Physical, interactive, and adaptable objects as mediators for co-creativity

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Abstract

As co-creativity emerges from the interaction between two creative agents, one expects to have a mediator artifact between them. In this paper, we highlight the importance of physicality (or materiality) in the design and development process of human-computer co-creative interactions.

Introduction

Human-computer co-creativity is an emerging field of study that considers the collaborative improvisation and active interplay of humans and computers as creative agents (Davis 2013; Jordanous 2017; Kantosalo and Riihiaho 2019).

In this paper, we raise the discussion about physical interfaces for human-computer co-creativity. We consider the theories of embodiment¹ and enaction² (Davis et al. 2015) to raise our central hypothesis that is to increase the creative potential the co-creative mediation should consider the physicality of perception and actuation between the creative agents in the environment.

Soma design proposes to consider the human body as the starting point for conceiving new artifacts (Höök 2018). Designers should incorporate human bodies' perception of the world instead of mostly focussing on signs and logical thinking.

As researches prove that "movements, emotions, experiences, and thinking are inseparable" (Höök 2018, p. 2), it is essential to consider physicality and gestural manipulation in interaction design. Through our body we interact with the world (Hornecker 2011). Therefore, we should take it into account during the design process.

In that sense, we sustain that physical, interactive, and adaptable objects can be adequate interfaces for humancomputer co-creativity. *Physical* because we interact with the object using our body; *interactive* since the object can perceive, process, and actuate accordingly to human inputs; and *adaptable* as the artifact can adapt (or be adapted) to different scenarios and situations.

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In human-computer co-creativity, it is expected to exist a mediator artifact between the two agents. We argue that it is crucial to consider physical aspects during the creation process to fulfill higher creative potential.

With this approach, we think that humans can better engage in creative processes in which computers act as cocreators, as humans can better understand and communicate through physical mediation.

Physical interactivity

When compared to graphical user interfaces, the physical interactive objects' adaptability is more constrained (Lim et al. 2013). However, advances in new materials, digital fabrication techniques (Weichel et al. 2015), sensors, actuators, and microcontrollers provide plausible alternatives to overcome these limitations.

Interactive and adaptable objects can perceive the user interaction or the environment and can react by adapting its parameters of appearance and form or actuating in the physical world (Jansen, Dragicevic, and Fekete 2013).

The established area of tangible and embodied interaction "merges physical form and computation, resulting in interactive and responsive form" (Hornecker 2011) and provides subsidies to enable creative relations between humans and machines (Kim et al. 2017).

With the technical advances, we expect that soon it will be common to use physical, interactive, and adaptable interfaces in co-creative scenarios. Since the tangibility presents multiple sensing alternatives (active touch, tactile, kinaesthetic, and proprioceptive) (Hornecker 2011), the embodied approach can increase the communication channels between machines and humans, better integrating these two agents in creative symbiosis.

Physical prototyping toolkit

In the past years, we have developed a toolkit for conceiving and prototyping digital musical instruments based on parts inspired by existing instruments³. The conceptual method is an idea generation (or ideation) technique based on the morphological analysis (Cross 2000) from engineering design and design theory.

¹**Embodiment** structures cognition by the way in which our bodies enable us to interact with the environment (Davis et al. 2015).

²Enaction is based on the concept that the experience of reality, considering a cognitive agent, occurs during the continuous interaction with the world (Davis et al. 2015).

³https://probat.io



Figure 1: Probatio version 1.0 - different postures and combination possibilities

We performed evaluation sessions and published the results in a previous paper (Calegario et al. 2017) and a book (Calegario 2019). In the context of human-computer cocreativity, we want to highlight the importance of Probatio's objects that embed previous gestural communication, encapsulate technical details, and focus on expanding human interactivity to achieve creative results. The fundamental idea is to foster intuitive interaction rather than technical worries that interrupts the creative thinking (Sadler et al. 2016).

With Probatio, designers can physically communicate with musicians and vice versa, presenting and experimenting with blocks that can be adequate sensors for specific intentions and contexts. For instance, Figure 1 presents different combinations considering two ways of holding a musical instrument: laptop and guitar-like posture. The toolkit seems suitable for further investigations of human-human co-creativity that can inform aspects applicable to humancomputer collaboration.

In this advance, we consider that in future versions of the system, the computer can be a creative partner for designing new digital musical instruments by understanding (sensing and processing) the musical contexts and intentions and communicating (actuating) at the material level.

Conclusion

In this paper, we discussed the importance of physical, interactive, and adaptable interfaces for human-computer cocreativity. What are the impacts of physical, interactive, adaptable interfaces in engagement during a co-creative process? Are mice, keyboards, and flat screens the interfaces we want for the future of co-creativity?

Tangible and embodied interaction plays an essential role in user's understanding and communication with physical interactive interfaces. We believe that it is vital to explore the intersection between this area and human-computer cocreativity as a part of the research agenda.

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