

# What is Wearable Technology Art?

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Today we know that art can be a lot of things. We know we can not pin it down by medium or format or even context any more. Yet despite this new formal freedom, art conceived as something *worn on the body* has had a conflicted and often elusive reputation. Moreover, works that are wearable contribute to an unknown history of projects people do not necessarily link together or think of as part of a cohesive practice. And this is despite many similarities between garments and art as normatively considered, including, for both, dependence on commercial infrastructures and resonance in cultural literature. All the same, writers like Sung Bok Kim, in an article entitled "Is Fashion Art?" have pointed out that the aesthetic nature of garments is often overlooked.[1]

Arguably, it is with the advent of wearable technology--mobile media--that artists working with wearables have begun to achieve critical mass and their activities have crystallized into a type of creative practice that merits analysis and an expanded discourse. This is so despite many encumbrances--for one, artists working in "wearable media" navigate a tough path for their work, between commercial fashion, theatrical costume, or craft project, on the one hand, and engineering device or commercial prototype, on the other. But there are some strong unifying ideas: this work 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." Additionally, and perhaps most importantly of all, the work is deployed critically in terms of viewer interaction and experience. Elsewhere in this volume I describe, under the term "Critical Garment Discourse," some of the practices that produce this work. [2] But here at the outset, I want to lay groundwork for assembling a provisional history of such practices (I use provisional, as it remains a history in flux, as opposed to canonical history, the type of history these artists, and this writer, are trying to avoid).

So, how can we begin to think coherently about practices by artists from such divergent fields--even antithetical disciplines--as engineering, computational technology, fashion, garment design, and performance art? Is there a set of practices we might call wearable technology art (WTA)? How can we formulate a flexible framing system that traverses disciplinary boundaries of art, technology, media, and dress? In fact, this is just the kind of challenge being addressed by

emerging models for interdisciplinary research into media history and cultural knowledge--new models such as, for example, Siegfried Zielinski's "variantology," a loosely defined retooling of intellectual inquiry that circumvents institutional standardization and modularization:

Currently, research is only considered excellent if it is committed to some programme or main focus and serves common denominators that are based on contracted political agreements . . . . [Variantology tries] to react naively to this culture of bloc formation and programmatic standardization [and] contains a paradox . . . . Phenomena that are diametrically opposed, that rub each other the wrong way, where there is friction between them . . . congregate under a provisional roof.[3]

Variantology is also a strategy for incorporating the concept of media intrinsically into historical research, rather than having to center research on a singular genealogy of media. Instead, Zielinski says, "media are spaces of action for constructed attempts to connect what is separated." [4] Media is a kind of connective tissue or spatial field. And this may be the best way to think about art and design practices, like wearable technology art, that incorporate ideas about dress (garments and/or fashion), technology, art, and social mobility, from both aesthetic, and critical, points of view.

Wearable technology art (WTA), then, supposes an intensely hybrid and dynamic space of investigation. To begin with, perhaps we can construct an overview of some of the divergent historical trajectories in play within it.

## Where Did It All Begin?

Fashion and garments are terms we use almost interchangeably in this investigation, because they belong today, in the "era of fashion after fashion" (as some have called it), to the same continuum of processes that includes a widespread heightening of awareness of personal presentation in a world of social appearances and accelerating choices.[5] The very notion of fashion, maintain many writers from Baudelaire to recent authors like Ulrich Lehmann and Gilles Lipovetsky, is bound up with the advent of modernism (a fact present in the French terms *mode* and *moderne*). But modernism itself is also a cultural con-

dition brought about by, among other things, a particular level of technological advancement manifested in terms of industrial production, mass marketing, and urbanized society.[6] So fashion, modernism, and technology are inevitably bound up together.

In the mid-19th century Baudelaire, the archetypal figure of modernism, wrote extensively about fashion and art, and in 1874 the French symbolist poet Stéphane Mallarmé edited a fashion magazine, *La Dernière Mode*. [7] It was 1907 when Adolf Loos condemned his own Austrian society for not being modern enough, and did so using fashion imagery: in an age of industrial growth and expanded literacy, why did they maintain the same dependency on ornamented attire that tribal societies did? [8] Walter Benjamin, who decades later wrote the notes we know as *The Arcades Project*, commented that fashion is "the mould in which modernity is cast." [9] And Mark Wigley, in *White Walls, Designer Dresses*, argues that fashion--or rather anti-fashion, but certainly dress--was the model(!) for Le Corbusier's writings about modernism in architecture. [10]

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Accordingly, the title of our exhibition, *Social Fabrics*, restores a modernist garment metaphor to its origins as well: the pioneer of sociology, philosopher George Simmel, in his writings at the turn of the 20th century, regarded society as a whole as *Gewebe* (fabric), and its inner relations, in Lehmann's comparison, are likened to the connections between different embroideries or threads. [11]

Throughout the 20th century the dialogue between garments and technology is as persistent as the dialogue that particular garment styles also continuously sustain with both their forebears in the past and their imagined counterparts in the future--Benjamin in particular comments on the peculiar ability of fashion to defy simple notions of time. But, practically speaking, technological inventions have driven key developments in the recent history of wearables. For example, the development of elastic thread in the 1930s, as a result of research in synthetics, led to rapid changes in women's undergarments and eventually in clothes themselves. After World War II garments from runway to retail reflected ideas culled from science fiction, and **Intelligent Agent 8.1**

its delineation of futurist lifestyles, and the space race, as well as industrialization. We remember that Jacquard's loom is a forerunner of digital devices. Even the rise of mass media in the post-World War II years could be connected to the notion of the demise of fashion as couture and its reemergence as commerce.

## Wearable Technology

So, garments reflect their technological culture, or their culture's fascination with technology. It is no surprise that examples of wearable technology (that we could arguably recognize as such) reach back beyond the Enlightenment. Eyeglasses were invented in the 1200s--are they wearable technology? And wrist watches (as opposed to clocks carried in pockets or on chains, which are earlier) were developed by Jacquet-Droz and Leschet in 1790, but for their first hundred years were exclusively women's accessories (an early example of technology's association of femininity with the body that is also characteristic of modernism). Wearable technology fills post-war spy and sci-fi literature, from Batman's military-derived utility belt full of gadgets and Dick Tracy's 2-Way Wrist Radio in the 1940s, through James Bond's Seiko telex watch and *Star Trek: The Next Generation's* wearable communicators in the 1980s.

Originally, wearable computing, an early iteration of wearable technology as we know it today, is thought to have begun with Edward O. Thorp's pocket-sized analog computer developed in 1961 to predict results in roulette games in Las Vegas. But there is an important distinction to be made: functional portable gadgets--wearable computing--are not actually *worn*, they are carried or held, and ultimately have little to do with the conceptual and body-based nature of wearable technology, though the two are often confused in accounts of wearable computing. [12] The next stage, the earliest wearable webcams, a result of increasing experimentation in the field of telepresence in the 1980s, were developed by Steve Mann, an engineer who used the technology to interface with the internet in performance-type projects that received a lot of attention. [13] But a rise in interest in actual wearables that could perform computational tasks coincided with an increase in numbers of women in engineering programs such as the Media Lab at MIT in the late 20th century. [14]

In fact, wearable technology erupted in the 1990s due to a confluence of multiple forces, not the least of which was inspiration from literature and mass media. Devices in Neal Stephenson's widely read novel, *Snow Crash* (1992), helped focus creative energy unleashed by the wearables imagined by William Gibson some years before (*Neuromancer*, 1984). The trend picked up speed with *Star Trek: The Next Generation* series, which ran from 1987 to 1994, and *Deep Space Nine*,

which ran from 1993 to 1999. With their androids and cyborgs, episodes in these series explored, on a popular level, issues raised since the time of Mary Shelley concerning the integration of man and machine. At the same time, critical literature contributed, especially the rise of cyberfeminism: a key text was Donna Haraway's "Cyborg Manifesto," published in a specialist journal in 1985 but in a more widely available version in 1991.[15] Also, in the 1990s, advances in wireless technology, networks, RFID tags, and sensory devices brought forth the spiraling world of "ubiquitous computing" we are still trying to navigate today.

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In the same decade, DARPA/ARPA started programs to explore the arena of wearable computers and devices for use in battle.[16] But there were impetuses from fashion as well. Designer Thierry Mugler showed jackets printed like circuit boards on the runway in 1991 and Walter Van Beirendock used flashing LEDs on T-shirts in his "Avatar" collection in 1997. That was a banner year that also saw Margaret Orth at the MIT Media Lab develop methods for stitching electronic circuits directly into fabric. The same year, a "Smart Clothes Fashion Show" created by the students and faculty of Creapôle École de Création (Paris), in collaboration with Professor Alex Pentland (MIT), was held at the Pompidou Center in Paris. In 1999 Katrina Barillova used her intelligence training in the Czech government to conceive of technological garments and founded the influential *Charmed Technology*. [17] These few examples must serve to represent the flurry of activity during these years.

As a result of that activity, literature on aspects of wearable technology began to appear--though at a pace that is slow by comparison--notably Bradley Quinn's *Techno-Fashion* (2002), Suzanne Lee's *Fashioning the Future: Tomorrow's Wardrobe* (2004), and Sabine Seymour's (forthcoming) *Fashionable Technology: The Intersection of Design, Fashion, Science and Technology*. But 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.[18]

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Rather, the most promising ideas were put forth by certain practitioners themselves. In 1998, a Master's student at MIT's Media Lab, Elise Co, who designed many garments utilizing luminosity, remote activation, and bodily sensors, was also among the first technicians to articulate and explore the ramifications of wearable technology for human expression in the context of garments and fashion. Co writes:

With this research work I have tried to explore the ways that technology and computation can expand the vocabulary of fashion and change the way we think about our bodies as they relate to others and the environment. From the experience of designing and implementing each project, it is clear that we must somehow become more facile, able to move dexterously between various aspects of design. Beyond a generalized system for creating computational garments lies the fundamental need to change our notions of hardware and software as separate entities, removed from the physicality of fabric, wind, and shape.[19]

In her work, Co brought together crucial considerations for understanding wearable technology as a multifarious practice: technology and computation vastly expand what we are able to "say" with, or about, garments. And the bodily experience of wearing and moving in them is central.

## Wearable Art

But what possible roots does the practice of WTA have already in the art world? What is the history of wearable art? In fact, while the phrase is common parlance, its use is often casual and its meaning, vague. Fashion and art have always had close connections, from the time Paul Poiret, a founder of French couture, told his clients he was making art works and his shop was a studio. But serious art in the form of clothes, presented on the body (as opposed to on a wall, for example), emerged in the 1950s and 1960s alongside art world interest in the body (body art) and in time-based art forms, like performance and video. Artists like Atsuko Tanaka (*Electric Dress*, 1959) created wearable works that could be worn or "hung." By the 1980s and early 1990s, with the development of the feminist art movement and its interest in fabric as art medium and art world critique as a practice, wearable art had become a more common theme, though not always an accepted one. Its marginality is epitomized perhaps by Hunter Reynolds' *Patina du Prey's Aids Memorial Dress* (1994-present), a ball gown embroidered with the names of thousands of AIDS victims. It has been widely exhibited internationally for more than a decade, but remains relatively unknown. On the whole, wearable art has been a critically invisible practice.

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If art-as-dress remained on the fringes, high fashion was welcomed by major art museums in the 1990s. True, even earlier Diana Vreeland's fashionable exhibitions, culminating with her Yves Saint-Laurent retrospective in 1984, hung frequently at the Metropolitan Museum in New York, but they were under the auspices of the Met's Costume Institute. The cause of art and fashion was taken on as a strategy by Director Thomas Krens, with feature shows like *Art/Fashion* (1997), curated by Germano Celant, Luigi Settembrini, and Ingrid Sischy, at the Guggenheim Soho, and *Giorgio Armani: A Retrospective* at the uptown Guggenheim in 2000. The latter show especially helped fuel widespread criticism of Krens's marketing-oriented vision for the Guggenheim brand, but negative criticism has a way of advancing the discourse anyway, and art-as-fashion became ensconced in the worlds of museums and exhibitions.

As opposed to actual fashion, which is unabashedly commercial, art (its institutional articulation) has long maintained a fantastical existence behind a mask of disinterested aesthetics, while being madly and schizophrenically market driven. You might say art, for some, has not come out of the proverbial closet. Within such a context, wearable art, as it were, faded into the woodwork. Despite suffering through institutional denial, wearable art possesses the unique ability to comment on culture and the way we live our lives, and so it has survived and thrived and has been the subject of a growing number of exhibitions at university galleries in recent years, including (in the U.S.) the Tufts University Art Gallery's successful touring exhibition, *Pattern Language: Clothing As Communicator* (2005, curated by Judith Hoos Fox) and Columbia College Chicago's *Sartorial Flux* (2006, curated by Valerie LaMontagne). Blogs and websites also demonstrate continued interest in the interface of avant garde fashion and art, particularly *Showstudio* (which went on line in 2000 and is still going strong: see <http://www.showstudio.com/>) and *Fashion Projects* (online and in print journal begun in 2005: see <http://fashionprojects.org/>).

Likewise, garments and fashion play a significant physical and conceptual role in the work of many contemporary artists, though this is seldom acknowledged as a critical direction. Cindy Sherman, Vanessa Beecroft, Robert Kushner, Sylvie Fleury, Rosemary Trockel, Andrea Zittel, Matthew Barney, Tracey Emin, Yinka Shonibare, Thomas Hirschhorn, Christine Hill (her *Volksboutique* at the 2007 Venice Biennial), and Richard Prince, among many others, engage with the culture (and sometimes the industries) of dress and fashion in their work.[20]

Interestingly, a guru of new media art, Lev Manovich, in 2000, was among the few significant spokesmen to realize the potential of fashion (broadly defined) for art:

It is the beginning of the new century . . . . We want to imagine ourselves anew. If visual art, hopelessly stuck in recycling its recent history over and over, can no longer help us, where can we turn? Enter fashion. Fashion is everything contemporary art is not: it is concerned with beauty; it is well aware of its history over many centuries, rather than just recent decades; it is more semiotically layered than the most complex Photoshop composite you ever worked on; and it has one ever present constraint (and only constraints can lead to great art)--the human figure. This constraint gives the art of fashion its vitality, its optimism and its inventiveness.[21]

It turns out that garments and fashion--as facts or ideas--occur constantly in art, and in an act of aesthetic sleepwalking we continuously forget how persistent their presence is, so imbedded is the superficiality of our viewpoint, or just perhaps our collective amnesia, on this subject.

## Wearable Technology Art (WTA)--a Cohesive Practice?

Like artists working with wearables, artists working in all forms and technologies of digital and electronic media also face waffling recognition by the art world. History shows us that the art world shies away from association with technology and science (most of us have heard enough about C.P. Snow's 1959 lecture, "The Two Cultures").[22] But, here again, things are changing. Pioneering surveys, like Christiane Paul's *Digital Art* (2003), have begun to appear, as have a few anthologies seeking to define a discipline, like *MediaArtHistories* (ed. Oliver Grau, 2007), but critical literature on specific work is still limited and scattered, and comprehensive indexing is lacking both online and off. A few key works provide examples in a field where much has yet to be written. For example, Edward Shanken has demonstrated correspondences between the appearance of technological art works in the 1960s and the advent of conceptual art--a defining development that still informs art today.[23] But many specific technological art practices go unrecorded or unrecognized by wider potential audiences, and certainly practices involving technology worn on the body are among the casualties.

Moreover, a role for fashion and garments in ivy tower discourses of culture and aesthetics has been slow to emerge. So it is not surprising that practices involving wearable technology have received little attention in the academy, or even that such attention as exists has frequently been directed toward notions about skin and the naked body, not what is conceived around it. Not that works by groups like KnoWear (*Skinthetics*) and the performative experiments of Orlan, Stelarc, and the like are not important and thought provoking, but they

do not engage with quotidian reality and intersect both the "space of places" and the "space of flows" (real and virtual space/time experience) as often as creative experiments with wearable media do.[24]

In fact, much WTA research is scattered widely in academic departments and institutes around the globe. It could hardly be otherwise, since there are so many different challenges: smart textiles, woven circuitry, luminosity, sensor and networking implementation, and critical strategy. Among institutions where efforts in these areas are taking place are Extra-Soft (XS) Labs and the Hexagram Institute at Concordia University in Toronto; Saint Martins College, University of the Arts, London; the Australian 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.[25] There are increasing numbers of artists involved, and these artists are scattered among international centers. But practitioners tend to communicate with each other regularly. Online forums and consortiums have helped establish networks for the artists and designers and their growing audiences, like CuteCircuit (<http://www.cutecircuit.com/>) and the Fashionable Technology Research Consortium (<http://moondial.typepad.com/fashionabletechnology/2007/04/index.html>). Technological and other wearables are regularly featured on major blogs like *We Make Money Not Art* (<http://www.we-make-money-not-art.com/>). Even such a commercially entrenched institution as ACM Siggraph, which has had wearable technology shows for years, has abandoned the dramatic, rock and goth-inspired productions full of cyber disco wear that characterized the shows during the 1990s, and turned to modified runway shows that feature the creativity of individual designers and artists in a vast array of looks, technologies, topics, and associations.[26]

## Conclusion

WTA is gaining momentum. Through the efforts of the artists themselves, this kind of work is achieving visibility and expanding exhibition opportunities and online resources. Moreover, the work is getting noticed. Designers in the fashion industry (with its history of interest in technological innovation) are increasingly experimenting with technologically enhanced garments. Hussein Chalayan, for example, who has straddled commercial design and WTA for years, most recently created a stir with his "111" exhibition of animatronic couture--dresses that expand and contract, and reference the history of fashion --shown at his Spring 2007 runway show in Paris (beneath each

model's skirt was a computer-driven system designed by the creative engineering firm 2D3D). The interest of the fashion industry in art and creativity, not to mention the current "Project Runway effect" of the popular television series--all of this has helped energize interest in WTA.

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But the creative synergy of WTA is also fueled by the exponential rate of developments in mobile media technologies and industries and, in the academy, the corresponding rise of social theory concerning mobile networks, virtual societies, and web 2.0 phenomena. As mobile media becomes a more pervasive part of our experience as humans, and the technology itself vanishes into walls, furniture, pockets, and streets--as technology merges reality with the bubble of virtuality (Microsoft's Surface Technology, for example)--WTA can and hopefully will continue to do the opposite: make connections with the palpable, the fantastic, the self-consciously mechanistic, and the intractably corporeal aspects of the body as dynamic interface.

Still, there is a lot to be done. There are scarce financial resources for artists, who depend upon too few established institutions for financial support to do research or travel the distances required to show their work at still scattered international venues. And yet, one cannot help but wonder whether institutional recognition the way it exists in the art world might snuff out the very energy and wild experimentation that characterizes WTA and distinguishes artists in this field, who must "connect things that are separated." Perhaps new standards for aesthetic merit need to be devised. The same crippling effect might be true for critical discourse. WTA pulls together practices--science, technology, fashion/dress, visual/collaborative/performance art--that have grated against each other in the annals of art history. In no other art form that I can think of is the experience of being inside the work so rich, so profoundly associative, and at the same time so rife with real sensual and psychological impact. Not only are the technologies that artists deploy highly diverse, but the historical and cultural trajectories the critic must untangle multiply like shooting stars. There is no single meaning, no

logical explanation. If WTA is to be properly interpreted and understood, traditional linear strategies for academic analysis will have to adapt just as inventively.

## References

- [1]Sung Bok Kim, "Is Fashion Art?" *Fashion Theory* Vol. 2, No. 1 (1998), pp. 51-72.
- [2]See "Dress for Stress" in this issue of *Intelligent Agent*.
- [3]Siegfried Zielinski and Silvia M. Wagnermaier, "Depth of Subject and Diversity of Method: An Introduction to Variantology," in *Variantology 1: On Deep Time Relations of Arts, Sciences, and Technologies*, Siegfried Zielinski and Silvia M. Wagnermaier, eds., Kunstwissenschaftliche Bibliothek Vol. 31 (Walther König: Köln, 2005), pp. 7-8.
- [4]Siegfried Zielinski, *Deep Time of the Media* (MIT Press: Cambridge, MA, 2006), p. 7.
- [5]"Fashion after fashion" refers to the what has come after the rise and fall of the modernist couture houses, from Worth to Yves Saint Laurent, and involves changes in fashion's marketing, and the nature of its appeal. The term comes from Barbara Vinken, *Mode nach der Mode: Geist und Kleid am Ende des Jahrhunderts* (Fischer: Frankfurt, 1993).
- [6]Other characteristics involved and noted by writers, like a newly sensitized notion of time, all hinge on a condition of technologization. See Ulrich Lehmann, *Tigersprung: Fashion in Modernity* (MIT Press: Cambridge, MA, 2000); Gilles Lipovetsky, *The Empire of Fashion: Dressing Modern Democracy*, trans. Catherine Porter (Princeton Univ. Press, Princeton, 1994); and Elizabeth Wilson, *Adorned in Dreams: Fashion and Modernity*, rev. ed. (Rutgers University Press: New Brunswick, NJ, 2003).
- [7]Charles Baudelaire, *Le Peintre de la vie moderne*, written between 1859 and 1861; Mallarmé's *La Dernière Mode*, 1874.
- [8]Adolf Loos, "Ornament and Crime," in *Adolf Loos: Pioneer of Modern Architecture*, Münz and Künstler, eds. (Praeger: New York, 1966), pp. 226-231.
- [9]Walter Benjamin, *The Arcades Project*, trans. Howard Eiland and Kevin McLaughlin (Belknap/Harvard Univ. Press: Cambridge, MA, 1999).
- [10]Mark Wigley, *White Walls, Designer Dresses: The Fashioning of Modern Architecture* (MIT Press: Cambridge, MA, 1995).
- [11]Lehmann, p. 129.
- [12]See for example Bradley Rhodes's "Brief History of Wearable Computing," ca. 1999, written as a part of the Wearable Computing activity under Sandy Pentland's Human Dynamics Group at the MIT Media Lab.  
<http://www.media.mit.edu/wearables/lizzy/timeline.html#1907> accessed December 12, 2007.
- [13]Christiane Paul, *Digital Art* (Thames & Hudson: London and New York, 2003), p. 164.
- [14]The fact that both women and blacks were scarce at the Media Lab is discussed by Ronald Roach and Laurie Dunivant Sneiderman in "MIT's Media Lab," *Black Issues in Higher Education* (March 2, 2000), n.p. See also *Women, Work and Computerization: Spinning a Web from Past to Future*, A. Frances Grundy, ed. (Springer: Berlin, 1997).
- [15]Donna Haraway, "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," in *Simians, Cyborgs and Women: The Reinvention of Nature* (Routledge: New York, 1991; essay originally published in 1985).
- [16]DARPA (Defense Advanced Research Projects Agency) is the research and development branch of the United States Department of Defense.
- [17]Quinn, pp. 71-75.
- [18]Sabine Seymour's *Fashionable Technology: The Intersection of Design, Fashion, Science and Technology*, forthcoming in 2008, will take a more holistic approach.
- [19]Elise Co, "Computation and Technology as Expressive Elements of Fashion," M.S. Thesis at MIT, Program of Media Arts and Sciences, 1998. Accessed December 10, 2007 from <http://acg.media.mit.edu/people/elise/>.
- [20]And examples need not be restricted to contemporary artists. Andy Warhol pioneered the involvement of artists with fashion in the 20th century, but numerous fashion designers have contextualized their couture within the art world. See Carolyn Evans, *Fashion at the Edge: Spectacle, Modernity, and Deathliness* (Yale University Press: New Haven, 2003).
- [21]Lev Manovich, "Fashion Sites" (2001), accessed December 19, 2006 from [http://www.manovich.net/DOCS/art\\_fashion.html](http://www.manovich.net/DOCS/art_fashion.html).
- [22]British scientist and novelist C.P. Snow's "The Two Cultures" was an influential Rede Lecture at the University of Cambridge in which he said that science and the humanities were two cultures that had suffered a complete breakdown in communication.
- [23]Edward A. Shanken, "The House That Jack Built: Jack Burnham's Concept of 'Software' as a Metaphor for Art," L.E.A. Archives, Vol. 6, No. 10 (1998) accessed December 10, 2007 from <http://www.artextra.com/>.
- [24]Peter Allen and Carla Murry (KnoWear), *Skinthetic, 1999; Stelarc: The Monograph*, ed. Marquard Smith (MIT Press: Cambridge, MA, 2005). The space of places and the space of flows are roughly equivalent to physical/social space and virtual or networked space; see Manuel Castells, *Rise of the Network Society* (Oxford University Press: Oxford, 1996).
- [25]Am-I-Able Network consists of the School of Interactive Arts and Technology, Simon Fraser University (SIAT), Extra Soft Labs (XSLabs), Concordia University, and the Banff New Media Institute (BNMI).
- [26]The 2007 Siggraph Fashion show, entitled *Unravel* and "curated" by Amanda Parkes, even produced a small catalog.