

# Digital Humanities and Techno-Animism in Wearables: A Case-Study-Based Collaborative Design Framework for Digitally-Ensouled Jewellery

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**Abstract.** Technology-enhanced jewellery capable of collecting bio-data are rapidly establishing a presence in the market. Yet there is limited focus on applying core values of traditional jewellery in the making process. In this research, we were inspired by the theory of animism, and investigated the concepts of techno-animism and digital ensoulment of jewellery. By going back to the roots of jewellery design, we investigate the cultural and social importance of the jewellery components and making techniques and propose a set of guidelines that consider data collection as a fundamental component of the creation process. Our findings are based on two research based jewellery-making workshops, along with a technology review and our guidelines aim to provide a set of accessible and actionable suggestions for the design of future technology-enhanced jewellery.

**Keywords:** Animism · Wearable · Jewellery · Digital ensoulment · Design

## 1 Introduction

What is observed in the latest wave of technological tools to appear in the global market, is an exponential rise in the number of wearable accessories which can gather and analyse bio-data from the user. As these technological accessories attempt to digitally “ensoul” information – store bio-data inside the physical object – we form an analogy with animistic practices in the sense of attributing a spirit (anima) to inanimate objects and categorize the process as a form of techno-animism. Even though the idea that we are living in a techno-animist world is not something new – theorists from a number of disciplines such as Laurel, Erik Davis, Alfred Gell, Betti Marenko- have discussed variations of this concept extensively in their work [3, 9, 10, 17, 18] there was never a correlation, to our knowledge, between design methodologies and creation techniques rooted in animist principles – and our contemporary designers and makers working on the current generation of techno-animist wearable accessories.

Our contribution is in the field of jewellery making and animism, particularly in the practices itself of ‘ensoulement.’ Whereas ‘ensoulement’ of things and objects in animist societies is often carried out ceremonially, underlying cultural etiquettes and cosmological worldviews, the process of “data ensoulment” by technological tools such as digital jewellery is approached from a perspective reflecting consumerist principles. It is not so much cultural narrative and design process of the tech tool itself in its entirety which is given special significance but its internal memory card and the information saved within it: photos, videos, documents, notes and passwords. Emerging technologies currently available in the market that gather bio-data such as the ‘Fitbit’ fitness products and ‘Jawbone’ bracelets are indicative of this trend [16, 30]. These digital wearables, as with most products that follow technological breakthroughs, place emphasis primarily on product design intended for mass production – and not on their perennial use. They are designed to be functional only for very short period of time, perhaps a few years. Moreover they show little concern to core values of traditional jewellery design, which is the focus of our investigation.

In this research, we attempted to re-ground the field by firstly investigating the roots of “data ensoulment” in jewellery and to create a methodology of creating technology enhanced wearable accessories, based on the knowledge of the past. We believe that our research can positively contribute towards the maturity of the practice and to the much needed shift towards a greater balance between core values of craftsmanship from one end, and cutting edge technology on the other, so that they integrate and inform each other in a unified practice. This paper delineates the results of the first part of our research, a dialogue and a workshop with traditional craft jewellery designers, to produce a set of guidelines to drive further our research. 22 designers, ranging from undergraduate students to experienced designers, were invited to create jewellery that “evolve” over the course of time, depending on the data collected from the wearer. The designers were interviewed and invited to talk about their design methodology and thinking process. The results were then used to produce a set of guidelines, which were subsequently contextualized by findings taken from public research.

This research builds further on the work of pioneers in the field such as Jayne Wallace and her collaborators who conducted extensive work on over the years on the concept of “digital jewellery” [34–36] and how they can be used as a communication device. We also acknowledge the work done by Yulia Silina and Hamed Haddadi who created a very detailed and comprehensive survey of current “ensouled jewellery” that are currently in the market [29]. This work differentiates itself by concentrating specifically on shape changing, evolving jewellery. The aim of research is twofold. Firstly, to invite the disciplines working in this field to start re-thinking their approach on the process of ensoulement of technological tools which collect bio-data and secondly to produce a set of easily accessible and actionable guidelines for designers and engineers currently working towards shape-shifting wearable accessories.

In the next section, we will shortly discuss our theoretical grounding, exploring the theories of animism within the discipline of social anthropology. Following up, an outline of existing products and research on digital jewellery will be presented. We will then introduce our workshop process and data collection method. The following section is our main contribution, the presentation of our 10 guidelines supported by the empirical evidences from the workshops. We will further discussed the current

wearable technologies and their future usage in digital ensouled jewellery. Finally, the paper concludes by an overview of the author's future plans and the technologies they are currently investigating.

## 2 Digital Humanities

Tracing the historical evolution of the field Digital Humanities, Schnapp and Presner explained in an article entitled 'Digital Humanities Manifesto 2.0' [33] that there have been two waves. During the first wave the field was known as "Computational Humanities" or "Humanities Computing" and it was expected to provide support to "real" humanists who treated the machineries efficiency as a "servant" in humanities research projects rather than as "its participant enabling of criticism" [25]. We argue that we are experiencing the onset of the second wave. As the outreach of research projects have expanded and the computationally efficiencies are rapidly advancing it has become clear in academic circles that "Computational Humanities", though by nature a hybrid domain, has reached a point where it constitutes a disciplinary field in its own right, with its own orthodoxies, particular professional practices, standards and theories. As Hayles noted [14], renaming the field to "Digital Humanities" was done to acknowledge that computational analysis was part and parcel of research projects ranging from STEM to Social Sciences and Humanities. Thus if the first wave of Digital Humanities is quantitative, focusing on archiving, taxonomizing data, text encoding, markup, scholarly editing and establishing a technological infrastructure, the second wave, quoting Schnapp and Presner, is "qualitative, interpretive, experiential, emotive [and] generative in character." In this wave Digital Humanities are employed in the service of "humanities core methodological strengths" such as "attention to complexity, medium specificity, historical context, analytical depth, critique and interpretation." Digital Humanities 2.0 introduced new disciplinary paradigms, convergent fields, hybrid methodologies, and publications models that are not limited to print culture.

Berry [2] proposes and invites scholars to ride a third wave. In this shift he explains we should explore how knowledge is transformed in the 21st century by assuming a philosophical approach to the subject of computer coding and software and connect these are "to the materiality of this growing digital world." Rather than focus exclusively on digital practices that tend to be conceptualized in terms of ICT skills and competences, in Digital Humanities 3.0 we should reflect upon "the epistemic changes produced by the digital component in the digital humanities in the light of its medium specificity" and explore how the various possibilities that can be presented as computational forms mediate our experience of contemporary culture and society. Therefore, "If code and software are to become objects of research for the humanities and social sciences, including philosophy, we will need to grasp both the ontic and ontological dimensions of computer code." "[We] could say" Berry writes "that third-wave digital humanities points the way in which digital technology highlights the anomalies generated in a humanities research project and which leads to the questioning of the assumptions implicit in such research, e.g. close reading, canon formation, periodization, liberal humanism, etc. Moreover, no matter (pun intended) how immaterial and

wireless digital information may be appear or critically argued to be abstracted from matter, it is never independent from material processes, nor abstracted from infra-structural constraints. Bits are both logical and material entities. Blanchette [4] argued that “the historical dialectic between abstraction and implementation is absent from computer scientists’ own accounts of their discipline” and cautions that without a mode of analysis addressing the “stuff of computing” we run the risk of resorting to theories addressing embodied subjects interacting “in environments curiously lacking specific material constraints.”

In this paper, we contribute to the debate by setting up an experiment which brings together stakeholders from different disciplines and ask them to work together in order to produce a coherent methodology of action. The chosen stakeholders – anthropologists, jewellery designers and engineers - have limited experience working across the disciplines and through this case study our aim is to identify any issues and propose a working methodology of collaboration.

### 3 Theories of Animism

Encountered in societies around the world animism is the worldview whereby non-human entities, non-organic objects, cultural artefacts and natural formations are embedded with a spiritual essence or soul, as well as a sense of ‘secondary agency,’ often retaining the capacity to assume personhood and engage in direct dialogue with humans. The process itself of ensoulment can be spontaneous or performed ceremonially. Amongst Amerindian people for example objects are believed to be endowed with the capacity to attract individuals with whom they come into casual contact, while other objects can only become animated through intimate association. Some objects in-turn may be perceived as a source of sorcery or to be endowed with important fertilising powers which increase with the passage of time and with their transmission from generation to generation [26].

Animism is not absent from ‘modern societies, nor the West, despite positivist and objectivist discourses – a characteristic of the modern world and Western thought– which insists on the interior differences between humans and non-humans (as well as natural objects) in that only humans possess a meaningful sense of selfhood, whether individual (mind, language, capacity of symbolism) or collective [12]. In a recent article Santos Granero offers several examples of objects treated as if ensouled within the west, from Paganini violin, to wedding dresses passed down from mothers to their daughters, to cell phones with important data [26]. Objects, artefacts or tools with significance that goes beyond the metaphorical, but touches upon the spiritual. Santos Granero presents the case of Barack Obama who was sworn in as US president using not one but two bibles. The one was the bible used by Abraham Lincoln and the other was the bible used by Martin Luther King because, as Barack Obama explained there was a “connection” between “the sacrifices of these two men” and himself getting elected.

Anthropologist writing on animism since the postmodern turn in the 1980’s have considered animism as a relational notion regarding human-environmental relationships [2] with things and objects in a landscape retaining capacity for ‘secondary agency’. Strathern proposes the concept of the ‘dividual’ as opposed to “individual” to describe

members in animists societies, which denotes ‘a person constituted by relationships [19], material objects included.’ In her work Strathern draws from Gibson’s Ecological Approach to Visual Perception and his affordance theory where the landscape is not only perceived as spatial and morphological relationships, but filled with latent possibilities for action (*affordance*). “The perceiving of an affordance is” wrote Gibson “a process of perceiving a value-rich ecological object. Any substance, any surface, any layout has some affordance for benefit or injury to someone. Physics may be value-free, but ecology is not” [15]. A stone affords to be sited upon, to be used as a table, as a door holder, to be thrown against a wall. If it’s small enough it can be used as a bead on a jewellery, and in recent years, embedded with technologies collecting bio-data.

In recent theories on animism, led by Viveiros de Castro [32], authors call for an ontological reorientation of our theoretical framework that resonates with the natives’ point of view. Producing animist accounts premised on non-animist assumptions, these authors argue, will only produce contradictory results. Cartesian metaphysics and concepts such as Nature Vs Culture –characterising the Western Intellectual Tradition– are not capable of analysing the relational ontology of animism or grasp an animist universe where such distinctions are absent [4, 12, 25, 26, 31, 32] “This approach “writes Holdbraad” gives logical priority to the task of conceptualization: what kind of thing must ‘things’ and ‘spirits’ be if statements such as ‘things are spirits’ are to make sense as more than just bizarre oxymorons?” [12].

Whereas symbolism and cultural metaphor are implicit in the relational approach which advances the ideas of multiculturalism, inter-subjectivity and one nature, an animist worldview from an ontological framework is multinatural, perspectival and uni-cultural. Spirits, entities in dreams, rivers, trees, insects, cultural artefacts, animals and humans co-exist symmetrically in one experiential reality as ‘persons’ clothed with a particular form (nature) and who act according to the perspective accorded by that form in a cosmological performance of alliances amidst warfare [31, 32]. Engaging with animism thus becomes an existential ontology which, following Tim Ingold, sets to “recover that original openness to the world in which the people whom we (that is, western-trained ethnologists) call animist find the meaning of life” [12]. Tim Ingold fuses together ecology and phenomenology to argue that societal culture is in many respects the weaving together of material objects in a process of “emerging involvement” within the “lifeworld” and that life itself is woven together by a web of movements [13].

It is within this theoretical narrative of animism where we place our research for digital jewellery identifying the creative as well as ritual process that needs to be followed in order to induce meaning and the sentiments of craftsmanship to the maker and the wearer.

## 4 Wearables and Fashion

During the last twenty years, research into technology enhanced jewellery was primarily conducted by technology companies like IBM and Nokia [28]. Most of the commercial available wearables currently fall under the *Wellness and Sports & Fitness* market sectors [6] and these objects focus around the idea of telling the wearer something about their bodily state. Researchers, such as Wallace and Seymour, argue

towards the potential computational jewellery however they stress the importance to move away from products that look too much like gadgets [19, 27]. Jayne Wallace did extensive research in the field of “digital jewellery” and she describes her work as an exploration of the potential of jewellery, digital technologies and design artefacts within meaningful spaces in people’s lives [5]. In her work, which is both physical and conceptual has laid out the foundation for both design and theory of technology embedded jewellery, primarily investigating the development of digital artefacts and design methods that explore intimate contexts of human experience [36]. Building on the hypothesis that “*If an object embodies elements of personal significance for an individual, attachment with that object may occur. Attachment through form and function will lead to an enduring relationship between individual and object*” [35] Wallace developed three research strands: The exploration of significance and attachment of a jewellery piece through (a) personal use (b) personal symbolism and (c) through the unique communication afforded by the digital function of the jewellery. Both the hypothesis and the research directions exemplify the commonalities between the literature and the principles of Animism.

Yulia Silina, in her paper “New Directions in Jewellery” has done an extensive survey, examining 187 jewellery-like devices that are either already available on the market or at various stages of development and research [28]. In their discussion, they state that “although jewellers understand the market, consumers and historical context of adornment and jewellery use, until recently they were able to create simple on/off devices, missing out on the potential of computational technology. On the other hand engineers and to some extent product designers, often misunderstood the core requirements surrounding fashionable technology” (ibid). Recently however, they are happy to notice an increase in collaboration between engineers and jewellers and they has been an increase in aesthetic and technological pieces evident in pieces such as *Misfit Swarosky Shine, Cuff* [29] and *FibBit Tory Burch* [30]. Unlike traditional jewellery pieces, Yulia noted that the majority of the current jewellery-like devices use material which are “but a poor shadow” of precious metals, gemstones, woods and shells. They then continue to identify products such as *Purple* [23] and *Looksee* [17] that clearly demonstrate that it’s well worth looking at producing pieces through the eyes of a jeweller (ibid). It is also very interesting to note that they identify the immense potential of color/odor/temperature and shape shifting material to the new dimension and communication they can offer to technology enhanced jewellery.

A final related discussion point, raised by Yulia, is the one regarding interaction modalities. In order to move away from what we call “gadgets”, makers are now attempting to conceal screens and LEDs. This opens up unexplored avenues of novel modalities and this is exactly where our research falls under.

## 5 Our Approach Towards the Guidelines

The investigation began with an extensive literature review on technologically enhanced jewellery design methodologies (presented in the previous section) and technological trends (presented in a subsequent section) in both the academic and the commercial sectors, followed by two design workshops.

In the beginning, we compiled a questionnaire, which was sent to 22 designers (12 undergraduate students and 10 experienced designers, averagely aging 33.5 years-old, and 19 are females), aimed to get an insight into their background and skills, current work methodologies, past experience with technology and their interest to experiment with new methods and techniques. These questions were partially shaped by the three research strands identified by Wallace and discussed in the previous section. In order to enhance creative spontaneity and freshness we intentionally looked for designers with no extensive experience with technology, as we wanted to avoid bringing in their past methodologies in the creative process.

Subsequently, the designers were asked to attend a full day workshop where they would have to complete a brief by creating prototype designs. As there were a large number of participants, two workshops were organized at two university labs in two days. The designers were introduced to current trends in digital jewellery design and subsequently presented with the workshop brief. The designers had one full day to complete the work and present their prototypes by the end of the day. They had the creative freedom to use any kind of materials they wished. At the end of each workshop, there was a presentation session and a discussion and the whole day was documented through video recordings.

Here we present an outline of the brief:

*This research envisions the creation of jewellery that evolve (change characteristics such as shape and color) over the course of time, depending on the data it collects from its wearer. Our aim is to create pieces of jewellery that become personalized over a period of time thus creating a deeper emotional connection with its owner.*

*The speculative material you are meant to use, will be infused with a technology that will be able to “en-soul” the bio data of its wearer. It will be able to understand a persons’ mood, attributes and emotional state (happiness, sadness, excitement, fear, anger) and gradually evolve to reflect the person’s life.*

*As each piece will be slowly changing, no two pieces will be the same. At its final form, the jewellery will be a visualization of certain character traits of an individual and because of this we hope the jewellery will acquire an even greater emotional value and be able to transcend generations.*

## 6 Guidelines for Digitally “Ensouled” Jewellery

The following guidelines were prepared by drawing from the literature review, our grounding theory on Animism, and the 2 workshops. The guidelines are separated into two types – Type A Guidelines which should apply to all types of “ensouled” jewellery and Type B Guidelines – Which offer possibilities of different variations.

Reviewing core Animism principles, we can see that objects: act as a representation of past events (addressed in our guidelines 2, 3, 9, 10), carry social status (addressed in guideline 9 and 10) and that the manner which with they are worn (address in guideline 4). We can also see that there is a great importance in the act of making them (address in guideline 6) and at the moment where they are passed over from one generation to the next (address in guidelines 5 and 6). Furthermore, Tim Ingold, talking about the

“lifeworld” it’s almost as he is predicting the fusion of the real and the virtual worlds in our contemporary society and the importance it will play in the development of emotions and the self (guideline 7). Finally, by looking at the work of Wallace and Yulia, it is clear to say that the most common pitfall of technology enhanced jewellery is their look and feel. Most of the guidelines are pushing towards traditional jewellery design but this is addressed directly in guidelines 1, 6, 8, 9 and 10.

## 6.1 Type A: General Guidelines

### 1. Aesthetic Qualities

“Current technology jewellery forgets the importance of tradition and nostalgia, and even though I usually stay away from traditional designs, in this case I think it’s important to go back to the basics.”

Jewellery pieces should adhere to classic jewellery design principles.

Strategies for designers:

- Consider attractiveness and aesthetics of traditional jewellery pieces. Designers should pay special attention to craftsmanship and quality of materials.
- Aesthetic values should be considered by designing for different user groups and offering a choice of diverse material qualities – for example precious or non-precious materials to meet customer satisfaction.

### 2. Reflecting feelings (or data) on the Jewellery piece

Create a *code* that translates the data into different configurations, adhering to aesthetic qualities of your target market.

Figure 1 (a) and (b) show two examples where happiness creates more elongated shape, sadness creates compress, confidence creates smooth surface, and shy for rough surface, and anxiety for ripple.



(a)



(b)

**Fig. 1.** (a) Clay Prototype, 2015, Kelly Santer. (b) Clay Prototype, 2015, Lukas Grewenig





**Fig. 2.** Clay Prototype, 2015, Kristina Sutcliffe



**Fig. 3.** Sketch Prototype, 2015, Annette Holmgaard Laugesen

#### Strategies for Designers:

- Consider a variety of shapes and/or colours that are distinguishable by different types of emotions (or data).
- Distinguish individual emotions derived from different occurrences through a variety of shapes and/or colours so that they can be identified.

#### 3. Transparency of Feelings to the outside world

It is evident from the research that not all designers want to create jewellery that make the feelings of the wearers transparent to everyone. A method needs to be identified that “protects” the wearer from feeling over exposed.

#### Strategies for Designers:

- Consider finding ways to personalize the meaning to the owner. One way to do this could be to have a modular design that allows different configurations.

Consider a form that allows you to conceal and reveal personal qualities within individual jewellery pieces, like a pendant, bracelet or ring. Not only to think about the placement, but also take into account colour and texture as a means to conceal and reveal. As shown in Fig. 2, Krsitna stated “Outside is pretty and beautiful, inside it has green spikes, reflecting the real emotion.”

#### 4. Contact with the Skin

Jewellery should have direct contact with the skin, as this creates a much more intimate relationship with the object.

#### Strategies for designers:

- Consider bangles, necklaces and rings.
- Biodata can be more easily connected when there is contact with the skin.

#### 5. Pass down generations

With the sketch illustrated in Fig. 3, Annette said “the family is like rings in tree junk, in different colors to represent period in life”.

Ancestral knowledge can be accumulated and then re-mapped when passed down a generation.

#### Strategies for Designers:

- Clearly differentiate where one generation begins and where it ends.

- Differentiating between generations could be one way to build up layers of evolution of the piece.
- Slow down the shape shifting process.
- Changes should occur over a number of years.

#### 6. Involve the owner in the making process

The owner should feel part of the making process of the piece. This offers greatest personalization and expresses individuality. Figure 4 shows an example of the rings breaking apart based on the wearer's life event.

Strategies for Designers:

- Single jewellery breaks and into more pieces, creating multiple individual heirlooms.
- Single jewellery breaks/fractures and re-assembles in different configurations.

#### 7. Collect information from the virtual self

Emotions are expressed in more than one realm with the virtual self – realized through online interactions and social networks – being equally important as physical interactions.

Strategies for designers:

- Consider the possibility to also collect emotional data from social networks.
- Use online data as a way to filter bio data (e.g. identify what caused spikes in emotions).

## 6.2 Type B - Guidelines for Variations

### 8. Modular Designs

Through the use of a modular system (pieces of jewellery made to allow user customization) wearers have the flexibility to choose from a range of custom-generated components.

Strategies for designers:

- Offer pieces which be worn alone or as part of a set.
- Each piece should evolve in a different manner to allow differentiation.

Joanna sketched a set of bracelets where each represents wearer's emotion in each day, as shown in Fig. 5. She says, "You could choose which ones you want to wear depending on your mood – You can choose to wear the ones that were generated in a happy day of your life or a sad one."

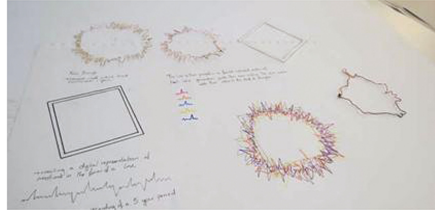
### 9. Social Status

By demonstrating a literal depiction of emotions or circumstances, the designer creates pieces that elevate the social status of the wearer, as shown in Fig. 6.

Strategies for Designers:



**Fig. 4.** Clay Prototype, 2015, Philip Palmen



**Fig. 5.** Sketch Prototype, 2015, Joanna Garner

- Consider the use of demonstrating emotions in a literal (1 to 1 mapping) to create pieces that demonstrate pure characteristics – i.e. honesty, courage.

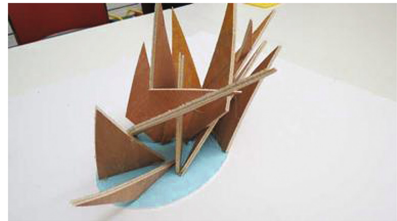
“A piece of jewellery can be viewed like a diary of your life.” Says Mirka

#### 10. Negative Emotions

Research reveals that in some occurrences, people would like to disclose attributes, which are perceived as not being positive (such as fear, pain and frustration). Figure 7 shows one example sculpture that reflects the anger.



**Fig. 6.** Clay Prototype, 2015, Mirka Janeckova



**Fig. 7.** Wood Prototype, 2015, Annette Holmgaard Laugesen

#### Strategies for Designers:

- Turn negative emotions into powerful shapes.
- Consider the use of segmental structures, which can grow freely in a variety of different directions to create spectacular forms.

Annette states, “What if the jewellery turns beautiful when negative emotions happen?”

## 7 Further Case-Study

In this section we will analyse two existing digital jewellery (i.e. Fitbit Charge<sup>1</sup> and Ringly Ring<sup>2</sup>), in the context of Animistic Jewellery, by applying the ten guidelines described in the previous sections.

### 7.1 Fitbit Charge

Fitbit Charge, released in October 2014, is a device that user wears on his/her wrist and tracks a number of statistics in real-time, including steps taken, distance travelled, calories burned, stairs climbed and active minutes throughout the day, while the Charge in the night, tracks sleep. As shown in Fig. 8, the Fitbit Charge is made of a flexible, durable elastomer material similar to that used in many sports watches, and it shows the real-time data on its OLED display, to notify the wearer with light flashing and tactile vibration. In addition, the wearer's information will be shown with more visualization in the online dashboard or the mobile application which synchronize with the wearable Fitbit Charge in real time.

Although the Fitbit Charge could be closely attached to the wearer's skin (Guideline No. 4), we can see that its form did not follow the aesthetics of the traditional jewellery (Guideline No.1), but present a type of industrial product design. With its unified (i.e. non-personalized) shape (Guideline No. 6 & 7) and dis-embodied information, the Fitbit Charge system doesn't take the further steps to transform the bio-data into more personally meaningful information, such as emotion, and reflect on the accessory itself (Guideline No. 2 & 3), thus it would be difficult to represent personal meanings and be passed down through generations (Guideline No. 5). Like most of today's digital gadget, Fitbit Charge could be easily disposed and replaced while newer generations or more advanced competitive products are released.

### 7.2 Ringly Ring

The Ringly Ring (Fig. 9) is a Bluetooth-enabled notification ring that connects to the wearer's smartphone and keeps them updated with incoming texts, calls, and emails via dimming LEDs and vibrating patterns. The Ringly Ring hides the technologies under the normal form of a ring, keeping the traditional aesthetics of the ring-type jewellery (Guideline No. 1). Compared to the Fitbit Charge which is to be worn on the wrist, the Ringly Ring presents a more closed contact to the wearer with the finger as the tightly wearing position (Guideline No. 4). In addition, the company provides a customization service that allows their customers to design their own shapes and sizes, to create a more personalized accessory (Guideline No. 6). However, falling into the same dilemma as the Fitbit Charge, the Ringly Ring does not elaborate the digital information into a more personalized representation, further limiting its capability of

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<sup>1</sup> <https://www.fitbit.com/hk/charge>.

<sup>2</sup> <https://ringly.com/>.

reflecting emotions and social status, and being passed down through generations (Guideline No. 2, 3, 5, and 9).



**Fig. 8.** Fitbit Charge. Website: <https://www.fitbit.com/hk/charge>



**Fig. 9.** Rignly Ring. Website: <https://ringly.com/>

In summary, we observed the upcoming trend of bringing back and personalizing the aesthetics of traditional jewellery in the design of wearable accessories. However, there is still a long way to achieve the animistic jewellery that could reflect the wearers' personal feelings, both positive and negative, through the intrinsic properties (i.e. color and shape) of the accessories, and further be transferred through generations, partly due to the limitation in the current technologies. In the next section, we will provide our insights and visions on how science and technology could support the design of animistic jewellery.

## 8 Insights on Technology

While most of emerging wearable technologies have been overlooking rich emotional associations of jewellery [36], we envision that, underlining animist, or rather techno-animist principle the future of digital jewellery, “ensouled” though technologies, will re-emphasize core values such as reflecting social and emotional states. In this section, we will review and discuss the existing wearable technologies, and provide our vision on how the future technology could support the design and manufacturing of digital jewellery as transgenerational life reflection, i.e. ensoulment.

### 8.1 Viewing Past Experiences

As animism revealed that inanimate objects were often painted in various colors as the reflection of ensoulment, existing digital garment and jewellery have widely adapted color as their main output channel, and this was also reflected in our workshops that colors were used to indicate emotions.

LED is the most popular visual components embedded in fashion items and controlled by digital personal information [1, 7, 30]. Although LED lights were currently common due to its low cost, its emissive nature leads to the reduction of ubiquity [37].

On the other hand, non-emissive display technologies that have recently emerged, such as *e-ink* [8] and *thermochromic paint* [20], are currently being applied in digital garment design. Although the thermochromic ink is currently limited by the size of the controlling system and the variety of the colors, it is predictable that this technology can be embedded into tiny jewellery with future manufacturing technology that could minimize the size of the system. E-ink is one more mature technology has been applied in tablets and current research explores its application in wearables, such as bracelet [6] and shoes [33].

In summary, non-emissive display technology would be more preferred for the digitally-ensouled jewellery in the future, as the surface could be dyed or painted with e-ink or thermochromic ink, and controlled by the minimized technology inside.

## 8.2 Shaping Past Experiences

While color has been widely adapted in digital fashion design, our workshops revealed that the colors in one piece of jewellery were rarely designed to evolve through generations, but rather being utilized as indicators and associated with particular emotions/activities (guideline 2). Instead, similar to the ancient ensouled statues which were often either manually crafted or naturally weathered into various shapes, the 3D information of the jewellery (e.g. shape, layout, and surface texture) were preferred by our workshop participants for reflecting the accumulated information of the wearer. A few participants commented that when the wearer touches it, he/she can feel the shape and the surface, and empathize the past (guideline 4).

The shape evolvement of the digital jewellery is highly related to the research in shape-changing interface. Hiroshi Ishii envisioned Radical Atoms [14], which “takes a leap beyond tangible interfaces by assuming a hypothetical generation of materials that can change form and appearance dynamically” based on digital information. Under this vision, Yao et al. [39] invented bioLogic, a new shape-changing interface using bacillus subtilis cells that can be actuated by different humidity. The demonstrated application in wearables suggested the possible adoption by the digital ensouled jewellery in our vision. What’s more, thin pieces of shape-memory alloy (SMA) have been well adapted in flexible materials, such as fabric and paper, to trigger shape-changing effects in handicraft [40]. Yang et al. [38] invented the 3D printing technique with shape memory polymer, which can be used in wider usage of personal fabrication for digitally-ensouled jewellery in the future.

## 8.3 Collecting Past Experiences

While the traditional ensouled objects were often crafted manually in the beginning and naturally worn through generations, we envision that the digital “ensouled” jewellery could update itself automatically through sensing the daily life of the wearer. Two types of the input channels were observed in our workshops: actively accumulating the wearer’s physiological information; and passively receiving life events from the wearer’s digital profile, such as social media.

The most obvious signs of emotional arousal involve changes in the activity of the visceral motor (autonomic) system [24]. As jewellery, such as ring, necklace, bangle, and bracelet, are directly contacted to the human skin (guideline 4), the galvanic skin response (GSR) [11] and the heart/pulse rate [22] can be used to reflect the emotional states of the wearer. The optical-reflection-based pulse sensor has been widely available, and can be integrated into various wearables, such as bracelet and bangle, necklace, and earring.

While emotional states could be directly retrieved from the on-body physiological sensor, more specific life events can be inserted by the wearer, e.g. through social network. One common comment from the workshop is that “the wearer would like the privilege to decide which emotion/life event to be reflected from the worn jewellery”. Thus, manual input of emotions/events provides a controllable method for digital “ensouled” jewellery. This design suggestion can be supported by a recent development from Google “Project Jacquard” [21], which created a woven material that contains integrated conductive threads that enables the wearer to interact with cloth through touching.

In addition, although most participants proposed real-time update on the digital-ensouled jewellery, a few designers stated the importance of “updating”/“ensouling” the jewellery offline, concerning the issue of privacy leaking. We envision that in the future, there would be a charging station for the wearer to update his/her jewellery which would be made of advanced smart materials.

## 9 Discussion and Conclusion

In general our workshops revealed that designers desired the technology to be an integral part of the jewellery though not the dominant aspect. The challenge is to create a common platform and language that enables a fluid and clear communication between artists and engineers. This case study presents the working process of a cross discipline collaborative project between a group of designers, anthropologists, craft makers and engineers. The case study produced a set of guidelines for “digitally ensouled” jewellery that have emerged from our workshops. The aim of this study was to a) produce a set of guidelines which can be made available to jewellery designers and engineers working in the field and b) to study and evaluate the work process of multi-disciplinary collaboration. During our workshops we identified the following issues:

- Jewellery makers did not always identify the need of embedding technology in their crafts, nor did they recognise outright the potential applications of tech-jewellery. Many makers expressed the feeling that their hand made crafts are “better” and more “authentic” without technological capabilities.
- Jewellery makers and designers sometimes asked for technologically impossible solutions.
- Engineers often prioritised functional and high level concepts whereas designers could spend a considerable amount on details which contributed on aesthetic qualities rather than functionality. In general designers placed more attention to

aesthetics, placing attention to detail, a feature which was not considered important by engineers.

- Engineers were over-eager to include technical solutions or technological capabilities to all pieces as well as to explore functional purpose in the crafts.
- Designers desired to work along a design concept. Engineers were more fluid with experimenting with technological possibilities often deviating from design briefs and concepts laid out by designers.

The specificity of our workshop was that it explored how “techno-animistic” principles can be applied in traditional jewellery making. Underlining the capacity of technological tools and accessories to digitally store intimate information we formed an analogy with animistic practices observed worldwide of attributing a spirit (anima) to inanimate objects. We highlighted two central aspects of animism that physical objects that are considered ensouled have a cross genealogical life span and that process itself of its production and consumption is, depending on the particular culture at hand, often performed ceremonially. Our workshop examined the process of production of jewellery which have the capacity to be digitally ‘ensouled’ throughout the users life and which could be passed down generations. We envisioned the creation of jewellery that evolve or change characteristics such as shape and color– over the course of time, depending on the data collected from its wearer. Our aim was to create pieces of jewellery that become personalized, both in form and content- over a period of time thus creating a deeper emotional connection with its owner.

In today’s fast paced society we have become accustomed to receive immediate feedback in our communication interactions associating technological progress with faster results. Jewellery pieces, however, can be symbols of status, knowledge and worldviews. Elements might take a lifetime to develop. Our workshop findings suggested that there is a need to dis-associate digitally “ensouled” jewellery from the notion of immediate feedback and instead install to the users who wear them that its production and use is conducted rather ceremonially and that the accumulation of digital information within it will evolve organically and over a large period of time, similar to the way a sacred armband is passed down generations.

Based on these workshop findings, we derived 10 design guidelines for designing digital ensouled jewellery that could reflect the wearer’s life and be passed through generations. Our future plan is to develop a prototype of the technology and we invite jewellery designers to apply our guidelines in their work. This will help us better understand how the guidelines work in practice, and provide insights about how they need to be developed further. We anticipate the need to occasionally revisit the guidelines, especially as material technologies continue to evolve.

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