The Role of a Digital Visualization Tool in Generating Novel Service Design Concepts for the Energy Industry

Abstract
We describe the use of a digital information visualization tool in the context of a collaborative service design workshop, carried out as part of a project for a major energy supplier. The workshop was aimed at developing new service design concepts enabled by the potential of smart homes and devices. We present an initial analysis of the way in which the tool was used in the workshop with the aim to provide a better understanding of how such tools can contribute to the generation of creative outputs in similar contexts in the future.

Author Keywords
Computer-supported creativity; collaborative creativity; idea generation; creative co-design workshops.

ACM Classification Keywords
H.5.2. [Information interfaces and presentation]: User Interfaces, User-centered design, Theory and methods.

Introduction
Previous work [4,5] has shown that visualized data offer a potential source of inspiration for design workshop participants. But how does this work and how can we best design tools to support this? In this short
paper, we describe an example taken from a collaborative design workshop in which participants used a digital design tool, alongside other more conventional physical tools. We propose an approach to analyzing the way in which this tool was used that we hope can shed some light on the potential role of this and other digital tools in supporting the generation of novel design concepts.

**Background and Context**

The work described in this proposal took place as part of a project for a major energy supplier aimed at designing new services to utilise the data generated by smart energy meters [4,5]. The workshop from which the activity described here was drawn was one of a series of eight workshops in which the aim was to generate concepts for products or services that could help reduce peaks in domestic energy consumption. Each workshop involved three graduate level student participants who came from mixed backgrounds, included a variety of different activities and lasted approximately two hours. The activity discussed in this proposal was part of a divergent ideation session undertaken early on in one of the workshops.

**The Use of a Digital Visualization Tool**

The digital design tool that is the focus of this proposal was an interactive information visualization tool [2] (see Figure 1), and was developed specifically for this series of workshops. It visualizes energy consumption data obtained from two sources [3,8]. Interactions with these data are facilitated by a series of clickable icons, arranged around the top right hand corner, which enable a simple AND filter. Towards the top, a clickable bubble chart shows average hourly consumption of classes of domestic appliance, based on the selected filters. Below, a heatmap timeline displays half-hourly National Grid demand data, based on the selected season and day filters. Towards the bottom, the average yearly consumption for appliances is shown using a series of bar charts, which are based on the selected demographic filter. Our intention with this design was to facilitate participants’ exploration of energy data, following Shneiderman’s description of the way visualization supports hypothesis formation and testing, and, through this, creative insight [9].

![Figure 1: Screenshot of interface visualizing smart meter energy data presented to workshop participants on an iPad](image)

The digital tool was provided to participants in the workshop on a single iPad, that was shared by all 3 participants, alongside physical design tools and materials including Post-Its, pens and printed paper worksheets (see Figure 2). Different tools and materials were used in different activities. The activity of interest here involved generating new ideas: participants were asked to “try to come up with as many different ideas
as you possibly can for products, services or incentives that will help us shift electricity consumption away from peak hours", and to capture each idea they generated on a separate post-it note. This activity typically lasted 30-40 minutes.

**Approach to Analysis and Presentation**

All workshops were videoed using a single camera. To understand the role of the digital visualization tool in supporting the collaborative generation of novel design concepts, we first adopted a critical incident approach [7] to identifying typical examples of the ways in which ideas emerged during the activity of interest. We then began to analyse the video recordings of a small number of these incidents. Each incident was defined as starting with an interaction with the digital tool, and involved the development of one or more ideas, ending with the idea or ideas being individually recorded on Post-It notes.

Our approach to analysis is influenced by previous work on video and the analysis of work and interaction [1]. In our analysis, we seek to highlight both non-verbal behaviours and verbal utterances of each of the participants over the course of an idea generation incident, as well as interaction with, and reference to, elements of the digital visualization tool, and use of physical tools (pen and Post-It) to record the ideas generated.

**Figure 2** shows an extract from the analysis of one incident presented in graphic format. We are developing this method of presenting our analysis graphically in order to better convey the dynamics inherent in the complex interactions of participants’ words, gestures and actions, and use of tools and materials. This graphic format also enables us to more clearly show the connection between the visualized data, the insights participants gain from exploring these data, and the design ideas they are generating and developing. The timeline helps us place the current activity within the ongoing ideation.

In the incident from which the analysis in Figure 2 is drawn, participants appear to adopt a step-by-step, analytical approach to exploration of the visualized smart meter data. Participants interact with the iPad to explore different views, and the quantitative data are integral to the way their ideas develop and are refined. The abstract representation, user-controlled interactions and relatively narrow scope of the energy consumption data enable comparison of different views of these data, and keep the group’s ideation focused around the interface. Their interactions during the development of this idea involve both direct use of the data, for example by tapping interface buttons to change the view of the data, and also reference to the data during conversation, for example by pointing out information to underpin their contributions to the development of the idea.

**Questions**

Through our analysis we hope to begin to address a number of important questions relating to the use of interactive visualizations of data generated during everyday activities as a tool to support design ideation and creativity. These include, but are not limited to:

1. What relationships exist between data, the way they are visualized, the insights participants gain and the design ideas they inspire?
2. Are there important patterns in the types of idea generated using different tools that mean that some are more likely than others to be adopted?

3. Which tools within this, and similar, blended environments can most usefully be digitized?

Figure 2: An example of our visual approach to presenting analysis, which shows the refinement of an insight from data exploration into a design idea that is subsequently recorded on a Post-It note.
Conclusion
In our analysis to date, we believe there is evidence that visualizing the data generated during everyday activities through a digital visualization tool such as that described above offers an effective source of inspiration for workshop participants’ creative design ideas, in a way that can augment traditional non-digital approaches. Further research is needed to better understand how to do this, and we hope that participating in this workshop would be a good starting point for this.

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References