

Virtual Adornments: Haute Couture Practices for IoT Connecting Apparel

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ABSTRACT

The Internet of Things (IoT) [3, 16, 35] is a physical-digital ecosystem of compliant technologies and heterogeneous parts, enabling vast transmissions of data and candid, pervasive presence of things [40]. Fashion, on the other hand, is an embodied practice, an information medium of material, social, cultural, economic and political forces. Many wearables are outfitted to actuate data input sources as a visualised display. However, the impact and rich possibilities of fashion adornment practices for embodied data engagement in IoT wearables design have been overlooked. Introducing computational materials of the IoT to physical properties pushes this virtual system into the physical realm. In this research, an aesthetic criterion of haute couture practices considers the material turn [34, 39]. Design cases of fashion-led adornment style are a promising path to follow in the context of designing wearables for an *Internet of Worn Things*.

Author Keywords

Wearables; Internet of Things; fashion; haute couture; research through design; material cultures.

CSS Concepts

- Human-centered computing~Interface design prototyping
- Applied computing~Performing arts
- Computer systems organization~Robotic components

LITERATURE REVIEW

The IoT's ubiquitous [41], enmeshed ecology enables autonomous processing and aggregation of big data transactions amongst the digital-physical world. Data security vulnerabilities are addressed as a key issue [42, 14], as is locating dynamic topologies [31] of IoT connected *worn things*. Moreover, our shifting engagement with computational material, wireless technologies and data, provokes diverse aesthetic and material dialogue; the material

turn, notions of screen essentialism [4, 13, 25], computational medial affordances such as glitches, pattern recognition, autonomous behaviours [6, 36] and disembodied aesthetics [12, 32]. As wearables, IoT systems, have notably advanced tracking practices, such as the Quantified self [23, 37] and remote social interactions [9]. Given the susceptibility of networked denizens in a pervasive socio-technical system, it is timely to question the habitual IoT paradigm [2, 26], framing the networked *body-worn things* in this ecology. Accordingly, worn quantified data visualisation is critiqued [18], as are aesthetic data input sources [7, 25] and bodily-sensory outputs [1, 38, 44]. While ornamental textile approaches have been explored for textile computation (5, 11, 15, 25, 33), my research draws from rich fashion traditions of haute couture [8, 10, 28], whose embellishment practices offer a tactile, aesthetic refinement for wearables.

RESEARCH QUESTIONS

By foregrounding a fashion perspective, networked *worn things* are viewed through a computational material lens.

- In what ways can fashion-led, embodied material practices craft computational material into meaningful data visualisation, for networked wearables in an *Internet of Worn Things* ecology?
- How can computational material and its medial affordances interrogate aesthetic expression for haute couture adornment practices, to broaden bodily-sensory modes of output?

APPROACH

In my research inquiry, I adapt Research through Design (RtD) [14], to the specific context of crafting IoT connected fashion wearables and extend it by integrating antidisciplinary [20] and performative [17, 19, 27] tactics. RtD supports my investigation of embodied engagement with computational materials through fashion design processes as a mode of inquiry. In this research, a collection of IoT connected garments - *Virtual Adornments* are devised to customise wireless technologies and data-sets for use in haute couture adornment style, to probe networks of *worn things*. Using the design mechanisms and conditions relevant for garments, future outcomes are imagined, emergent material prototypes constructed and artefacts devised to engage with broader ethics of dynamic, networked, worn data transactions. Making negotiates antidisciplinary interventions and performative observations, using material investigation,

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prototyping material artefacts to incite feedback, see emergent patterns and to articulate unfamiliar conditions. Methods employed in this approach are drawn from RtD design processes: *contextual review of practice and literature, material and aesthetic investigation and ideation, material probes*[21] and *embodied ideation*[43], *action research diaries, prototypes, testing, performative artefacts, wearer interventions*.

WORK IN PROGRESS

Prototypes

The *Virtual Adornments* collection explores visual and tactile bodily-sensory aesthetic expressions for empowered data input and refined output systems, through consistent haute couture adornment style. This approach is unique, in the sense that hardware components are replaced before tailored on garments. This creates significant differences in the aesthetic expression since the reworked materials correspond to tactile textures, reminiscent of fashion haute couture collections. Two exploratory works in this series are; *Live:scape BLOOM* [29, 30], an IoT dress with robotic embellishment that kinetically responds to quantified weather phenomena, and *Aura:maton*, IoT connected corsetry that electronically releases scent based on quantified physiological data. Both garments explore embodied, autonomous behaviour of data expression in the IoT.



Figure 1. Video still of *Live:scape BLOOM*. Haute couture robotic embellishment detail.

Embodied Design Workshops

Further, an initial phase of embodied design workshops with new media, theatre, fashion and interaction design students, faculty, and dancers has been conducted. Additional requirements were necessary to deepen ideation for what future networked data expressions may fit, move, perform, look and feel. The aim was to probe tactile, bodily experience through materials and movement gestures, and program IoT wearables into the act of wearing. Early analysis unearths that the resulting wearables conceptualisations are specific to individual material, sensory, bodily, style and cultural orientation.

Performative artefacts

Exhibiting *Live:scapeBLOOM* as a performative artefact revealed a range of individual responses — many described desires for broader sensory-aesthetic expression, such as

added LED's for greater effect, scent producing flower embellishment, or more reciprocative interaction behaviour than autonomous live streams of quantified wind data. A hardware 'glitch' in *Live:scape BLOOM* created coquettish movement and provoked intrigue from one viewer. Rather than debug the glitch, it is a compelling shaping material to reconceptualise autonomous computational pattern recognition and medial affordances into the wearables design process: *embellishment repeat patterns, materials, garment patternmaking, silhouettes, data input sources and output hardware, performative interaction design, embodied, dynamic prototyping, testing interventions, film presentation*.



Figure 2. Detail of an emergent material prototype in the design process of making an olfactory output for data expression.

DISCUSSION AND FUTURE WORK

Performative analysis of *Livescape:BLOOM* has informed aesthetic direction for *Aura:maton*. In consideration of data-triggered scent embellishment, material investigations for ambient scent as opposed to skin worn, and required hardware options, the overall expression was drastically modified to accommodate the volatile, temporal behaviour of scent material. Instead, immaterial forms such as fog, temporal traces, and fabric transparency were used to capture aesthetic properties metaphorically. My objective is to value the practice and material improvisation of fashion haute couture for IoT wearables, so they can be worn as everyday garments and appreciated for augmented wireless data visualisation. The approach of aligning established fashion and textile embellishment with computational material practices for the field of IoT, while drawing on familiar routines in the design process, proves suitable for this research. Wearables can be more than computational display. Rather, artefacts of identification within dynamic, physical-digital systems, contributing to the grounding of the fashion wearables design as a bodily-sensory practice. Ongoing work explores wearer probes, that scaffold interactions of IoT mediated garments to leverage broader public responses and experiential accounts of the *Virtual Adornments* collection.



Figure 3. Video still of *AURA:maton*. Performative analysis of haute couture robotic corsetry.

CONCLUSION

My research reveals what can be considered failures of autonomous technological processing, as crucial to material and design innovation. This view advances practice in fashion-led IoT connected wearables, critiquing inclination toward designing for seamless technological functionality. By looking outside the boundaries of IoT usage, and introducing a fashion perspective for an *Internet of Worn Things*, my work resists ubiquitous technological scenarios of automated network assembly and function, to propose more nuanced responses of fashion wearables as a complex, layered, embodied practice.

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