

Sentimental Soft Robotics as Companion Artefacts

Extended Abstract[†]

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ABSTRACT

In my practice-led PhD research I explore new dimensions of human-machine relations in the affective space by making and engaging social interaction. I make robotic artefacts whose movements are responsive and later aimed to be adaptive to human emotional cues. Soft robotic mechanism and materials are adopted as enabling technology for they contribute to the pursuit of artefacts with the integrity of computational intelligence and aesthetic serendipity.

These artefacts offer organic appearances and sensual movements. The interactive movements are programmable and data about human interactivity at the same time.

Their aesthetic value functions in attracting people to interact with them. Through interaction, the embedded sensors collect data on interactors' behaviour. Through data analysis it aims to find patterns that infer affective status, and could later adapt their own behaviours accordingly.

Their sensual properties namely the organic appearance and sensual movements facilitate establish connection on an emotional level. Unlike computational artefacts which often come with pre-defined interaction guidelines and prescribed 'emotional status', these artefacts enable a process of relation forming at individual level, through accumulated interaction. The design perceives emotion as interaction and supports the understanding, interpretation and experiencing of emotions.

The research and practice naturally falls in three stages.

Stage one: learning material and kinetic properties of soft robotic artefacts through studio making.

Stage two: Engaging human interaction through public facing workshops to collect observation and feedback.

Stage three: developing artefacts in specific context.

My research is at the end of stage two and actively seeking context to bring the research and practice to stage three. This paper would brief the development of the early research stages and project later stages and hope to collect feedback and comments.

KEYWORDS

Soft robotic artefacts, emotional relations, affective interaction, natural movement, embodied approach

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1 INTRODUCTION

Conventional companion objects such as soft toys, personal accessories do not have the computational intelligence and the interactiveness. Computational artefacts, which claim to address emotional space such as wearable device, smart tracking watch, wristband, people often fail to have

connection on emotional level. This research and practice situated in this gap. Thus the first question of this research is to find whether it is possible to source material that has the integrity of computational intelligence and aesthetic serendipity. Soft robotics offers great opportunity. Although much research has been done within the engineering community and artists' community, the focused has been more on the accuracy of control and animalism. The sentimentality of such material is under-researched. The research and practice thus tries to address this gap with an embodied approach.

The research also aims to enable an open-ended process for the artefacts and their human partners to form affective relations through accumulated interactions. Don Normal holds that personal interaction is the key to establish emotional bond and personal meaning with objects [1]. Boehner et al view emotion as interaction, and advocates the goal of affective systems to be to support human in experiencing emotion in its complexity and ambiguity [2]. This gap of affective relation forming could not be satisfied with pre-defined interaction model and re-determined parameters of affective status.

The research and practice naturally falls in three stages, with sub questions as below:

- What is the agency of soft robotic materials in facilitating emotional bond between companion artefacts and their human interactors?
- What are the material properties that are 'designable' or exploitable?
- What is the capability of embedded sensing so as to capture data of people's affective status during its different behaviour?
- How would people want to relate themselves to these artefacts?

2 three stages of research and practice

2.1 Stage one: learning material and kinetic properties of soft robotic artefacts through studio making.



Figure 1, prototypes of soft robotic artefacts

Three types of artefacts were explored:

- a. Several basic artefacts following the pneumatic soft robotic mechanism were made. The material is mainly silicone which air-channel designed. Air is pumped into the silicone robot manually or with pump so as to create movements (Figure 1.)
- b. The artefacts movement is responsive to heart rate [3]
- c. Movements and collect data about interactors' affective status. In order to capture human affective status, a facial recognition software has been employed during the interaction, in a piece called *Kinetic spatial installation adaptive to human emotion cues* [4], as shown in fig.2



Figure.2 artefacts with 5 behaviours connect with facial recognition software, Software support: Michael Straeubig, Mechatronics collaborator: Adrian Godwin

2.2 Stage two: Engaging human interaction through public facing workshops to collect observation and feedback.

Two kinds of activities constitute of stage two. 1. Free interaction workshop 2. Making

personalised companion artefacts with soft robotic toolkit.

During the "free interaction workshops", participants interact with the robotic artefacts freely. Feedbacks were collected via conversation and questionnaire. One such case is during Design Research Society conference 2016 [3].

In the "making personalised companion artefacts workshops", followed by the same activity as in the "free interaction workshop", participants were asked to work in groups to imagine a scenario of living with their personalised robotic affective artefact, and prototype with tangible materials provided. Soft robotic toolkits developed by the author and her collaborator were provided to enable the making. Such cases include three workshops during October - November 2016 in the V&A, London, AcrossRCA project at the Royal College of Art [4] and the State of Emotion Festival Berlin [5].

Sample video of interactive artefacts could be seen in a work-in-progress project during Jan 2017 [6].

Observations and feedback in these workshops showed that there is a strong agency of such artefacts in creating instant human connection on emotional level. Participants rate the movements and tactile quality of the artefacts contributes the most to the sensations they evoke. During the workshops, below questions were discussed or observed:

What kind of interactions do participants engage with the artefacts?

What kind of relations people would like to establish with their artefacts, e.g. on the body (wearable), off the body (in space), visible or invisible to others?

The documentation and the findings of these questions are informing the next stage of the research and practice.

Stage three: developing artefacts in specific context.

3. Summary

The pilot studies in stage one and two of the research show that there is a strong agency in these artefacts in inducing human emotions. Participants attribute the most impactful elements to movement and tactile qualities (touch) of these artefacts. It is possible to develop a set of non-verbal movement pattern of interaction and be able

to collect data about people's behavioural cues, e.g. different force of touch, whether interacting or not.

Once effective interaction is designed, through data processing, it is possible for the artefacts to adapt to human behaviour. To be companion objects.

The supporting video of this stage could be find in below links:

<https://feuetbois.net/2017/01/27/sentimental-soft-robotic-wip-show-jan-2017-rca/>

4. Next steps

During stage three of the research and practice which is scheduled from 2017-2018, specific context would be discussed and specifically designed artefacts will be developed.

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