the collapse of communism: utopia is too pure an idea for either reality or political programmes. Still meaningful and vital as a means to ideate change and alternative futures, utopia must be left untouched in the realm of the imaginary; it is a manifest truth which bears repeating: utopia as totalising idea becomes totalitarianism under politics (Marin 1993, 413).

While it is the top-down, prescriptive utopianism of modernism that prevails in contemporary wearable technology, in their realisation as prototypes (rather than as mass- or high-fashion), contemporary wearable technology exists in the highly theoretical, visionary realm of imaginary perfection. With this in mind, wearable technology can have an innocuous, if not important role in pursuing utopia in the unspoilable realm of the imaginary, as it has done in the first decade of the twenty-first century. Continuing what art and fashion has always done, wearable technology imagines the future, providing a vital connection to the real through the material to fulfil what Carter (1997, 78) identifies as the primary utopian objective: critiquing the present.
5.6 Conclusion

The study has contributed a wider analysis on the symbolic and cultural meanings of the body and technology in wearable technology, and thus contributes to the achievements of the 2nd wave cultural literature (identified in the literature review). Namely, through investigating the relationship between technology, the body and techno-utopian ideas, the study has both drawn upon and extended Cranny-Francis and Ryan’s analysis of wearable technology’s symbolic treatment of the body, as discussed in the literature review. I have discovered that wearable technology’s engagement with prosthetic metaphors and posthuman ideas, as discussed by Cranny-Francis and Ryan, provides a key insight to the unexamined techno-utopian project of wearable technology. In particular, I have argued that the technologised body is regarded by the wearable technology projects under analysis as the techno-utopian ideal: it is cast in the perfection of the machine; it is able to perform as an ideal instrument of social perfection; and finally, it is reordered for perfect harmonisation with all living and inorganic things governed by singular techno-utopian system.

It is through applying the framework of fashion studies that I have been able to bring a fresh perspective to the discursive of wearable technology. Specifically, I have applied and extended theoretical insights offered by Evans (her idea that fashion using technology draws on the techno-utopian ideas of early twentieth century fashion) and Carter (his identification of techno-utopian ideas, impulses and aesthetics in early twentieth century fashion), by exploring the genealogy of early twentieth century fashion history in the context of early twenty-first century fashion history. Taking what was already known in fashion discourse – that the techno-utopian imaginary was a key feature in the development of early twentieth century technologised fashion – I have offered what has not yet been identified, in detail, in relation to wearable technology: that the techno-utopian impulse of twentieth century technologised fashion abides in twenty-first century wearable technology through a number of themes, ideas, metaphors, tropes, impulses and aesthetics.
My comparative analysis of examples of technologised fashion from the early part of the twentieth century, and wearable technology from the early part of the twenty-first century, has elucidated my central thesis, namely that both historical and contemporary instances explore the coming together of fashion, the body and technology as the techno-utopian project of perfecting the future through technology. This study has therefore demonstrated that wearable technology is not a twenty-first century phenomenon catalysed by recent material advances (such as smart textiles and nanotechnology), but rather, as the coming together of the body, dress and technology, it is a contemporary extension of twentieth century technologised fashion. My analysis of the symbols, aesthetics and ideas in wearable technology and technologised fashion from both periods reveal an abiding desire to create technological attire for a future imagined as a techno-utopia. In this regard, I have met the stated aims of this study to: 1) situate the contemporary practice of wearable technology in relation to historical instances of technologised fashion, and; 2) bring a fashion historical perspective to wearable technology in order to provide a fuller historical and theoretical picture of wearable technology.

My discovery that the twentieth century techno-utopian impulse abides in wearable technology points to further directions in wearable technology research. One example of how this research may be taken further is to trace the contemporary wearable technology techno-utopian impulse back to 1960s techno-utopian technologised fashions, which drew on the technologies and extra-terrestrial potentials inspired by the USA-USSR space race. Adding to the discoveries of this study, an analysis of 1960s technologised fashion would provide a more complete picture of the development of the techno-utopian impulse in technologised fashion between the twentieth and twenty-first centuries.
Reference List


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