Can Wearable Toolkits Help Us Design Re-usable and Sustainable Technologies?

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Wearable construction/tool kits enable individuals to iterate on ideas – to build a prototype, take it apart, and make changes. In this workshop paper I discuss three previously-published wearable toolkits that I worked on during my thesis, discuss future directions where I would like to expand upon them, and discuss how they can help us think about re-usability and designing for wearable technologies that can change over time.

CCS Concepts: • **Human-centered computing → User interface toolkits**.

Additional Key Words and Phrases: e-textiles, crafting, sustainability, education

1 INTRODUCTION

Consumers are increasingly aware of the negative impacts of fast fashion and textile waste. This is even more concerning for researchers in the field of e-textiles because we combine textile waste streams with electronic waste streams, and interweaving them makes it even harder to re-use materials.

Though e-textiles are difficult to recycle, in this short paper I begin to think about how wearable toolkits, many with re-usable modular components for easy iteration on design concepts, could also be used for considering modular wearable products – either for changing wearables from one type of garment to another, or for adding wearable technology to items we already own.

2 EXAMPLES

During my thesis I have worked on three construction/tool kits that focus on the re-use of materials. Here I briefly describe the projects and sketch out some areas for future research.

2.1 Wearable Bits

Wearable Bits[3, 4] (Figure 1) is a construction kit made of e-textile samples on tessellated laser cut squares. Rather than having swatches in a swatchbook, Wearable Bits enable individuals to combine swatches together with interconnecting tabs and slots. Swatches can be tested in-situ, for example, makers can prototype any garment such as shirts, pants, and dresses, and along the way adjust prototypes to be the right size and shape. This also allows for testing and iteration since users can try on prototypes and replace components as needed based on factors such as comfort, style, and social acceptability.

Area for future exploration: During our user study [4] we noticed that when users worked with the medium fidelity Wearable Bits they also tended to design prototype concepts that were modular and could change over time. By having this type of re-use during the design process, could this encourage users to ideate wearable concepts that are also re-usable and reconfigurable? Such as an interactive garment that users could reconfigure when they want to move on to something new? This is something we would like to explore with high fidelity Wearable Bits and garments that users could iterate on over time.

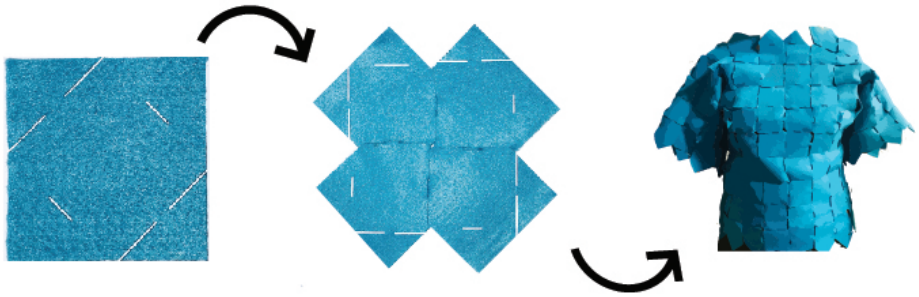

Fig. 1. Wearable Bits: modular e-textile samples that can be connected to form any garment [4]

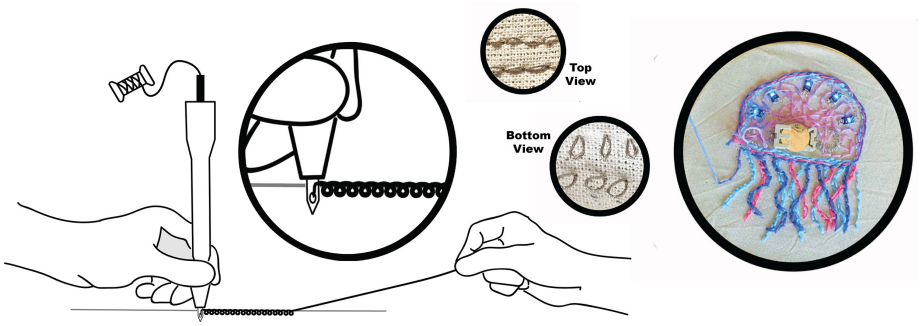

Fig. 2. Punch-Sketching E-textiles: using punch needle to make circuits that can be sketched and easily removed [5]

2.2 Punch-Sketching E-textiles

E-textile prototyping involves a lot of consumable materials, which makes it quite expensive in classroom settings. Beginners also tend to get frustrated with initial e-textile exercises because of the permanence of stitched-in circuits. To help with this we designed Punch-Sketching E-textiles [5] (Figure 2), which uses a punch needle to stitch out circuits with e-textile threads that can be easily pulled out and re-used. The goal of this toolkit was to enable the same type of iterative exploration and tinkering that students can do with breadboards and wires, but to also enable individuals to learn about the unique material properties of e-textile threads, such as how they short easily if threads are left hanging.

Area for future exploration: In our paper [5] we discuss an application example of an interactive tote bag that a user could continuously update and change with new designs. Rather than getting rid of outdated e-textile garments and accessories, could users/makers just pull out their designs and use the same materials to make new ones? Our previous work demonstrated how quick iteration could happen within the same prototyping session, but how can we make this practical over the long-term?

2.3 E-Darning Sampler

Patching Textiles [2] is a project that discusses interviews with visible mending educators on how they teach individuals to upcycle and mend their clothes. Many of our participants discussed how their favourite garments were made even

Fig. 3. E-Darning Sampler: a sampler demonstrating how to make an e-textile patch[1]

more special with unique mends that were seen as improving the garment through personalization and customization. These interviews with visible menders inspired me to develop the E-Darning Sampler [1] (Figure 3), which uses these mending techniques and combines them with e-textiles to demonstrate how we could upcycle our clothes with e-textiles, and augment items we already own. So rather than everyone purchasing new interactive garments, makers could update the ones they already have with new potentials.

Area for future exploration: In the previous paper I focused on the samplers that help individuals learn the techniques - but how could we augment the wide variety of mending tools to help encourage re-use and upcycling?

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