

Where fashion, jewellery and wearable technology meet

Abstract

In this article we relate the fields of fashion, jewellery and wearable technology in terms of the emphasis on respectively social, personal and instrumental values. Moreover, we describe how the subfields of soft wearables, digital jewellery and fashion jewellery emerge on the intersections of these fields. The main contribution of the article is twofold. Firstly, we identify and explore the potential of the area at the cross-section of all three fields, which is so far hardly explored by academia. We discuss what it takes from design-researchers in the field of digital jewellery to explore the newly identified design space: broadening their frame of reference and changing their approach of wearable technology. We suggest to broaden the frame of references from Art Jewellery to jewellery in general. And, we advocate a shift in the perspective on wearable technology, from criticizing what it lacks to appreciating its merits. Within wearable technology, we find technological-sturdy artefacts, which can be used in a cultural probe in order to explore emergent behaviour, interactions and appreciation. Secondly, we argue that this overview should not be misunderstood as static and over-simplified. On the one hand, we need to be aware of the heterogeneity of each of the fields. On the other hand, we like to stress the relativity of the differences between the fields. Therefore, we emphasize the importance of looking at the overview on different levels of detail, cherishing and challenging both similarities and differences of fashion, jewellery, wearable technology, in order to explore the full potential of these three fields and all possible intersections.

Introduction

Fashion, jewellery and wearable technology are three entities that share the proximity to the human body, yet that are different in terms of - for example - materials used, production techniques, duration of lifecycle and sales platform. From a scholarly perspective, they have been approached as separate fields for a long time. We expect though that the application of electronics on the human body can hugely benefit from a proper understanding of these fields and their intersections. Therefore, we first describe the three fields separately. Then we create an overview that shows how the three fields overlap. In the

discussion we describe the different level of detail of the overview and the importance of being aware of that. From there we explore how the insights gained from the overview could influence future research.

Introducing the fields of fashion, jewellery and wearable technology

Before looking at their mutual relationships, we first describe the fields of fashion, jewellery and wearable technology by their most important characteristics.

Fashion

Although fashion has been studied throughout time and from many perspectives, it took until the early 20th century to become a respected field of study, which is referred to as fashion theory. In contrast to what the name suggests, it is not one coherent theory, but an accumulation of concepts and theories. Theorists generally agree though that fashion is inherently about change (Lillethun, 2016, p. 117).

The constant change of fashion has been explained from different perspectives. From a psychological perspective, Flügel (2016) explains fashion as the constant recalibration of the balance between *decoration* and *modesty*. We humans have the innate tendency to expose and adorn our (naked) body, as can be seen with young children and primitive cultures. At the same time, we feel the need to cover our body and have to restrain from attracting attention. The latter is partly innate – but not as strong as the tendency to expose – and partly based on habits and conventions. Clothing forms the ideal medium to balance modesty and decoration, as it covers the naked body while at the time offering a canvas to decorate and accentuate certain body parts. Since habits and conventions tend to change over time and differ from place to place, fashion is in constant flux. (Flügel, 2016)

From a sociological perspective, Simmel (1957) identifies the concepts of *imitation* and *differentiation* as the driving forces behind the constant change in fashion. Humans tend to imitate the social class they (aspire to) belong to, striving for social acceptance and upward social mobility. At the same time, social classes tend to differentiate themselves from lower classes: as soon as a lower class starts to imitate a certain fashion, a new fashion is adopted (Simmel, 1957). This spread of fashion from higher to lower social classes is called ‘the trickle-down effect’. With the emancipation of diverse minorities and the rise of sub- and youth-cultures throughout the second half of the 20th century, fashion is no longer one-directional, but spreads itself also across (trickle-across)

social classes and in upward direction (trickle-up) (Field, 1970).

Building upon the imperative of upward social mobility, that is typical for capitalistic societies, Fallers (1954) uses a socio-economical argument to explain the constant change in fashion. Everyone strives to achieve a higher social status. However, the social ladder is triangularly shaped, which implies that not everyone can eventually reach the next level. Although the aspired status might not be achieved, the trickle-effect provides the social-stayers at least with the aspired status symbols (Fallers, 1954). Contemporary fashion marketing exploits this mechanism by offering brand-accessories (e.g. shoes, bags, perfumes) for those who cannot effort the haute couture pieces.

Next to their explanation of the constant change in fashion, the abovementioned theories reveal another important aspect of fashion: its meaning in the social context. The clothes people wear, reveal a lot about their social status, believes and values. Fashion can therefore be regarded as a sign system that facilitates the social intercourse¹.

Jewellery

Jewellery is a much younger field of study than fashion. Unger (2010) advocates a multidisciplinary approach in the formulation of jewellery theory, taking into account humanities (psychology, sociology and anthropology), art history, economics, literature and fashion theory.

In contrast to the rapid changes and social significance in the field of fashion, jewellery tends to be of a more timeless nature and borne out of personal significance (Unger & Leeuwen, 2017, p. 139). Several authors have described the meanings of jewellery, see for Den Besten (2011, pp. 11–12) and Reinders (2016, pp. 113–114). In the context of this paper, we present the motives to wear jewellery as formulated by Unger & van Leeuwen (2017), because of the broad scope they adopted: taking into account both historical and contemporary examples and unique pieces as well as designs for the masses. They distinguish *beauty and eroticism, power and politics, property and economics, religion and morality, desire and memory and emotions* as motives to wear jewellery.

Beauty and eroticism: as we have previously seen, humans have the innate tendency to adorn their body. The authors illustrate the importance of proportion and sensorial qualities in jewellery, in relation to the human body and the human senses. Moreover, they raise the question whether beauty is in

¹ For further readings on meaning creation within fashion see for example Barthes (1990) and McCracken (1986)

a piece of jewellery, in the way the piece accentuates certain body parts or in the way the wearer 'only' feels more beautiful when wearing the piece (Unger and Leeuwen, 2017, pp. 323–371).

Power and politics: the wearing of jewellery can underline social stratification. This can be formal and regulated, as we for example see with monarchs wearing a crown, mayors wearing a chain of office and soldiers wearing the decorations fitting their military rank. Yet, also the jewellery that is informally worn on a day-to-day basis expresses social status to the world and confirms and supports the self-esteem of the wearer (Unger and Leeuwen, 2017, pp. 371–407).

Prosperity and economics (Unger and Leeuwen, 2017, pp. 407–439): Precious metals and stones represent an enduring financial value, due to their rarity, as well as their physical and visual qualities. In pre-monetary societies and during wartime, jewellery is a practical and safe way to take care of one's financial wealth. At the same time jewellery can be used to show prosperity. It is interesting though how plain 'showing off' is regulated by social norms. According to 20th century Dutch etiquette books, modesty with regards to the number and kind of jewellery worn to a certain occasion is required (Unger, 2004, pp. 198–199)

Throughout the 20th century fine jewellery houses like *Cartier*² and *Van Cleef & Arpels*³ added immaterial value to their pieces by means of signature designs. This branding mechanism is related to the one we see in fashion, yet not as strongly developed.

In the motives described so far, we see resemblances with the topics described in the previous paragraph. This is understandable as jewellery theory partly builds upon fashion theory. At the same time, we like to stress the subtle different accents.

Religion and morality: jewellery can help the wearer to deal with the mysteries and uncertainties of life by providing psychological protection. Examples of this are primitive talismans and amulets, as well as jewellery containing religious symbols and gemstones that are thought to hold magical powers. (Unger and Leeuwen, 2017, pp. 439–463)

² <https://www.cartier.com>

³ <https://www.vancleefarpels.com/eu/de.html>

Desire: jewellery often expresses a desire. Unger and Van Leeuwen (2017, pp. 463–497) particularly mention the longing for past times (retro-styles), for other places (jewellery as souvenirs), for the pure beauty of nature (expressed in organic shapes and naturalistic motives) and for simplicity (as expression of the future or to avoid to stand out).

Memory and emotions overarch all preceding motives to wear jewellery. Although often referring to deceased persons or past events, mementos should not be regarded as merely nostalgic artefacts, yet as components of the wearers' current identity. Some mementos are very private: worn invisibly underneath one's clothes, hidden on the flipside of a pendant or within a locket, or simply 'unreadable' for a general observer. Others use shared, archetypical or conventional symbols. Charm bracelets, wedding bands and red remembrance poppies are examples of the latter. (Unger and Leeuwen, 2017, pp. 463–499)

Wearable technology

Over the last decennia electronics have miniaturized, making electronic devices first portable and later wearable. At the same time storing capacity and the number of integrated functions has multiplied. And lastly, electronic devices no longer stand alone, yet are constantly connected to the cloud. These technological developments allowed for the emergence of the new field of wearable technology. This development has opened up many opportunities. The proximity to the human body, for example, allows for the use of unexplored modalities like warmth and vibration. The constant on-body sensing creates a rich amount of physiological data that has the potential to, for example, monitor our health and reveal behavioural patterns.

In order to get a better understanding of the possible applications of wearable technology we like to refer to the Wearable Technology Application chart as created by the Beecham Group (2018). Silina and Haddadi (2015a) earlier referred to a previous version of this chart. The chart divides the field of wearable technology in eight sectors: glamor, communication, lifestyle computing, sport/fitness, wellness, medical, security/safety and business operations. The chart provides examples of applications, functions and products for each sector.

In the sector *glamor* we find animated decorative designs. An example of this category is *Gemio*⁴, a bracelet with dynamic light patterns that sync to music. The designs in the category *communication* are primarily extensions of the wearer's cell-phone, which prevent the wearer from constantly having to check his or her phone. Incoming calls, messages, activities on social media and notifications are filtered according to rules set by the user.

The *lifestyle computing sector* includes applications related to interacting with computing resource, for example head up display – glasses and gesture control bands. The sectors *Sport/fitness*, *Wellness* and *Medical* are all three activity trackers and/or physiological monitors, respectively aiming at physical training, daily activity and health monitoring. The sector *Security/safety* encompasses designs that support the work of emergency services as well as the safety of individuals. Emergency bracelet *Safelet*⁵ is an example of the latter: when activated a text message with GPS-location is sent to relatives, other users nearby and emergency services. The designs in the final sector, *Business operations*, form an interface to the internet of things (IoT). An example of this sector is *NFC ring*⁶, that functions as a contactless identifier for payment, unlocking doors or exchanging contact-information.

The Wearable Technology Application Chart shows a broad variety of applications both in professional and private contexts with a focus on practical functionality. We are especially interested in those that lay closest to the fields of jewellery and fashion in terms of aesthetics, materialisation and application.

⁴ <https://gogemio.com>

⁵ <https://safelet.com>

⁶ <https://nfcring.com>

status	2017	2020
on market	24	19
pre-order phase	11	2
concept phase	7	2
unclear status	2	3
aborted activities	10	27
changed their activities	0	1

Table 1 - Overview of market status of 54 jewellery-like wearable technology designs in 2017 and 2020

In early 2017 we made an overview of 54 of this kind of wearables that were introduced in the media since 2011. Although we did not formulate any strict selection criteria, we do think that this collection can provide some insights in the market. For each design we listed, product name, company name, website, year of introduction, sector of application, functionalities, used materials, advertisement slogan (positioning) and market status. Table 1 shows their market status back in 2017 and in early 2020. This shows that it is an emerging market, that is quickly changing and constantly searching for applications to build a sustainable business around. Although quite some companies aborted their activities. Some seem to succeed and manage to scale-up. For example, *K ring*⁷, a ring with NFC technology that enables the wearer to pay with his/her ring. *K ring* paired up with *ABN Amro Bank*⁸, so that the banks customers can link the ring to their bank account and pay with it.

⁷ <https://mykring.com>

⁸ <https://www.abnamro.com> and <https://www.abnamro.com/en/newsroom/press-releases/2019/pay-contactless-with-abn-amro-using-ring-watch-or-bracelet.html>

Intersections of fashion, jewellery and wearable technology: creating an overview

When looking at the foregoing descriptions of the three fields, we see similarities as well as differences. For example: the adorning quality – respectively labelled as *decoration*, *beauty* and *glamor* – is a topic in all three fields. However, each of the fields emphasizes different aspects. Fashion theory makes the connection to modesty and social conventions. Jewellery theory accentuates the relation with the human body and the individual perception of beauty. And within the field of wearable technology the focus is on the dynamic expressive quality of the piece.

We could continue by summarizing all similarities and differences, however, we consider it to be more interesting to move to a higher level of abstraction and explore how the three fields relate to one another. We suggest to seeing the three fields as partly overlapping circles (see figure 1). When compared to the other fields, each field has a dominant emphasis: within fashion its meaning in the *social context* is relatively important, within jewellery the emphasis is more on *personal significance*, whereas within wearable technology the *instrumental quality* is essential. Be aware that these are accents: we do not argue that they are exclusive. So, for example, fashion does have instrumental and personal meaning but generally spoken these are not as dominant as its meaning in the social context. Likewise, we neither deny the social and instrumental value of jewellery, nor the social and personal meaning of wearable technology.

By their nature, the fields of fashion and wearable technology have a much faster pace than jewellery, due to the constant change and technology push, respectively, whereas the field of jewellery has a slower pace, because of the personal significance and the use of durable materials.

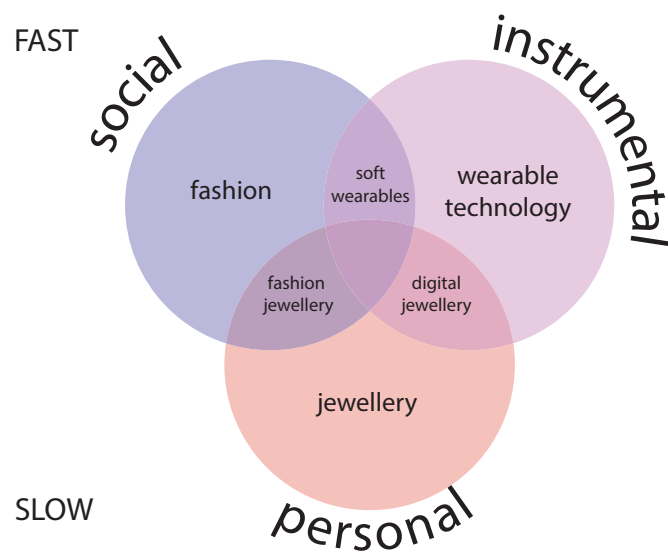


Figure 1 – positioning the fields of fashion, jewellery and wearable technology in relation to each other.

We find four subfields in the overlap of the three main fields. The first subfield to emerge was *fashion or costume jewellery*: decorative elements made of ‘a wide range of ordinary and semiprecious materials [...] that have an ephemeral function, destined to fade away when fashion changes’ (Farnetti Cera, 1997, p. 10). Although the making of jewellery from non- and semiprecious materials dates back to the 18th century (Phillips, 1996, p. 187), fashion jewellery was most popular throughout the 20th century (den Besten, 2011, p. 22). Fashion jewellery benefitted from the new materials (like bakelite) and the department stores, which emerged in the slipstream of the first industrial revolution (Unger and Leeuwen, 2017, p. 615). Gabrielle (Coco) Chanel and Elsa Schiaparelli are the names of two couturiers that are indissolubly connected to early 20th century highlights of fashion jewellery. They convinced their well-to-do clients to leave their ‘real jewellery’ in the safe and replace them by more fashionable and expressive pieces of fashion jewellery. In his essay ‘From gemstones to jewellery’ Roland Barthes analyses how fashion jewellery democratized and secularized jewellery, releasing its singular and magical nature.

Because of its redundant nature, Barthes, who interpreted fashion as a sign system⁹, sees fashion jewellery as an important signifier, that is able to give meaning, structure and personality to clothing (den Besten, 2011, pp. 22–23).

Secondly, on the intersection of fashion and wearable technology we see the emergence of *soft wearables*. Tomico and Wilde (2016) wrote that ‘Soft wearables include clothing and textile-based accessories that incorporate smart textiles and soft electronic interfaces to enable responsive and interactive experiences. When designed well, soft wearables leverage the cultural, sociological and material qualities of textiles, fashion and dress; diverse capabilities and meanings of the body; as well as the qualities and capabilities afforded by smart and programmable elements.’ From this description we see on the one side that soft wearables, because of the close link to textiles, faces very specific challenges in terms of fitting, integration, sustainability and washability (Seymour, 2008; Toeters, 2019). On the other side it uses a crafts approach to explore the implications of close-to-the-body applications of technology, just like we will see on the third intersection.

Thirdly, on the intersection of jewellery and wearable technology the subfield of *digital jewellery* emerges: design concepts that try to balance the instrumental opportunities of wearable technology and the personal meaning of jewellery. Existing wearable technologies have been criticized for lacking an understanding of the implications of the proximity to the human body in terms of aesthetics and personal significance (Wallace & Dearden, 2005). During the last decade the integration of jewellery and wearable technology has been addressed in the academic world by scholars with a background in technology, interaction design and/or craft, mainly through design explorations (e.g. Miner, Chan and Campbell, 2001; Wallace, 2007; White and Steel, 2007; Werner, Wettach and Hornecker, 2008; Ashbrook, Baudisch and White, 2011; Perrault *et al.*, 2013; Silina and Haddadi, 2015b; Versteeg, van den Hoven and Hummels, 2016; Koulidou, Wallace and Dylan, 2019). Others sketched the field and advocated a specific approach (Wallace and Press, 2004; Kettley, 2005; Wallace and Dearden, 2005; Koulidou, 2018).

And fourth, there is the – in Figure 1 unnamed - intersection of the three fields, which we will discuss below.

⁹ See (Barthes, 1990)

Discussion

Before taking a closer look at the unnamed middle part, we will address a possible shortcoming of the overview we created.

Like every schematic overview figure1 can easily be misunderstood as static and over-simplified. We need to be aware that each of the fields is heterogeneous in itself. When we for example zoom in on the field of fashion, we will find that the field exists of *haute couture*, *ready-to-wear (prêt-à-porter)* and *mass-produced clothing*. Likewise, within the field of jewellery we find *art jewellery*, *studio jewellery* and *fine jewellery (haute joaillerie)*. Within the relatively young field of wearable technology the contours of categories are not that sharply defined yet. To make it even more complex we need to be aware of numerous relations between the categories. For example, each category of fashion is associated with a specific type of costume jewellery (Farnetti Cera, 1997, pp. 10–11).

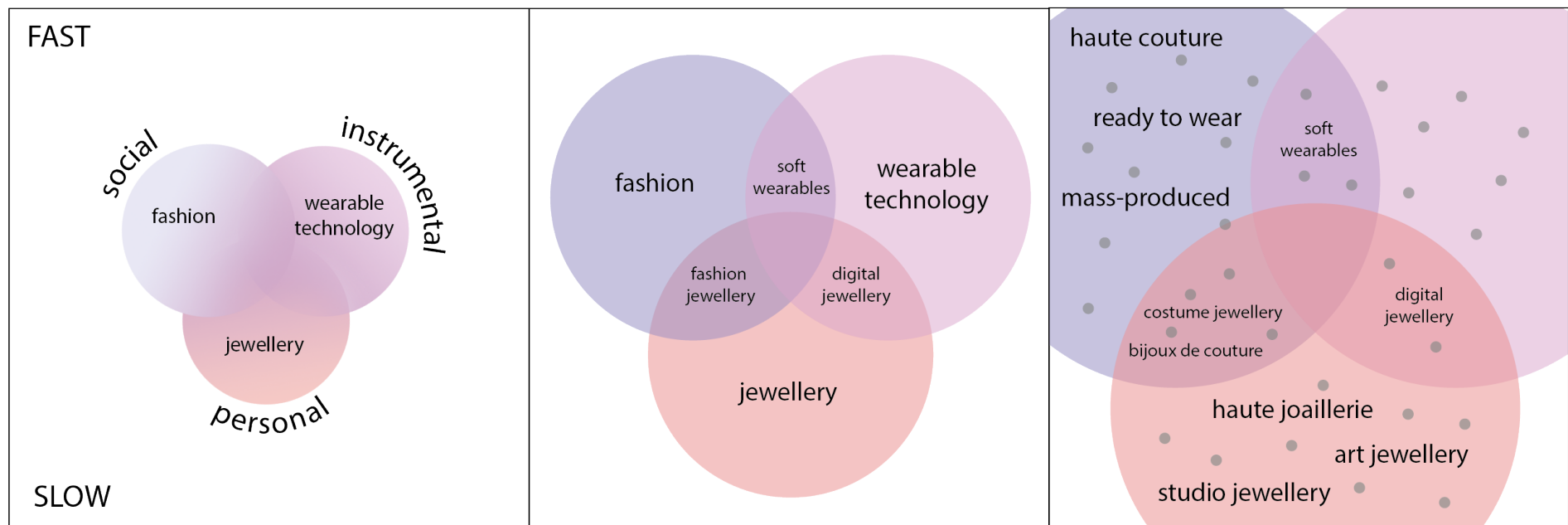


Figure 2 Overview of the fields of fashion, jewellery and wearable technology on different levels of detail. The dots in the far-right - most detailed picture - portray brands and individual designers.

Zooming in further, brings us to the level of single brands and individual designers. Here we find the subtleties of their design-DNA expressed through autonomous ideas and unique craftsmanship. The diversity on this level is the richest in the fields of fashion and jewellery. Think for example of the corsetry of *Jean-Paul Gaultier*¹⁰, the tweed deux pieces of *Chanel*¹¹, the Panthère of *Cartier*¹² and the Spannring of *Niessing*¹³. Or the signature of individual designers, for example the technology-enabled organic pieces of fashion designer Iris van Herpen¹⁴ and the apparent primitively shaped pieces with piles of stones by jeweller Karl Fritsch¹⁵. We fully agree with authors (Kettley, 2007; Koulidou, Wallace and Dylan, 2019) who have previously argued that awareness and appreciation of this richness of craftsmanship can be beneficial for the development of digital jewellery.

Inspired by Tamminen and Holmgren (2016), we consider it important to not only zoom-in, but also zoom-out and adopt a more holistic perspective. Doing so creates awareness that fashion, jewellery and wearable technology – despite differences in pace and emphasis – in the end share the proximity to the human body. Such a holistic perspective has three benefits. First of all, from a distance the borders between the fields will start to blur, which reminds us that in reality the borders are not as sharp as they seem on paper. For example, the fine jewellery collections of big fashion houses like *Chanel*¹¹ and *Dior*¹⁶ are in terms of materials and applied craftsmanship hard to tell apart from those of the luxury jewellery houses (Unger and Leeuwen, 2017, p. 615).

Secondly, in a holistic perspective the apparent contradiction between *technique* – associated with the unique craftsmanship of fashion and jewellery – and *technology* – associated with the industrial mass production of wearable technology – will fade away. In our personal experience, craftsmen often tend to refuse technology either based on anxiety for the unknown or out of a fear that the unique qualities of their craft will get lost. In an earlier study on the value of additive manufacturing for jewellery, the first author concluded that digital technologies broaden the opportunities in terms of complex shapes, dynamic constructions and radical personalisation. Moreover, great potential was found in a hybrid approach, where digital production technology does not take over existing practice, but merges in and therewith renews it (Versteeg and den Besten, 2014). Fulfilling this potential requires an open-minded and

¹⁰ <https://www.jeanpaulgaultier.com> (the menu-button 'La Maison' leads to his corsetry, among other signature creations)

¹¹ <https://www.chanel.com> (a short documentary on the tweed deux piece can be found on <https://inside.chanel.com/en/jacket>)

¹² <https://www.cartier.com> (under the menu-button 'The Maison' one can go to a section on the Panthère)

¹³ <https://niessing.com> (on the homepage there is a menu-option 'Spannring')

¹⁴ <https://www.irisvanherpen.com>

¹⁵ <https://www.karl-fritsch.com>

¹⁶ <https://www.dior.com>

multi-disciplinary approach. Nachtigall (2019) arrives at comparable conclusions in his extensive study into the combination of additive manufacturing and craftsmanship (in this study: shoemaking) for ultra-personalization.

Thirdly, zooming out brings into scope adjacent fields like accessories and wearable aids, which we can learn from as well.

For the above-mentioned reasons, we like to stress that it is beneficial to switch between different levels of detail. In this perspective figure 1, is merely one level.

Let's zoom in further and concentrate on the previously identified design-space in the middle, where fashion, jewellery and wearable technology overlap (see figure 3). Here one would expect to find designs that balance qualities of all fields. This space can be approached from the three adjacent subfields fashion jewellery, soft wearables and digital jewellery.

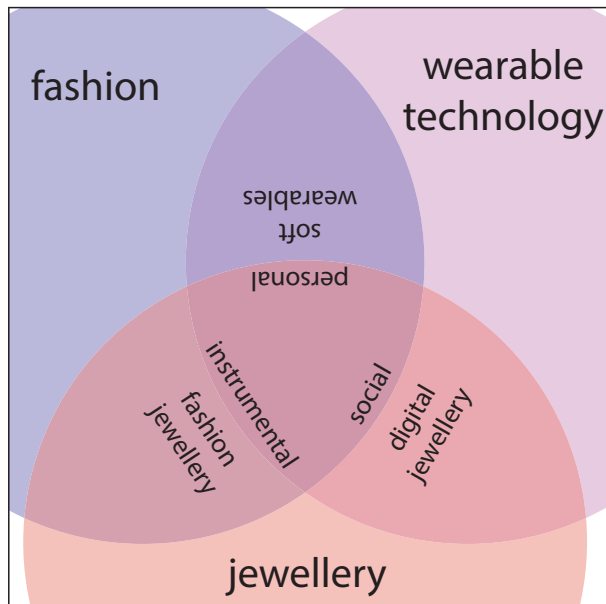


Figure 3 - Further zoomed-in version of previous figure, showing how the space in the middle adds respectively an instrumental, social and personal perspective to the subfields fashion jewellery, digital jewellery and soft wearables.

Each of these subfields already balances elements of two fields. For example, digital jewellery combines the personal value of jewellery with the instrumental qualities of wearable technology. When approaching the middle from the subfield digital jewellery, the social aspect of fashion is added, so we might think of the middle as *social digital jewellery*. Or, coming from soft wearables, as *personal soft wearables*. Or, coming from fashion jewellery, as *instrumental fashion jewellery*. Each of these perspectives on the design space in the middle is equally interesting to explore. Yet, in this article we will focus on social digital jewellery.

Design-researchers in the field of digital jewellery – including ourselves – so far explored how the personal significance and intimacy of jewellery could be maintained while creating a digital piece. These designs primarily focus on the wearer (White and Steel, 2007; Versteeg, Van Den Hoven and Hummels, 2016; Koulidou, 2018) or on the wearer and a significant other (Silina and Haddadi, 2015b; Koulidou, 2018). Sometimes the pieces are even designed with a specific wearer in mind (Wallace, 2007). Moving to the design space in the middle of figure 3, challenges these researchers to also think about the broader social context. How to design digital jewellery that not only hold value for the wearer, yet also search a connection to other people? Pieces that express the wearers' wish to adhere to or distinguish from a certain social group? Thinking about the social context, forces us to think beyond single pieces and introduces networks of somehow connected designs. This connection can both be expressed by physical means like shapes and materials or be a digital connection through the world wide web. Abandoning single pieces in favour of pieces produced in series fits the realm of (wearable) technology production, with relatively high initial costs and low prices per unit.

This also means that we might have to broaden our frame of reference. As design-researchers working on digital jewellery, we so far tend to use *art jewellery*¹⁷ as our frame of reference. *Art jewellery* is the category of jewellery that emerged during the last decades of the twentieth century re-imagining what jewellery could be. This led for example to the use and appreciation of non-precious materials and expressive designs with an emphasis on conceptual quality. Yet, its radical approach also created a niche that is only appreciated by a small group of wearers. Or in the words of Lin Cheung; 'Contemporary jewellery is not often seen worn by 'ordinary' people going about their daily business' (Cheung, Clarke and Clarke, 2006, p. 21). Introducing the social context requires us to broaden our frame of reference and explicitly include jewellery, fashion and wearable technology. When it comes to jewellery we

¹⁷ This field is also referred to as contemporary jewellery, studio jewellery, research jewellery, jewellery design and author jewellery: see Den Besten (2011, pp. 9–11) for a reflection on nomenclature of this field.

support the plea of Unger for the appreciation of nondescript jewellery (Unger, 2010, pp. 161–162), as they - despite their modesty – do play an important role in the daily social context. Including fashion in our frame of reference enables us to build up on the previously described fashion theories. Wearable technology has so far been approached with a certain disdain by design researchers in the field of digital jewellery. Yet, within wearable technology, we find serial available, relatively small and technological-sturdy artefacts, which can be used in a cultural probe in order to explore emergent behaviour, interactions and appreciation.

The following example might help to concretise the foregoing. In 2015 the Swedish start-up *Pins Collective*¹⁸ introduced Pin One to the market. Pin One is a circular brooch holding a reflective LCD screen, to which the wearer can upload an animated GIF-image via Bluetooth using the accompanying mobile phone application. The app allows one to curate his or her own images and browse, like and wear the images of other members of the Pins Collective Community (see Figure 4).

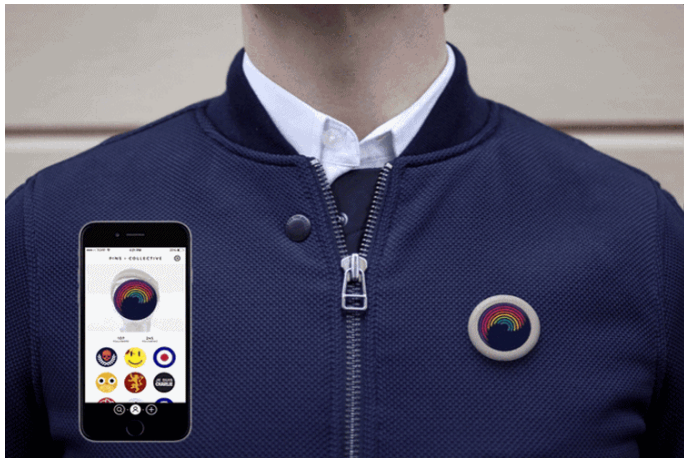


Figure 4 - Pin One by Pins Collective (photo credit: Pins Collective)

¹⁸ <https://pinscollective.com>

We are aware that from a jewellery and fashion perspective comments can be made about the materiality of the piece, yet instead of being critical we like to invite you to look at the opportunities of pin One. From personal experience we know that wearing Pin One is a conscious act: as a wearer one has to decide what image to wear at a certain occasion. The image can vary from an aesthetic pattern matching the colour of one's clothes to a subtle message or silent activism (like buttons). Depending on the image displayed, the context and the wearers' intention pin One can be closer to (instrumental) fashion jewellery, (personal) soft wearables or (social) digital jewellery. In either case the constantly changing animated Gif-image attracts the attention of others and functions as a conversation-starter and a means to express one's taste, preferences and beliefs. This way Pin One starts to play an explicit role in the social context. Now imagine what could happen if more people wear Pin One. Its social function is further supported by the mobile phone app, which allows wearers to connect to kindred spirits. In our perspective it would be interesting to use the serial availability and technological robustness of pieces like Pin One to study and iterate on both the experience and behaviour of individual wearers and the behaviour and appreciation that emerges when a larger group wears it in a social context. This study would require a post-phenomenological perspective in which Pine One mediates between the wearer and the world. Meaning is created in the interaction between the two, which might imply that emphasis can dynamically shift between personal, social and instrumental value.

Conclusions

The overview created in this article helps to better understand the mutual relations between fashion, jewellery and wearable technology. It not only creates awareness of the different perspectives, but also of the different levels of detail that should be considered. This awareness will help to further explore the design space that we identified on the overlap of the three fields. We propose to use commercial examples of wearable technology, like pin One, in this process, as they are serially available, relatively small and technologically-sturdy.

Writing this article has sharpened our thoughts and challenged us to rethink the limitations of our own perspective. We hope it has a similar effect on you. But most of all we hope that you will enjoy wearing jewellery. In whatever (sub)field it might fall.

References

- Ashbrook, D., Baudisch, P. and White, S. (2011) 'Nenya', *Proceedings of the 2011 annual conference on Human factors in computing systems - CHI '11*, p. 2043. doi: 10.1145/1978942.1979238.
- Barthes, R. (1990) *The Fashion System*. Berkeley: University of California Press.
- Beecham Research (2018) *World of Wearable Technology Applications Towards Function With Style*, Beecham Research. Available at: <http://www.beechamresearch.com/article.aspx?id=20> (Accessed: 21 January 2020).
- den Besten, L. (2011) *On jewellery: A compendium of international contemporary art jewellery*. Edited by W. Brouwer. Arnoldsche.
- Cheung, L., Clarke, B. and Clarke, I. (eds) (2006) *New Directions in Jewellery II*. London: Black Dog Publishing.
- Fallers, L. A. (1954) 'A Note on the " Trickle Effect "', *The Public Opinion Quarterly*, 18(3), pp. 314–321.
- Farnetti Cera, D. (1997) *Costume Jewellery*. Milan: ACC Art Books.
- Field, G. A. (1970) 'The status float phenomenon: upward diffusion of innovation', *Business Horizons*, 13(4), pp. 45–52.
- Flügel, J. C. (2016) 'The fundamental motives', in Welters, L. and Lillethun, A. (eds) *The fashion reader*. second. Bloomsbury. (original work published in 1930), pp. 169–173.
- Kettley, S. (2005) 'Framing the Ambiguous Wearable', *Convivio web-zine*, (2), pp. 1–15.
- Kettley, S. (2007) *Crafting the wearable computer*, *Computing*. Napier University, Edinburgh.
- Koulidou, N. (2018) 'Why should jewellers care about the digital?', *Journal of Jewellery Research*, 01(February), pp. 17–33. Available at: <http://www.journalofjewelleryresearch.org/wp-content/uploads/2018/04/JOJR-vol-1-Koulidou.pdf>.
- Koulidou, N., Wallace, J. and Dylan, T. (2019) 'The materiality of digital jewellery from a jeweller ' s perspective', *Proceedings of the 4th Biennial Research Through Design Conference*, (March), pp. 1–16. doi: m9.figshare.7855748.v1.
- Lillethun, A. (2016) 'Fashion theory - introduction', in Lillethun, A. and Welters, L. (eds) *The fashion reader*. second edi. Bloomsbury, pp. 117–123.
- McCracken, G. (1986) 'Culture and Consumption: A Theoretical Account of the Structure and Movement of the Cultural Meaning of Consumer Goods', *Journal of Consumer Research*, 13(1), pp. 71–84. doi: 10.1086/209048.

- Miner, C. S., Chan, D. M. and Campbell, C. (2001) 'Digital jewelry: wearable technology for everyday life', *Extended Abstracts on Human Factors in Computing Systems*, pp. 45–46. doi: 10.1145/634067.634098.
- Nachtigall, T. R. (2019) *Materializing data: craftsmanship and technology for ultra-personalisation*.
- Perrault, S. T. et al. (2013) 'Watchit: simple gestures and eyes-free interaction for wristwatches and bracelets', *Proceedings of CHI 2013*, pp. 1451–1460. doi: 10.1145/2470654.2466192.
- Phillips, C. (1996) *Jewelry: from Antiquity to the Present*. London: Thames & Hudson.
- Reinders, C. E. M. (2016) *(re)Defining Jewellery: sieradencollectie CODA Museum*. Apeldoorn, The Netherlands: CODA.
- Seymour, S. (2008) *Fashionable Technology: the intersection of design, fashion, science, and technology*. Vienna, Austria: Springer.
- Silina, Y. and Haddadi, H. (2015a) "' New Directions in Jewelry ": a Close Look at Emerging Trends & Developments in Jewelry - like Wearable Devices', *ISWC '15 Proceedings of the 2015 ACM International Symposium on Wearable Computers*, pp. 49–56. doi: 10.1145/2802083.2808410.
- Silina, Y. and Haddadi, H. (2015b) 'The Distant Heart : Mediating Long-Distance Relationships through Connected Computational Jewelry', *arXiv*. Available at: <http://arxiv.org/abs/1505.00489>.
- Simmel, G. (1957) 'Fashion', *American journal of sociology*, 62(6), pp. 541–558.
- Toeters, M. (ed.) (2019) *Unfolding Fashion Tech: Pioneers of Bright Futures 2000-2020*. Eindhoven: Onomatopee.
- Tomico, O. and Wilde, D. (2016) 'Soft, embodied, situated & connected: enriching interactions with soft wearables', *mUX: The Journal of Mobile User Experience*. *mUX: The Journal of Mobile User Experience*, 5(1), pp. 1–17. doi: 10.1186/s13678-016-0006-z.
- Unger, M. (2004) *Het Nederlandse sieraad in de 20ste eeuw (Dutch jewellery in the 20th century)*. Bussum.
- Unger, M. (2010) *Jewellery in context*. english tr. Arnoldsche.
- Unger, M. and Leeuwen, S. van (2017) *Jewellery Matters*. Rotterdam: nai010 publishers.
- Versteeg, M. F. and den Besten, E. L. (2014) 'Add What ? a Reflection on the Application of Additive Manufacturing for the Creation of Jewellery'.
- Versteeg, M., van den Hoven, E. and Hummels, C. (2016) 'Interactive Jewellery: A Design Exploration', *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction*, pp. 44–52. doi: 10.1145/2839462.2839504.

- Versteeg, M., Van Den Hoven, E. and Hummels, C. (2016) 'Interactive Jewellery: A design exploration', *TEI 2016 - Proceedings of the 10th Anniversary Conference on Tangible Embedded and Embodied Interaction*, pp. 44–52. doi: 10.1145/2839462.2839504.
- Wallace, J. (2007) 'Emotionally charged: A practice-centred enquiry of digital jewellery and personal emotional significance', *Development*, (July), pp. 1–228. doi: 10.1258/jrsm.100.8.368.
- Wallace, J. and Dearden, A. (2005) 'Digital jewellery as experience', *Future Interaction Design*, pp. 193–216.
- Wallace, J. and Press, M. (2004) 'All This Useless Beauty: The Case for Craft Practice in Design For a Digital Age', *The Design Journal*, 7(November), pp. 42–53. doi: 10.2752/146069204789354417.
- Werner, J., Wettach, R. and Hornecker, E. (2008) 'United-pulse: feeling your partner's pulse', *Proceedings of the 10th international conference on Human computer interaction with mobile devices and services*, pp. 535–538. doi: 10.1145/1409240.1409338.
- White, H. and Steel, E. (2007) 'Agents of change: from collection to connection', *The Design Journal*, 10(2), pp. 22–34. Available at: <http://www.tandfonline.com/dianus.libr.tue.nl/doi/pdf/10.2752/146069207789272703> (Accessed: 2 November 2015).