

The Wearable Self: Braiding a Feminist Critique within a Somaesthetics Framework for Design

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Abstract. This paper describes the exploratory design process of Wo.Defy, a bioresponsive wearable garment that integrates interaction design with feminist critique through an emphasis on intimacy, self-agency and self-reflection. Our research is based on a Somaesthetics framework addressing values of self-experience, poetics, materiality, and interaction semantics. Wo.Defy critically engages concepts of cultural history and identity to develop a richer understanding of design for the self. Our research design is informed by the historical precedent of the Self-Combing Sisters, a suffragette group in early 20th century Chinese society, who challenged the traditional Chinese status quo of gender roles and social conceptions of pre-arranged marriages through their chosen dress and styling of their hair. Wo.Defy contributes to the design discourse of wearable, embodied interaction by integrating cultural historical research into contemporary wearable design practice, braiding a feminist HCI agenda within a somaesthetics framework.

Keywords: Bioresponsive Wearable Technology, Somaesthetics, Feminist HCI, Embodied Interaction, Cultural Research, Breath interaction, Kinetic Response, Design for the Self, Materiality, Silk, Hair.

1 Introduction

Framed within somaesthetics [19], [20] and an HCI feminist agenda [2], this paper applies cultural historical research expressed as a set of design features to further enrich the design of user experience within interactive wearable technology.

Cultural history is a backbone that shapes our personal experience of society. It forms and greatly influences political values that indirectly affect the behaviour, beliefs, attitudes, and styles of the people within it. Clothing is a cultural artifact that reflects socio-cultural values including personal attitudes of self-selection, -preference and identity. Clothing portrays both personal and cultural expression and can represent the tension between self-agency and self-assimilation within larger cultural expectations. Within HCI, new technological developments continue to shape perspectives of how people explore, experience, and interact with their cultural surroundings. However, culturally oriented research within HCI, often focuses on representing the larger external cultural expression [6], [12], while the presence of the internal voice of the self within culture is often limited or even forgotten, due to the vast

attentional focus and distraction that exists in the world outside of ourselves. Our research explores how interactive clothing can support attentional focus to our own bodystate within a cultural context. Functioning like a second skin layered on the surface or our body, our garments can mediate communication between our own self-sensing and our surrounding environment. We have designed Wo.Defy, an interactive wearable garment, to bridge the experience of the self as mediated by technology with our own cultural influences. The word “Wo” means “I” in Chinese; explored through elements of self-connection, intimacy, self-actuation and the interplay of fabrics, micro-controllers, and sensors, Wo.defy reveals subjective and personal data through the control of the wearer, contributing to a richer understanding to the concept of self agency and self advocacy. We evaluate our prototype from the perspective of a Research through Design methodology. Our Wo.Defy garment embeds bio-sensing technology to cultivate somaesthetic interaction that supports self-awareness and self-reflection within a specific cultural context. Our design process incorporates cultural narrative to inspire and develop a set of design features that express critical design choices that can be integrated into interaction design experience.

The objective of Wo.Defy is to develop a bioresponsive dress that incorporates a culturally enriched, interactive wearable narrative that elicits self-reflection and dialogue. We frame our design research within the context of somaesthetics [17] integrating an HCI feminist agenda [2] through a cultural historical context. Based on a somaesthetic framework for interaction design, Wo.Defy 1) highlights the self-experience of the wearer, 2) formulates poetics derived from metaphors of cultural appropriation, style, and history, 3) integrates materiality using silk, human hair, and responsive soft-circuits, and 4) develops interaction semantics based on self-agency through incorporating breath and kinetic movement. By integrating a somaesthetics framework through the lens of a feminist agenda within HCI, we highlight historic cultural references that integrate our design choices. Our design choices support the values of Pluralism, Advocacy, Embodiment, and Self-disclosure as articulated in Bardzell’s Feminist HCI [2]. We articulate a set of design features that support our research design goals of ameliorating self-awareness and self-reflection within a cultural context. Our design focuses on transformation of the self through user-experience contributing to the discourse of embodied interaction by braiding a somaesthetic framework with feminist HCI principles in the context of cultural HCI.

2 The Self-combing Sisters

Wo.Defy is informed by the historical precedent of the Self-Combing Sisters. *Zì shū nǚ* (自梳女) translates as the “Self-Combing Sisters” in Chinese [15], [18], [21]. Residing in the southern Canton Province in China from late 1800s-mid 1900s, this suffragette group challenged the traditional Chinese status quo towards gender roles and the customs of pre-arranged and arranged marriages. Resisting domestication, many of these women held employment within silk weaving factories, which transformed them into contributors to the financial welfare of the household [21]. Through celibacy and pursuit of personal and economic independence, the

Self-Combing Sisters repositioned their roles in society: women as fulfilling economically and individually self-sufficient social roles outside the bounds of marriage.

The Self-Combing Sisters advocated for a social and personal claim to self-choice regarding marriage and work. Their desire to remain un-married and to work in factories as individual benefactors provided them with a kind independence and economic status. This was socially expressed through the distinctive aesthetic appearance of their hair: a bounded bun or plait of a married woman, signifying their ‘marriage to the self’, a reference to turning inward to protect the self from cultural demands and also a concealment of the female semblance of youth, beauty, sensuality, and seduction [18], [22]. For these women, the self-binding hair ritual inversely signified freedom from being restrained by marriage.

The design process of Wo.Defy takes as inspiration the self-responsive and critical reflection of the Self-Combing Sisters by embedding the values and daily practices through the selection of form, material, and the development of its interaction model. The cultural history of the Self-Combing Sisters articulates a foundation for the design concept and construction of the wearable dress, Wo.Defy.

3 Designing for Somaesthetic Experience

Somaesthetics, a concept originated by Richard Shusterman a contemporary pragmatist philosopher, values the role of body experience (or soma) in aesthetic appreciation [19]. Shusterman considers somaesthetics within three categories; analytic somaesthetics, pragmatic somaesthetics, and practical somaesthetics. Analytic somaesthetics consists of descriptive studies of our bodily perceptions and somatic practices and their usages in cognitive, social, and cultural aspects. Pragmatic somaesthetics, on the other hand, involves a normative inquiry into specific disciplines to improve our bodily experience and encourage the comparative critique. Practical somaesthetics focuses on concrete bodily practices by aiming at somatic self-improvement.

The narrative of the Self-Combing Sisters demonstrates both a pragmatic and practical somaesthetics of self-reflection and self-regulation. Shusterman argues for the value of employing somaesthetics in designing for body consciousness, which establishes a critical perspective on the socio-cultural influences influencing design practice [20]. Wo.Defy explores paying attention to our physiological state in order to access self-awareness and self-reflection. This concept is supported not only by pragmatist philosophy but also by physiological research which indicates that directing attention to one’s bodystate supports self-knowledge and can lead to higher-levels of physical, cognitive and emotional performance in our daily lives [4], [5], [19].

Our design research contributes to concepts of self-advocacy through the integration of design principles that support design for the self. Our work with body-based somatic practices can provide new insights within user experience design in HCI [16]. Wo.Defy contributes to the design discourse of wearable, embodied interaction by integrating cultural historical research into contemporary wearable design practice, braiding a feminist HCI agenda within a somaesthetics framework.

4 Emphasis on Feminist Interaction

Within Somaesthetics, our lens of Feminist HCI highlights an agenda that supports the values of Pluralism, Advocacy, Embodiment, and Self-disclosure within the interaction design process [2]. While, the Self-Combing Sisters illustrate attitudes and traits of such an agenda, their contribution to reconstructing social identity has not been explicitly acknowledged within Chinese cultural history. Nevertheless the *Nǚquán zhǔyì* (女權主義) translates as ‘the viewpoint of powerful women’ [13].

Wo.Defy aims to embed the attitude of the Self-Combing Sisters *Nǚquán zhǔyì* into wearable design and embodied interaction. We develop and implement a set of design features influenced by the cultural history of the Self-Combing Sisters.

The Self-Combing Sisters’ stance against arranged marriages transformed cultural models within their own community, advocating for a greater range of personal choice regarding self-agency and identity. The controversial actions of the Self-Combing Sisters separated them from their family and community. Without a husband and children the Self-Combing Sisters were able to devote their time to silk-weaving in the factories leading to economic independence and stability. This ultimately enabled these women to ‘give-back’ and even maintain economical support for their extended family and community. As their circle of independence led to providing much needed economic support to their local families and community, the community in turn was able to recognize and accept the way of life of the Self-Combing Sisters. This historical narrative illustrates the feminist principles, of *advocacy* for their life-style, *self-disclosure* and *embodiment* (represented in part through their choice of hair style and dress), leading ultimately to cultural *pluralism* in their communities’ acceptance of their agency, life-style and identity. While striving for gender equality, the underlying intention of the Self-Combing sisters was to maintain control of their own bodies, identities, and sexual choices. Their advocacy and evidence of self-disclosure is visibly recognized through the choice in their physical appearance (how they wore their hair), their choice in marital status and their life-style choices, working in the silk-factories to increase economic independence for themselves and their families.

Shusterman articulates a similarly framed somaesthetics critique integrating a feminine aesthetic and representation of the female body, inciting “women to self-examine and self-maintain her somatic feelings for a better control, the familiarization of her body, and the transformation into somatic knowledge” [19]. Braiding a somaesthetic framework within feminist HCI principles in the context of cultural HCI, we appropriate the concept of hair and clothing and its intimate relationship with the body, drawing inspiration from the Self-Combing Sisters narrative to design for wearable technology.

While feminist discourse has existed within critical theory for over half a century, a focus on Feminist HCI has emerged only recently with Bardzell’s introduction of a design agenda that acknowledges feminism as a lens within technology design. A subsequent CHI workshop in 2011, *Feminism and Interaction Design* resulted in a number of workshop papers, including Ascencao’s [1] interactive audio-visual installation, ‘Euphoric Femme’, which aims to ameliorate attitudes and create a discourse around female sexual subjectivity and Lehtinen’s [14] evaluation of feminist interaction design in HCI which examines vibrator design, providing an analysis of preferences in technology and sexuality.

Wo.Defy integrates a Feminist design agenda through its incorporation of Pluralism, Advocacy, Embodiment, and Self-disclosure. Both Pluralism and Advocacy are incorporated within the conceptual design of Wo.Defy as an exploratory process involving socio-historical research, while Embodiment and Self-Disclosure are incorporated into the material design and use of breath sensors and soft-sensor actuators to both reveal and conceal bodydata. Our design has stemmed from a desire to incorporate critical reflection based on the historical socio-cultural example of the Self-Combing sisters. Inspired by the narrative of the Self-Combing Sisters [15], [18], [22] we provide a design context that includes the craftwork of silk weaving and the integration of human hair, as referenced in their socio-historical agenda. Through investigating and evaluating historical precedents of identity construction, Wo.Defy highlights the use of critical reflection as a design strategy and catalyst for interaction design that promotes self-change and agency.

5 Somaesthetics in Cultural HCI

Culturally oriented research within HCI, often focuses on representing the larger forces of cultural expression [6], [12], while the presence of the internal voice of the self within culture is often set aside, due to the vast attentional focus in the world outside of ourselves. Our research explores how interactive clothing can support attentional focus and self-reflection with our own bodystate while maintaining a cultural context.

Self-reflection requires paying attention to one's self-experience in the world. Our sense of self can be considered as a set of blueprints that influence our perspective and attitude for our own behaviour, decisions, and interactions towards our surrounding environment [10]. An ability to accurately attend to and reflect upon the various aspects of one's emotional and physical well-being is crucial for a higher development in cognitive, emotional and physical ability [9].

Bio-medical studies show that a shift of attention between external and internal happenings can be supported by 'distraction', which diminishes external stimuli for an emphasis on internal information. Thus, self-awareness can be induced through focus on the self's physiological reactions and psychological state [4]. Wo.Defy fosters an interactive experience using breath sensors that focus the wearer's attention on their breathing patterns. The technique of focusing attention to affect change in our bodystate is a core pragmatic strategy of somatic practice. We apply a somaesthetics framework in the conceptual development of the bioresponsive dress Wo.Defy [17]. Somaesthetics can support somatic connoisseurship (the development of somatic knowledge) to support interaction design within the field of HCI [16]. Wo.Defy adopts a Somaesthetic design that braids a feminist HCI agenda within a somaesthetics framework through the lens of feminist interaction [2].

6 Wo.Defy: Defying Expectation

Wo.Defy is a bioresponsive wearable dress that explores the somaesthetics of sensory interaction. Wo.Defy incorporates techniques of self-awareness by directing attention to the wearer's breath which in turn actuates kinetic changes in the garment's material

properties revealing and concealing fabric layers in the front pelvic regions of the garment. Historical research on the Self-Combing Sisters dress and work habits is used as inspiration to select material, form, color, textures, and symbols for the wearable design. The integration of cultural associations drawn from the Self-Combing Sisters constitute a somaesthetic framework for the design of Wo.Defy, including: 1) the self-experience of the wearer, 2) poetics derived from metaphors of cultural appropriation, style, and history, 3) integration of materiality using silk and human hair 4) development of interaction semantics based on self-agency through incorporating breath and kinetic movement.



Fig. 1. Fig. 2. Wo.Defy 2012-14

7 Poetics in Design and Interaction

Wo.Defy borrows from the culturally rich background of the Self-Combing Sisters. Wo.Defy collects physiological breath data to both reveal and conceal body state. Inspired by the practice of Noh Theatre, Wo.Defy reveals the wearer's internal emotions through inner body rhythm expressed through the act of breathing [7]. A custom made breath-band embedded with a piezo force sensor and a soft circuit band wraps around the wearer's chest capturing the amplitude of each breath. This enables the wearer to noticing shifts between behavioural (autonomous) breathing and sensory breathing can illustrate shifts in body state [3], [8]. Wo.Defy supports a design concept of self-disclosure and embodiment [2].



Fig. 2. The Neckline and the Broadened Shoulders

Wo.Defy incorporates elements of gender blurring, which is reinforced by the widened shoulder pad of the traditional qípáo (旗袍), a wedding garment traditionally worn by Chinese women. The widened shoulder pad incorporates a symbolic reference to ‘shouldering’ economic responsibility and independence typically a role held by the male family members. This was physically indicated through attributes of broader shoulders and a higher ranking in the family hierarchical structure. The traditional qípáo wedding dress worn by Chinese women has a right-overlapping neckline. Wo.Defy inverts this neckline incorporating a left overlapping neckline reserved for the male thus appropriating and blurring gender roles and identity. Traditional Chinese heritage maintains a structure of the male standing on the left and the woman on the right. Wo.Defy appropriates these cultural gender designs to mirror a counter-position in social and family structure, representing the economic and financial contribution of the Self-Combing Sisters [2].



Fig. 3. Integrating a palette of white as a cultural critique towards agency and sexuality

The white colour of Wo.Defy again blends contrasting symbolic meaning across East and West cultures. In Chinese culture, white is seen as a mournful colour that signifies the ending of a life and is often worn in funerals; on the other hand, white suggests purity in the Western culture and is often worn in weddings and baptisms to symbolize a gateway between innocence and self-actualization. As such, the Wo.Defy garment signifies a ‘death’ of normative cultural expectations, and the critical act of ‘marrying the self’ as a constructive stance towards self-agency. Wo.Defy also acknowledges pluralism [2] by bridging a cultural critique between East and West. The designers replaced the lucky red and gold colour palette of a Chinese wedding with an ‘unlucky’ white colour. This contextualizes the traditional wedding qípáo dress as a commentary on the burial of normative beauty associated with pre-arranged marriage and pre-ordained sexual relationships that were eschewed by the Self-Combing Sisters.

8 The Materiality of the Self within Cultural History

Materials are selected based on their literacy, agency and sensitivity to cultural background, body, and mind. The Self-Combing Sisters were favoured in the silk factory

during the industrial revolution in China because of their freedom from domestic obligations and contributed to significant economic growth in the Southern Canton province of China around the late 1800s [21].

Various forms of raw silk are hand-sewn within the design construction of Wo.Defy to symbolize the versatility of the Self-Combing Sisters, represent their craftsmanship in the silk-weaving arts, and honour their constructive contribution to their community. The foundational layer of the wearable garment is made of dupioni silk fabric layered with hundreds of hand-sewn silk chiffon flowers that lay organically from the central torso and spreading downward toward the feet of the dress. Extending from the left neckline to the waistline of Wo.Defy is a small black strand of human hair interwoven into a long braid of white silk fibers. The progressive transition from the black human hair to the white raw silk fiber visualizes a process of concealing beauty and resisting pre-arranged sexual relationships in favor of a self-disclosure that both acknowledges agency, celibacy and self-sufficiency.

Human hair acts as an analogy and structure for the conceptual development of Wo.Defy since hair narrates one's life story through literally documenting the health and vitality of the body. The incorporation of black hair with white silk parallels life to death cycle, the concealing to revealing self-state, and the advocacy of resisting external influences in favor of self-choice and the acknowledgment of pluralism [2].



Fig. 4. The interwoven silk fibers, fabric (organza & chiffon), human hair

9 Interaction Semantics

The Lilypad Arduino board on the left chest collects the hidden and underlying breathing pattern of the wearer. The expansion and contraction of each breath is translated as a pulsating light pattern on Wo.Defy. The light-emitting diodes illuminate as the chest expands to compress against the force sensor and dim as the chest contracts to loosen the tension towards the force sensor.

The Arduino Uno microcontroller board on the back of the garment captures the slightest movement of the wearer with a Lilypad tri-axis accelerometer located on the vertebrae. When the wearer generates any motion, the servo motors pull upward on a collection of translucent threads which connect to a bed of silk chiffon flowers throughout the dress. The contracting and dilating silk chiffon flowers caused by the kinetic input draws a metaphor to the contraction of pubococcygeus muscles. This references the female body advocating personal choice.



Fig. 5. (Left) The breath chest band containing the squared FSR sensor transmits pressure data to the Lilypad Arduino microcontroller. (Right) The LEDs illuminate based on the values sent from the Lilypad Arduino microcontroller board.



Fig. 6. The shoulder shells house the 2 servomotors that pull on the organza flowers

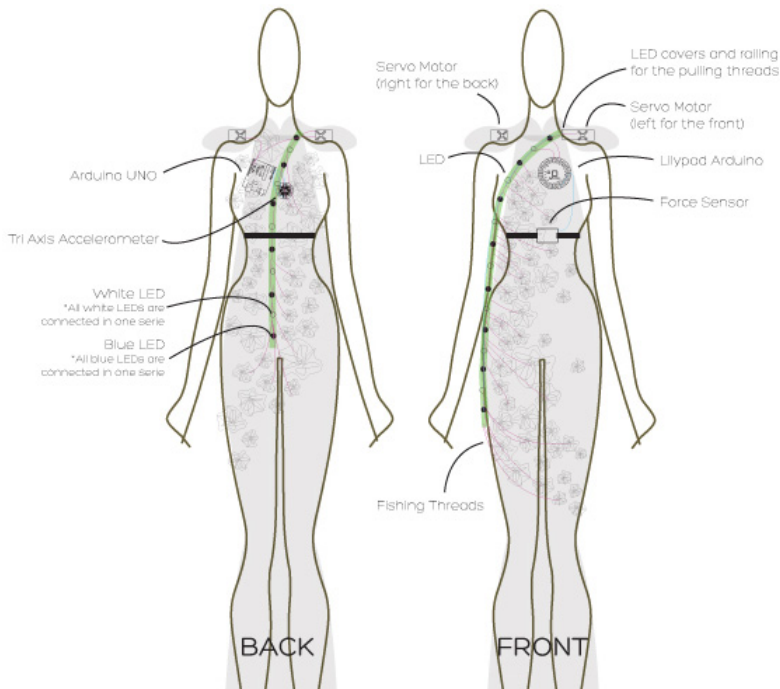


Fig. 7. Schematic Illustration of Wo.Defy

The synchronous expression and artistic mimicry of the physiological information considers the bioresponsive dress as a ‘sister’ who fosters an opportunity for self-disclosure. The acts of illuminating/opening and dimming/concealing of visual expressions on Wo.Defy enact as self-control and self-agency through self-experience. Anthropomorphic expressions are reflected in the lights that illuminate and flowers that contract and expand on the surface of Wo.Defy.

10 Conclusion

Wo.Defy contributes to the design discourse of wearable, embodied interaction by integrating cultural historical research into contemporary wearable design practice, braiding a feminist HCI agenda within a somaesthetics framework. Wo.Defy is informed by the cultural narrative of the Self-Combing Sisters’ conscious design of their own lives. Based on a somaesthetic framework for interaction design, Wo.Defy 1) highlights the self-experience of the wearer, 2) formulates poetics derived from metaphors of cultural appropriation, style, and history, 3) integrates materiality using silk, human hair, and responsive soft-circuits 4) develops interaction semantics based on self-agency through incorporating breath and kinetic movement [17]. By integrating a somaesthetics framework through the lens of a feminist agenda that supports the values of Pluralism, Advocacy, Embodiment, and Self-disclosure within HCI [2], we highlight historic cultural references that integrate our design choices. Our design consciously reveals internal bodily information against external environments in forms of physiological and emotional data through the reactive garment, raising critical questions around design for self-awareness and self-reflection.

Wo.Defy incorporates material signifiers that reference Chinese cultural practices; including its construction of black human hair and white silk, referencing the life to death cycle within the Chinese culture. Self-disclosure is designed through the visibility of the wearer’s states incorporated through the breath sensor, accelerometer and the kinetic response of the floret designs to the bio-data. This references the Self-Combing Sisters stance toward their own agency of their bodily and economic choices. The design of Wo.Defy embodies these historical concepts through its material design process.

11 Discussion and Future Work

Wo.Defy has combined a framework of somaesthetics practices with a feminist agenda to advocate for design practices that support self-awareness, -reflection, and -disclosure and that can ameliorate user experience. Directing attention to one’s bodystate supports self-knowledge and can lead to higher-levels of physical, cognitive and emotional performance in our daily lives [4], [5], [19]. Our initial qualitative data has been gathered from participants at 6 exhibitions and has indicated that a cultural historical narrative can create a legible context for shaping user awareness of their own state within a cultural context. Participants used a talk aloud process that reflected upon their experience of self-revealing and self-concealing expressions

through bioresponsive technology based on breath. Our initial findings support our goals of furthering our design research by crafting a qualitative somaesthetic instrument to further understand how wearable technologies and biosensors can support the development of our attentional skills. As highlighted by Shusterman [19], the application of somaesthetics toward designing technology that supports attention to one's own state can lead to knowledge for an increase in everyday emotional, physical and cognitive well-being and performance. In our next stage of research we will iterate the prototype and develop an evaluation strategy to assess breath input as a mechanism to address self-observation. This is an application of pragmatic and practical somaesthetics strategies in interaction design for user experience and has the potential to reinvigorate bodily understanding and practice within human computer interaction.

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