

# Employing Creative Practice as a Research Method in the Field of Wearable and Interactive Technologies

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**Abstract.** With the emergence of relatively accessible programmable micro-controllers, artistic use and designer application of wearable technologies have increased significantly over the last decade. This paper suggests these creations are more than a mere implementation of emerging technologies for creative practitioners to extend their artistic expression, but a method applicable within research and development. Creative practitioners generally approach their subject matter intuitively and holistically and are therefore capable of facilitating insights where rational approaches may not. Working on the periphery of computer science has the advantage of an outsider perspective, which can result in un-thought of solutions to previously unresolved problems. In this paper we discuss the merits of this approach within wearable and interactive research and describe one such procedure on the basis of a wearable device.

**Keywords:** Creative practice, alternative research methods, wearable technologies, interactive technologies, Arts-Based Research, insight, outsiders perception, Bamboo Whisper, perception of communication.

## 1 Introduction

In recent years, technological development of relatively accessible programmable microprocessors and programming platforms has seen a surge in artistic use and designer application of wearable technologies. The results range from pragmatic gadgetry, in some way augmenting its wearer, through to aesthetically enhanced fashion and the more whimsical artistic creations, which to a greater or lesser extent seem best described by their lack of usability. Assuming research to be a process concerned with the creation of knowledge and of knowing, we suggest these latter creations to be more than artistic expression of emerging technologies by tech-savvy creative people, but also possessing an inherent quality that is applicable as a method for research and development of interactive and wearable technologies [1], [2]. Arts-based research is defined by Eliot W. Eisner as ‘an effort to extend beyond the limiting constraints of discursive communication in order to express meanings that would otherwise be inef-fable’ [3]. Philosopher Michael Polanyi speaks of tacit knowledge, knowledge that exists beyond the boundaries of language [4]. Outside the limitations of linguistics,

the creative practitioner has an aesthetic awareness and a refined sense of perception combined with an ability to find form articulated through the affordances of shapes, haptics, lights and sounds to facilitate comprehension and knowledge transfer.

## 2 Applying Creative Strategies in Problem Solving

Problem solving generally involves one of the following strategies: analytical processing: methodological and conscious search, or insight: sudden awareness of the solution to a problem with little or no conscious access to the processing. Insight is a key aspect of creative thought and associated with a propensity toward diffuse rather than focused attention, resulting in ineffective filtering and enhanced awareness of peripheral environmental stimuli, which trigger remote association [5]. Phenomena like serendipity, hunches and sudden insights play a considerable part in scientific discovery. Often perceived as luck or coincidence, these occurrences are not accidental but denote an ability to combine hitherto disparate parts and create an environment fertile for the unexpected to manifest [6]. This is a skill regularly taught and developed as part of the curriculum in arts and design schools. Creative practitioners have the liberty to explore new technologies in unanticipated ways, uninhibited by the computer science tradition of Human Computer Interaction (HCI) and free from market demands for profitable research [7]. Experts operating on the margin of their field are known to achieve great results by creating and engaging in unique projects<sup>1</sup>.

## 3 Research Focus

Wearable technology has traditionally been regarded as a subcategory to ubiquitous computing and consequently the main concern within research has been on technological development, work tasks and usability. However, wearables signify a break away from the computer as a cognitive and rational device augmenting our brains and constitute a convergence point of a multitude of disciplines. As such, our concern is not with the technology itself but aims to deconstruct the narratives created by market-oriented research into a humanistic and cultural perception of the agents involved [2].

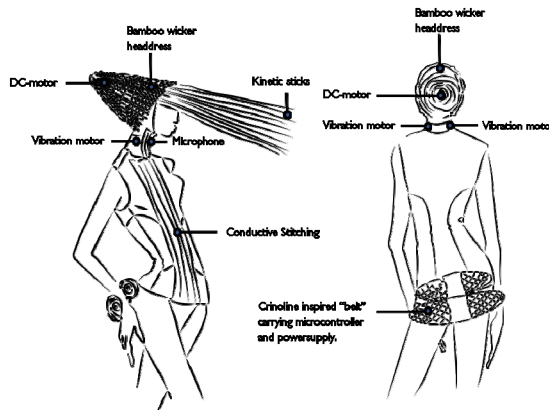
## 4 Applied Methods

Leaning on the principles of grounded theory, the research case study cited below began without a preconceived hypothesis or anticipated results. Rather, the process is more like one of reverse engineering a hypothesis that begins with a trial and error method of praxis-based experiments; the results of which constitute primary data collection that inform a second set of experiments. This process continues as

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<sup>1</sup> In crowd-sourcing initiatives focusing on scientific problem-solving, a thirty per cent resolution rate has been observed when handing over problems to experts outside their respective fields [8].

categories of interest become apparent, in this case a deeper understanding of human communication and the effects of alteration and augmentation thereof. Key to this methodology is an openness to embrace discovery and remain free of expectations of what will be found or precisely how to get there [9]. Furthermore, direct experiences, being the emerging notions perceived whilst creating the project, constitute inductive and deductive thinking through phenomenological experience of materials and forms. Following an arts-based approach, the authors initiated the creation of Bamboo Whisper, two wearable communication devices, each consisting of a felted garment with a conical bamboo headdress. Both devices incorporate an electronic system and a micro-processor, translating the voices into movement of the protruding bamboo sticks and vibration in the other wearers' device. The design of the headdress encloses the head, thereby directing the wearer's vision forward and limiting their peripheral vision, amplifying somatic immediate proprioception and limiting distraction. Unlike arts-based research, we consider the creative result a vehicle for approaching our subject matter as opposed to it constituting the research in itself [3]. For example, this device generates patterns of information in the form of rhythmic percussive structures which represent the source bio-data in new forms. Anomalies can become apparent that were previously invisible. Another implication identified is the user experience of haptic interfaces and their implications in HCI. The wealth of experiential capacity of the body informs what the authors identify as 'interface aesthetics' [10].



**Fig. 1.** The Bamboo Whisper devices, powered by Arduino Lilypads. Integrated microphones capture the vocal input. The data is sent via Xbee Radios to the other wearers device in real-time to drive the DC- and vibrating motors, causing the kinetic movement and haptic feedback.

## 5 Observations

The sensory system constitutes a fundamental source of cognition [11]; so when working through the senses one gains an understanding of the affordances, properties and limitations of a medium that are difficult to explain or learn by means other than practical application. The occurrence of insight is inherent in the process. It is

probable that this effect can be attributed to the interplay between the brain entering a resting or meditative state due to the monotonous work processes involved and the associations evoked by the haptic feedback of the materials. The entire project found its shape step-by-step within this process. The aural aspect created by the movement only became apparent when testing revealed an unintended delay in the code. This led to the discovery of the bonnet “talking back”. Subsequently the project was adapted to an initial prototype that enabled the bonnet to “talk” directly to the public. This approach sits in contrast to conducting experiments in controlled laboratory environments that easily trigger preconceived cognitive patterns or reactions: behavior is not the same as it would be in a natural setting. Therefore, presenting Bamboo Whisper in a performative, public setting is a strategy and effective research technique to gauge and observe underlying attitudes toward the design of wearables [12]. When the prototype was exhibited, visitors usually suspected motion-detection was triggering the hats’ movement and paced about in front of the mannequin wearing the device. Unable to produce a controllable response, they disregarded the reaction as being random and lost interest. They only continued to play if they established a working relationship with the bamboo. One observer associated the clacking sticks with human echolocation, a technique applied by a minority of blind people to orient themselves within objects, working similarly to the sonar of several animal species.

## **6 Discussion/Results**

When applying creative practice in research, the process starts with the recognition of an interesting aesthetic phenomenon and combines it with seemingly unrelated fields of interest. In the case of Bamboo Whisper, the fascinating appearance and physical properties of a traditionally woven basket is transformed into an instrument to explore extended capacities of human communication. The intuitive approach of the creative practitioner to a subject leads to unforeseen results which do not need an interpretation as such. Instead the crafted product is placed in a performative setting, opening up for the possibilities of spontaneous interaction with the public. Observing reactions and evaluating interpretations can facilitate new insights. Avoiding traditional methods such as representative user groups and controlled settings, in combination with the strong presentation aesthetics, allows for extreme and normally overlooked aspects to emerge. One example of this is the association of echolocation with the clacking of the moving sticks. Confidence in both the value of the process and that the means will ultimately lead to the goal negates a concept of failure, a prerequisite to maintaining the receptive state of mind paramount to achieving results.

## **7 Future Development**

A congruent next step will be to expand the project to encompass a swarm of devices in a large network, engaging the wearers in a collective experience shaping a bizarre yet common space defined by new modes and parameters of interaction. Likewise, introducing new testing devices which are controlled by the public and enhance public engagement in the haptic experience will add another angle to the experiment.

Further, the responses to the audible aspect and potentials of Bamboo Whisper, are encouraging development of evolutionary designs, catering directly for use as echolocation devices, investigating the possibility of creating artificially induced multi-modal transfer. In this regard selecting user-groups with abnormal sensory development could provide new and extraordinary insights to the project.

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