



Developers, designers, consumers to
play **equal roles** in the progression of
smart clothing market

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Introduction

Smart clothing incorporates a wide range of products and devices, but primarily refers to technical garments either made from e-textiles or with form fitted clothing embedded with electrocardiograph (ECG) and/or optical sensors. These unique materials (and the devices that work in conjunction with them), are often referred to as “intelligent”, meaning they are capable of sensing and responding to multiple stimuli from the environment (Ariyatun, Holland and Harrison, 2005). These stimuli are often biometric such as heart rate, positional such as type of movement, and locational such as using GPS.

Historically, smart clothing has experienced great difficulty achieving general acceptance from consumers. Experts agree that the dismissed state of the marketplace is due to the fact that the user’s needs are not considered nor incorporated enough in the design process (Ariyatun, Holland and Harrison, 2005). Several changes in the design process of wearable technologies need to be implemented in order to overcome this market barrier. Moreover, fashion designers need to be confident and informed about the underlying wearable technology, in conjunction with the needs of the intended user.

This article aims to uncover the current disparities in the design direction and production of smart clothing and what can be done to facilitate them in the future in order to increase market participation. It will also analyze the benefits to production that come with extensive collaboration between product developers, fashion designers and consumers.

Current disparities in the design of smart clothing

The apparel is, more often than not, the part of the product that is most aesthetically pleasing and initially draws the consumer’s attention. Most consumers are enthusiastic about the new and exciting technological features of smart clothing but would also prefer to uphold their personal sense of style at the same time (Suh, Carroll and Cassill, 2010). A clear and focused design direction is one of the most vital components of smart clothing development.

An all-encompassing analysis of past and current market trends shows that fashion forecasting and consumer opinions can greatly aid the development process and ensure that a more appealing product is delivered to the consumer. Directly involving target consumers in some or all of the stages of the design process can help uncover what exactly the target consumer prefers, thus leading to a more appealing overall product. This feedback is often the best way to gain an understanding of the importance of the aesthetic or fashionableness of a product, in comparison to the functionality of a device. Adjustments should be made in order to reflect both the consumers’ wants and needs in the products themselves.

Current disparities in the design process of smart clothing include a lack of a lengthy and in-depth design research phase. This often results in an exponential increase in the cost of redesigning the product as it nears production. Some of the most important considerations to make in the early stages of development include

how the product will interact with both the environment and the intended user.(Suh, Carroll and Cassill, 2010).

In the near future, we need to change the approach of wearable technology production by re-centering the design direction around the user, as opposed to the focusing solely on technological component. By redefining the target market as people who are interesting in promoting or maintaining a healthy lifestyle, instead of a broader group of those interested in technology in general, smart clothes will be able to directly appeal to their audience.

The design principles of smart clothing development

In a 2005 study on The Future Design Direction of Smart Clothing Development, researchers conducted interviews and distributed surveys to groups of product developers, fashion designers and consumers alike in order to achieve a holistic view of the wearable technology industry.

Product developers agreed that smart clothing should have a design direction that is similar to that of functional clothing, which are specially designed for extreme conditions, such as fire fighting uniforms. Developers agreed that smart clothing's recent migration towards distinct sectors such as the "physical monitoring, sportswear and personal healthcare" has played a large role in a designing attributes according to specification of the target market. A clearer understanding of the marketplace, such as a well-defined customer requirement document, makes it easier for product developers to build smart clothing that will appeal to target consumers. Lastly, developers noted that social acceptance of the product was vital. The design of these products should be simple so as to prolong its lifecycle in a world of ever-changing trends. The monitor or technological component ought to be as unnoticeable as possible in order for the garment to be deemed wearable and socially acceptable by consumers (Ariyatun, Holland and Harrison, 2005).

Fashion designers, when asked the same questions as the product developers, unsurprisingly focused more on the aesthetic aspect of wearable technology. Many agreed that the design direction needed to be more commercial in order to appeal to a larger consumer group. To them, the low social acceptance of wearable technology by target consumers was a result of low consideration of fashion and aesthetic design. To conclude, they noted that it was acceptable for the technological aspect of the design to be visible, so long as it was "attractive" in appearance and could be "added or removed easily due to the user's functional and emotional requirement" (Ariyatun, Holland and Harrison, 2005).

Consumers tended to agree with the notion that a physical monitoring application was the "appropriate direction for the mass market in the future" (Ariyatun, Holland and Harrison, 2005). This group was most concerned with if and how the product would be able to help them both physically and mentally. While aesthetic remained an important aspect to many, the functionality of the device took precedence.

At the conclusion of the study, researchers found that there was a large correlation between what each group believed would help expand and promote the smart clothing market. Product developers, fashion designers

and consumers all agreed that the target audience that made the most sense was those who were interested in health, sports and personal, physical appearance. They also agreed on the notion that consumers generally expected to achieve a higher quality of life by purchasing and utilizing the smart clothing product. In terms of design direction, most agreed that smart clothing should lean towards “sportswear and personal healthcare applications” due to the lifestyles and preferences of the target consumer group. Beyond that, it was noted that most consumers, regardless of what they are purchasing, will initially choose something based off of physical appearance, but then will consider the functionality of the product. Therefore, smart clothes should be both aesthetically attractive as well as functional. Lastly, smart clothes should be as customizable as possible, with the technological component being either invisible or removable (Ariyatun, Holland and Harrison, 2005).

Checklist of design considerations for smart clothing development

1. **Identifying the end user needs** - User needs should inform decision making with regard to the balance of functional and aesthetic considerations in the design development of smart clothing
2. **Understanding the user’s physiology,**
 - a) Designers must have knowledge of textile properties and construction in tandem with basic knowledge of human physiology and issues to do with survival in extreme conditions
 - b) Breathability, thermal regulation, movement, fit, agility, sensitivity, and grip
 - c) In order to provide a comfortable microclimate, smart clothing designers need feedback from end users regarding issues such as workload, moisture management, thermal regulation and protection from a range of potentially hostile environments
 - d) Functional apparel, driven by innovation in fibers, fabrics and garment manufacturing techniques, enables the end user to feel good which promotes better comfort, performance and quality of life
3. **Understanding the user’s activity type** - Little guidance is available to assist the current smart clothing designer in the pattern development of garments for extreme posture and body movement with functional detail such as 'arm lift', articulated elbow and knee constructions. Standard garment size charts, diagrams and corresponding tailor's dummies cater for relatively restricted movement and traditional cutting is depicted in erect 'fashion' poses. For sport the usual requirement is to be super lightweight with minimum bulk for easy storage.
4. **Understanding the user’s culture and aesthetic considerations,**
 - a) Smart clothing designers should require guidance in their selection and application of technical textiles, aspects of style, cutting and methods of manufacture and finish while selecting and adopting appropriate technologies at every stage in the design research and development process

- b) Smart clothing designers must communicate with sales teams, retailers and end users to achieve aesthetically strong design statements that also promote maximum performance characteristics in the product
 - c) Greater comfort and safety in performance clothing often hinders the appearance of the garment. Aesthetic has not always been of major importance in smart clothing
5. **Understanding sustainability in manufacturing.**
- a) Sustainability and ethics in design should be a major concern for the product development team from fiber production through to the disposal of garments at the end of their use
 - b) The aim of the design team is to achieve minimal environmental impact without compromising technical performance
 - c) Sustainability in design based on the philosophy of simplicity and quality. This follows the theory that there is nothing that is extraneous in good design; everything matters, and every part serves a purpose.
6. **Understanding the user experience (UX) of the garment** - The garment should be developed through experience and experimentation. By studying the UX of end users and looking at what their real-world requirements would be, smart clothing designers can prioritize the functional attributes that a garment may have. Instead of developing generalized solutions, focus can be directed towards specific issues. A balance between functional value and available power resources may have to be found
7. **Understanding the underlying technology** - Technical understanding of various biometric, positional and other innovative technology is required for effective design of Smart clothing designers.
8. **Understanding appropriate construction methods** - In contrast to Fashion design, where it is rare for the designer to have 'hands on' involvement in prototype garment manufacture. The designer of smart clothing must have an awareness of the capabilities or restrictions of both traditional and state of the art manufacturing methods and provide detailed technical design specifications, describing such procedures

(McCann, Hurford and Martin, 2005)

Conclusion

The evolution of wearable technology has been lengthy and sufficient adaptations have occurred in both the technology and fashion sectors. The design direction of wearables is constantly changing, as new technology becomes available and realizations about consumer preferences are brought to light. The future of wearable

technology remains largely in question, but the education of fashion designers in conjunction with the consideration of consumer preferences must be priorities if the market should continue to expand.

Some of the largest questions experts are asking about the future of wearable technology is how much of a role social trends will play in wearable adoption in the coming years and how fashionable you can make a wearable without compromising its function. Answers to these questions lie in the necessary collaboration between fashion companies and technology product developers. With a massive emphasis on practicality and customization, future wearable technology is likely to be able to completely adjust to the wearer's wants and needs (Larkin, 2018).

In order for successful collaboration to occur, however, fashion designers and their respective teams of researchers and design directors must obtain a holistic understanding of both the technical and creative components of smart clothing. Currently many designers lack this necessary understanding. Product developers must continue to aid in this process by providing designers with resources so that they are able to learn about emerging technologies and the needs of the intended consumers.

References

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