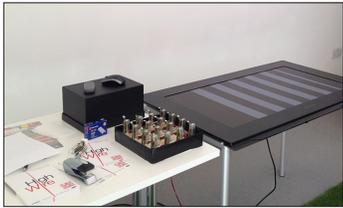


### A Public Ideation of Shape-Changing Interfaces



To expose and document a range of applications for shape-change, we employed unstructured brainstorming within a public engagement study [10]. A 74-participant brainstorming exercise with members of the public produced 336 individual ideas that were coded into 11 major themes: entertainment, augmented living, medical, tools & utensils, research, architecture, infrastructure, industry, wearables, and education & training. This paper documents the methodology and resultant application ideas along with reflections on the approach for gathering application ideas to enable shape-changing interactive surfaces and objects.

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# Drawing Design Futures for Shape-Changing Interfaces

#### Abstract

Shape-Changing interfaces have the potential to change the world by giving tangible form to computational interactions: but what will we use them for, and what are the implications of adopting such technologies? This doctorate investigates the current breadth of research prototypes, their classifications, limitations and possibilities – with the ultimate goal of informing application design and usage for shape-change. The interdisciplinary nature of this enquiry employs mixed methodologies such as sketching user scenarios and creating design fictions to inform the field, whilst public facing workshops allow for fresh perspectives on future design and use cases.

#### Author Keywords

Shape-Change; Sketching; User Experience; Design Fiction; Public Engagement;

#### ACM Classification Keywords

H.5.m. Information interfaces and presentation: Miscellaneous.

#### Introduction

Shape-changing interfaces represent the next step in physical computing: these devices are tangible – often self-actuating – technologies straddling a number of materials, mechanisms and applications. They have the potential to engage with our emotions [6, 8], add dimensionality to data [7, 12] and utilise multiple

### Using Design Fiction to Inform Shape-Changing Interface Design and Use



We propose the use of design fiction to investigate potential applications for this technology: using design fiction to create artifacts relating to future use scenarios for shape-change. Whilst research within shape change often proposes future use-cases for prototypes during discussion, they are seldom in a form that presents them as everyday artifacts. Here, we present and discuss a printed gameplay instruction manual for a truly high resolution shape-changing game entitled *First Hand*, which aims to draw parallels between current gaming practices and the tangible nature of shape-changing interfaces [11].

sensory inputs and outputs [3, 5].

The current limiting factor in the development, and ultimately, the adoption of shape-change is the current prototypical nature of the field, and lack of forward planning with regards to potential use cases, applications and products. Research typically focuses on short term user studies with small numbers of academic-based participants as proof of concept, often abandoning the prototype at the end of a research project, or simply moving on to the next exciting device made possible by an ever-changing field. The question thus remains: What is shape-change good for? Further, do we need or want this technology?

In order to begin to answer this question, we conducted a large scale study in a public setting, asking participants to generate application ideas for shape-changing technology. *ShapeClip* [2] prototyping tools were used as boundary objects in order to explain the concept to a non-expert audience. The response was exceptional, 336 ideas were generated by 74 participants, spanning 11 categories (see sidebar on the first page). These ideas were often written, but many participants shared their thoughts as sketches: these sketches showed more than just basic concepts, they also showed glimpses into the world in which they might exist.

Designery sketching around the theme of shape-change has primarily been addressed by Rasmussen et al. [9] but also in a limited form by other researchers as part of the on-going design process for prototyping and idea generation [4]. Within other fields, such as engineering, students are commonly encouraged to use hand-sketching to explore ideas, but it is often under-utilised in STEM subjects partially due to the idea that “I can’t draw” [1],

and partially due to the advent of computer-aided design programs. The visual nature of such data made it possible for the researcher to develop sketches into detailed user scenarios in the style of design fiction, that is, the products shown are not yet developed, but are shown as integrated into everyday life.

Based on the success of the public ideation study, the decision was made to expand the investigation to include a wider variety of examples of shape-change. A systematic review of shape-changing interfaces was undertaken (based on the criteria of more than one type of input and output occurring on the same surface) and all prototypes analysed for common features before being classified into seven hardware categories. These types of hardware were then designed in a low-fidelity format so that the interactive properties of all types of shape-change can be mimicked on a small scale, and thus demonstrated to varying audiences.

The low-fidelity shape-changing interfaces will be part of a large scale study using non-expert participants who will generate ideas and sketched data with which to co-create illustrated design fiction scenarios utilising shape-changing technology as it might exist in our future. The final stage of investigation aims to consolidate the previous research into prototype classification, design sketching, user experience and design fiction in order to inform the design and use of shape-changing hardware and applications, with the intention of feeding this data back into the research community and ultimately helping to shape the direction of the field.

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