# Wear.x: developing wearables that embody felt experience

**Janne Mascha Beuthel**
SDU Design
University of Southern Denmark
Kolding, Denmark
mascha.beuthel@gmx.de

**Danielle Wilde**
SDU Design
University of Southern Denmark
Kolding, Denmark
d@daniellewilde.com



## Abstract
Physical discomfort can be highly personal, difficult to discern from the outside, challenging to effectively communicate. Yet communicating discomfort can be of great value. We present a method for developing wearables that transfer one person's discomfort to another: a modified fashion ideation process that enables a person to bring their hidden embodied experiences into wearable form. Using five complementary foci, the method seeks to simulate rather than replicate; to support people to find abstracted expressions for their lived experiences of discomfort, with which to negotiate shared understanding. The resulting wearables support empathic engagement with how another person might feel.

## Authors Keywords
Wearables; Felt Experience; Fashion Ideation; Embodiment; Empathy.

## ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

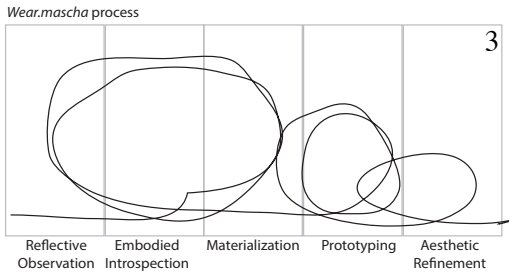
## Introduction
Physical discomfort can be idiosyncratic. It is a mistake, for example, to assume that one person's migraine or knee problem resembles another's. Such conditions can impact a person's ability to engage in personal, social and professional situations. Yet, communicating their influences on daily routines can be challenging.

As Sheets-Johnstone explains: "What is experientially felt in both an affective and kinaesthetic sense (…) poses a challenge to language not only because such experiences are dynamic, but because language is not experience in the first place" [11]. Added to this challenge, people typically determine the embodied experiences of others based on outside appearance, using their personal experiences as "a source of evidence" for their conclusions [4]. This comparison process can easily lead to misjudgements, and inhibit the development of productive shared understandings.

The *wear.x* method has been developed to address this issue. Using five foci in an interwoven process that draws from fashion ideation processes (c.f. [6]), the creator of a *wear.x* wearable develops an idiosyncratic instance of their physical discomfort. These foci: *Reflective Observation*; *Embodied Introspection*; *Materialisation*; *Prototyping*; and *Aesthetic Refinement* are cycled through in different ways by each *wear.x* creator, depending on their expertise, idosyncratic instincts and emergent findings (c.f. fig.3-4). The resulting wearables—abstracted simulations of the creator's embodied experience of their physical discomfort—are used to negotiate shared understanding through enhanced exchange. The aim is not to transfer the physical discomfort. Rather, it is to facilitate embodied understanding of what it might be like to experience this particular discomfort.

Following, we describe the five foci, and demonstrate how they have been used to develop two *wear.x* instances: *wear.mascha* simulates a person's migraine and tinnitus; *wear.giovanni* simulates another person's knee problems. *Wear.mascha* served as the basis for developing the *wear.x* method. The method was then abstracted to become accesible for use by other designers, or—as in the case of *wear.giovanni*—novices supported by a design facilitator.





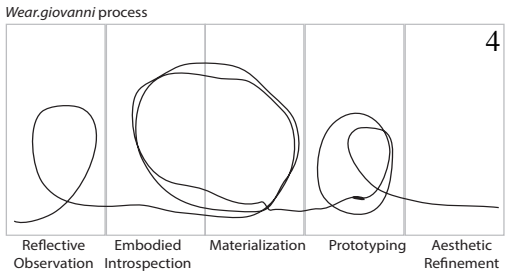




**Fig. 1-4. Example *wear.x* instances and process maps: *wear.mascha* (1, 3); *wear.giovanni* (2, 4)**


**Fig. 5-6. Sketches made during Reflective Observation:** ***wear.mascha* (5)*; wear.giovanni (6)***

## 1.Reflective Observation

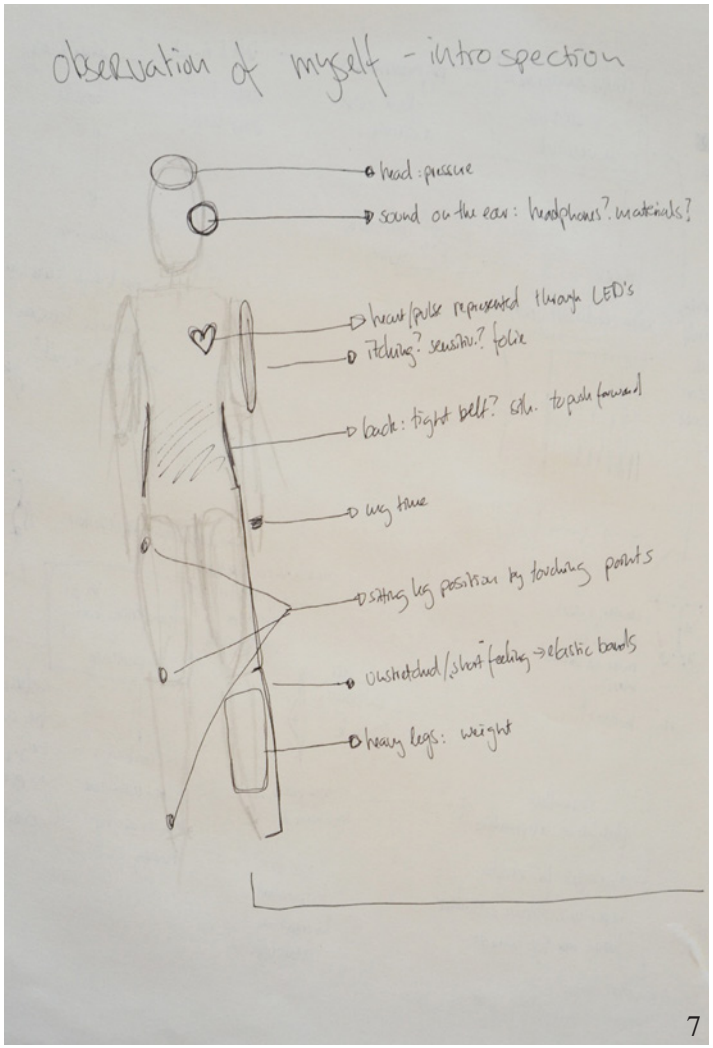
People often judge other's inner experiences based on outside appearance, without tangible proof [4]. Reflective observation can be instrumental in reaching a more critical view of felt experience. In practice, this means observing people in daily life, documenting assumptions about how that person may feel, and then reflecting on the many ways those assumptions may or may not actually reflect the experience of the person observed. Documentation methods such as sketching combined with notation are ideal for visualising observations. Sketching, in particular, involves the hand, and thus our embodied cognitive process in the representational process [5]. It involves abstraction, interpretation and reinterpretation of what has been seen [3]. This foci assists the *wear.x* creator to reflect on the degrees to which assumptions can diverge from reality, recognising that one can never fully understand how it feels to be in someone else's body through observation alone.

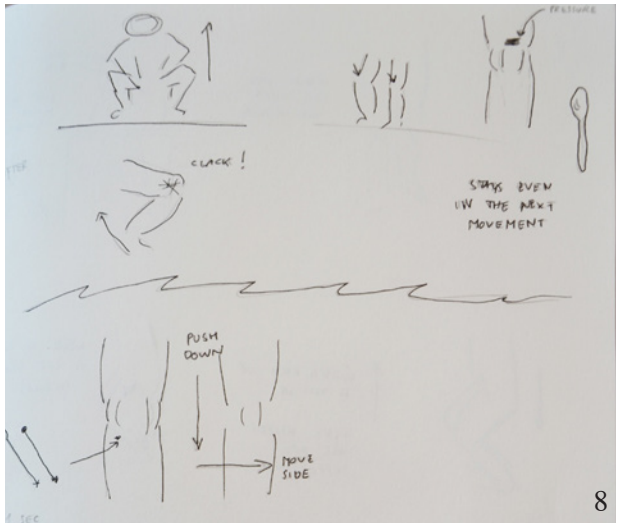
## 2.Embodied Introspection

In this focus, the creator turns their attention inwards, treating their personal, embodied experiences in daily life as their source of knowledge.

Each individual knows her or his own body, its behaviour and experiences from an inside perspective [4]. Such knowledge serves as the primary resource for creating *wear.x* wearables. By turning careful attention to one´s own body in the mundane enactment of everyday life, one can identify aches, pains, issues with movement, etc. that can contribute to specific discomforts and more general malaise. These details are documented through sketches and notes (c.f. fig. 7-9) for enhanced reflection [3, 5].

To give others nuanced access to the identified discomforts it is crucial to exemplify them in *feel-able* form: to make them accessible through physical experience. This focus enables the creator of a *wear.x* wearable to determine which experiences are essential to include in their instance, and gather reflections on how they might be transferred into tangible form.



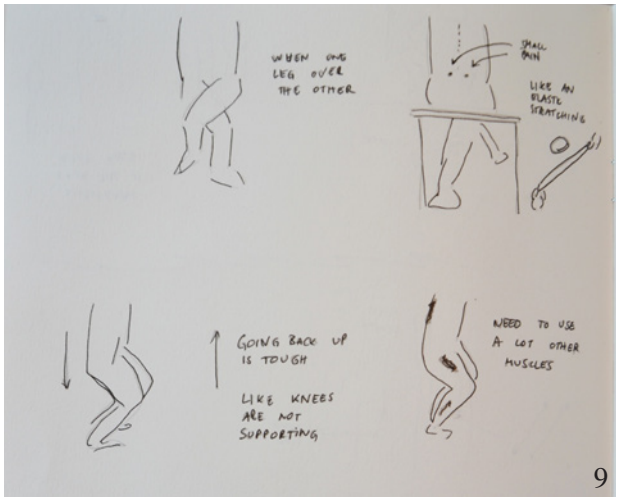




**Fig. 7-9. Embodied Introspection: *wear.mascha* (7); *wear.giovanni* (8-9)**

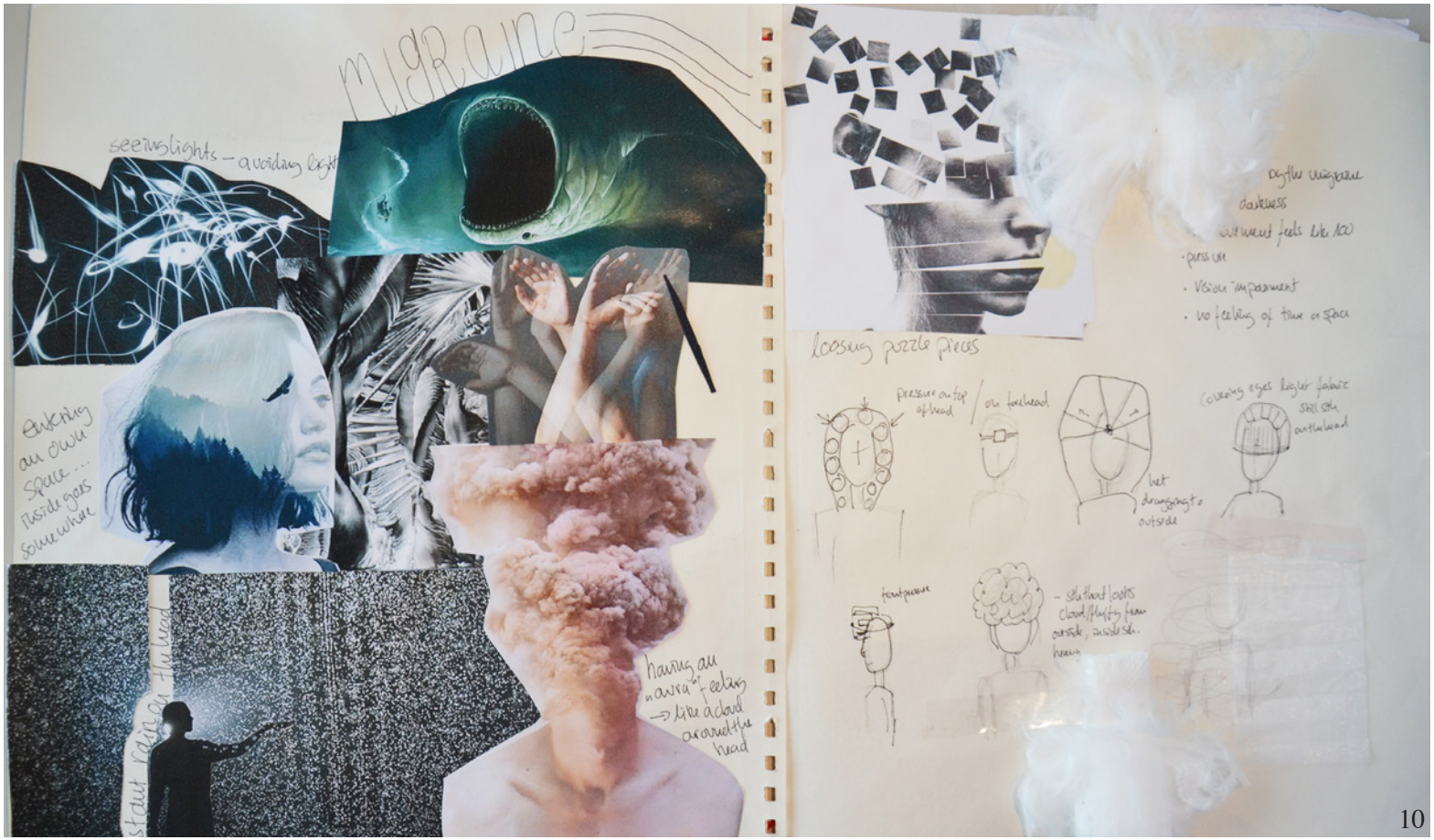



**Fig. 10.** ***Wear.mascha*** **experience board for migraine**

## 3.Materialisation

In this focus, images, materials, notes and sketching are combined in an "experience board", in a move towards finding a material expression for the chosen discomforts. The aim is to assist the creator to find unique ways of bringing their design into existence in the world [2]. Similar to image-based mood boards [8], experience boards capture emergent design ideas and inspirations, and enable the creator to explore the available design space. The boards enrich this process through the use of mixed methods (c.f. fig. 10-14). Experience boards should reflect idiosyncratic impulses, rather than pragmatic considerations related to a final outcome. The meanings attributed to materials should be negotiated in situated actions throughout development [7], rather than being determined when selected.

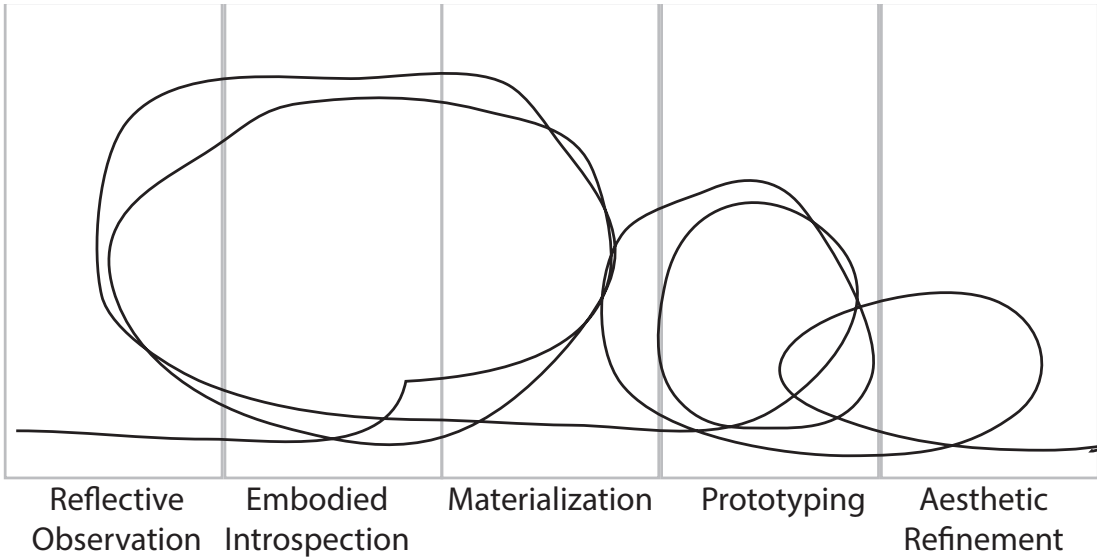



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**Fig. 11. *Wear.mascha* experience board for tinnitus**

Through their rich material expression, experience boards assist the *wear.x* creator to abstract their felt experiences. To move from inner sensations to aesthetically compelling images and materials, and thereby create a bridge through to tangible form. It is not necessary in this focus to define how the materials will be worn. Rather, the creator cycles through the observations and insights gleaned from the previous two foci, and takes time to experiment with abstracting them into visual and tactile forms. The tinnitus sound of the *wear.mascha* creator, for example, was depicted through an image of insects attacking a human ear (c.f. fig. 11). This image was abstracted by referencing the sound that tinfoil creates when crinkled. Tinfoil-based material explorations led to the use of vibration motors in the final prototype.

The first three foci can be revisited as often as desired throughout the development process. Whichever focus is foregrounded, it is important to stay with the process—not to rush through it, as each focus foregrounds different sensibilities. Collectively, they enrich reflection on the problematic of bringing embodied sensations into *feel-able* form.

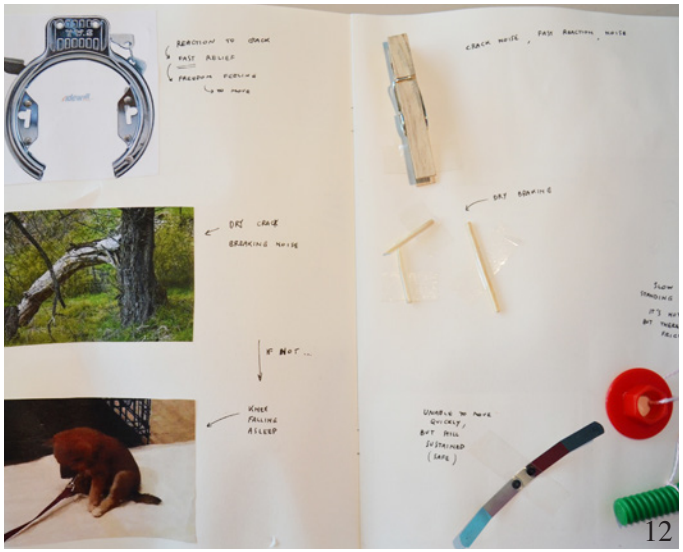



**Fig. 12-13. *Wear.giovanni* experience boards for the knees**


**Fig. 14-20. Prototyping process: *wear.mascha* (14-17); *wear.giovanni* (18-20)**

## 4.Prototyping

In the fourth focus, the *wear.x* creator begins to place the collected "experiences" on their own and others' bodies. The aim is to discover how they might eventually be worn. The focus here shifts between: "Ideating on the body in context (...). Exploring materials on, with and through the body in context (…). [and] Prototyping functionality on the body in context (...)." [13]. Significantly, each person tested will relate to the materials from a particular—idiosyncratic—perspective. The process of leveraging these, perhaps diverse, reflections will iteratively shape the decision-making process. Cycling through making and testing will support the emergence of an appropriate embodiment of the creator's discomfort.

*Wear.x* instances are worn. The emerging object should thus be able to be put on and taken off by people with different physical capacities and attributes. The final instance should also be *appropriately wearable*. In determining what constitutes appropriate, the creator will need to be: flexible in their decision-making, and sensitive to the responses of participants. They should also resist making decisions too quickly. Impulsive decisions can close down a prototype's potential, and short-circuit the development process. The aim in this focus is therefore to develop a relatively unresolved and flexible prototype that can fit radically different body types and thus be tested by as wide a variety of people as possible.

**5.Aesthetic Refinement**
This focus engages with the aesthetic impacts of the emerging wearable: how it looks, feels, smells, etc., and thus the complex aesthetic ways in which it simulates the discomfort it will embody. Most *wear.x* wearables will be seen before being worn. The visual impact will thus be important. Following, tactile aspects are crucial. How will it feel to put it on? Indeed, how will it be put on? Is the wearer "dressed" by the creator, or do they put it on themselves, navigating the unknown of this curious wearable, undertaking a different path of discovery?

This focus transforms a rough prototype into an aesthetically refined wearable that effectively simulates the aesthetic richness of the chosen physical discomfort. The aesthetics of the wearable should thus converge the creator's vision, with the wearer's rich physical experience of the artifact.

In the following pages, we discuss *wear.mascha* and *wear.giovanni*, to clarify how the method plays out in action.


**Fig. 21-26. Development stages of the head piece of *wear.mascha***




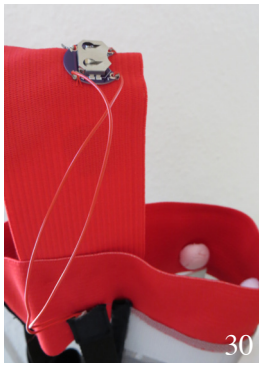



**Fig. 27-31 *wear.mascha*: overview (27); details: headpiece (28-30), vest (31)**

### *wear.mascha*

*Wear.mascha* (fig. 27-31) consists of a vest and headpiece, designed to simulate the creator's migraine and tinnitus. The headpiece is made of two elastic straps that create tension. Inside the headpiece, four half-Styrofoam balls point towards the wearer's skull to simulate pressure. A mask covers the face, and two mirrors are placed at the temples, facing towards the eyes to simulate a feeling of introversion, of being isolated and unable to socialise. The creator's migraine radiates through her entire body. To simulate this aspect of the experience, adjustable straps connect the headpiece to a half-vest, to pull the wearer's head towards their torso. To simulate the creator's lived experience of tinnitus, the headpiece includes a vibrating motor, positioned over each ear. To the creator's surprise, it was determined during user testing that the high-pitched sound of her tinnitus was not sufficiently nuanced to simulate her experience of living with this constant, annoying sound, in part because the sound was familiar to most people. The use of vibration provided a more accurate simulation of her particular lived experience of tinnitus.


### *wear.giovanni*

*Wear.giovanni* (fig. 32-35) consists of three elements: *the bubble*; *the cracking*; and *the needle*, which collectively simulate the creator's knee problems.

*The bubble* (fig.33) is a soft, warm strap with an embedded an air bubble, tied around the leg, above the knee, with the bubble facing inwards. This element simulates the experience that—after certain movements—air seems to accumulate under the creator's skin. This feeling is at first comfortable and warm. It then becomes unpleasant, and can only be released through use of *the cracking* (fig.34).

*The cracking* is a crushed can that attaches to *the bubble*'s strap at the rear of the knee to create a cracking sound whenever the leg is bent. This element simulates the creaking and cracking of the creator's joints.

*The needle* (fig.35) is an adjustable strap with a cardboard rectangle and pointy stone. *The needle* is used to pressure a specific point on the outer side of the left knee. The cardboard rectangle pushes the stone more strongly onto the contact point to enhance pressure.




**Fig. 32-35.** ***wear.giovanni*****: overview (32); details:** ***the bubble*** **(33),** ***the bubble + the cracking*** **(34),** ***the needle*** **(35).**


**Fig. 36-41: User testing: *wear.mascha:* creator testing (36); user testing (37-38); *wear.giovanni* user testing (39-41).**

### *Wear.x*–enhanced embodied exchange

*Wear.mascha* and *wear.giovanni* were tested with a variety of users, aged between 22-45 years. No information was provided about the project's intentions. This ambiguity helped to determine the instances' effectiveness.

Most participants demonstrated a high level of curiosity—through body movements, attitudes and questions—about the appearance of *wear.mascha*. Some expressed concerns about *wear.giovanni*, in particular *the needle*, which "looked painful". Responses when wearing the two instances ranged between extremes. One user could not bear the vibration of *wear.mascha* at his head and stopped the testing process after a few minutes. In contrast, another user enjoyed wearing the prototype, moving around with it and experimenting to understand how it would influence his body in motion. A third user of *wear.mascha* said "this reminds me of having my migraine". This statement led to an exchange of personal experiences of living with migraine. The materiality of *wear.mascha* was used to negotiate shared understanding. Similarly, *wear.giovanni* instantly reminded two users of their personal knee impairments, and *the cracking* sound appeared familiar to all users tested: on hearing it they all proclaimed having experienced similar bone and joint cracking. While this response had value, reactions to *the needle* were more pertinent from the creator's perspective, who said that *the needle* enabled him to express something that others do not typically know about him. The particular materiality of his instance enabled him to negotiate shared understanding of the pain he experiences when walking, and in other situations in daily life, something he had not previously managed to adequately communicate.

Over the course of 15 user tests, we determined that 5-10 minutes wearing a *wear.x* instance was sufficient to get

an impression of the different components of the wearable. Of course, how a user experiences the simulated discomforts is idiosyncratic. They each walked, jumped, or otherwise maneuvered their body to explore the impact of the *wear.x* instance. Wearablility thus became a crucial attribute. Users would pay close attention to the different qualities of their embodied engagement with the instance, and their felt experience of what the instance was doing to them. This attentiveness was used as a primary resource to negotiate a way through to shared understanding. In the process, the instances pointed to potential user groups (creator and wearer pairings), and use cases.

## Potential User Groups and Use Cases

*User 1: Users that have not previously experienced the issues embodied in the instance.* In testing, such users claimed a new understanding of the *wear.x* creator, and enhanced understanding of the impact such experiences might have on their daily life.

*User 2: Users that have personal experience of discomforts similar to those embodied in the instance.* In this case, the *wear.x* instance served as a locus for fruitful and unexpected dialogue about similarities, differences and possible treatments. Participants also discussed an emergent sense of community that they thought might help overcome the feelings of isolation that often accompany challenging, embodied discomfort.

We propose potential users of *wear.x* wearables could include healthcare professionals, family, friends, colleagues and employers. *Wear.x* could thus help doctors, social workers, life-partners and others improve professional support services and productively reshape shared daily routines. Following we discuss some related work to provide further context.

## Related approaches

A range of methods exist to support empathic understanding of discomfort. *Empathic Modelling* [14], for example, is an informal technique that designers can use to put themselves in the position of a disabled user, to better understand how a particular disability might play out in everyday situations. This method does not focus on personal experience. Rather it uses affordable materials to quickly protype projected situations, as a first step towards understanding a particular user group. [14]. In a different approach, *The Chronic Facility* [12] uses food as an abstract representational tool to enable individuals to communicate their embodied experience of *Multiple Sclerosis*. This approach enables doctors and patients to find unique expressions for their complex feelings and discomforts. Case-specific projects have also been developed to afford embodied reflection on a range of discomforts (c.f. [1, 9, 10]). These examples, the above methods, and our findings to date point towards the value of enriching people's ability to negotiate shared understanding of the embodied experience of discomfort, and the need for focused development in this area.

## Conclusion

The *wear.x* method allows the creation of *wear.x* wearables by a variety of people, with the purpose of affording alternative articulations of that which is difficult to bring into language. *Wear.x* instances afford enriched, embodied connection, conversation and exchange: perception is enhanced through the interplay of materials, form and felt experience, and new understanding emerge. *Wear.x* wearables thus empower creators and users to experience their surroundings and each other in a new way. Our findings underline the social value of *wear.x* wearables, the contribution of the *wear.x* method, and the value of extending this research, in particular in different use-case scenarios.

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