WearEC: Designing Toolkits for Exploring Wearable Electrochromic Displays

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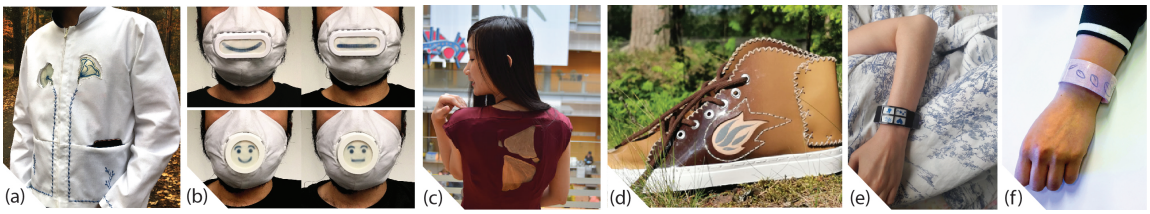

Fig. 1. Examples of wearable EC Displays. (a) DecoLive Jacket expressing availability for social interaction [6], (b) Face masks designs indicating when wearer smiles [4], (c) LinnDress for revealing or concealing skin [8], (d) Vitaboot indicating raised heart rate [11], (e) a bracelet for communication within long distance relationships [9], (f) a customizable bracelet as a calm reminder[1].

CCS Concepts: • **Human-centered computing → Systems and tools for interaction design**.

Additional Key Words and Phrases: Toolkits, wearables, electrochromic displays

1 INTRODUCTION

Electrochromic (EC) displays are graphical segment-based displays that transition between two predefined visual states when a small voltage is applied. They are flexible, transparent and can be fabricated in a free-form shape, which makes them fitting candidates for designing wearables. Compared to light-emitting technologies (e.g. LEDs), these displays promise subtle indications and expressive uses without drawing much attention [3]. Leveraging these opportunities, our previous works demonstrated wearable design with EC displays within various form factors (see Figure 1). However, for designers, exploring subtle visual output modalities is a challenging task. In this work, we present WearEC, two toolkit designs that aim to enable designers to quickly explore interactivity, flexibility and transparency of the EC displays on body.

2 PROGRAMMABLE KIT

The Programmable kit is composed of addressable hexagonal display modules that are attached to each other (Figure 2). As already demonstrated [2, 12], the hexagonal shape is suitable for wearable form factors. The modules can be programmed to switch between blue and white (transparent) states by using a microprocessor and sensors. The designers can explore interactions by attaching the modules together on the body and assigning different animations by programming them.

3 TRANSPARENT KIT

The Transparent Kit is composed of connector/power modules that control naked EC modules (Figure 3). Through transparency and flexibility without being enclosed in a hard case, the naked EC modules allow designers to augment appearances coherent to the textiles and body forms. Designers connect the EC displays and switch their states manually by pressing the buttons. This allows quickly attaching the ECs to customize the form and interactivity of the toolkit. Additionally, the TransPrint method [10] provides easy guidelines, opening up the design space for customized EC displays (Figure 3-b) .

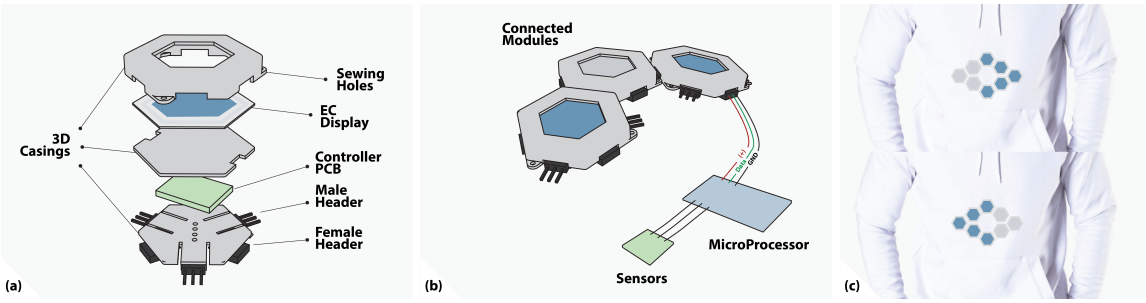

Fig. 2. Programmable Kit. (a) module details, (b) modules, a microprocessor and a sensor for programming, (c) two programmed state of the kit on chest.

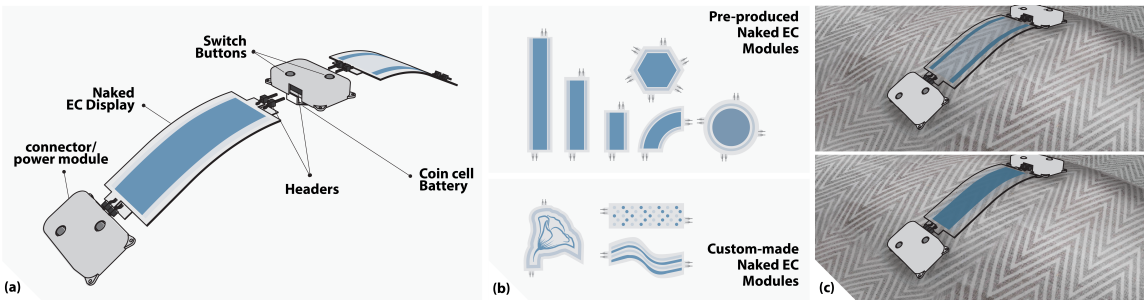

Fig. 3. Transparent Kit. (a) Modules and their details, (b) naked EC screen alternatives, (c) two state of the EC display on a fabric.

4 DISCUSSION

Although subtle modalities are advised for wearables [3, 5, 7], current toolkits lack non-light emitting visual output modalities. We argue that both kits support designers in that direction, enabling quick form and interactivity explorations with EC displays. The programmable kit allows broader interactivity with potential integration of sensors and animations. Yet, it requires programming knowledge and confining the EC displays within hard cases limits the ability to benefit from flexibility and transparency. On the other hand, the transparent kit exploits these qualities by with the integration of naked EC modules (Figure 3-c). Although this kit is limited in terms of programming the visual output, it allows designers to integrate an augmentation directly on textiles and wearables.

ACKNOWLEDGMENTS

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