

# Adorned in Memes: Exploring the Adoption of Social Wearables in Nordic Student Culture

Felix Anand Epp  
mail@felix.science  
Aalto University  
Espoo, Finland

Anna Kantosalo  
anna.kantosalo@helsinki.fi  
Aalto University  
Espoo, Finland  
University of Helsinki  
Helsinki, Finland

Nehal Jain  
jainehal03@gmail.com  
Aalto University  
Espoo, Finland

Andrés Lucero  
lucero@acm.org  
Aalto University  
Espoo, Finland

Elisa D. Mekler  
elisa.mekler@aalto.fi  
Aalto University  
Espoo, Finland



Figure 1: Some of the Digi Merkki that participants created.

## ABSTRACT

Social wearables promise to augment and enhance social interactions. However, despite two decades of HCI research on wearables, we are yet to see widespread adoption of social wearables into everyday life. More in-situ investigations into the social dynamics and cultural practices afforded by wearing interactive technology are needed to understand the drivers and barriers to adoption. To this end, we study social wearables in the context of Nordic student culture and the students' practice of adorning boiler suits. Through a co-creation process, we designed Digi Merkki, a personalised interactive clothing patch. In a two-week elicitation diary study,

we captured how 16 students adopted Digi Merkki into their social practices. We found that Digi Merkki afforded a variety of social interaction strategies, including sharing, spamming, and stealing pictures, which supported meaning-making and community-building. Based on our findings, we articulate "Memetic Expression" as a strong concept for designing social wearables.

## CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; **Empirical studies in collaborative and social computing**; **Empirical studies in ubiquitous and mobile computing**; *Collaborative and social computing theory, concepts and paradigms*; Ubiquitous computing; Interaction paradigms.

## KEYWORDS

Research through Design, Social Wearables, Social Practices, Adornment, Digital Expression, Co-design, Field Study, Memes, Social Computing, Wearable Computing, Nordic Student Culture



This work is licensed under a Creative Commons Attribution International 4.0 License.

CHI '22, April 29-May 5, 2022, New Orleans, LA, USA  
© 2022 Copyright held by the owner/author(s).  
ACM ISBN 978-1-4503-9157-3/22/04.  
<https://doi.org/10.1145/3491102.3517733>

**ACM Reference Format:**

Felix Anand Epp, Anna Kantosalo, Nehal Jain, Andrés Lucero, and Elisa D. Mekler. 2022. Adorned in Memes: Exploring the Adoption of Social Wearables in Nordic Student Culture. In *CHI Conference on Human Factors in Computing Systems (CHI '22)*, April 29–May 5, 2022, New Orleans, LA, USA. ACM, New York, NY, USA, 18 pages. <https://doi.org/10.1145/3491102.3517733>

## 1 INTRODUCTION

Wearables and smart garments have made their way into everyday life. Significant growth of the smart clothes market are expected in the coming years with a myriad of new clothing items that will be connected [56]. Meanwhile, fitness trackers and smartwatches have already become everyday clothing items. Through their immediacy to our bodies, wearables are with us through the patchwork of situations that make up our lives [47].

When taking on the form of clothing, wearables become a part of our appearance, and therefore our self-presentation [24] and their attributes become part of our expressions towards others. Therefore, design scholars have argued that wearables need to be considered in terms of their performative characteristics and consequently included fashion design into the process of creating wearable products [17, 65]. As such, wearable design touches the disciplines of HCI, Design and Fashion alike.

Concurrently, HCI scholars have been eager to leverage technology that is co-present in our face-to-face engagements. These co-present technologies promise to enhance our collocated social interactions, augment self-presentation or enable new ways to connect with people [50] – in short, social wearables [12]. A recent call for a renewed push towards creating such technologies focuses on how wearable technologies can augment social interactions and extend our capabilities [29]. To this end scholars have identified different quality criteria and requirements for design. On the technical level, wearables, both as fashion technologies and as augmentations of social interactions, need the right balance between sensing and actuating [12, 66]. On the social level, researchers raised questions of power, invasiveness [12, 66], and social acceptability [12, 51]. However, despite more than two decades of co-present interactive systems, Isbister [29] concludes that the promises of such technologies have not yet successfully transferred into our everyday lives and commercial wearable still mainly focus on use-cases around health [31]. While it is yet unclear what impedes adoption, it is likely that HCI still lacks a comprehensive understanding of how social technology and wearables constitute people's everyday social interactions. Most existing research breaks down social interactions into distinct instances of interaction, e.g. in the form of “social ice-breaking” [e.g. 7], without considering the context of people's lives [50]. Consequently, a better understanding of how to design social wearables that embed into our lives, as well as how they shape social life is needed to identify underlying drivers as well as potentially foster the adoption of wearables for social interactions [17].

This gap calls for explorations of technology embedded in people's everyday life. Here, a perspective on *social practices* is particularly useful, as they are understood as performances of everyday behaviour and building blocks that make up the lives of their enactors [60]. Therefore, we present a research-through-design [63] case employing practices-oriented design [42] that resulted in a

novel social wearable embedded into existing practices. The focus of our work was not to design and evaluate a social wearable, but rather to understand people's practices with social wearables via generative design research [72].

Specifically, our work is situated in the context of Nordic student life, where students practice a rich cultural tradition of wearing colourful boiler suits in private student events and public life (see Figures 1, 2 & 10). By applying various adornments, such as clothing patches, these suits become an expression of group membership and individuality [20]. In this paper, we present the co-design [72] of a social wearable, Digi Merkki, as well as a field intervention in the specific cultural context of Nordic university student dress. We investigate how Nordic university students utilise Digi Merkki, an interactive clothing patch, for their socio-cultural practices to gain a better understanding of how a particular community of practice adopts a social wearable, bringing a digital form of expression into a traditionally mostly analogous adornment practice.

From our field study we identified three main themes: Digi Merkki shaped our participants' social practices of adornment. In particular, the openness of our design fostered emergent practices such as dare challenges and spamming. Moreover, participants came up with varying strategies to navigate tensions brought on by the changing practices. Across these themes, we identified internet memes as a helpful tool for participants to mediate meanings when interacting with others through Digi Merkki.

Based on this, our work makes the following contributions: First, we showcase a design intervention with a wearable that successfully shaped students' social practices, at least in the short-term. In particular, we identify memes in digital culture as a mediating concept that fostered integration into existing social practices, as well as facilitating emerging novel practices. Second, we articulate Memetic Expression as a novel strong concept for the design of social technology to foster identity and community. Taken together these contributions may inform researchers and designers in understanding and guiding the adoption of social wearables.

## 2 RELATED WORK

### 2.1 Augmenting Face-to-Face Social Interactions

Recently, HCI scholars have argued for renewed efforts in using interactive technologies for augmenting collocated social interactions [29, 50]. This call follows an over two-decades-long history of researching technology that suits interpersonal interactions in the “same place, same time”. Early works studied wearables [3, 21, 52] and public displays [46] to present personal information to collocated people. With the advent of mobile devices, researchers investigated self-expression [55] and picture sharing [43] by leveraging the proximity of people for engagement through technology. In recent years, research efforts have concentrated on understanding uses of personal displays for public viewing [9, 32, 37, 40]. Especially, advances in fabrication and smart textiles have led to the exploration of wearable displays and expressive garments to attract attention [7, 15, 25, 53], display personal information [1, 8, 9, 25, 26, 53], or other social signalling [14, 26, 45]. Another strand of research has looked at wearables as more proactive tools of changing collocated

social interactions, like secret nudging [35] or gaming [6, 30]. Both strands can be considered under the term “social wearables” [12].

Despite these efforts and advancements in wearable computing, widespread adoption of these social wearables has remained limited, despite computer-mediated communication permeating everyday life. This disparity was attested by Olsson and colleagues in their literature review of technologies for collocated social interaction [50] and critiqued in Isbister’s suggestion for “supra-human technology” [29]. Existing works have used approaches centred around a design artefact [8, 9, 14, 15, 25, 35], data [7, 9, 32], or the users’ proximity [7, 32]. Only few studies [11, 45] have investigated the social settings, practices and rules in place. This deficit corresponds with Olsson and co-authors’ observations for all collocated social interactions technology [50]. This research gap is particularly evident when we consider that the social relationship between people is the strongest factor for interpersonal engagement [67] and social influence a dominant factor for the adoption of collaborative technology [49]. Hence, a deeper dive into everyday settings and social practices is necessary to gain insights into the drivers underlying the adoption of wearable social technology.

## 2.2 Designing Social Wearables

Wearables can indeed be adopted in our everyday lives while integrating with our social interactions, as exemplified by findings on smartwatch use [47]. However, in the previous section, we identified a gap of technology that actively augments social interactions. Dunne and colleagues [17] have already identified aesthetics, social identity and cultural norms as factors of social acceptability of wearables. As these norms and identities change over time for every individual, Dunne and colleagues conclude that a checklist for achieving the social acceptability of wearables is not feasible. Instead, they suggest several guiding questions. For example, “What mechanisms are available to mediate that acceptance process?” [17] Similarly, privacy is an often quoted factor for the successful adoption of social wearables [12]. However, Dourish & Bell [16] suggest privacy as a dynamic concept of negotiation for ubiquitous technology to “support the human social and cultural practices through which [privacy and related concepts] are managed and sustained.” Over recent years, other works have contributed guiding principles. In their work on textile screens, Devendorf and colleagues [14] propose ambiguity as a tool to allow for open experiences. This aligns with Fallman’s [22] assertion that for experiences that should be “lasting or even grow . . . , usability may be counterproductive”. Even more so, interactions that require effort can create meaningfulness and therefore be a source for design, especially in socially engaging systems [36].

Similarly, work on social wearables proposed openness in the functioning of systems. Dagan and colleagues [12] suggest that the interplay of actuation and sensing might be reconfigured by the wearer, as a promising approach. Further, social wearable scholars made use of “strong concepts” [27] to formulate guiding principles. With “interdependent wearables” [30] and “synergetic technologies” [10], Isbister and colleagues articulated strong concepts that can be leveraged for social wearables and beyond.

Outside of the field of HCI, the adoption of wearables is also studied in marketing research. Kalantari [34] suggests user-centred

methods and that users “actually wear the devices” when inquired about adoption. Ideally, such studies should investigate how users “develop attitudes towards wearable technologies over time.” This aligns with Olsson et al.’s [50] proposal to focus on distinct socio-cultural settings. Indeed early works in the field of “same place, same time” technologies proposed design for culture and community [4, 38]. However, HCI scholars have rarely picked up on this avenue.

## 2.3 Adornment, Fashion and Digital Expression

In recent years, fashion design has looked into wearables in the form of “fashionable wearables” [23, 65] and “digital expression” in clothing [45]. Here, researchers try to understand how digital garments might integrate their technical functions into the social functions of dress.

Adornment long has been understood as a tool for an individual to demarcate personality [61]. In her seminal book “Adorned in Dreams” Wilson [70, p.3] unites adornment, dress and fashion as human activities that do not just express superficiality but actually “play symbolic, communicative and aesthetic roles.” From the current understanding in fashion studies, we can see wearables as part of the social system of reproducing symbols and identity through consumption and display [2, 19]. Work in fashion design on wearable technology [23, 45, 65] suggests exploring people’s lived experience in “genuine social contexts” to identify “emerging patterns” [45]. In “same place, same time” literature, few works have evaluated their design for effects on the social practices of participants [50]. Hence, clothing practices and adornment are particularly promising social practices to explore wearables that are meant to augment our social interactions.



**Figure 2: The boiler suit of an active student after finishing their studies.**

## 3 NORDIC STUDENT CULTURE AND THE PRACTICE OF ADORNING BOILER SUITS

Fashion is a tool used by people to form distinct social groups [70]. University students often follow certain styles, even as a form of tradition, e.g. letterman jackets in North America [69]. In European countries fraternities have followed particular cultural dress codes for centuries. Nordic students, for instance, developed a tradition of



wearing colourful boiler suits [68]. Student associations in Finland, Sweden and Canada provide their members with these suits as a form of affiliation [68]. In Finland, students dress in their boiler suits for different occasions: parties and ceremonies, especially around spring carnival (fi: *Vappu*), but also educational events and excursions. These colloquially named “student overalls” (fi: *opiskelijahaalarit*) have a particular colour for each student association and are customised by each student individually.

We based our work on this particular socio-cultural context, as it serves as a clear delineation of social practice. Practices depend on the interconnections between different elements, which Shove et al. [60] categorise as materials, competences and meanings. As connections form and break between these defining elements, practices emerge, persist and disappear. Next, we describe the practice of adorning boiler suits in more detail based on previous ethnographic accounts [20], as well as our own observations and experiences.

**3.0.1 Materials.** The dress oriented practices include several clothing items as materials: The oldest clothing item connected to this practice is the student cap. Nordic students traditionally wear white student caps during the summer period starting with the Vappu carnival celebrations on the eve of May the first. Technical students (colloquial Finnish: “Teekkari”) earn the right to wear a specific Teekkari cap. These technical students also first introduced boiler suits as a student outfit. Nowadays most subject associations hand out overalls or lab coats as uniforms for their members, each with a specific association colour. Central to the adornment practice are clothing patches. These patches are handed out by associations, in events, as promotional materials by companies or sold by patch dealers. Students collect a large amount of patches, so it is quite common that space on the boiler suit runs out (see Figure 2). Therefore students have a pocket full of loose patches to sew on later or trade. Several other adornments are also frequently used, like drinking cups, belts, ropes, pins or custom-made collars and hoods. Especially for the technological students these materials include electronics reflecting their field of study.

**3.0.2 Competences.** In the first week of studies new students are introduced to the traditions of the student community and subject associations. The associations even give dedicated lectures on the particular clothing traditions, including the boiler suits. Due to mandatory military service most men already have knowledge of military traditions, which help them to understand ranks, structures and heraldry symbols inside these student associations. Most Finnish students already know how to do basic sewing due to housekeeping education in primary school. Students gather other competences supporting their adornment practices from subjects or topical associations.

**3.0.3 Meanings.** Most meanings associated with this practice revolve around the identities of the students. By adorning their suits, they generate a personal presentable history, which represents their status and membership. Consequently a lot of themes in this community deal with community and brotherhood. Being a student means being part of youth culture, as one lives the first time by themselves. In so far, testing out limits, e.g. alcohol, intimate relationships, is tightly intertwined with the adornment practice

itself, for example, legs of the boiler suit may be exchanged with intimate partners and arms with friends. While this community cherishes traditions, they also celebrate reinventing them. In general self-made adornments are valued highly, exemplified by the rule to sew on the patches, never glue. Consequently local memes and their distribution can constantly be seen with ever new patches referencing existing memes and student life (see the adaptation of the meme “This is fine”<sup>1</sup> in the right picture in Figure 1).

## 4 CO-DESIGNING AN INTERACTIVE CLOTHING PATCH

In the following section, we describe our collaborative design process that led to our field intervention. We illustrate our design activities and the characteristics of the research prototype.



Figure 3: Different stages of the prototypes during our co-design activities.

### 4.1 Co-design Process

Our motivation was to understand the adoption of social wearables situated in people’s practices. This practices-oriented approach [42] deals with a speculative future. We choose the generative, collaborative research practice of co-creative design as it fosters “learning from the collective creativity” of the community to innovate [72]. This co-design approach is generative in developing and studying prototypes [58]. Therefore, the design process needed to result in a wearable research prototype for augmenting social interaction that embeds in the local cultural practices. Here, we chose to design for possibility [13] not to solve a problem, and built on the community’s existing assets, instead of its needs [71]. This position shifted the perspective towards a potential future this community desires. In our process we facilitated co-design tasks, implemented various prototypes, and iterated based on participant feedback and testing.

The design group consisted of the first author, who was responsible for facilitation and prototype implementation and up to four more HCI researchers and designers from the same institution with varying involvement. Additionally, we invited two students with

<sup>1</sup>This Is Fine. Know Your Meme. Retrieved January 10, 2022 from <https://knowyourmeme.com/memes/this-is-fine>



extensive knowledge of the local student culture as co-designers into our design group. Both co-designers had extensive proficiency in crafting student outfits, in organising community events in the local student culture, and student traditions, and one of the co-designers was a cosplayer [41], i.e., they create and wear their own costumes representing popular media characters. Together with the first author these two students were participating in the design process throughout.

We adapted the design framework for Social Wearables by Dagan and coauthors [12] to guide the design decisions. The framework encompasses five aspects of social wearables for design: Sensing, Actuating, Sensing-Actuating Interplay, Personal and Social Requirements, and Social Acceptability. We added two categories that did not focus on interaction but material characteristics. The factor “form” asked for material characteristics as well as clothing style and aesthetics. The factor “environment” asked for endurance requirements and context of use, e.g. “water resistance”.<sup>2</sup> We derived these additional requirements from existing frameworks of wearability [17, 48].

We formulated first ideas for Digi Merkki during a co-design workshop on social wearables for eight students facilitated by two designers. This workshop was for design and engineering students to work on individual ideas for wearables based on our revised social wearables design framework. The workshop was informed by design concepts for Nordic students identified in our earlier work [20] as inspirations. Our design group saw potential in the concepts “Personal Displays For Ice-breaking”, “Displaying Group Belonging Dynamically”, “Interactive Badges for Collecting”, “Grabbing Attention”, and “Status Display” (see [20] for more details). Therefore our design process aimed for a social wearable that brings people together and supports them in self-expression.

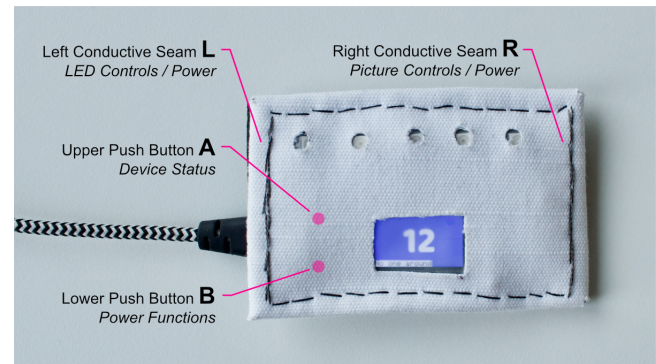
Based on the community practices revolving around developing identity, the concepts and the feedback from students during the workshop, we decided on the main functionality and piece of clothing of our social wearables in our group of co-designers. The core functionality of Digi Merkki aimed for “enabling handshakes”, “displaying social ties”, and “self-expression” as a merge of the concepts above. This initial idea aimed at directly integrating the technology into the overalls themselves.

We changed the design to non-physical handshakes to offer interactions with strangers, which also helped in the context of changing physical distance regulations due to the COVID-19 pandemic. We then decided on the form of an interactive clothing patch that connects to other patches nearby, which enabled interaction over bigger distances and more flexibility in how students would use the wearable on their overalls. Together with our co-designers, we identified requirements based on these goals: Digi Merkki needs to integrate into the overall and not become an additional device; visualisations must be visible beyond 1.5 meter distance; the patch needs to be water-resistant for outside use.

After producing the first rapid prototype (circular patch in Figure 3), we probed three devices in a week-long field test with three people (two researchers from the design group, one external). This test made us explore the interaction concepts, the wearability and technical implementation. Based on the findings, we refined the

interaction design and aesthetics in another co-design session. Initially, users performed the non-physical handshake by entering a five-digit cypher. We realised that trading pictures simulates a handshake and switched to a time-based interaction. The first prototypes had touch surfaces that resembled push buttons. However, those interactions made the device appear as a mobile device instead of a wearable embedded into clothing. To enable more embodied interaction, capacitive sensing was embedded into the seams, so users can use their whole hands to cover parts of the patch. We also changed the dimensions to the final format (rectangular prototypes in Figure 3) and decided on implementing a semi-flexible attachment with hook and loop fasteners to allow a variety of body positions. This way we managed to create something integrated enough to be considered part of the overall, while still allowing for easy access to the electronics.

We then tested the final functionality in a four-person event (one researcher from the group, three externals). This mainly contributed to stability improvements. After that, the co-design focused on structuring the intervention around activities for the students, not just the prototype itself as we moved on to testing the wearable with students in-situ. We revisited the production process (see Figure 3) to make it easier to multiply and copy Digi Merkki. We included options to customise the physical (front layer fabric) and digital (personal pictures and LED colour) aspects of Digi Merkki to the students preferences. The final product was a creation kit with the electronics ready-to-use and instructions for producing a personal patch (see Figure 7). Here, we chose involving handicrafts for enabling personalisation and leveraging pre-existing skills [54].



**Figure 4: A Digi Merkki prototype showing the final functionality while charging.**

## 4.2 Scenario and System Design

Looking at Digi Merkki as a mobile experience for collocated interactions, we can describe it from a temporal, spatial, social and technological perspective [44]. Without clear goals or a time frame Digi Merkki allows for individual pace. Patches connect to each other in an approximately 50-meter radius. The proximity to other users enables social interactions through the devices. The primary features are synchronous visualisations based on proximity and social ties and trading digital images with collocated users. These

<sup>2</sup>See the template in the supplementary material.

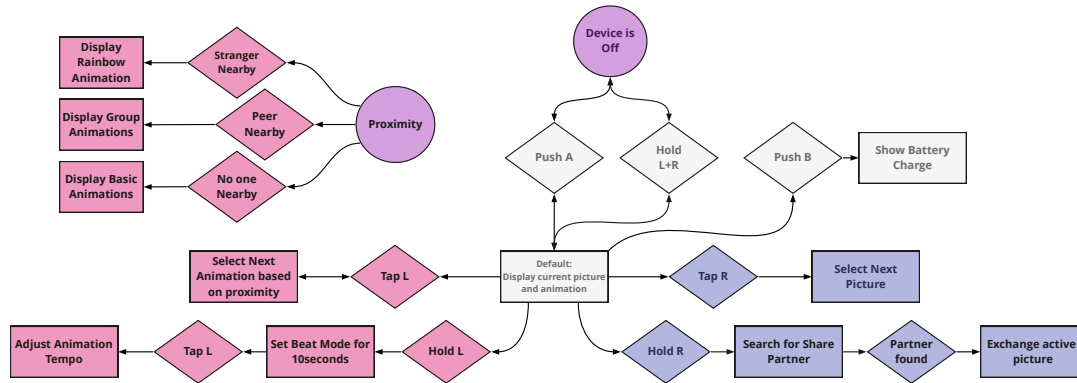


Figure 5: Flow diagram of Digi Merkki depicting the operation of the light animations in red and the picture trading in blue.

technological functions rely on the coordination of activities between participants. Apart from the relation towards other users and their decisions, there are no external triggers from the environment.

The final patch consists of a screen, LED lights, WiFi for connectivity, and capacitive seams and push buttons to control the device with a size of approximately 65x95 mm and a thickness of about 11 mm. The patch will alert the user of nearby devices by changing to a specific LED animation (see Figure 5): Each participant's lights have a user-defined colour. Being around people who are part of your friend group activates more complex albeit single-colour animation patterns. If strangers are close by, the patch lights up in a rainbow pattern.

The patch senses user input through capacitive touch embedded into the seams. As shown in Figure 4, there are two touch-sensitive seams to use the patch. The right seam (R) controls the pictures on the screen, the left seam (L) controls the LED animations and touching both at the same time controls power. Additionally, two push buttons (A, B) are under the fabric next to the screen for secondary functions and fallback power control. A single tap on L or R selects the next animation or picture, respectively. Additionally, users can change the speed of all animations by holding and then tapping L. Adjusting the speed also synchronises the speed on the patches of close-by users. To trade pictures, two users have to hold down R for five seconds simultaneously. This will exchange the pictures currently selected in their respective screens.

### 4.3 Technical Implementation

All devices follow the same technical design. This allowed us to reproduce devices in sufficient numbers to function collectively. As a basis for the computational requirements, we choose development boards based on the ESP32 chip to handle logic and establish connectivity. We decided on WiFi and a mesh network topology to allow connections between different aggregations of collocated users and the use of a high-level protocol to support our rapid prototyping. For user input, we used capacitive sensing in the seams of the device. After testing different setups and textile force sensors, we chose those to enable robust low fidelity interactions. For output, the micro-controller has an embedded 240x135 pixel TFT screen. Additionally, we attached a flexible strip of addressable colour light-emitting diodes. The device is powered by a 1000mAh

Lithium-Ion battery attached to an internal charging controller on the micro-controller.

## 5 FIELD INTERVENTION

The main goal of this work was to explore potential drivers of adoption of social wearables from an in-situ perspective on practices. Therefore, the focus of our work was not to design and evaluate a social wearable but rather to understand changing user practices. We here understand adoption as the Nordic students' utilisation of a social wearable in their cultural practices. To this end, we conducted a field study adjunct to our design process. This field study focused on exploring the effects on students' practices of creating and using an interactive clothing patch.






We produced 20 co-creation kits with the same functionality and distributed them to a mix of individuals and groups. First, participants customised and finished their devices in remote group workshops or alone. Then we captured their use and interactions with an elicitation diary study over two weeks with four organised gatherings. Finally, we interviewed each participant individually for their experience. The university's ethics committee assessed and approved the study.

### 5.1 Research Questions

As our unit of analysis was students' practices [39] rather than individual momentary interactions with Digi Merkki, we formulated the following research questions to guide data collection and analysis:

- RQ1: How do individual students utilise Digi Merkki with different strategies?
- RQ2: What measures do participants perform to adapt their self-expression practices and social interactions to the constraints introduced by Digi Merkki?

RQ1 helped us to keep an individual perspective. RQ2 looks at the relationship between the changes in practices and the specific characteristics of Digi Merkki. This perspective should help identify insights on the barriers and limitations of adoption in people's practices.

Week	1	2	3	4	5	6	7	8	9	10	11
Phase	1: Co-Creation						2: Elicitation Diary Study				
Participants	20						16				
Measures	<i>Recruiting</i> 	<i>Cocreation</i> 				<i>Halftime Briefs</i> 	<i>Gatherings and Diaries</i> 	<i>Interviews</i> 			

**Figure 6: Timeline of the field study over eleven weeks. The activities (written in italics and underlined) were held remotely until the seventh week.**

## 5.2 Participants

For our study, we recruited 20 students (13 men, five women, one non-binary person, one person chose not to disclose their gender) between 19 and 26 years (average 22). To have a mixed sample of the local student population, we recruited students from different disciplines. The participants spread across different study years (seven first-year, seven second- to third-year and six fourth year and later) and fields, from computer sciences (12), other STEM fields (5), as well as pedagogy (2) and design (1). All students were active in student associations like subject guilds or interest clubs (e.g. crafts or video games). They attended multiple association events a year, with nine participants holding active chairing roles in their respective associations. We recruited individuals and groups of friends to have a mix of different social ties between our participants. Each participant received ownership of their creation kit and their version of Digi Merkki. Four participants did not join the elicitation diary study due to time constraints. For the additional time spent on the data collection, each participant of the remaining 16 participants received two cinema vouchers with an approximate value of 15 USD.

## 5.3 Procedure

The primary method to collect data on our research questions was a field study using a design intervention. As shown in Figure 6, the field study consisted of two main phases the co-creation and the elicitation diary study:

- (1) Participants remotely created personal interactive clothing patches based on our electronic textiles co-creation kits.
- (2) Participants wore Digi Merkki and reported their experience in a two-week elicitation diary and subsequent individual interviews.

**5.3.1 Recruitment and Questionnaire.** We advertised the study in local student social media channels. After registering their interest, we invited students to a personal video call. The personal calls helped brief participants about the procedure and establish a personal connection between researchers and participants. This connection was essential for the personal character of the interviews. Participants also received all necessary study documents electronically before the study.

After this briefing, students could sign up by filling in a questionnaire. The questionnaire captured standard demographic information and more detailed factors of the student's participation in the local cultural activities. Finally, participants provided three

digital images and a colour-code for their personalised interactive clothing patch.



**Figure 7: Contents of the co-creation kit that each participant received.**

**5.3.2 Co-Creation.** For building their personalised Digi Merkki, each participant received a creation kit containing the electronics patch prototype, various textiles and a battery (see Figure 7). Participants received detailed instructions for the process (see Figure 8) and were free to build their Digi Merkki by themselves or with our assistance during remote workshops. To empower our participants, we provided means to modify and appropriate Digi Merkki throughout the intervention. The hardware specifications and software are available as open-source<sup>3</sup>. Further, we encouraged participants to use and modify their patches freely.



**Figure 8: These pictures are examples from the instructions given to the participants.**

<sup>3</sup>Felix A. Epp. 2022. eppfel/DigiMerkki: Field Evaluation Prototype. Zenodo. DOI:<https://doi.org/10.5281/zenodo.6327712>



**5.3.3 Elicitation Diaries.** After participants had finished their patches, we met them again in personal calls. At his point between the two phases of the study, four participants dropped out of the study. These participants voiced time commitment as the reason for not attending the rest of the study. Hence, we only gathered feedback on the co-creation experience and briefed the remaining 16 participants on the procedure of the field study.

For capturing the participants' utilisation of Digi Merkki, we used an event-contingent survey to fill an elicitation diary [33]. The survey contained two parts, "suit-up" and "return". Participants filled the suit-up survey every time they dressed up and wore Digi Merkki. Participants filled out the return survey when they were on their way home from an event or started charging Digi Merkki. The quick surveys asked for contextualising information, like social ties and activities, and samples of experiences with Digi Merkki. These snapshot diaries are not descriptive but elicit deeper inquiry in the consecutive individual interviews. This shorter process removed the burden of filling detailed diaries while still capturing accounts of subjective experience.

**5.3.4 Gatherings and Observations.** With a small-scale study in a large student population, the chances of serendipitous encounters between participants were low, mainly because events were limited in size due to the ongoing COVID-19 pandemic. Therefore we staged four small events during the 14 days of data collection. Each event was advertised as an after-work hang-out and provided light catering. The third and fourth events included a barbecue by one of the participants. All gatherings were open ended and lasted between 90 and 120 minutes, and two researchers were attending for participant observations. The two researchers reflected on their observational notes after each gathering. Additionally, we introduced a competition for collecting the most pictures as an incentive for the participants to engage with each other.

**5.3.5 Individual Post-intervention Interviews.** People present themselves based on their audience. Hence, it was paramount to interview each participant individually to allow a more intimate reflection on their motives during the social engagements with Digi Merkki. We interviewed all participants of the second phase ( $n = 16$ ) individually during the two weeks after the field intervention. Participants handed over their patches to retrieve the internal log data. We interviewed them about their experience with Digi Merkki and other participants. Each interview contained individual questions based on the observations and diary entries. The interviews lasted one hour on average (from 43 min to 1:39 h) with a total of 16.25 hours of interview material.

## 5.4 Data Collection and Analysis

We used a mix of collection methods to capture how students perceived Digi Merkki and how participants utilised Digi Merkki as part of "wearing student uniforms". The primary source for answering our research questions were the individual interviews. Our analysis drew from:

- Questionnaire answers on cultural practices
- Resulting designs of the co-creation (patches and choices of digital pictures)
- Elicitation Diaries

- Field notes from the participant observation during four organised gatherings
- Logging of device interactions of each participant
- Audio-recordings of the in-depth individualised interviews

As presented before, this work aimed to investigate participants' lived experiences, views, and practices. Therefore we chose reflective thematic analysis [5]. Informed by the understanding of self-presentation practices [24] and socio-cultural practices around fashion [19, 70], two researchers coded each half of the interview transcripts. The research questions guide the development of higher-level codes in iterations of reflection between the two researchers. Here, we took a perspective that assumes practices as non-static and identities and behaviour as relative. We then used visualisations of the device interaction data to reflect on our themes. Our analysis generated 25 sub-themes that formed three main themes.

## 6 RESULTS

The following section reports on the three themes we developed in our thematic analysis. We have to note that data points outside the gatherings we facilitated were marginal. Participants reported a lack of student events due to ongoing COVID-19 limitations. Because students wear boiler suits primarily for group settings, there was little need to wear them and, therefore, little use for the patch. Nevertheless, the participants described the organised gatherings comparable to other student events. Further, our themes show clearly how Digi Merkki sparked stark responses from our participants and how they adopted and sustained emergent practices. While each section represents a theme, the subsections reference popular memes to better immerse in the studied culture.

### 6.1 Digi Merkki Adds to Student Social Practices

Our first theme demonstrates Digi Merkki as a material in the students' practices. Here Digi Merkki functioned as an item for adornment and its characteristics brought a new intensity to the practice.

**6.1.1 I Can Has Picture?**<sup>4</sup> The primary motivation to participate in our study and to engage with Digi Merkki came from the underlying practice of adorning the boiler suit: P7 "The whole [boiler suit] culture is about showing off all the badges you have." Moreover, Digi Merkki's lights and screen stand out, especially in nighttime events. Hence, in two accounts of participants using the patch outside our organised gatherings were "an opportunity to show off" (P10). Concurrently, Digi Merkki offered a way to adorn the boiler suit with lights to attract attention and copious visual depictions. Some students aimed for high quantities of pictures for their digital patch, while others looked to collect only particular pictures they were interested in.

Adorning the boiler suits also serves to express the self. Consequently, many participants choose their initial three pictures (see Figure 9) to express their interests (e.g. popular media in 9c,f,u,v or professional topics in 9d,m), affiliation (country in 9p or student association (not depicted)) or identity (e.g. gender in 9b). Especially

<sup>4</sup>References "LOLcats", in particular "Happy Cat" <https://knowyourmeme.com/memes/happy-cat>



**Figure 9: A subset of the pictures participants chose. The caption reads as: [identifier]: [times exchanged between participants], [number of distinct participants that received the picture]. The pictures a, b and x were from participants that did not participate in picture trading. Copyright held by a: Rick Astley / BMG, c: Laser Unicorns Productions, f: Moomin Characters Oy, o: KC Green, t: Aardman Animations Ltd., u: Oksana Rogožina / Jan Smrčka, v: JOKER / NHK / NEP / PPI, x: paxiti**

interesting was that picture memes seemed a valuable source to communicate a mood non-verbally: P7: “[Picture 9i] is my totem animal for the last half a year”. For their picture choices, students often relied on the prevalence of customised stickers in messaging apps, like Telegram, Instagram or Snapchat.

Throughout our field intervention, participants appropriated Digi Merkki for their own needs. According to the culture, students need to stand out with something unique. This uniqueness showed in the participants’ deliberate design choices. Many participants created some customisation outside of the predefined options. For example, participant three chose a reflective outer fabric, participant ten sewed a brim around the screen (see Figure 1 left), participant five skipped cutting the holes and opted to let the LEDs shimmer through the fabric, and participant 14 integrated some detailed embroidery (see Figure 1 bottom). Three participants went even so far as to construct their own hard- or software. Participant 15 built a handheld device with physical buttons in order to have a more long-lasting, safer device. At the same time, participant 13 developed software to draw arbitrary graphics on the micro controllers screen using a mobile phone through a web application. However, this also removed the original software and P13’s possibility to participate in any of the group interactions provided by Digi Merkki. On the contrary P15 asked to reset his device to the original software to participate, although they had implemented some games for the device.

Another use of Digi Merkki that stemmed from existing student culture practices was reminiscence. Many overall patches relate to past events, and their boiler suit becomes a collection of memories

with time. While this presents social status, it also serves students a more inward function. The patches help to remember fond memories and materialise a personal history. This practice showed in the utilisation of Digi Merkki in two ways. First, participants selected pictures for their sentimental value, e.g. as “fun memories from my childhood” (P15). Second, the activity of trading pictures through Digi Merkki brought joy because it resembled Pokémon and other trading games. Finally, multiple participants reported, how they browsed their digital pictures to remember the attached memories.

In summary, we can note that boiler suit practices revolve around membership by connecting students to their subject associations and the student community as a whole. Students confirmed this explicating their motivation to meet new people in our gatherings. Digi Merkki enabled and facilitated social interaction like a “social lubricant” (P10). Wearing Digi Merkki functioned as a ticket-to-talk [57]. For example, participant seven joined a board meeting of their subject association wearing Digi Merkki and was approached because of the characteristics of the device: “people were asking me ‘oh, was it these super expensive kits?’” Furthermore, the rainbow coloured proximity-based animations became “a social enabler” (P8). Additionally, wearing Digi Merkki already symbolised some common interests to others, which can function as a ticket. Lastly, picture trading served as “ice-breakers” (P3) or “conversation starter” (P1). Although pictures were often generic depictions, most pictures bore some personal connections to the wearer, which functioned as a gateway to engage in meaningful conversations.



(a) Two participants posing with the Digi Merkki.



(b) Participants using the Digi Merkki during an event.

**Figure 10:** Students were wearing Digi Merrki during the diary study (a) and using it actively during the organised events (b).

**6.1.2 One Does Not Simply Walk Into Conversation**<sup>5</sup>. All these behaviours exemplify how Digi Merkki integrated into the existing social practices of the students. However, Digi Merkki was able to augment these practices with a new intensity, as P13 described: “[Digi Merkki is] both for you as a relic, but also for [signalling to others] ... , but it’s stronger in both directions.” For one, *versatility* of a digital screen allowed people to display rare, missing or forbidden pictures, as P14 explains: “I was interested in getting the Moomin<sup>6</sup> pictures because we cannot have them ... on the overall anymore”. Further, this *versatility* enabled participants to choose what they wanted to depict more flexibly at any given point in time. Another characteristic is *expressivity*. It helped a wearer to draw attention to themselves in ways fabric patches cannot. Lastly, the characteristic of *connectedness* allowed trading pictures rapidly and introduced a non-verbal communication channel. This showed in the affordance of Digi Merkki that led to episodes when participants focused only on their devices (see Figure 10b), however “were still all together despite not looking or talking to each other” (P8). This was in contrast to participant 13 and their customised prototype. Participant 14 viewed that prototype problematic, as it set a focus on phone interaction over Digi Merkki: “If [they are] always handling the [interactive patch] over [their] phone ... then [they] are just on [their] phone. ... people will not notice it as what it is and it will probably not create the interesting conversation.”

## 6.2 Digi Merkki Fosters Emergent Social Practices

In the second theme we describe how participants adapted new ways of interacting with Digi Merkki and each other. They appropriated Digi Merkki in their own ways to introduce dare challenges

and playfully teasing each other. As knowledge of such novel usage spread between participants, emergent social practices were formed in this particular group.

**6.2.1 Challenge Accepted**<sup>7</sup>. A group of three participants attached a dare challenge to each of their pictures before the intervention started. To receive one of their pictures, a trading partner first had to fulfil the respective challenge. For example, participant ten required a kiss for picture 33 and picture 38 was a trophy for beating participant two in a drinking game (see Figure 9s). While this practice of pictures as achievements added game-like character to picture trading, participant five described the challenges as “one way of giving [the pictures] meaning”. The three participants each purposefully thought of one easy challenge to use as a conversation starter.

In the course of the field intervention, these dare challenges were not only upheld by their creators but also adopted by other participants. By the end of our data collection, each of the three initiators (P2, P5, P10) had still not shared one picture because no one had fulfilled its challenge (see Figure 9(33,38)). Some other participants that encountered the challenges adapted such “rules” (P1, P14) for their pictures. The challenges spread over multiple participants, as participant one adopted them from participant 14, without knowing another group (P2, P5, P10) had initially introduced them.

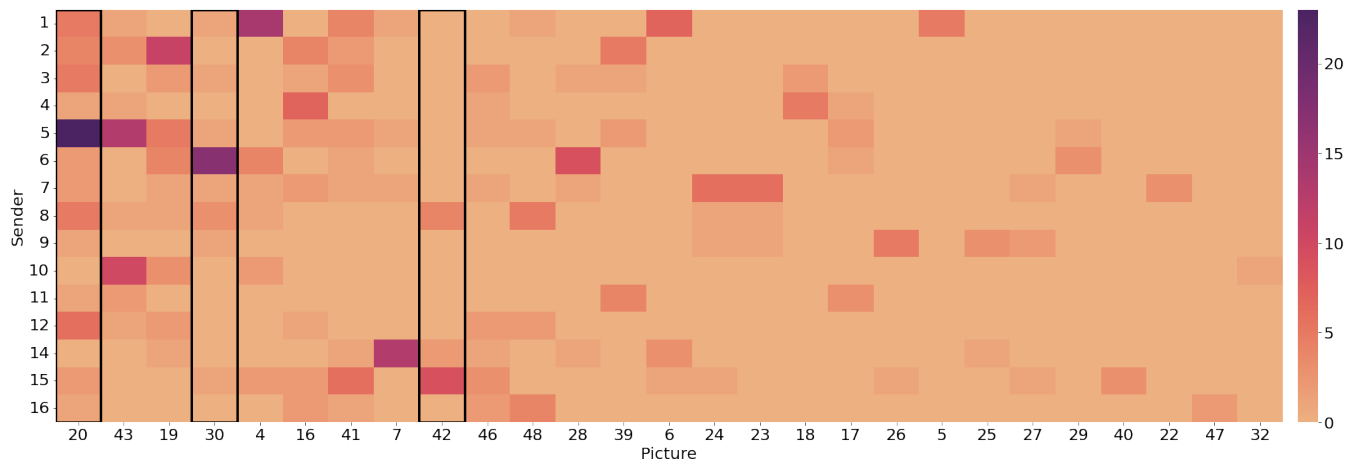
Another form of challenge developed from the prevalence of certain memetic picture sets. Multiple participants had picked similar pictures, e.g. cats or Moomins. This motivated participants to collect these particular pictures as a set. In conclusion, participants found ways to induce meaning, whether through scarcity or achievements.

<sup>5</sup>References “One Does Not Simply Walk Into Mordor” <https://knowyourmeme.com/memes/one-does-not-simply-walk-into-mordor>

<sup>6</sup>Moomins are a popular franchise in Finland

<sup>7</sup>References “Challenge Accepted” <https://knowyourmeme.com/memes/challenge-accepted>





**Figure 11: Heatmap depicting how often a participant shared a particular picture. The high-intensity (i.e., dark red) spots clearly show participants chose specific pictures to send repeatedly. The framed columns represent the pictures in Figure 12. Pictures are ordered from highest to lowest sharing.**

6.2.2 *The Struggle is Real Fun*<sup>8</sup>. The emergent social practice which changed Digi Merkki's reception and utilisation the most was a form of spamming. Due to the time-based picture trading interaction, a third player could spam the network by constantly holding the respective seam for sharing. Once any other participant started a trade, they consequently traded pictures with the spammer. This aspect was neither intended in the design nor had it been discovered in the pilot study. Participants coined this as "spamming", "stealing", "snitching", or "hi-jacking". While the act of spamming interrupted one to one social interactions, it was seen by participants as a way to enable group interaction. In particular, participant 16 used spamming to enter a dyadic interaction from the outside: "[P12 and P13] were exchanging some pictures, so I just sneaked in there." This act of spamming was seen as "friendly teasing" (P1), "annoying in a fun way" (P8) or "act[ing] mad because it's fun" (P7). These reactions seemed to stem from the openness of the design, as participant eight formulated aptly: "Since it wasn't necessarily enforced [to] trade with the person in front of you, there were no rules . . . , it made the hijacking possible, so acceptable and funny." The spamming added a surprise element to the trading activity. Participants liked the its chaotic nature of receiving unexpected pictures. This unexpectedness affected the people that tried to trade, but also spammers: "Because it's not guaranteed that I'm able to snatch it away. If it works, it's still a small achievement" (P5). This heightened feeling of achievement was based on the uncertainty of the interactions and introduced another game-like aspect to the social interactions. By actively engaging in spamming, the participants made picture trading more effortful and, consequently, certain pictures more meaningful.

The participants even used dedicated pictures to communicate the teasing. As you can see from Figure 12a, in particular, participant five sent the "thumbs up cat" again and again to all other participants. Other dedicated spamming pictures were "hackerman" (9c),

"laughing cat" (9h) and "dick butt" (9o), which shows in the Figure 11 as high-intensity spots. In contrast, the picture showing "Pingu" in Figure 12c was also popular but not reshared after people had it in their collection. Hence, participants reappropriated the cat picture (9i) of P12 to communicate the humouristic nature of teasing. As participant 14 paints it: "[The cat] is telling you like 'haha, don't do this you'll anyway just get me again'". For this reappropriation of meaning, the picture memes seemed particularly useful, as all the most shared pictures have some meme-like characteristics (see Figure 11).

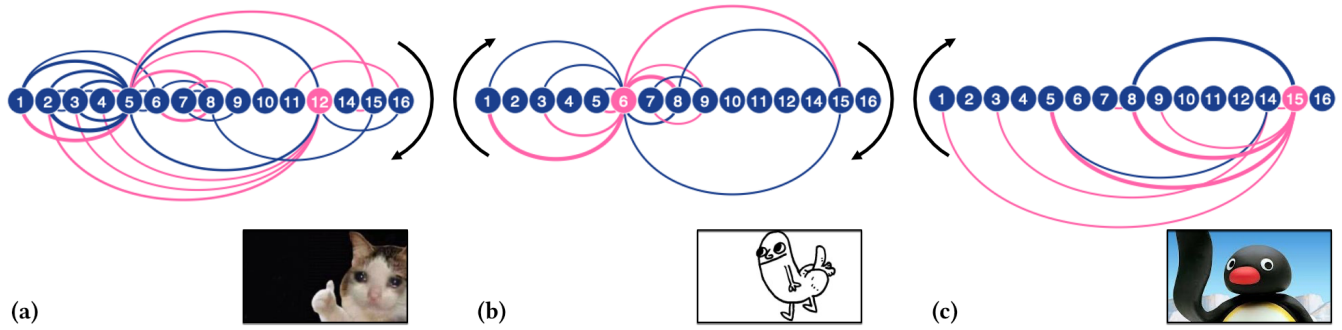
### 6.3 Students Navigate Divergent Emerging Practices

Finally, our third theme highlights how participants actively shaped the practices around Digi Merkki based on their individual competences. Participants at times had contrary aims for using the spamming or the Digi Merkki as an ice-breaker. However, they formulate clear proposals how to navigate and even shape those through building structural elements in the community or their own agency.

6.3.1 *Well, That Escalated Quickly*<sup>9</sup>. While some participants attached importance to contributing to the community, others were more interested in propagating and promoting an idea. Many participants thought carefully about what pictures might be interesting for others. However, some participants picked pictures that only represented their interests. For example, participant one intended to spread their love for mathematics, hoping that more people would get interested in this topic. This way, they would have more people with a common interest. This strategy also showed in the way they appropriated the challenges. While participant five wanted to increase the value of their pictures by attaching achievements to them, participant one adapted the challenges differently. They

<sup>8</sup>References "The Struggle is Real" <https://knowyourmeme.com/memes/the-struggle-is-real>

<sup>9</sup>References "That Escalated Quickly" <https://knowyourmeme.com/memes/that-escalated-quickly>



**Figure 12: Network graphs showing how 15 participants shared the particular pictures a:20, b:30 and c:42. Nodes represent participants and lines show unidirectional sharing between two participants in clock-wise direction. The thickness corresponds to the amount of times a picture was sent. Nodes in magenta represent the initial owners of the pictures and the magenta arrows show how the picture initially spread through the network. Blue arrows show the reception of pictures once that picture was already in the receivers possession. Thumbnails copyright: b: KC Green, c: JOKER / NHK / NEP / PPI**

recognised how challenges added meaning to the pictures and used this again to promote mathematics through the maths meme (see Figure 9d). Furthermore, participant six made it their personal challenge to spread their “dick butt” picture even against others interest: “[they] really did not like the picture. I wanted to have that picture sent to [them] in a playful way, nothing malicious or anything.” As apparent from the graph in Figure 12b dick butt mainly was sent from participant six to others, while others rarely send it forward. Participant 13 even aimed for controversy with his choice of images: “I want to propagate the weeb shit.” They hoped to make their ideas part of the mainstream: “It becomes more of a normy thing”.

While most people enjoyed the competition as something “not too serious”, there were also divergent practices in trading pictures. On one side, participant 15 handed their device over to others, so they could go through the pictures and take the ones they preferred. For them, “the main idea was that we would eventually get all the pictures”. On the other side, some saw the spamming exploit more as a chance for stealing: “I was more thinking of getting pictures for myself rather than letting people have mine”(P10).

**6.3.2 If we could stop stealing pictures, that’d be great.**<sup>10</sup> We have reported how Digi Merkki was a conversation starter. Participants that describe themselves as introverts explained how this helped to avoid “awkward” small-talk: “You start the conversation that way, without having to [say] ‘oh what have you been doing this weekend?’”(P1). Meanwhile, participant 13 did not bring their custom device to the first gathering. Therefore, they could not participate: “The point was to use the devices. I didn’t have it, so it was awkward for me”. Of course, the study setting created this distinction because it gave the gatherings a clear context. However, even when participant 13 joined with their custom application, others noted how not participating in the interactions mediated by Digi Merkki excluded P13, as participant described it: “[P13] could engage ..., but [they] couldn’t understand or relate.... I felt [they] couldn’t be part of the community.” Hence, participants recognised problems of inclusion and even expressed their wishes for developing such

technology further. Participant 14 said, “It would be sad if [Digi Merkki] would be an exclusive thing. I would wish that it could be shared with people all over the place.” They suggested rules for the community to limit the stealing and incentivise asking for pictures. As stated before, participant 15 saw it more relaxed: “Memes come and go, and if something is funny and makes people laugh, it’s worthwhile.”

In summary, participants dealt differently with the unprecedented social interactions around the interactive clothing patch. Beyond personal strategies to navigate these group practices, participants discussed and proposed structures to formalise some of these practices. Hence, they took ownership of shaping the practice.

## 7 DISCUSSION

Despite decades of HCI research on social wearables, they have yet to achieve widespread adoption. Thus, this work aimed to gain a better understanding of what drives and hinders adoption of social wearables by studying how they shape adornment and social practices *in-situ*. In the following, we discuss the implications of our work for the understanding and design of social wearables in particular, and social technology more generally.

### 7.1 Varying Adoption of a Social Wearable Reveal Negotiation Practices

Both in the wearable co-creation process and the field study, we observed the students’ utilisation of Digi Merkki and the emergent patterns in their social practices. As noted, the adornment practices of Nordic students revolve around developing identity through distinction and group membership. We saw how our design intervention contributed to the practice of meeting new people as a conversation starter (“social lubricant”) and adding a digital component to their boiler suit adornment. Furthermore, the activities during the intervention and the collected pictures contributed to reminiscence, just like analogue patches and other student events. Additionally, we observed emerging patterns with regards to students negotiating individuality and membership in the form of dare challenges and spamming. We also saw how our participants made

<sup>10</sup>References “That Would Be Great” <https://knowyourmeme.com/memes/that-would-be-great>

use of the ambiguity [14] Digi Merkki provided and were able to perform their social identity [17].

Especially the emergent practices revealed conflicting strategies in peoples utilisation of Digi Merkki. Considering our first research question, we saw how some participants introduced dare challenges, but others adapted them to their needs, as this particular practice spread through the group. Some participants saw value in those challenges for making their personal pictures more meaningful, while others used that effect to spread a particular idea for their benefit. While most enjoyed spamming as a way of friendly teasing, there were accounts of antagonism between people (see the example of Dick Butt in section 6.3.1). However, Digi Merkki also indirectly led to awkwardness and exclusion when one participant could not participate in the networked features.

However, participants navigated these consequential tensions and awkwardness by negotiating meanings. When Digi Merkki sparked a change in practice, this required the participants to re-define the meanings constituting their cultural practices. However, meanings, e.g. the contents of a picture or the aesthetics of a garment, are socially defined. Therefore we can use a dialogical perspective of meanings not as fixed elements transmitted between people, but unstable outcomes of ongoing negotiations [2, chps. 6 & 7]. We observed how meaning of content (i.e., the pictures participants chose) changed. For example, the thumbs-up cat changed to an expression of superiority and consequently became part of expressing social identity. However, this required negotiation between the individual participant and the community. In fact, also the meanings of people's actions were negotiated. After all, participants affirmed spamming as a fun activity that enabled group interactions, despite it being uncontrollable.

As we have outlined in section 2.2, adoption of a product has been explained through the concept of acceptability, i.e. aesthetics, identity, and privacy [16, 17, 49]. The factors influencing adoption are attached to meanings (What is private? What is acceptable? How does a wearable express social identity?). When applying a dialogical perspective, we can view technology as a way to mediate the negotiation of those factors. Therefore, we see potential in designing for a social wearables that mediates the negotiation of meanings, which provides people with the potential to adopt a technology in their lives.

## 7.2 Characteristics Supporting Involvement and the Mediation of Meanings

The characteristics of our intervention encouraged involvement. Specifically our participatory process—starting with the co-design, followed by co-creation of the digital patch and creating meetings in the participants environment—increased democratic and bottom-up social organisation. The co-design of the prototype resulted in an artefact relevant to the students. The creation kit provided means for personal involvement through personalisation. For example, the students could solve the question of acceptable positioning of the patch on their body themselves by sewing on the patch anywhere and attaching it flexibly with the hook and loop fastener. Similarly, Digi Merkki had do-it-yourself characteristics, which contributed to its appropriation. Digi Merkki's screen allowed full-colour pictures but constrained them into a compact format. Participants also

cleverly used pre-existing memes in their pictures, which invited others to use them for their own purpose. Consequently, the appropriation led to more involvement and made it more meaningful to the participants.

Additionally, the loosely defined interplay of actuation and sensing also enabled students to mediate identity and meanings. Digi Merkki did not dictate a use scenario as neither the meanings of trading a picture, nor the meaning of content was defined. The functionality relied on the participants to balance fair use between them. This openness allowed for the emergence of spamming and the introduction of dare challenges. The possibility of the spamming led to fun. Some participants enjoyed the feeling of superiority created by discovering it; others enjoyed the incongruity of the unexpected behaviour. Albeit indirect, we see this as a notion of mischief and humour as a resource for design [28]. Additionally, this made interactions tricky and introduced problems. However, the extra effort made the actual interpersonal interactions more meaningful, which matches with findings in existing work [36]. The balance of control that Digi Merkki provided, enabled participants to reappropriate the picture-trading for spamming but still protected participants' "exclusive" pictures (as two participants never gave away a picture due to their unfulfilled challenges). In conclusion, the characteristics of our intervention invited for appropriation and personalisation and this way supported mediation of meanings.

## 7.3 Memes in Digital Culture Foster Social Identity and Community

Finally, our work contributes to the design literature on social wearables by identifying that the observed characteristics of our intervention appear to correspond to success criteria of memes in digital culture. First, we note that the concept of *internet memes* was not a part of our design process, nor a theoretical starting point for our analysis. Instead they emerged as a theme that cut across all other themes, through the materials participants chose to include into their digital patches, as well as their interactions.

As defined by Shifman [59], "internet memes" are groups of content units that invite imitation. In contrast, a *viral* is a single distinct piece of content that is shared rapidly through the internet. Memes, however, are potentially only shared in fringe communities. Following this, we observed participants using memes as elements of meaning and competence in their social practices. Through the memes' diffusion in their existing practices—i.e. in online communication and boiler suit adornment—the students use the existing meanings of those memes and their competencies in *memeing*<sup>11</sup>. Concurrently, fashion studies identified memes as a trend in clothing design [62]. Here, garments are designed to become memes, that invite for copying and imitation and are not perceived as an "original". While HCI scholars have recently explored memes as a design material [64], they have to date not been discussed as a concept for the design of technology in collocated social interactions.

These attributes reveal memes as a tool for involvement and for expressing membership to ever smaller groups and building community within them. In our study, we could see how the practice of

<sup>11</sup>Memeing. Know Your Meme. Retrieved February 28, 2022 from <https://knowyourmeme.com/memes/memeing>



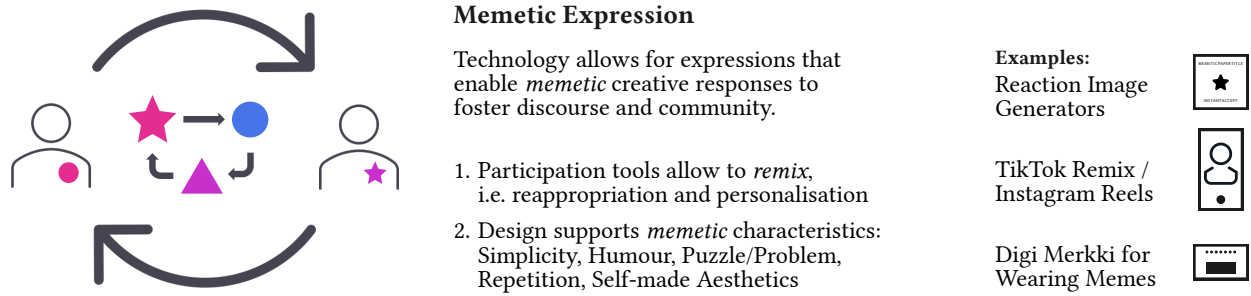


Figure 13: A diagrammatic representation of the strong concept “Memetic Expression”.

adorning boiler suits and the practice of creating and sharing memes intertwined. As previously noted, the student practices around the boiler suits mainly revolve around developing and shaping identity [20]: A student’s collection of patches creates a distinction from the “uniform” of the student association, while expressing membership based on the patch’s content. By adding a digital component to adornments, students foremost utilised memes. These memes offered a new granularity of distinction through imitation, which references existing meanings, while at the same time introducing an individual component. These characteristics offer the students an easy tool to build identity and community. To this end, we articulate a more general abstraction of this mechanism in the form of a strong concept for design.

## 8 MEMETIC EXPRESSION AS A STRONG CONCEPT FOR DESIGN

We propose *Memetic Expression* as a strong concept [27] for designing social technology. Memes foster discourse and therefore offer an ideal tool for designers to build identity and community. The concept of Memetic Expression suggests wearables (or other social technologies) should foster remix and emergent use. Instead of striving for viral success, we focus on the inclusive and participatory aspects of memes, which enable or facilitate social interaction. By leveraging the strong concept of Memetic Expression, we make social wearables an inclusive social participation tool.

Strong concepts [27] embody design knowledge between particular instances and generalised theories. Memetic Expression matches the criteria of a strong concept as it is agnostic towards technology or specific system instances; it emerges through interaction; and it speaks to the behaviour and practices of the users while remaining a part of the design artifact. Memetic Expression addresses changing practices at its core. While the concept was popular in our context, it reflects properties of the participatory culture prevalent in the digital age in general. Our case demonstrates how Memetic Expression works in different types of social technologies; While memes are primarily found in computer-mediated-communication, the users transferred this concept easily to face-to-face technology, supporting the potential of the concept to cut across into the domain of collocated social interactions. As a strong design concept, Memetic Expression considers especially the layer of sensing and actuation interplay, yet is not restricted to a particular form.

### 8.1 Principles

The concept of memetic expression addresses technology that mediates interpersonal communication. The core principle makes use of how memes work. Successful memes are expressions that enable memetic and creative responses. The particularities of memes support identity development and forming group membership. Through these processes, memes, not virals, build community.

Shifman [59] describes factors that make memes successful: participation tools, simplicity, humour, puzzle/problem and memetic potential (i.e. repetition and self-made aesthetics). We build on these factors and formulate guiding principles and questions for designing social wearables and expressive social technology. The overarching aim of Memetic Expression is a design that fosters “memetic” creative responses between its users to drive discourse and community.

**8.1.1 Participation Tools for Remix.** The first and most concrete principle of memetic expression aims to provide users with tools for participation beyond mere propagation. The technology needs to offer involvement that allows people to “reappropriate and personalise universal content” [59], in short, “remix”. Remixing content heightens a users sense of ownership and agency.

**8.1.2 Supporting Memetic Characteristics.** The second principle guides which characteristics of remixing should be supported by a design. These characteristics contribute to the memetic success of content and therefore increase the chances of fostering discourse and community. The characteristics are: Simplicity, Humour, Puzzle/Problem, Repetition and Self-made aesthetics. For memetic success, not all characteristics are necessary but a combination increases the chances for propagation.

*Simplicity* borrows from the memetic success factor of *simple packaging*, which allows content to be shared or imitated easily. Design can support simplicity by introducing constraints. Constraints can support creativity and creative responses heighten a meme’s chances to spread. Further, simple messages are easier to understand quickly. Limiting expressions to specific formats can help people to achieve simplicity.

*Humour* is a core characteristic of memetic success. In the design of interactive technologies, humour [28] and valance [9] have been suggested. While researchers have described frameworks on playfulness (e.g. wearables [6]), the memetic expression concept does not aim for gaming devices. Instead, it supports social interaction

**Table 1: Design principles of Memetic Expression as a strong concept**

Participation Tools	<i>Are users actively involved in shaping the sensing–actuation–interplay? What are the tools the design offers for participation? How can users/wearers express themselves freely? Does it support a remix of meanings?</i>
Simplicity	<i>Does the digital expression allow for pre-existing symbols? Does the actuation lie on the sweet spot between explicit and implicit information?</i>
Humour	<i>Does the design allow for unexpected use and surprises? Does the design build upon playfulness?</i>
Puzzle/Problem	<i>How can participants make the interaction more effortful, hence meaningful? How is the design supporting gameful task fulfilment?</i>
Repetition	<i>Does the system support repetition by reducing barriers to exchanging (memetic) content?</i>
Self-made Aesthetics	<i>What about the aesthetics of the design expresses something self-made?</i>

in general. In this way, a design should allow for humorous content without thinking of it as a game.

Successful memes always introduce a *puzzle or problem*, which again invites participation. We know that game-like mechanics foster social interaction [30]. However, again the system must invite for gameful tasks fulfilment and not enforce specific game mechanics. Designers can support this through mechanics indirectly linked to competitiveness. This way, users can introduce their own challenges or competitions.

Another factor that supports memetic success is *repetition*. When design introduces few consequences for sharing content, the barrier for resharing is lower. Digital designs efficiently cater for lower friction, and designers can directly replace existing analogue expressions to that effect.

Especially, picture memes often follow typical formats that resemble *self-made aesthetics*. The appearance of something self-made lowers the barrier for others to modify it. Designers can introduce this by enabling participation tools that make it easier for users to produce something of their own. Designers can aid users by copying existing memetic formats.

## 8.2 Other Examples of Memetic Expression: Image Macros and Mobile Short Videos

The success of memes as vessels for communication is apparent through their omnipresence in online communities. To visualise the strong concept, we showcase some designs leveraging memetic expression. While our study aimed at fixing the gap in the adoption of social wearables, there are successful examples of older and more recent designs in mediated communication that show how memetic expression can foster discourse in other domains.

*Image macros* are considered as the most popular form of picture memes. Several services such as “Meme Generator - Imgflip”<sup>12</sup> offer users tools for creating meme images. These services make use of Memetic Expression contributing to the adoption of image macros on a wide-scale. First, they offer participation tools through collections of meme templates that make it easy to imitate known memes while creating something unique. They also cleverly support memetic characteristics as image macros build upon the concept of a canned joke [18]. Humour is often provided by the meme template. Simplicity is achieved through the standardised format of a reaction

image plus two short lines of text. As the reaction text is normally split in to a top and bottom part this pun format enables a puzzle.

The success of the social media platform TikTok<sup>13</sup> can be ascribed to its design being “geared toward imitation and replication” [73] and therefore it corresponds to the concept of memetic expression. Again, the first principle of participation tools is provided by the use of other video and soundtracks as a starting point for a remix and various pre-built filters and effects for customisation. While the content are short videos, which offer a wide variety, the format again is limited in time and orientation. The constraints in format support the characteristics of humour and simplicity. Similar to aspects of successful memes on youtube [59], repetition is an often used characteristic on TikTok. Repetition is supported by the easy editing tools that help to quickly generate copies and watching content based on a group of remixed content. The instant messaging service Instagram copied most of these design elements in their “Reel” feature.<sup>14</sup> And the video platform YouTube, not only added a short video feature in 2020 but also introduced a way to remix existing videos by introducing a “create” button to their player interface<sup>15</sup>

## 9 LIMITATIONS AND FUTURE WORK

First, while Digi Merkki was adequate as a research prototype, its design is lacking compared to a finished product. The limitations of today’s smart textiles are undoubtedly a hindrance for adoption. In our case, the small resolution of the screen added a useful constraint, but its dimensions also lead participants to hold the device in their hands while interacting, which could have distracted or detracted from engaging with other students. A flexible display would be an adequate solution to support wearability, but those are not yet readily available for rapid prototyping. Furthermore, coated flexible electronics would make the digital patch water-proof to sustain the weather conditions as well as the drinking and bathing practices of the students. Finally, a more refined iteration of Digi Merkki would need to reduce the trading distance of images to a couple of meters to avoid an overload of connections for the devices and the users in larger gatherings. Additionally, Bluetooth or another low power

<sup>12</sup>“Meme Generator - Imgflip”. Retrieved January 8, 2022 from <https://imgflip.com/memegenerator>

<sup>13</sup>TikTok - Make Your Day. Retrieved January 8, 2022 from <https://www.tiktok.com/>

<sup>14</sup>Instagram Reels — Share & Create Short Videos. Retrieved 1 January 2022, from <https://about.instagram.com/features/reels>

<sup>15</sup>2021. YouTube Adds a “Create” Button for Shorts in Player Interface. Beebom. Retrieved January 8, 2022 from <https://beebom.com/youtube-adds-a-create-button-for-shorts-in-player-interface/>

transmission technology would be more suitable for permanent use.

Next, we note that our field study presented a unique case and therefore its results have to be seen in context. Our study employed a picture trading competition as a means to spark engagement with Digi Merkki. Yet such incentives make it difficult to generalise the effects of the interactive clothing patch. However, we consider the results as an outcome of the intervention. When designers want to consider social practices with wearables, they are required to look beyond the individual moment-to-moment device interactions. In the case of Digi Merkki, the practices of collecting high quantities of patches and competitions to earn rewards are already part of Nordic student culture (see section 3). Nevertheless, the incentive on trading pictures might have led to less reporting on the proximity feature. Due to the pandemic, events for using the digital patch were organised deliberately with this study in mind and data outside of in crowd events and with non-wearers, is therefore scarce. We hope this can be studied in more detail, once limitations due to the ongoing pandemic are eased.

Finally, Digi Merkki's function as a social lubricant was likely reinforced via its relative novelty. A continuous influx of new students and consequently new pictures would probably incentivise continuous use. In the case of boiler suits, Digi Merkki's function would likely shift from adornment to reminiscing, once students leave their university life behind. Nevertheless, more longitudinal studies on the practices around wearing technology that augments social interactions are necessary to understand what shapes adoption (and abandonment) of social wearables over time.

## 10 CONCLUSION

We study a social wearable in a distinct socio-cultural context to identify guiding design principles for the adoption of social wearables. Our design proved to be effective in augmenting the participants' existing social practices. Additionally, we reported on how our intervention generated emergent social practices, and participants navigated tensions in divergent social strategies through the help of memes. From this finding, we formulated the strong concept of "Memetic Expression" to guide future design. When HCI aims to augment our co-present social interactions, scholars often focus on mediating specific interactions, such as digitising social signalling. If we design our technologies with an understanding that reduces communication to finite states (e.g. binary: available for engagement vs avoiding it), then our designs will be limited as well. In contrast, a perspective that respects the complexities of our social life needs to be open for participatory culture as showcased by internet memes.

## ACKNOWLEDGMENTS

We want to thank our co-designers Rasmus Ruhola, Anna He, Tapio "Tassu" Takala, Ilyena Hirskey-Douglas, Emmi Puota and Maria Serena Ciaburri, as well as Antti Salovaara for his guidance. This work was supported by the Academy of Finland project grant Digital Aura (311090). Additionally the work by Anna Kantasalo was supported by CACDAR (328729) and Felix A. Epp by Future Methods (330124).

## REFERENCES

- [1] Rain Ashford. 2019. An Exploration of Responsive and Emotive Wearables through Research Prototyping. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems - CHI '19*. ACM Press, Glasgow, Scotland UK, 1–4. <https://doi.org/10.1145/3290607.3313284>
- [2] Malcolm Barnard. 2014. *Fashion Theory* (zeroth ed.). <https://doi.org/10.4324/9780203862100>
- [3] Richard Borovoy, Fred Martin, Sunil Vemuri, Mitchel Resnick, Brian Silverman, and Chris Hancock. 1998. Meme Tags and Community Mirrors: Moving from Conferences to Collaboration. In *Proceedings of the 1998 ACM Conference on Computer Supported Cooperative Work (CSCW '98)*. Association for Computing Machinery, New York, NY, USA, 159–168. <https://doi.org/10.1145/289444.289490>
- [4] Rick Borovoy, Brian Silverman, Tim Gorton, Matt Notowidigdo, Brian Knepp, Mitchel Resnick, and Jeff Klann. 2001. Folk Computing: Revisiting Oral Tradition as a Scaffold for Co-Present Communities. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '01)*. Association for Computing Machinery, New York, NY, USA, 466–473. <https://doi.org/10.1145/365024.365316>
- [5] Virginia Braun and Victoria Clarke. 2020. One Size Fits All? What Counts as Quality Practice in (Reflexive) Thematic Analysis? *Qualitative Research in Psychology* 0, 0 (Aug. 2020), 1–25. <https://doi.org/10.1080/14780887.2020.1769238>
- [6] Ögüz 'Oz' Buruk, Katherine Isbister, and Tess Tanenbaum. 2019. A Design Framework for Playful Wearables. In *Proceedings of the 14th International Conference on the Foundations of Digital Games (FDG '19)*. Association for Computing Machinery, New York, NY, USA, 19:1–19:12. <https://doi.org/10.1145/3337722.3337733>
- [7] Jay Chen and Azza Abouzied. 2016. One LED Is Enough: Catalyzing Face-to-face Interactions at Conferences with a Gentle Nudge. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing - CSCW '16*. ACM Press, San Francisco, California, USA, 172–182. <https://doi.org/10.1145/2818048.2819969>
- [8] Ashley Colley, Minna Pakanen, Saara Koskinen, Kirsu Mikkonen, and Jonna Häkkinä. 2016. Smart Handbag as a Wearable Public Display - Exploring Concepts and User Perceptions. In *Proceedings of the 7th Augmented Human International Conference 2016 on - AH '16*. ACM Press, Geneva, Switzerland, 1–8. <https://doi.org/10.1145/2875194.2875212>
- [9] Ashley Colley, Bastian Pfleging, Florian Alt, and Jonna Häkkinä. 2020. Exploring Public Wearable Display of Wellness Tracker Data. *International Journal of Human-Computer Studies* 138 (June 2020), 102408. <https://doi.org/10.1016/j.ijhcs.2020.102408>
- [10] Ella Dagan and Katherine Isbister. 2021. Synergistic Social Technology: Designing Systems with Needs and Support. In *Designing Interactive Systems Conference 2021 (DIS '21)*. Association for Computing Machinery, New York, NY, USA, 1419–1432. <https://doi.org/10.1145/3461778.3462021>
- [11] Ella Dagan, Elena Márquez Segura, Ferran Altarriba Bertran, Miguel Flores, and Katherine Isbister. 2019. Designing 'True Colors': A Social Wearable That Affords Vulnerability. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*. Association for Computing Machinery, New York, NY, USA, 33:1–33:14. <https://doi.org/10.1145/3290605.3300263>
- [12] Ella Dagan, Elena Márquez Segura, Ferran Altarriba Bertran, Miguel Flores, Robb Mitchell, and Katherine Isbister. 2019. Design Framework for Social Wearables. In *Proceedings of the 2019 on Designing Interactive Systems Conference (DIS '19)*. Association for Computing Machinery, New York, NY, USA, 1001–1015. <https://doi.org/10.1145/3322276.3322291>
- [13] Pieter Desmet and Marc Hassenzahl. 2012. Towards Happiness: Possibility-Driven Design. In *Human-Computer Interaction: The Agency Perspective*, Marielba Zacarias and José Valente de Oliveira (Eds.). Springer-Verlag, Berlin, Heidelberg, 3–27. [https://doi.org/10.1007/978-3-642-25691-2\\_1](https://doi.org/10.1007/978-3-642-25691-2_1)
- [14] Laura Devendorf, Kimiko Ryokai, Joanne Lo, Noura Howell, Jung Lin Lee, Nan-Wei Gong, M. Emre Karagozler, Shihoh Fukuhara, Ivan Poupyrev, and Eric Paulos. 2016. "I Don't Want to Wear a Screen": Probing Perceptions of and Possibilities for Dynamic Displays on Clothing. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems - CHI '16 (CHI '16)*. ACM Press, New York, NY, USA, 6028–6039. <https://doi.org/10.1145/2858036.2858192>
- [15] Christine Dierk, Molly Jane Pearce Nicholas, and Eric Paulos. 2018. AlterWear: Battery-Free Wearable Displays for Opportunistic Interactions. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18*. 1–11. <https://doi.org/10.1145/3173574.3173794>
- [16] Paul Dourish and Genevieve Bell. 2011. Rethinking Privacy. In *Divining a Digital Future: Mess and Mythology in Ubiquitous Computing*. MIT Press, Cambridge, Mass., 137–160. <http://ebookcentral.proquest.com/lib/aalto-ebooks/detail.action?docID=3339242>
- [17] Lucy Dunne, Halley Profita, and Clint Zeagler. 2014. Social Aspects of Wearability and Interaction. In *Wearable Sensors*. 25–43. <https://doi.org/10.1016/B978-0-12-418662-0.00026-X>
- [18] Marta Dynel. 2016. "I Has Seen Image Macros!" Advice Animal Memes as Visual-Verbal Jokes. (2016), 29.



- [19] Joanne Entwistle. 2015. *The Fashioned Body: Fashion, Dress and Modern Social Theory* (2. ed ed.). Polity Press, Cambridge.
- [20] Felix Anand Epp, Ilyena Hirskey-Douglas, Andrés Lucero, and Tapio Takala. 2020. Identity through Social Wearables: Designing with Finnish University Students. In *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society (NordCHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–11. <https://doi.org/10.1145/3419249.3420137>
- [21] Jennica Falk and Staffan Björk. 1999. The BubbleBadge: A Wearable Public Display. *CHI'99 extended abstracts on Human factors in computing systems* (1999), 318–319. <https://doi.org/10.1145/632716.632909>
- [22] Daniel Fallman. 2011. The New Good: Exploring the Potential of Philosophy of Technology to Contribute to Human-Computer Interaction. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11)*. Association for Computing Machinery, Vancouver, BC, Canada, 1051–1060. <https://doi.org/10.1145/1978942.1979099>
- [23] Çağlar Genç, Oğuz Turan Buruk, Sejda İnal Yılmaz, Kemal Can, and Oğuzhan Özcan. 2018. Recommendations for Designing Fashionable Wearables. *International Journal of Design* 12, 3 (2018), 1–19.
- [24] Erving Goffman. 1959. *The Presentation of Self in Everyday Life* (nachdr. ed.). New York, NY.
- [25] Emmi Harjunen, Ashley Colley, Piia Ryttilähti, and Jonna Häkkinen. 2020. IdleStripes Shirt - Wearable Display of Sedentary Time. In *Proceedings of the 9TH ACM International Symposium on Pervasive Displays (PerDis '20)*. Association for Computing Machinery, Manchester, United Kingdom, 29–36. <https://doi.org/10.1145/3393712.3395340>
- [26] Kate Hartman, Jackson McConnell, Boris Kourtoukov, Hillary Predko, and Izzie Colpitts-Campbell. 2015. Monarch: Self-Expression Through Wearable Kinetic Textiles. In *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction - TEI '14*. ACM Press, Stanford, California, USA, 413–414. <https://doi.org/10.1145/2677199.2690875>
- [27] Kristina Höök and Jonas Löwgren. 2012. Strong Concepts: Intermediate-level Knowledge in Interaction Design Research. *ACM Trans. Comput.-Hum. Interact.* 19, 3 (Oct. 2012), 23:1–23:18. <https://doi.org/10.1145/2362364.2362371>
- [28] Netta Iivari, Marianne Kinnula, Leena Kuure, and Tiina Keisanen. 2020. "Arseing around Was Fun!" – Humor as a Resource in Design and Making. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–13. <https://doi.org/10.1145/3313831.3376169>
- [29] Katherine Isbister. 2019. Toward 'Suprahuman' Technology. In *Proceedings of the Halfway to the Future Symposium 2019 on - HTTF 2019*. ACM Press, Nottingham, United Kingdom, 1–4. <https://doi.org/10.1145/3363384.3363468>
- [30] Katherine Isbister, Kaho Abe, and Michael Karlesky. 2017. Interdependent Wearables (for Play): A Strong Concept for Design. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. Association for Computing Machinery, New York, NY, USA, 465–471. <https://doi.org/10.1145/3025453.3025939>
- [31] Pradthana Jarusriboonchai and Jonna Häkkinen. 2019. Customisable Wearables: Exploring the Design Space of Wearable Technology. In *Proceedings of the 18th International Conference on Mobile and Ubiquitous Multimedia - MUM '19*. ACM Press, Pisa, Italy, 1–9. <https://doi.org/10.1145/3365610.3365635>
- [32] Pradthana Jarusriboonchai, Aris Malpaschas, Thomas Olsson, and Kaisa Väänänen. 2016. Increasing Collocated People-s Awareness of the Mobile User-s Activities: A Field Trial of Social Displays. In *CSCW '16*. ACM Press, 1689–1700. <https://doi.org/10.1145/2818048.2819900>
- [33] Jonathan Lazar, Jinjuan Heidi Feng, and Harry Hochheiser. 2010. *Research Methods in Human-Computer Interaction* (second edition ed.). Chichester, West Sussex, U.K.
- [34] Mahdokht Kalantari. 2017. Consumers' Adoption of Wearable Technologies: Literature Review, Synthesis, and Future Research Agenda. 12, 3 (2017), 274. <https://doi.org/10.1504/IJTMKT.2017.089665>
- [35] Kate Hartmann. [n. d.]. Nudgeables. <http://www.katehartman.com/projects/nudgeables/>
- [36] Ryan Kelly, Daniel Gooch, Bhagyashree Patil, and Leon Watts. 2017. Demanding by Design: Supporting Effortful Communication Practices in Close Personal Relationships. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17)*. Association for Computing Machinery, New York, NY, USA, 70–83. <https://doi.org/10.1145/2998181.2998184>
- [37] Lisa Kleinman, Tad Hirsch, and Matt Yurdana. 2015. Exploring Mobile Devices as Personal Public Displays. In *MobileHCI '15*. ACM Press, 233–243. <https://doi.org/10.1145/2785830.2785833>
- [38] G. Kortuem and Z. Segall. 2003. Wearable Communities: Augmenting Social Networks with Wearable Computers. *IEEE Pervasive Computing* 2, 1 (Jan. 2003), 71–78. <https://doi.org/10.1109/MPRV.2003.1186728>
- [39] Kari Kuutti and Liam J. Bannon. 2014. The Turn to Practice in HCI: Towards a Research Agenda. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*. Association for Computing Machinery, New York, NY, USA, 3543–3552. <https://doi.org/10.1145/2556288.2557111>
- [40] Mikko Kytö and David McGookin. 2017. Augmenting Multi-Party Face-to-Face Interactions Amongst Strangers with User Generated Content. *Computer Supported Cooperative Work (CSCW)* 26, 4-6 (Dec. 2017), 527–562. <https://doi.org/10.1007/s10606-017-9281-1>
- [41] Nicolle Lamerichs. 2014. Costuming as Subculture: The Multiple Bodies of Cosplay. 2, 1 (Oct. 2014), 113–125. [https://doi.org/10.1386/scene.2.1-2.113\\_1](https://doi.org/10.1386/scene.2.1-2.113_1)
- [42] Lenneke Kuijer. 2017. Practices-Oriented Design. In *Design for Behaviour Change*. Taylor and Francis Ltd., United Kingdom, 116–127. <https://doi.org/10.4324/9781315576602>
- [43] Andrés Lucero, Jussi Holopainen, and Tero Jokela. 2012. MobiComics: Collaborative Use of Mobile Phones and Large Displays for Public Expression. In *Proceedings of the 14th International Conference on Human-computer Interaction with Mobile Devices and Services (MobileHCI '12)*. Association for Computing Machinery, New York, NY, USA, 383–392. <https://doi.org/10.1145/2371574.2371634>
- [44] Sus Lundgren, Joel E. Fischer, Stuart Reeves, and Olof Torgersson. 2015. Designing Mobile Experiences for Collocated Interaction. *ACM Press*, 496–507. <https://doi.org/10.1145/2675133.2675171>
- [45] Angella Mackey, Ron Wakkary, Stephan Wensveen, and Oscar Tomico. 2017. "Can I Wear This?" Blending Clothing and Digital Expression by Wearing Dynamic Fabric. *International Journal of Design* 11, 3 (2017), 15. <http://www.ijdesign.org/index.php/IJDesign/article/view/3177/794>
- [46] Joseph F. McCarthy, David W. McDonald, Suzanne Soroczak, David H. Nguyen, and Al M. Rashid. 2004. Augmenting the Social Space of an Academic Conference. In *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work*. Association for Computing Machinery, 39–48.
- [47] Donald McMillan, Barry Brown, Airi Lampinen, Moira McGregor, Eve Hoggan, and Stefania Pizzi. 2017. Situating Wearables: Smartwatch Use in Context. In *CHI '17*. ACM Press, 3582–3594. <https://doi.org/10.1145/3025453.3025993>
- [48] Vivian Genaro Motti and Kelly Caine. 2014. Human Factors Considerations in the Design of Wearable Devices. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 58, 1 (Sept. 2014), 1820–1824. <https://doi.org/10.1177/1541931214581381>
- [49] Mark Olschewski, Uta Renken, and Benjamin Mueller. 2018. Collaboration Technology Adoption: Is It Me or Them? *International Journal of Technology Diffusion* 9, 3 (July 2018), 13–28. <https://doi.org/10.4018/IJTD.2018070102>
- [50] Thomas Olsson, Pradthana Jarusriboonchai, Paweł Woźniak, Susanna Paasovaara, Kaisa Väänänen, and Andrés Lucero. 2019. Technologies for Enhancing Collocated Social Interaction: Review of Design Solutions and Approaches. *Computer Supported Coop Work* (Feb. 2019). <https://doi.org/10.1007/s10606-019-09345-0>
- [51] Kaitlyn Ouwerson, Norene Kelly, and Stephen B. Gilbert. 2017. Fashion and Technology: Implications for the Social Acceptability of a Wearable Device. In *Human-Computer Interaction. User Interface Design, Development and Multimodality (Lecture Notes in Computer Science)*, Masaaki Kurosu (Ed.). Springer International Publishing, 203–213.
- [52] Eric Paulos and Elizabeth Goodman. 2004. The Familiar Stranger: Anxiety, Comfort, and Play in Public Places. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '04)*. Association for Computing Machinery, New York, NY, USA, 223–230. <https://doi.org/10.1145/985692.985721>
- [53] Jennifer Pearson, Simon Robinson, and Matt Jones. 2015. It's About Time: Smartwatches as Public Displays. In *CHI '15*. ACM Press, 1257–1266. <https://doi.org/10.1145/2702123.2702247>
- [54] Hannah Perner-Wilson, Leah Buechley, and Mika Satomi. 2011. Handcrafting Textile Interfaces from a Kit-of-No-Parts. In *Proceedings of the Fifth International Conference on Tangible, Embedded, and Embodied Interaction - TEI '11*. ACM Press, Funchal, Portugal, 61. <https://doi.org/10.1145/1935701.1935715>
- [55] Per Persson, Jan Blom, and Younghee Jung. 2005. DigiDress: A Field Trial of an Expressive Social Proximity Application. In *UbiComp 2005: Ubiquitous Computing: 7th International Conference, UbiComp 2005, Tokyo, Japan, September 11-14, 2005. Proceedings*, Michael Beigl, Stephen Intille, Jun Rekimoto, and Hideyuki Tokuda (Eds.). Springer Berlin Heidelberg, Berlin, Heidelberg, 195–212. [https://doi.org/10.1007/11551201\\_12](https://doi.org/10.1007/11551201_12)
- [56] Research and Markets. 2020. Global Wearable Computing Devices Market (2020 to 2025) - Growth, Trends & Forecasts. *GlobeNewswire News Room* (June 2020). <http://www.globenewswire.com/news-release/2020/06/24/2052588/0/en/Global-Wearable-Computing-Devices-Market-2020-to-2025-Growth-Trends-Forecasts.html>
- [57] Harvey Sacks and Gail Jefferson. 1995. *Lectures on Conversation: Volumes I & II* (1. publ. in one paperback volume 1995, [nachdr.] ed.). Oxford.
- [58] Elizabeth B.-N. Sanders and Pieter Jan Stappers. 2014. Probes, Toolkits and Prototypes: Three Approaches to Making in Codesigning. 10, 1 (2014), 5–14.
- [59] Limor Shifman. 2014. *Memes in Digital Culture*. MIT press.
- [60] Elizabeth Shove, Mika Pantzar, and Matt Watson. 2012. *The Dynamics of Social Practice: Everyday Life and How It Changes*. Los Angeles.
- [61] Georg Simmel. 1950. *The Sociology of Georg Simmel*. Simon and Schuster.
- [62] Synne Skjultstad. 2020. Vetements, Memes, and Connectivity: Fashion Media in the Era of Instagram. *Fashion Theory* 24, 2 (Feb. 2020), 181–209. <https://doi.org/10.1080/1362704X.2018.1491191>

- [63] Pieter Jan Stappers and Elisa Giaccardi. 2017. Research through Design. In *The Encyclopedia of Human-Computer Interaction*. <https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/research-through-design>
- [64] Nada Terzimehić, Svenja Yvonne Schött, Florian Bemann, and Daniel Buschek. 2021. MEMEories: Internet Memes as Means for Daily Journaling. In *Designing Interactive Systems Conference 2021*. Association for Computing Machinery, New York, NY, USA, 538–548. <http://doi.org/10.1145/3461778.3462080>
- [65] Oscar Tomico, Lars Hallnäs, Rung-Huei Liang, and Stephan A G Wensveen. 2017. Towards a Next Wave of Wearable and Fashionable Interactions. 11, 3 (2017), 6.
- [66] Lianne Toussaint and Marina Toeters. 2020. Keeping the Data within the Garment: Balancing Sensing and Actuating in Fashion Technology. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference*. Association for Computing Machinery, New York, NY, USA, 2229–2238. <https://doi.org/10.1145/3357236.3395577>
- [67] Jason Wiese, Patrick Gage Kelley, Lorrie Faith Cranor, Laura Dabbish, Jason I. Hong, and John Zimmerman. 2011. Are You Close with Me? Are You Nearby?: Investigating Social Groups, Closeness, and Willingness to Share. In *Proceedings of the 13th International Conference on Ubiquitous Computing*. Association for Computing Machinery, 197–206.
- [68] Wikipedia. 2021. Student Boilersuit. (Dec. 2021). [https://en.wikipedia.org/w/index.php?title=Student\\_boilersuit&oldid=1059118612](https://en.wikipedia.org/w/index.php?title=Student_boilersuit&oldid=1059118612)
- [69] Wikipedia. 2021. Letterman (Sports). (Oct. 2021). [https://en.wikipedia.org/w/index.php?title=Letterman\\_\(sports\)&oldid=1051128801](https://en.wikipedia.org/w/index.php?title=Letterman_(sports)&oldid=1051128801)
- [70] Elizabeth Wilson. 2003. *Adorned in Dreams: Fashion and Modernity*. IB Tauris.
- [71] Marisol Wong-Villacres, Aakash Gautam, Deborah Tatar, and Betsy DiSalvo. 2021. Reflections on Assets-Based Design: A Journey Towards A Collective of Assets-Based Thinkers. *Proc. ACM Hum.-Comput. Interact.* 5, CSCW2 (Oct. 2021), 401:1–401:32. <https://doi.org/10.1145/3479545>
- [72] Theodore Zamenopoulos and Katerina Alexiou. 2018. *Co-Design As Collaborative Research*. Bristol University/AHRC Connected Communities Programme, Bristol. [https://connected-communities.org/wp-content/uploads/2018/07/Co-Design\\_SP.pdf](https://connected-communities.org/wp-content/uploads/2018/07/Co-Design_SP.pdf)
- [73] Diana Zulli and David James Zulli. 2020. Extending the Internet Meme: Conceptualizing Technological Mimesis and Imitation Publics on the TikTok Platform. *New Media & Society* (Dec. 2020), 1461444820983603. <https://doi.org/10.1177/1461444820983603>