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Citation: Koulidou, Nantia, Wallace, Jayne and Smith, Neil (2018) The self between two places: Finding connections through digital jewellery. Making Futures, 5. pp. 1-14. ISSN 2042-1664

Published by: Plymouth College of Art

URL: [https://www.plymouthart.ac.uk/documents/Nantia\\_Kou...<https://www.plymouthart.ac.uk/documents/Nantia\\_Koulidou%2C\\_Jayne\\_Wallace\\_and\\_Neil\\_Smith.pdf>](https://www.plymouthart.ac.uk/documents/Nantia_Koulidou%2C_Jayne_Wallace_and_Neil_Smith.pdf)

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## **The self between two places: Finding connections through digital jewellery**

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### **Abstract**

This paper presents work undertaken as part of the first author's ongoing doctoral research into the nature of digital jewellery and the process of designing personal digital artefacts. In this paper we introduce two digital jewellery objects that focus on people in transition. Transitions in this context are the changes one experiences in physical, personal and social dimensions in the context of living in/between two countries. The concepts were inspired by the lives of three participants and the researcher who frequently travel back to their native countries, but who live permanently in the UK and who experience feelings of transition and what we will describe as "being in-between".

*Topoi* is a piece that reveals personal microphotographs at certain points in time. The piece is a hand held piece of jewellery containing tiny microfilm images from places that are significant to the individual from both countries. One can view the layers of microfilm with a magnifying glass and interact with different layers by manually focusing on different elements. A LED light activated by the heat of the palm allows one to peek briefly through the glass in short bursts. *Togetherness* is made up of two brooches, meant for two wearers in two countries. Each brooch works as data logger. The act of pinning the brooch on the body activates the piece, recording the time when the piece is worn. Such data logged is stored in a Micro-SD card inside the piece. This data is later used by an artisan to create a third piece that represents times when the two brooches were worn simultaneously.

Most of the digital devices that we live with come with a set of expectations such as: What does it do? How long does the battery last? How cutting edge is the technology? By contrast, this research offers a focus on atypical personal interactions in order to address a different range of questions and potentially open up our expectations of the digital.

## Introduction

### Critical reflections on wearable technology

Today there exist an increasing number of devices considered intimately linked to the body in the field of wearable technology, Internet of Things (IoT), e-textiles and bionics. While most of these devices are already commercially available such as smart watches and fitness trackers, other nuanced products like colour-changing textiles or bionic-prosthetic devices serve more specialised fields such as fashion or medicine. Many such devices are used to track body fitness, manage phone calls, messages or notifications from social-media. As communication devices, they have some of the functionalities of a mobile phone; receive calls, send reminders and notifications. As objects worn on the human body, they are small in size and typically have limited functionality, with minimal interfaces, compact displays and lower computing power. These examples, otherwise seen as wearables or wearable technology (Ryan, 2014) are always connected to faster computing devices. They are often supported by an application that can be accessed via an Android or iOS phone, while the device works in the background. Wearable and network of devices to augment people's everyday lives have become part of the consumer electronic landscapes, but some interesting questions arise about the quest for monitoring and measuring elements of one's body, behaviour and habits.

Wearables in the market are following the logic of what De Landa (1991) refers to as technological determinism, where technological innovation is looking for the next, expected level of evolution. This reflects what Ryan refers to as "a functionalist prejudice that technology is always in the present" (2014: 5). Many such devices praise for "corporate wellness" through self-qualification and "a circuit of self, device, work, gym, eat and sleep (repeat)" (O'Riordan, 2017: 66). A related hypothesis holds that making sense of numbers is equal to making sense of yourself, suggesting that quantifying the self and attempting self-knowledge through numbers is the core of most of the wearable technology.

Arguably, most of the existing examples of wearable technology rely on technological solutions that focus on functionality and efficiency. Hundreds of apps have been developed for achieving digitalised self-tracking and according to the Quantified Self (QS) website (Wolf and Kelly, 2007) over 500 self-tracking tools are being listed including geolocation, health, fitness, weight, sleep, diet and mood or feeling tracking apps. Lupton's critique (2017) on the QS movement exposes the tension between control and empowerment that follow from the ongoing collection, aggregation, representation, flow and re-contextualisation of personal data for commercial and political purposes. The accumulation numbers

about our behaviours and our bodies makes us wonder 'How much do we want to monitor ourselves? How much information is too much?'

Several authors have called into question the aim of wearables to cure, correct and enhance the performance of the human body. Morozov more broadly describes the field as “madly devoted to articulating facts”, which generate narratives that “seek out qualitative and linear casual explanations of life” (2014: 261). A linear narrative shows, however, little respect of the complexity of the actual human world and often leads to a narrow-minded view of wellness, which resembles Busch’s (2015) critique of the narcissistic view of self-improvement and Hacking’s critique of the fetishist collection of overt statistical data and “the avalanche of printed numbers” (1982: 28). We believe that we need a deeper understanding of what it means for people to be wearing wearable devices. To this end, new approaches to designing wearable technology are critical and necessary.

In this paper, we explore the field wearable technology from a maker’s perspective, offering two examples of digital jewellery<sup>1</sup>. The paper is structured as following: Firstly, we provide the landscape of existing conceptions of digital jewellery and we present our point of view. We then give a short description of two pieces of digital jewellery that are part of the first author’s doctoral research, before we present the narratives of the pieces. We conclude with a discussion on how the digital as a material within craft practice can suggest poetic interaction that can enrich people’s lives in a personal and intimate way.

### **Established nomenclature on digital Jewellery**

The digital information conveyed in rings, bracelets, necklaces and wristbands is known under the term digital jewellery or smart jewellery. The term digital jewellery was first introduced from IBM’s Almaden design Lab as wearable technology for every day, when traditional forms of adornment are involved with wearable and digital technologies (Miner et al., 2001). Their main intention was to make technology part of our daily life with the help of jewellery pieces connected with wireless networking system. Concurrently, Picard (1997) at the MIT Media Lab conducted research with a focus on sensing wearer’s autonomic Biosystems. She indicated how jewellery, as being relatively instructive in our daily lives, can effectively gather information about our habits and reactions to stimuli. In the more recent Human-Computer Interaction (HCI) literature, digital jewellery is defined in similar terms as “fashion

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jewellery that allow you to communicate by ways of e-mail, voicemail, and voice communication or “wearable ID devices that contain personal information like passwords, identification, and account information” (Jain, 2015: 388). Since the first digital jewellery to embed functions of digital devices in existing worn objects, jewellery continues to gain interest with more recent examples presented as luxurious smart accessories. Companies such as Nike, Fitbit or Jawbone collaborated with jewellery designers, for example, Tory Bunch for Fitbit and Yves Behar for Jawbone UP3 Wristbands to produce luxurious cases for the fitness trackers. But, this is just a limited interpretation of what digital jewellery could be. In the research, digital jewellery is developed and researched not for its purpose as accessory, but in its capacity to represent highly personal emotional meanings and convey a range of concepts related to being human (Smith, 1978) taking advantage of the increasing potentials of digital technologies in sensor functionality, connectivity and location awareness. Digital jewellery starts with understanding a person what he/she values and not with the technology that is already available. The technology is a tool and not an ultimate goal (Koulidou, 2018; Wallace, 2007).

### **Topoi: a piece of digital jewellery**

Topoi (see Figure 1) is a hand-held piece of digital jewellery containing tiny microfilm images from two countries that are significant to the owner. The piece is composed of a digital and a non-digital element. The digital part resembles a rock formation that is made of modelling putty with embedded crushed coal and oxidised silver. Within the piece are electronic components (which I will describe later) and layers of microfilm which are visible through a viewing window made from the edge of a found thimble. The non-digital part of the piece is a magnifying lens mounted in a silver frame, with a handle made from a found teaspoon. This lens allows the owner to look into the rock shaped form

A light source is required from within the form in order to view the images when using the magnifying lens and this is activated in response to human touch (see Figure 5). When a person holds the digital piece, the surface of the piece, (being made of silver) conducts electricity and turns on a small LED light. The electronic components are a capacity sensor, an LED light, a Teensy 3.2 board and a tiny battery. The capacity sensor detects when the contact is made, and the LED light gradually responds to the human touch and pressure of the palm by slowly lighting up. When the contact is broken, the light goes out instantly, however, when a person holds the piece tightly for a while, the light reaches full intensity and stays illuminated for a brief period of time after contact has been broken.

With external light alone, only the first layer of microfilm images is visible, however by activating the internal LED light, the person can view the other images on layers, which appear and recede by

manipulating the magnifying lens. This gives the opportunity to peek briefly through the glass and interact with the images in short bursts, before the light fades gradually again.



Figure 1. Topoi by Nantia Koulidou 2017. Milliput, Silver, found objects, electronics, film, magnifying glass. Looking through the glass. Nantia Koulidou © 2017 all rights reserved.

## **Togetherness: Connected brooches**

Togetherness is suite of four brooches. The first elements are a pair of digital brooches Anthos, meant for two wearers - each living in a different country (see Figure 2). They are made from 3D printed wood filament, a found twig, silver and electronic components. The second element of the suite is a further pair of non-digital brooches (Chronos see Figure 3) made as a result of the data collected from how the first pair of Anthos brooches are worn. They are composed of a twig, layers of coloured resin and stainless steel.

Two people each wear one of the Anthos brooches over a period of time and as they do so the electronic components within each brooch (Tinyduino boards - a real time clock, processor with battery support, a USB shield, a protoboard, an SD card and a 140mAh lithium polymer battery) capture time and date data comprising of how long and when the brooches are worn. Each Anthos brooch is constructed such that once the silver brooch pin is fastened (i.e. when someone pins it onto their clothing) the electronic circuit is closed and the data is then recorded and stored. As such, the brooch pin itself acts as the on/off switch in the electronic circuit.

After the two people have worn the Anthos brooches for a period of time (designated by them) the SD cards are removed and the stored data is used to inform the composition of the new Chronos brooches. Chronos were made by using another portion of the twig used in the Anthos pieces and dipping this into pots of coloured resin in response to and (guided by) the data of how long the Anthos brooches were worn. Once the twig has been dipped into multiple layers of different colours of resin the piece is cut open to reveal a cross section of coloured rings (see Figure 4) and the forms are made into the new Chronos brooches through the simple addition of a stainless-steel pin.

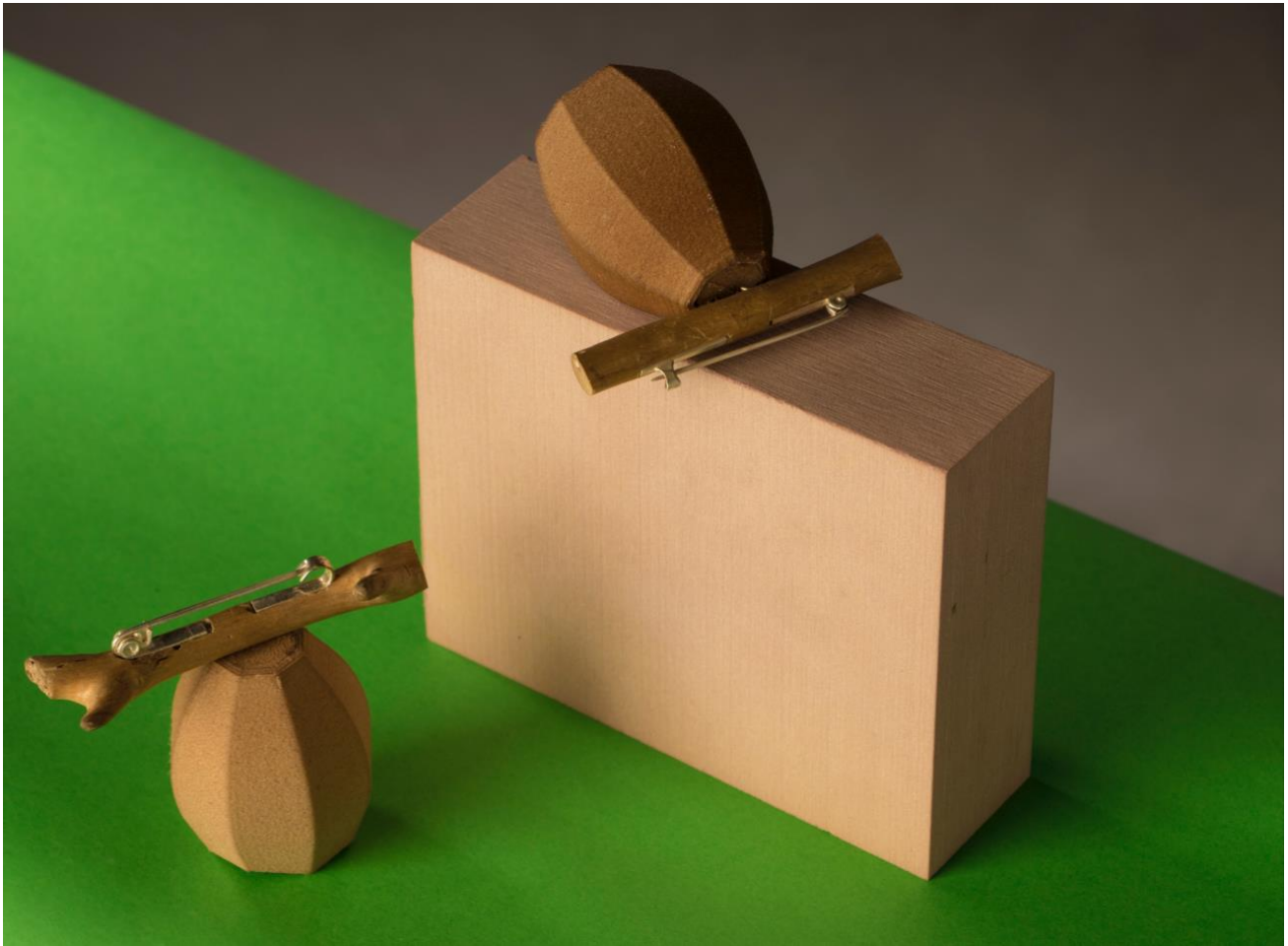


Figure 2. *Anthos* brooches by Nantia Koulidou, 2017. 3D printed wood filament, a found twig, silver and electronic components. Dimensions 7cmx5cmx5cm. Koulidou © 2017 all rights reserved.





Figure **Error! No text of specified style in document.**3 *Chronos* brooches by Nantia Koulidou 2017. A found twig, coloured resin and stainless-steel pin. Dimensions 2cmx2cmx2cm Nantia Koulidou © 2017 all rights reserved.



Figure 4 *Chronos* brooches. left to right. The twig is dipped in multi-coloured layers of resin and cut through. Nantia Koulidou © 2017 all rights reserved.

## **The self in/between two places**

This research we report on this paper is part of the first author's practice-based doctoral research, investigating on the role of digital jewellery to support sense of self. More specific, the research is concerned with understanding and supporting the transitions to the sense of self that people experience when living in/between two different countries, and especially when travelling between these two; places, lives and senses of self. This context stemmed from her personal experiences of travelling periodically between the United Kingdom and my country of origin - Greece. The trips caused her to notice changes in her sense of self in each different place (UK and Greece) and significantly the dynamics of these adjustments occurring during the journey itself.

We characterise examples of minor or nuanced fluctuations in the sense of self, such as those experienced during journeying between two locations/countries of home as 'short-term micro transitions'. Within the framework of micro transition (Holdsworth and Morgan, 2005) we create a distinction between the major life transitions such as marriage, childbirth or mourning a loved one (Cowan and Cowan, 2012) from the subtler changes to one's sense of self. Rather than major life transitions, we use the term short-term to refer to the more everyday encounters that can cause nuanced unsettling to what one perceives, personally, to be a stable sense of life and of self. Such contexts of experience can disturb our personal equilibrium causing us to seek forms of comfort. How we can find ways to adjust to the changes experienced and managed these transitions are rich contexts for the design of digital technologies and in particular personal, meaningful digital artefacts, such as digital jewellery.

To add depth to our explorations on digital jewellery and enable a particular level of discourse around the potentials of digital technology, the first author worked closely with three female interaction design researchers, Laura, Diane, Jude (functional names) born in different places in the world, but who currently lived and worked in the UK and periodically (approx. 2 – 3 times per year) travelled back to their home of origin for short breaks. She followed a participatory design process that started with an initial meeting with each of the participants, an exploratory workshop with all the participants and a number of one-to-one meetings that lasted for a period of two years. The resulted digital jewellery is inspired by the first author's lived experience and the lived experience of the three women. Before we

discuss the pieces in detail, we give some insights into how micro transitions affect one's sense of self in this context.

### **Personal reflections on feelings of transition: Being in-between**

The accounts of all three participants indicate the experience of living in/between two countries can take different forms. The accounts emphasise different dimensions of the experience and evokes different meanings for the individual and for each journey between the two countries. Diane experiences this transition as a period of gradual disconnection and reconnection when she experiences feelings of homesickness and disorientation. For the first few days in Diane's trip she is constantly adjusting to the places, people and things that are familiar to her in her present location; whereas, Jude's account of her experience of travelling home can be very different. She described that how she feels is dependent on where she is in her life and what is happening to friends and family in both places. She presented herself as being "constantly shifting, like a coral moving with the streams of an ocean". Laura's reflections communicate a strong sense of self, however, travelling back to her home country is an ongoing challenge "to meet the different" when feelings of home and notions of identity are floating every now and then, slowly appearing and disappearing in her thoughts. These feelings are more noticeable on the journey itself. Although the three women described very personal ways of engaging with their situations they all shared a sense of self that is floating, shifting and adjusting to the changes, which we describe as 'being in-between'. In the next section, we turn to discuss how the pieces support this concept of *being in-between*, by considering their form and materiality.

### **Narratives and landscapes**

#### **For the piece Microcosm**

The form of the piece resembles a rock formation that draws inspiration from Laura's love for mountaineering. It is made of modelling putty and small bits of found coal from Newcastle. The viewing part is a part of a found Stanhope thimble. For clarity, Stanhopes or "peeps" are miniature photographic lenses, incorporated in different objects from the mid-19th century onwards and thimbles was an example of such objects (Scott, 2017). The magnifying glass, that accompanies the piece, has the form of a mirror that both reflects and reveals aspects to one's sense of self, allowing someone to blend the images or focus in certain parts of the pictures.



Figure 5. Revealing the layers within. Topoi by Nantia Koulidou 2017. Screenshots from a video. Nantia Koulidou © 2017 all rights reserved.

During micro transitions, we believe that connecting with what is important for the individual can be significant to how one copes with the transition itself. Anchor points from both locations can support this process by connecting the participant with their sense of longing and empower the participant. During the explorative workshop, Diane reflected on the significance of a wedding photo album that includes portraits of significant others in both places. She commented that the album is very special to her because it has “everyone”, and that “everything else is always separate in her life”. Jude imagined a piece that could hold meanings from both places could potentially support her transition. Jude’s piece

would incorporate little parts of what home means to her, “like a coin with two sides” the piece’s two could represent her two homes, one in Germany and one in the UK.

To explore in more depth what was important for the participants in each of the ‘home’ locations we asked participants to contribute with a small number of photos that represented anchor points from both locations. Laura, Diane and Jude sent us photos that were significant for them. We decided to create microfilms from the pictures we received. Partly, we were inspired by the Stanhope thimbles and, partly, because the miniature nature of the objects creates a particular kind of intimate interaction that is private and separate to our everyday public life (see more Stewart, 1993).

More specifically, this piece was inspired by Laura’s stories and reflections on her anchor points. Key elements of the pictures we received were the sea and the mountains. The sea was the place where Laura felt reassured in her home country. Now her place of comfort is the Highlands of Scotland. Laura connected the sea with happy feelings of “home”. Sea is where I usually went to dream on... I wish Scotland will feel more like home in the future. This is my “sea” nowadays, where I go to dream... [referring to mountains]”. When Laura explored the layers of microfilm, she found herself reflecting on her life and her feelings of being in-between through adding to our conversation and discussing: “Climbing is part of me and it contributes to who I am [...] I remember when I was at Everest [...] and I was sick, but I got the to the top - I did it! I am really proud that I did it! It is like a reward being on the top - That’s how I feel when I look at the picture - it is an achievement.” [Laura].

*Topoi* is activated by holding the piece tightly. The light inside the piece gradually responds to the touch and slowly lights up, but only for a brief period of time. This interaction is based on a finding from the work with Laura and Jude that highlighted that having elements under your own control during a micro transition can be reassuring. Laura and Jude both described feelings of anxiety and discomfort because they had little or no control over all these transitions. The following quote captures this well: “[Transitions] happens over time, it is kind of waiting to arrive somewhere. I guess you can decide when it starts; it doesn’t start when you are on the plane, it starts when you decide. It could be when you are on the plane, it could be when you buy your ticket or when you arrive” [Jude].

### **For the piece Togetherness**

The brooches are made from a single found tree twig (see Figure 6a). The twig was cut into three parts; two parts were used to create the Anthos brooches and one for a different third brooch. The form that

hosts the electronics is 3d printed with a wood filament. The 3d printed wood form was chosen as a visual contrast to the physical wood, but also as a compliment to the digital function of the piece. The technology is not hidden in the piece but is a visible part of it. The pieces are similar, but not the same; the 3d form has slightly different colour, and the twigs are slightly different in shape and colour. There are slight deviations in each to give each piece a unique form, but at the same time reference to two different parts of the same whole (see Figure 6 b,c).

Insights from the research showed that people act in specific ways before and during the flight in order to connect with their family at home in indirect ways. These activities are intended to be points of conversation with their relatives. Laura shared with us that sometimes during the flights she reads the magazine *The Economist*. Her dad is an economist and always had the *Economist* at home; reading the magazine keeps her connected with him and it her way into a conversation with him when they meet. Jude reflected on crocheting and knitting during the flight. “When I go home for the Christmas holiday (which is often the case), I often bring some wool and crochet hooks to crochet during the flight. It’s something I have learnt from my grandmother and my mum, and I also bond over. We would usually share the newest creations via Skype and go to buy wool together on the local craft/ wool shop when we meet.” [Jude].

Jude’s and Laura’s reflections inspired us to think of ways to connect people during the micro transition by making use of the digital in ways that are non-intrusive in an environment where digital technology is often intrusive and direct. The connected brooches attempt to open a reflective space to allow the user time to think more critically about current examples of wearable technology that is continuously measuring and monitoring activities. When the pieces are activated, they capture time and duration being worn on the body much like other wearables that track a user’s activity. However, they differ from existing wearable technology as the pieces are not connected to an additional app, nor they are connected with each other. The connected brooches through this ambiguous connection suggest an indirect form of communication between two people.

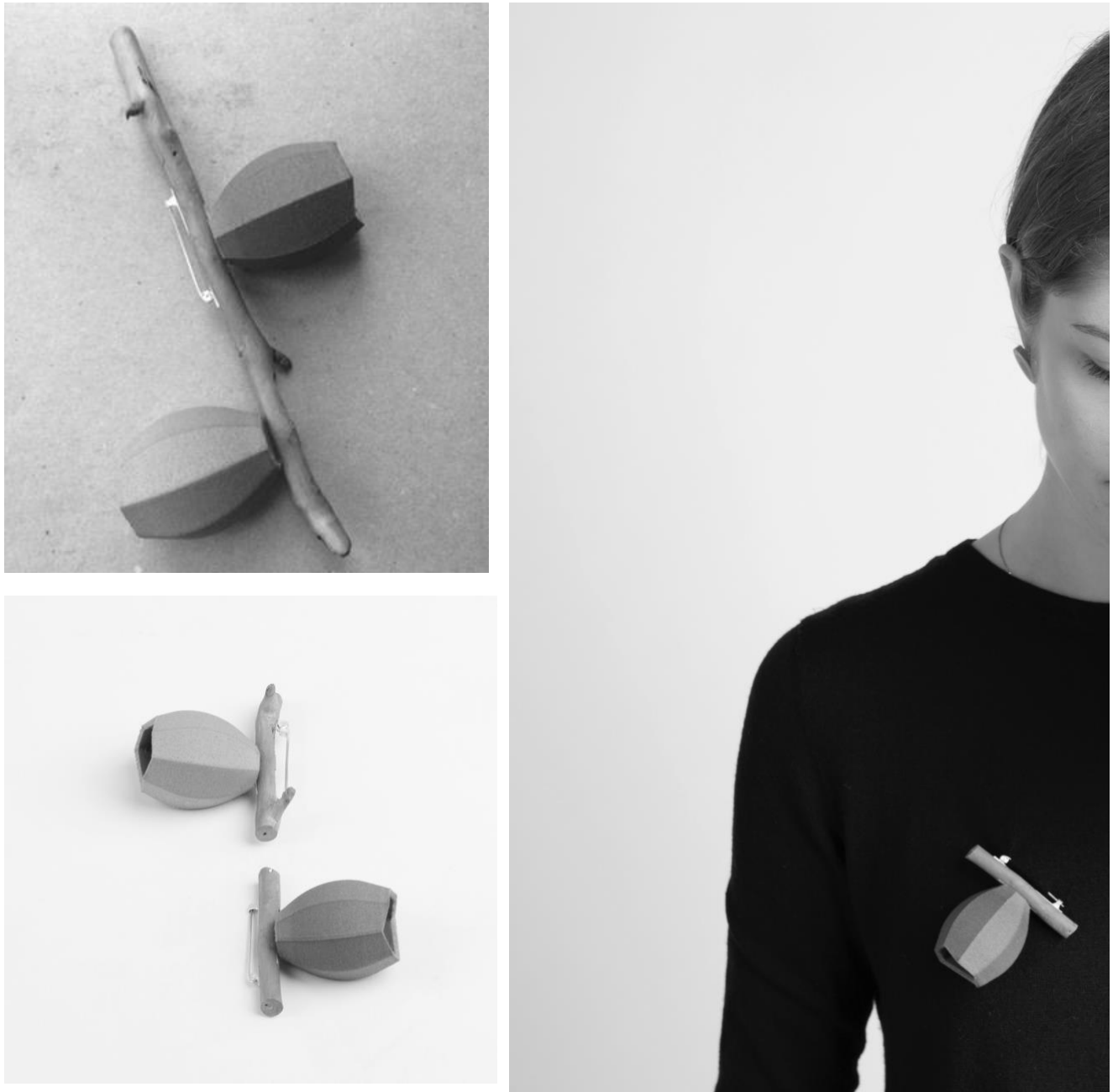


Figure 6. Togetherness by Nantia Koulidou 2017 a) The found tree twig b) The brooches c) The act of putting it on activates the piece. Nantia Koulidou © 2017 all rights reserved.

### **Poetic interactions with digital jewellery**

The technological force is moving fast with machine learning devices, implants, flexible sensors, and artificial intelligence. Increasingly digital devices play a role in valuing, understanding, amplifying and highlighting the body. We argued earlier in the paper that most of the existing wearable technology in

the market are driven by what is new and current in technological advances (O’Riordan, 2017; Ryan, 2014) and digital jewellery is seen as a luxurious accessory to host electronic components. (Jain, 2015; Miner, 2001; Picard, 1997). Most of the wearable devices that we live with come with a set of expectations such as: How long does the battery last? How cutting edge is the technology? How many functions does the device have?

In this research we acknowledge the complexity of human life, presenting an additional set of questions that reveal different levels of meaning for a person wearing digital devices. In this research, we focused on people during the transition of travelling between countries, ‘homes’ and senses of self and we identified opportunities for digital jewellery objects to support periods of *being in-between*. Inspired by the stories of female design researcher, who experience feelings of transition, we designed the pieces *Topoi* and *Togetherness*. The pieces are examples of digital objects that aim to support one’s sense self in a personal and intimate way. *Topoi* introduced an intimate interaction with layers of microfilm images from places that are significant to the individual from both countries that one can view only in short bursts. More specific, the digital in the piece *Topoi* enabled a very personal space where one can explore aspects of him/herself, when one decides. *Togetherness* suggested an indirect and non-intrusive way of connecting two significant others, where the digital enabled the creation of a new piece that signified a trace of a relationship. The significance of the digital pieces went beyond the interpretation of numbers to a more holistic understanding of wellness that valued the idiosyncrasies of each person.

*Topoi* and *Togetherness* challenge our expectations of digital connectivity and allows our new expectations and experiences to be realised. Digital jewellery is objects that take advantage of existing advances in wearable and digital technology but stays faithful to the values behind the piece and the social role of jewellery in peoples’ lives. The narratives relating to the materials in digital jewellery are also an important issue for makers. We have presented that wearable technology often relies on technological solutions that focus on functionality and efficiency, offering a limited interpretation of what digital jewellery could be (Wallace 2007). We add to this that, this limitation extends to the narrative associated with the pieces. We argued elsewhere (Koulidou, 2018) that in digital jewellery there is an inseparable connection between the function of the piece and its form and materials. The synthesis of form, material (traditional and digital) and interaction is what differentiates pieces of digital jewellery from other wearable technology. *Microcosmos* and *Togetherness* capture our thinking and direction of what digital jewellery can be. They offered alternative ways of connecting a person with one’s anchor points,



significant others and intimate places, suggesting rich and intriguing interactions between the wearer and his/her narratives. Taking these two examples of digital jewellery pieces as propositional objects, we challenge existing conceptions of digital jewellery and encourage makers to engage further in discussions on how the digital can enriches our lives in more poetic ways.

<sup>1</sup> Digital jewellery refers to jewellery pieces with embedded electronic components. (see more Wallace, 2007 and Kettley, 2008)

## References

- BUSCH, A. (2015) Interrogating Smart Jewelry. *Metalsmith*, 35, 52-57.
- COWAN, P. A. & COWAN, C. P. (2012) Normative family transitions, couple relationship quality, and healthy child development. *Normal family processes: Growing diversity and complexity*, 428-451.
- HACKING, I. (1982) Biopower and the Avalanche of Printed Numbers. *Humanities in Society*, 5, 279-295.
- HOLDSWORTH, C. & MORGAN, D. (2005) *Transitions in context: leaving home, independence and adulthood*, Maidenhead, Open University Press.
- JAIN, A. (2015) Digital Jewelry-a 'fashionable' leap in the field of wireless networking. Computing for Sustainable Global Development (INDIACom), 2015 2nd International Conference on, 2015. IEEE, 388-392.
- KETTLEY, S. (2008) Peacocks and wallflowers:(in) visibility with digital jewellery. *Visual Communication*, 7, 303-315.
- KOULIDOU, N. (2018) Why should jewellers care about the Digital? *Journal of Jewellery Research* 1, 17-33.
- LANDA, M. D. (1991) *War in the Age of Intelligent Machines*, Zone Books.
- LUPTON, D. (2017) Self-tracking, health and medicine. *Health Sociology Review*, 26, 1-5.
- MINER, C. S., CHAN, D. M. & CAMPBELL, C. (2001) Digital jewelry: wearable technology for everyday life. *CHI '01 Extended Abstracts on Human Factors in Computing Systems*. Seattle, Washington: ACM.
- MOROZOV, E. (2014) *To save everything, click here : technology, solutionism and the urge to fix problems that don't exist*, London, London : Penguin Books.
- O'RIORDAN, K. (2017) *Unreal objects digital materialities, technoscientific projects and political realities* %@ 978-1-78680-056-5 %U <http://public.eblib.com/choice/PublicFullRecord.aspx?p=4924346>.
- PICARD, R. W. & PICARD, R. (1997) *Affective computing*, MIT press Cambridge.
- RYAN, S. E. (2014) *Garments of paradise: wearable discourse in the digital age*, Cambridge, Massachusetts, The MIT Press %@ 978-0-262-02744-1 %L QA76.592 .R93 2014.
- SCOTT, J. (2017) *What are Stanhopes?* [Online]. Available: [http://www.stanhopes.info/what\\_are\\_stanhopes.html](http://www.stanhopes.info/what_are_stanhopes.html) [Accessed 04 April 2018].
- SMITH, M. B. (1978) Perspectives on selfhood. *American Psychologist*, 33, 1053.

- STEWART, S. (1993) *On longing : narratives of the miniature, the gigantic, the souvenir, the collection*, Durham, N.C.London, Durham, N.C.London : Duke University Press., p. 37-69
- WALLACE, J. (2007) Emotionally charged: A practice-centred enquiry of digital jewellery and personal emotional significance. *Res. Rep., Sheffield Hallam University*.
- WOLF, G. & KELLY, K. (2007) *Quantified Self guide to self-tracking tools* [Online]. <http://quantifiedself.com/guide/>. [Accessed April 2018].