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706. An Evaluation of the Accessory Approach in the Design of Personalized Wearable Health Devices Using a Biopsychosocial Framework

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ABSTRACT Incorporating an accessory approach into current systematic approaches in health design enables a personal addition to worn health devices. This paper presents a research project between nine accessory design students and Sahva, the Danish body aids company. The project shows how accessory design skills, practices and methods can contribute to the development of personal wearable health devices, as current designs often ignore the psychosocial preferences of the wearer.

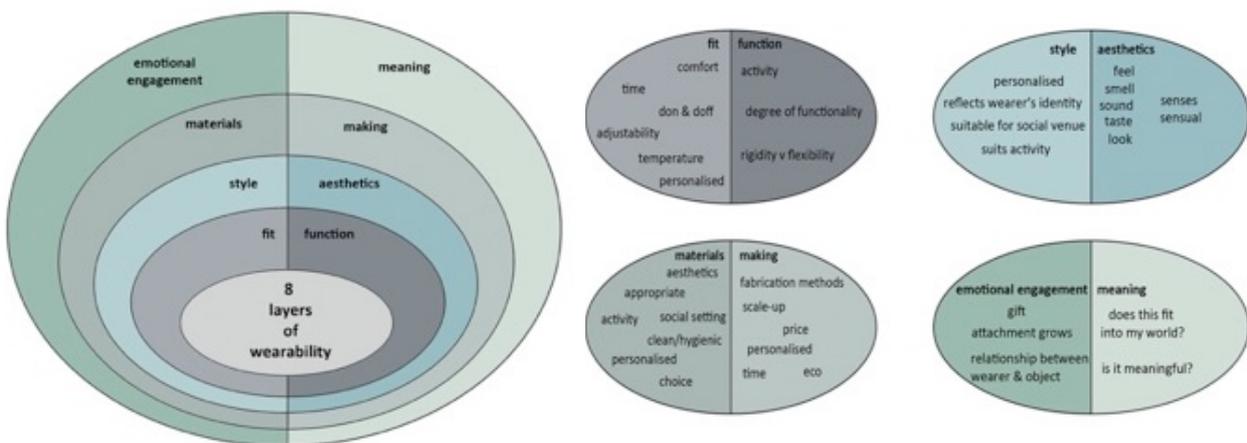
The project was analysed using Bush's (2017) framework for wearability that provides a biopsychosocial model for understanding and defining the wearer's personal needs towards health devices. The findings from the analysis support the consideration of the accessory approach for wearable health devices; since this approach clearly includes a focus on these personalized preferences of wearability that the wearer experiences/holds towards wearable health devices. Such a design approach develops Sahva's existing perception of its clients by demonstrating ways to articulate the personal needs of the wearer and thereby create personalized wearable designs.

Keywords: Accessory Design; Wearable Health Devices; Accessory Approach; Biopsychosocial Framework

Introduction

This paper explores how accessory design can contribute to the design of personal wearable health devices; since current design approaches ignore the psychosocial preferences of the wearer by focusing on a biomedical model (Bush 2015; Bush and ten Hompel 2017).

Responding to the need for incorporating wearers’ biopsychosocial needs in wearable health design processes, Peta Bush (2017) has developed the 8 Layers of Wearability model (fig. 1) to identify important design factors. The model is used to analyse how nine students use accessory design skills, practices and methods to affect their understanding and defining of the wearer’s



personal needs.

Figure.1: The 8 layers of wearability, according to Bush and ten Hompel 2017.

Bush’s model identifies the following design factors: fit, function, style, aesthetics, materials, making, emotional engagement and meaning as affecting wearability, a term that describes how wearable an object is perceived to be by its wearer.

According to Ravnberg and Söderström (2017), personal tastes with regards to aesthetics are the main reason for the rejection of assistive technologies. Profita et al. (2016) state that the acceptance of assistive wearable devices is influenced by social factors such as poor aesthetics, gender/age appropriateness, social acceptability and concerns that wearable health technology is stigmatising (Phillips and Zhao 1993; Parette and Scherer 2009).

Exploring this, accessory design practices are of interest for medical wearables, as they activate personal preferences (Møller and Kettley 2017), i.e. biopsychosocial values of the wearer. Accessories are also objects that people wear close to the body, however, people’s relationships to

them are very different to that of wearable health devices. We need only to consider the wearer and their wedding ring, or favourite scarf to be aware of this developing relationship.

Therefore, we propose the broad category of accessory design, from jewellery to clothing accessories, where its design skills and practices concern both tangible and embodied understandings of identity, function, emotions, stories and materials, as well as those design practices that concerns small-scaled refined making processes, to support a particular framing for personalising wearable health devices. We frame this as the accessory approach (Møller 2018) to incorporate accessory design methods when designing wearable health devices.

Aim

To evaluate the accessory approach, a research project between Danish orthosis company Sahva and nine accessory design students was developed to explore the design of personal objects with four of Sahva’s clients who consented to taking part (table. 1).

Table 1. The research project was framed as a five-week teaching programme.

| Week 1 | Week 2 | Week 3 | Week 4 | Week 5 |
|---------------------------------------|--|---------------------------------------|---|--|
| Literature review of accessory design | One-week workshop with Dr Jack Cunningham and Prof. Sarah Kettley | Second meeting with the Sahva clients | Two-day workshop with Peta Bush | Photo shoot |
| First meeting with Sahva clients | Two-day workshop with ten objects on a string + Three-day workshop of making a sensory jewellery piece | Lecture on ‘Ethics in Design’ | Introduction to person-centric wearables design and the ‘8 Layers of Wearability’ model | Final presentation for Sahva. The nine accessory design students present their findings and work |
| Studio work | | Studio work | Studio work | |

Demonstrating how the accessory approach can contribute to the development of personal wearable health devices, Sarah Kettley, Jack Cunningham and Peta Bush were invited as facilitators in the research project due to their relation to accessory design as well as design research.

Methods

In week one Kettley introduced a method that Astfalck had (2011) developed in her Mythemes/Lifelines, and asked the students to create ten objects on a string that would best describe their Sahva client. Developing Kettley’s brief, Cunningham then asked the students to create a sensory piece of jewellery for the individual wearer. In the fourth week, Peta Bush, who

also focuses on the wearer’s personal needs in her research into wearable orthosis design, facilitated a two-day workshop.

Analysis

Bush’s own frustrating experience of wearing medical devices, and orthoses in particular¹, led her to question the current approach of orthosis design. In her PhD research she explores wearers’ experiences and knowledge of orthoses using co-design techniques to identify design factors affecting the wearer’s acceptance of the orthoses. Her findings about wearability (fig. 1) then became the framework for analysing the nine students’ work to characterise how and if they implement these eight important design factors. In table 2, we understand which factors drove the student’s use of the accessory approach and how their different design projects and processes were perceived:

Table 2. To what degree the students incorporated important design factors for wearability.

| Student/ Factors | Cornelia | Frederikke | Mondo | Tomoki | Amanda | Josephine | Anne | Aur lie | Laura |
|-----------------------------|----------|------------|-------|--------|--------|-----------|------|---------|-------|
| Emotional Engagement | x | x | x | x | x | x | x | x | x |
| Meaning | x | x | x | | x | x | | x | x |
| Materials | x | | | x | x | | x | x | x |
| Making | | | | x | x | | | x | x |
| Style | x | | | | x | | x | x | x |
| Aesthetics | | x | x | | x | x | x | x | x |
| Fit | x | | | | | | | x | x |
| Function | | | | | | | | x | x |

Analysing the student projects using Bush’s model leads to moments of astonishment (Alvesson and K rremann 2011; Brinkmann 2014). We use these moments to describe situations, experiences or actions regarding how the students can direct their design skills, practice and methods towards the Sahva client’s personal preferences.

In the next section we use four of the above student projects to exemplify how the Sahva clients and the different workshops facilitated the student's outcomes.

Findings

One student, Frederikke, employs her accessory design skills, leading to a tangible and emotional description of how she perceives Per (her Sahva client) based on their first meeting. Kettley's exercise increased Frederikke's understanding of Per's story and identity. She used abstract symbols (fig. 2), e.g. the one solid ball of happiness, which she made in glittery paper and folded as a round cube, to describe his personality.



Figure 2: Frederikke and her tangible description of Per - her Sahva splint wearer, due to his stroke and a half-sided paralysis.

Furthermore, she used neoprene material together with metal to describe him as a person who likes functional objects and has a passion for heavy metal music. The light skin coloured pad she holds in her right hand is a symbol of Per's tattoo on the back of his knee, where he puts his electronic muscle stimulator. Per related to this immediately, when Frederikke presented the string at their next meeting. He was very touched by seeing how she had portrayed him, which facilitated a closer connection between them with rich and emotive dialogue.

The sharing of these ten objects was an astonishing moment, in that the activity facilitated a common thirdⁱⁱ. Therefore, this activity precipitated a very different conversation than their first; now Per was able to be more open about stories (normally kept private), relating to his traumatic accident, and their effect upon him.

Frederikke’s sense of translating these personal details into objects; her handling of difficult emotional narratives, as well as her small-scale refining process of the information, became a tangible tool for her to revisit during the design process. Also, the task enabled Frederikke to approach Per and his condition empathically and allowed her to fully address Per’s biopsychosocial needs in her design solution.

Sensory approach

Another student Amanda, and Dorthe, (Sahva orthotist and prosthetic-leg wearer), shows another important element of the accessory approach, (fig. 3), where Dorthe wore a brooch designed by



Amanda inspired by the string and Cunningham’s sensory brief.

Fig. 3: Amanda created a brooch (based on the ten objects on a string), which Dorthe wore for two weeks, along with diary entries about her experience.

Dorthe was struck by how well this brooch embodied herself and her personal style; writing in the diary she remarked that it was incredible that Amanda could create this jewellery based on only one conversation. In this respect, Amanda’s use of the methods increased her empathic understanding of Dorthe, resulting in a brooch that held both emotional and sensory meaning as Dorthe wore the brooch.

Use versus wear

Cornelia (student) worked with Christian, a prosthetic wearer. Although Cornelia experienced difficulties connecting with Christian, she continued her design process by investigating Sahva’s materials (fig. 4 A). She compared these with products from her home, which she associated with use (fig. 4 B).



Fig. 4: A) Images from Cornelia presentation, and her exploration of Sahva products, which she relates to her own functional objects. B) The objects Cornelia relates with wear.

She argued that objects for use are made of cheap materials and used mainly for functional and practical reasons. Also, there is little detailing, and the materials are mainly grey, black and uniform colours. In Bush’s workshop, the students were introduced to the difference between wear and use, and Cornelia used this understanding in an exploration of her worn objects. Here she found natural and precious materials, with small-scale details that characterise her personal style. This led her to create two sets of materials, based on her findings from the previous exploration (fig. 5 A), which she presented to a group of blindfolded persons, without informing them about her project (fig. 5 B).

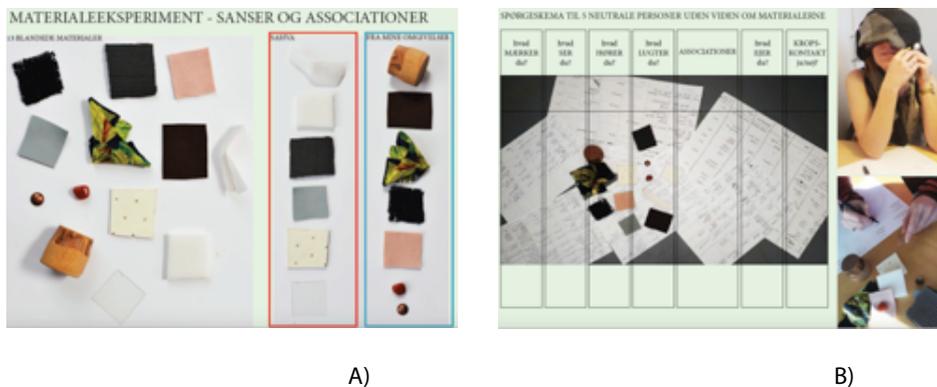


Fig. 5: A) Cornelia creates two material sample-sets, based on her observations from objects she wears and then materials used in Sahva’s products. B) Afterwards she presents the materials to a group of blindfolded participants.

As they touched the materials, she asked them: 1. To explain what they associate with the materials. 2. If they would like to wear the material close to their body.

In this way Cornelia explores five important design factors (table 2) and identifies that the test participants rated the materials Sahva uses quite negatively, as they associated them with work wear and other objects related to one-time use, such as baby napkins and packaging. In response to question 2, her participants were much more positive about the sample materials connected to

wear. Thereby Cornelia identified issues related to the wearer’s aesthetics and fit in terms of comfort, through a sensory experience of touching and associating the materials.

Accessory design skills

In the workshop with Bush, the students were also asked to develop quick prototypes to challenge existing perceptions of a Transcutaneous Electrical Nerve Stimulation (TENS) machine. Bush wears it on occasion to manage pain. According to Bush, the machine has many issues: the placement of buttons, ways of wearing, as well as the application of the pads to the body.

Aurélie chose to re-design the TENS machine as personalized jewellery, using nanotechnology, and natural, precious materials. (fig.6). Her re-design challenged the perception that wearable health devices have to be chunky, sporty or what the designers behind the TENS machine aimed for. Her concept was a neat and desirable solution that addresses fit and function. Further developments included a necklace with a rechargeable pendant for the pads that can be charged through body motion.

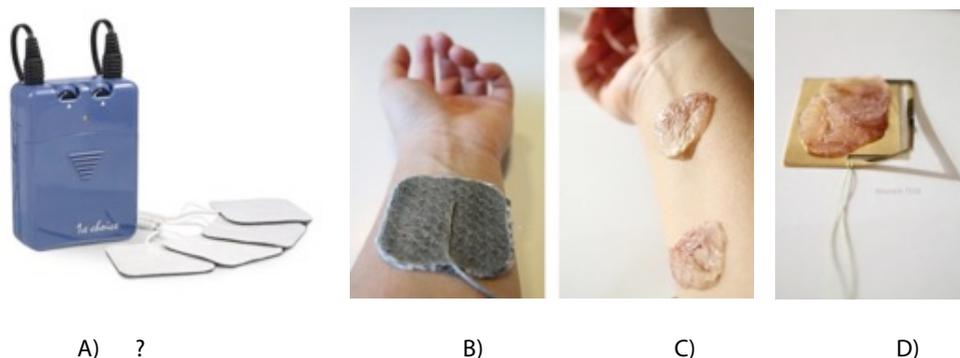


Figure 6: A) Bush’s wearable TENS machine. B) Aurélie shows the existing pads in function. C) She then incorporates a natural element, flower leaves, to make the pads more beautiful. D) Aurélie embeds the pads on a wearable neckpiece that through advanced nanotechnology could function as another TENS machine.

The flower petal stylized pads could also be varied, along with the shape and style of the pendant, to meet the wearer’s style and aesthetic preferences, and thereby become meaningful due to its personalization. In her treatment of the materials and the solutions, it seems that accessory design, and its focus on the emotional engagement between wearer and object, inspired her process of making to address all eight layers in Bush’s model.

Discussion

How did Sahva react to the student’s ideas and outcomes and the particular accessory design practice perspectives, skills and methods presented in this paper? Although Sahva raised relevant

issues about regulations, time issues and budget, the students surprised the Sahva attendees with their different approaches towards personal wearable health design.

Dorthe (Sahva orthotist and prosthetic wearer), stated that the experience had made her reconsider her professional approach. At the final presentation, she explained that receiving the brooch from Amanda was like receiving a gift. This astonishing moment affected her thinking about her Sahva clients. She told that she had begun to develop a more holistic approach towards her practice, so that rather than focusing on biomedical needs, she also considered their personal information in order to design solutions that she could offer as gifts.

This particular notion made the Sahva attendees realise that the existing practice of treating their clients as users could be reconsidered to include the wearer's emotional and social perspectives. This was also recognized in Cornelia's project, which raised several issues for Sahva concerning their choice of materials. Her project demonstrated that use versus wear makes a difference for the touch experience of Sahva's products, as well as the sensory and emotional relationship between the wearer and the object. Sahva were really engaged with her findings and explained that although their existing approach is concerned with constraints and budget, cost restriction and procurement needs, the projects inspired them to think differently about their approach. Another argument could be made that more desirable and precious materials would make the prosthetics or orthoses be worn for longer, or even create a stronger emotional relationship between the wearers and the object, to affect economic issues related to sustainable perspectives and longevity.

In regard to new product development, the students' skills, practice and methods also inspired Sahva, particularly their existing perception of their clients. Frederikke demonstrated ways to articulate the personal needs of Per. Aurélie used her insights to create a ready-for-market product, a TENS machine, as long as there is proof-of-concept for the incorporation of the nanotechnology. Influenced by the accessory approach, she made a well-fitting, functional, stylish and aesthetic health device that greatly emphasized emotional engagement and meaning for the wearer. Thereby the different projects evaluated the need for a different approach towards wearable health devices. This could be the accessory approach.

Conclusion

With the help of Sarah Kettley, Jack Cunningham and Peta Bush, the accessory students created nine well-devised projects, to meet the personal needs of four Sahva wearers. By incorporating accessory design skills, practices and methods, the students transformed emotional information into tangible objects to address the Sahva wearer's personal needs. Using Bush's (2017) 8 layers of wearability attached further personalized design factors to challenge existing perceptions of assistive wearables design, alongside the accessory approach, to generate an empathic and holistic understanding of the wearer. Evaluating the student's use of accessory design skills, practice and methods, the accessory approach facilitates wearable health designs for the wearer, to be carried on the wearer's body and to be about the wearer. This frames a personal need of the wearer on physical, psychological as well as social levels.

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ⁱ Bush has Ehlers-Danlos Syndrome, a connective tissue disorder and needs to wear medical devices to manage the condition

ⁱⁱ A concept that uses an activity to strengthen the relationship between people, and to develop new skills for opening up an emotional conversation. (Thempra 2017).