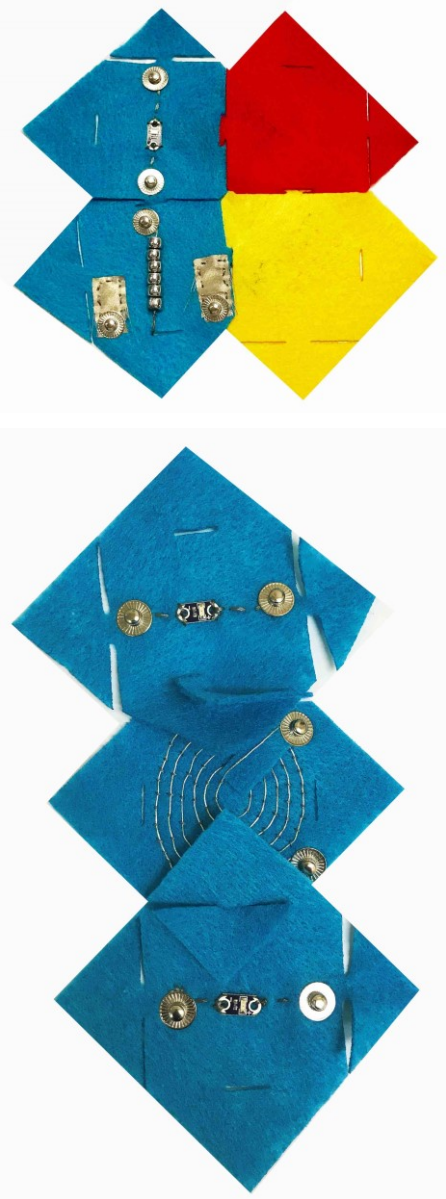

Figure 1 - Modular e-textile swatches

Swatch-bits: Prototyping E-textiles with Modular Swatches

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ABSTRACT

The creation of e-textile swatches is a common practice for documenting material experiments, sharing techniques with other practitioners, and for concept ideation. The Creative Interactions Lab has developed a system that turns e-textile swatches into easily connectable "bits" so that swatches can move between being an ideation tool into a prototyping tool(kit). The benefit of this approach is that experimental swatches and ideas for their use can be easily tested in context. In this studio, participants will be invited to bring their own swatches and/or prototypes, will learn how to create modular e-textile *swatch-bits*, and then we will spend the afternoon making prototypes and will engage in hands-on activities with the modular swatches. The goal of the studio will be to share e-textile prototyping techniques, and to discuss the potential for modular swatches to be incorporated into e-textile prototyping processes.

KEYWORDS

e-textiles; swatches; swatchbook; textiles; prototyping.

INTRODUCTION

Making with fabrics and e-textiles has gained increasing interest among the HCI community [5]. In this studio we will be introducing the concept of *swatch-bits* (Figure 1) for e-textile prototyping. Swatches are often used in textile design for concept ideation and exploring material properties.

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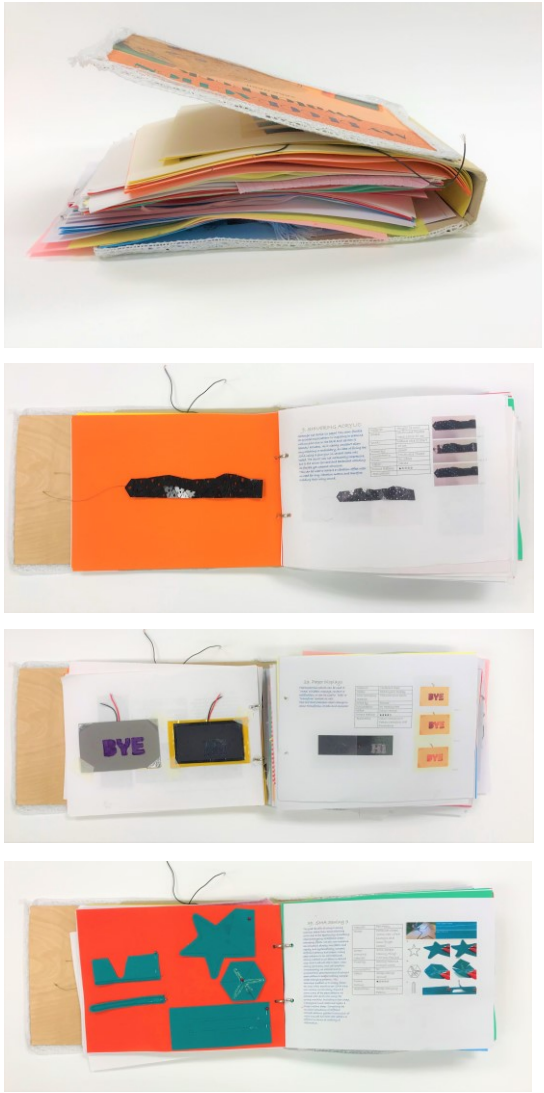

Figure 2 - Example of a swatchbook with samples and corresponding data sheets

Within e-textiles, the e-textile swatchbook exchange is a well-known example of e-textile practitioners sharing their making techniques with swatches and tools [6, 8, 17]. E-textile swatchbooks are often a type of "annotated portfolio" [3] used to document research through design practices [18, 20], and swatches typically have a corresponding data sheet to document features such as materials used and design processes for recreating them [1] (Figure 2). Interactive swatchbooks have received positive feedback from fashion industry professionals [7] and have proved useful for interdisciplinary collaboration, especially when working with individuals who have not used e-textiles before [19]. As swatchbooks are invaluable for sharing design research and for ideation, our team wanted to extend their value and be able to take swatches out of the swatchbook and try them out in context. For example, interactive swatches can be easily incorporated and tested in a wearable e-textile prototype or used for co-designing prototypes [10]. Previous work on e-textile toolkits, such as Quilt Snaps [4] and I*Catch[15], both a series of soft patches that can be connected together with sewing snaps, have explored modular e-textile components that connect and can be used as educational toolkits. With our *swatch-bits* we have incorporated this modular method with a specific focus on swatches. In this studio, we want to explore, share, and discuss how to bring swatches out of their books and into prototypes.

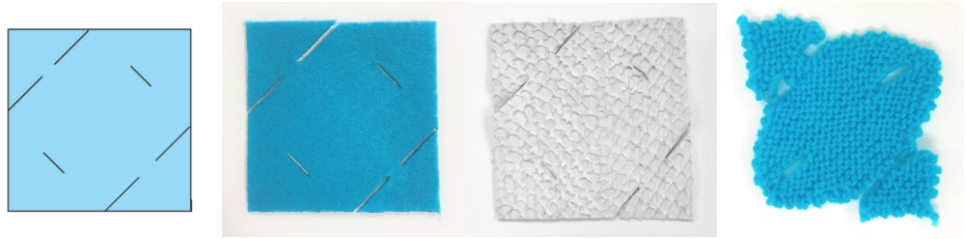

Figure 3 - The same template developed with laser cutting (felt), hand cutting (leather), and knitting (yarn)

SWATCH-BITS

Swatch-bits are made of a tessellated laser-cut file, but the same pattern can also be knit, crocheted, or cut out of fabric materials (Figure 3). This particular shape was adapted from the slot and tab design by Soepboer et al. [2]. The TEI 2020 paper *Wearable Bits: scaffolding creativity with a prototyping toolkit for wearable e-textiles* details the initial, felt version [11]. The pieces can then be woven together due to this repeated interlocking pattern and can be made in a variety of sizes (Figure 4). Similar to A Kit-of-No-Parts [16], the number of swatches can expand as desired, and involve different materials. Still, they are scalable through their tessellated pattern and easily connected via either metal snaps or conductive fabric. Designers, makers and researchers can use techniques such as hand sewing, knitting, weaving, embroidery, and felting to develop their swatches.

Figure 4 – *Swatch-bits* laid out and woven together

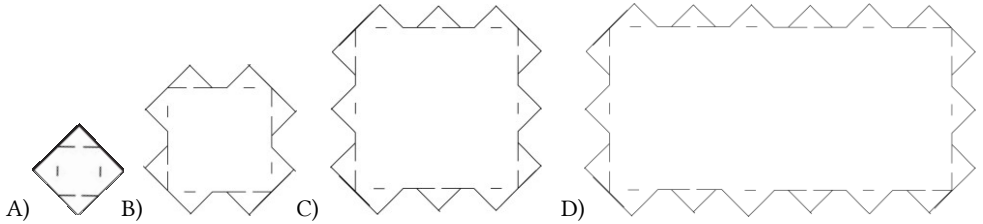

Figure 5 - The four sizes of *swatch-bits* that can be connected (a) small (3" x 3") (b) medium (4 ¼" x 4 ¼") (c) large (6 ¼" x 6 ¼") (d) extra-large (13 ½" x 6 ¼")

STUDIO PROPOSAL

In this studio, we would like to invite individuals who work with e-textiles, wearables, and soft interfaces to learn about how to build modular swatches, to discuss their current prototyping methods, and to develop prototypes using the *swatch-bits*.

STUDIO TOPICS AND SCHEDULE

Part 1: Introduction to Modular Swatches

We will go over the *swatch-bits* toolkit and how it turns an e-textile swatchbook into a prototyping and testing kit. We will present and explain the swatches our team have built so far, and the techniques used to build them (sewing, embroidery, knitting, weaving, and felting) (Figure 5).

Part 2: Participant Show-And-Tell

For knowledge and skill-sharing, participants will be invited to share their own swatches and prototypes with the group. Equally, we will share the template for the *swatch-bits* ahead of the studio if participants would like to create their own swatches in this way, but this is not required. They can also bring any samples and swatches they have that they would like to share. This essentially allows all participants – as well as our team- to explore different practices in the field and exchange experiences, challenges and limitations of making and crafting e-textiles. We will also discuss how the samples could be transformed into *swatch-bits* and the advantages or drawbacks of this.

Part 3: Making "Bits"

We will have a making session where participants will make *swatch-bits* by recreating one of our examples or developing one of their own. We will have a variety of tools (including but not limited to: mini looms, embroidery hoops, knitting and crochet needles, and sewing tools) and materials (e.g. fabric, felt, snaps, buttons, zips and conductive materials).

Figure 6 - The swatch templates are flexible to various applications included wearable e-textiles, interiors and decoration, and soft objects such as soft toys

Part 4: Prototype Making and Sharing

The main design activity in this studio will be hands-on prototyping of e-textile designs using *swatch-bits*. We will do some ideation activities to come up with concepts that individuals want to build. We imagine possible applications including prototypes for wearable e-textiles [10, 11], interior elements [13, 14] , and soft objects such as soft toys (Figure 6). Participants will build their own prototype(s) using the bits they have developed, the ones we provide or exchanging bits made by other participants. This will give them the opportunity to explore potentials and limitations by having a variety of bit-set. By the end of the studio, we will have each participant give a quick demonstration of their prototype to the group. If possible, it could be beneficial to the wider TEI community to show these prototypes during the demo conference session.

STUDIO OBJECTIVES

The guiding aim of the studio is to bring together a diverse group of participants (such as e-textile researchers, designers, makers, practitioners, and anyone with an interest to learn about e-textiles or soft interfaces) and to collectively explore the potentials, benefits and limitations of e-textiles *swatch-bits* through hands-on experimentation. We break down this overall aim into the two goals:

1. To share and exchange knowledge on e-textile making using modular swatches with designers, practitioners and researchers of wearables and soft interfaces. In these discussions, participants will be encouraged to discuss their current techniques and present their use of swatches in their practice.
2. To explore the potentials and challenges of current prototyping processes and swatches, as well as how *swatch-bits* can improve their prototyping experience and potentially overcome some of these current difficulties.

The topics discussed during this studio are relevant to TEI's focus on tangible interactions, and specifically tangible bits [9] and constructive assemblies [12]. The focus on e-textiles is also directly relevant to this year's theme of future bodies, future technologies.

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REFERENCES

[1] Andersen, K., Goveia, B., Tomico, O., Toeters, M., Mackey, A. and Nachtigall, T. 2019. Digital craftsmanship in the wearable senses lab. *ACM ISWC International Symposium on Wearable Computers* (2019), 257–260.

[2] Berber Soepboer and Fioen van Balgooi - Fragment Textiles: 2009. *https://en.refinity.eu/fragment-textiles.html*.

[3] Bowers, J. 2012. The logic of annotated portfolios: Communicating the value of "research through design." *Proceedings of the Designing Interactive Systems Conference, DIS '12* (2012), 68–77.

[4] Buechley, L., Elumeze, N., Dodson, C. and Eisenberg, M. 2005. Quilt snaps: A fabric based computational construction kit. *Proceedings - IEEE International Workshop on Wireless and Mobile Technologies in Education, WMTE 2005* (2005), 219–221.

[5] Dunne, L.E. 2019. Making with fabric: Foundations of soft goods and e-textiles fabrication. *Conference on Human Factors in Computing Systems - Proceedings* (2019), 5–7.

[6] E-textile Summercamp Swatch Exchange: *http://etextile-summercamp.org/swatch-exchange/*.

[7] Gilliland, S., Komor, N., Starner, T. and Zeagler, C. 2010. The textile interface swatchbook: Creating graphical user interface-like widgets with conductive embroidery. *Proceedings - International Symposium on Wearable Computers, ISWC*. Figure 1 (2010), 1–8.

[8] Hertenberger, A. et al. 2014. 2013 E-Textile Swatchbook Exchange: The Importance of Sharing Physical Work. *Proceedings - International Symposium on Wearable Computers, ISWC* (2014), 77–81.

[9] Ishii, H. 2008. Tangible Bits: Beyond Pixels. *Proceedings of the 2nd international conference on Tangible and embedded interaction* (2008).

[10] Jones, L. 2019. A co-design toolkit for wearable e-textiles. *Proceedings of the 2019 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2019 ACM International Symposium on Wearable Computers* (2019), 363–366.

[11] Jones, L., Nabil, S., Mcleod, A. and Girouard, A. 2020. Wearable Bits: scaffolding creativity with a prototyping toolkit for wearable e-textiles. *Proceedings of the Fourteenth International Conference on Tangible, Embedded, and Embodied Interaction* (2020).

[12] Leong, J., Perteneder, F., Jetter, H.-C. and Haller, M. 2017. What a Life! Building a Framework for Constructive Assemblies. *Proceedings of the Eleventh International Conference on Tangible, Embedded, and Embodied Interaction* (2017), 57–66.

[13] Nabil, S. 2019. *Organic User Interfaces for Interactive Interior Design (Unpublished PhD Thesis)*. Newcastle University, UK.

[14] Nabil, S., Kirk, D.S., Plötz, T., Trueman, J., Chatting, D., Dereshev, D. and Olivier, P. 2017. Interioractive: Smart materials in the hands of designers and architects for designing interactive interiors. *DIS 2017 - Proceedings of the 2017 ACM Conference on Designing Interactive Systems* (2017), 379–390.

[15] Ngai, G., Chan, S.C.F., Leong, H.V. and Ng, V.T.Y. 2013. Designing iCATch: A multipurpose, education-friendly construction kit for physical and wearable computing. *ACM Transactions on Computing Education (TOCE)*. 13, 2 (2013), 1–30.

[16] Perner-Wilson, H., Buechley, L. and Satomi, M. 2011. Handcrafting Textile Interfaces from A Kit-of-No-Parts. *Proceedings of the fifth international conference on Tangible, embedded, and embodied interaction* (2011), 61–68.

[17] Posch, I. and Fitzpatrick, G. 2018. Integrating Textile Materials with Electronic Making: Creating New Tools and Practices. *Proceedings of the Twelfth International Conference on Tangible, Embedded, and Embodied Interaction - TEI '18* (2018), 158–165.

[18] Stappers, P.J. and Giaccardi, E. 2017. Research Through Design. *The Interaction Design Foundation*.

[19] Zeagler, C., Audy, S., Pobiner, S., Profita, H., Gilliland, S. and Starner, T. 2013. The electronic textile interface workshop: Facilitating interdisciplinary collaboration. *International Symposium on Technology and Society, Proceedings* (2013), 76–85.

[20] Zimmerman, J., Stolterman, E. and Forlizzi, J. 2010. An Analysis and Critique of Research through Design: towards a formalization of a research approach. *Designing Interactive Systems* (2010), 310–319.