A Personal Visualisation Future: Domestic Data Sculptures

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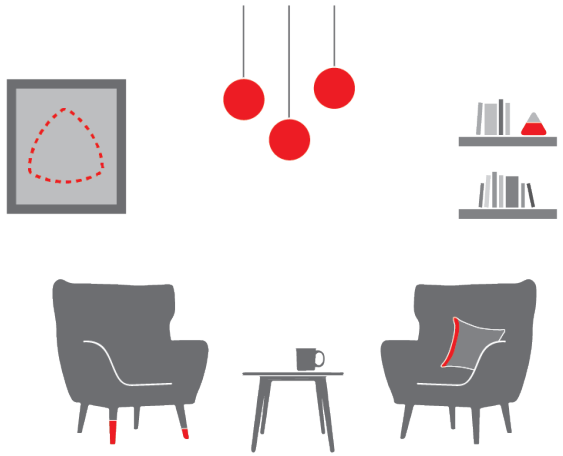

Abstract
As the collection and analysis of personal data has become increasingly prominent in the lives of many, an important question arises: how can such personal data best be conveyed in informal settings such as the home? In this paper, the argument for an exploration of personal visualisations beyond the screens of laptops, tablets and mobile devices is made. In particular, the potential of interactive domestic data sculptures is highlighted. A brief overview of the work that has been done in the area of physical visualisations till date is provided and three design challenges of creating personal data sculptures are discussed.

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Personal visualisation, data sculptures, physical visualisations, personal data, ambient technology

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

General Terms
Design, Human Factors

Introduction

Seven unread e-mails, 88 heartbeats per minute, two friend requests, 5043 steps, 132 micrograms of NO_2 per cubic metre of air, 14 socks to wash and the neighbour's music is just over 100 decibels. Personal data is everywhere. Advances in technology have made it increasingly easy and affordable to collect such data, whether it relates to an individual's health, social network or local environment. Gathering these types of data can be useful for a number of reasons: to give insight, to inform, to motivate behaviour change, to predict, and so forth. As these types of data can be of importance to many, the main challenge is: how do we enable easy analysis and manipulation of such personal data?

As the visualisation of data has proven to be valuable when analysing data in professional settings, it seems only natural to also turn to visualisations when dealing with data in personal settings. However, there are various differences between these two settings. For example, in the former the visualisations are generally aimed at expert users, whereas people in personal settings cannot be assumed to be knowledgeable about data, data analysis and data visualisation. Pousman et al. [5] argue that non-experts require more *casual information visualisation*. However, how to create such casual visualisations, and more specifically: how to create such casual visualisations of personal data, is currently still largely unknown.

In this paper, we argue that the current popularity of digital fabrication, the affordability of rapid prototyping platforms and the existing knowledge of affordances of physical visualisations should be combined to create interactive *domestic data sculptures*.

Physical visualisations

The concept of *physical visualisations* is defined by Jansen et al. [4] as "visualisations that are made of physical matter, as opposed to presented on a computer screen or projected on a surface as it is traditionally the case" (for examples, see: [1, 2, 6, 8]). The use of physical matter when visualising data is motivated by the many affordances physicality is believed to have, such as embodiment and more natural interactions [7].

A popular type of physical visualisations are *data sculptures*. Such sculptures are defined by Zhao et al. [8] "data-based physical artefacts, possessing both artistic and functional qualities, that aim to augment a nearby audience's understanding of data insights and any socially relevant issues that underlie it". In short: tangible representations of data are used to convey content, generally to a lay audience. While such sculptures have been used for centuries (see [2]), the combination of physical visualisations and technology is more recent – with one of the first examples dating from 1992: Durrell Bishop's Marble Answering Machine (described in [3]).

Domestic data sculptures

As can be seen in the overview of active physical visualisations created by Dragicevic et al. [1], till date few data sculptures have focused on the presentation of personal data. Furthermore, the majority of sculptures are developed as part of art projects, meaning few empirical evaluations have taken place. This highlights the need for the creation and evaluation of interactive *domestic data sculptures*.

While previously, the creation of interactive visualisations would have been costly and feasible for experts only, the arrival of digital fabrication technology (e.g. laser cutting

machines, 3D printers) and rapid prototyping platforms (e.g. Arduino and .NET Gadgeteer) have this process simple and affordable. Similar to ambient technology, such sculptures should be designed keeping aesthetics, ease of use and enjoyment in mind, allowing non-experts to interpret the personal data they gather in an accessible and playful manner.

Design challenges

Though all the tools for the development of domestic data sculptures are readily available, there are a number of design challenges that need to be overcome, including:

Visualising for the individual

As the name suggests, personal data is primarily very *personal* – and so any attempts at visualising, manipulating and analysing such data will have to take the person to whom it belongs into consideration. While some people may gather data on their health for very specific purposes, others may only want to know about extreme outliers in the data. Similarly, while some people may be looking for correlations between different data sources, others may only care about changes over time. For the creation of successful domestic data sculptures, they will need to be highly customised, as the interests and needs of the person in question will have to be taken into consideration in order to make them relevant. How can we take specific and evolving requirements of individuals into consideration when designing domestic data sculptures?

Visualising for the home

Besides the interests and needs relating to the data, designing for the home means the person's preferences relating to aesthetics and interaction of the data sculpture will also have to taken into account. As similar constraints have to be considered when designing and developing other technology for them home, whether ambient, calm or otherwise, this is not a novel challenge in the domain of HCI. Nevertheless, designing the data sculptures in such a way that they fit into people's homes and are accepted as part of the environment will be critical to their success. How can we design data sculptures customised to the aesthetic taste and interaction preferences of individuals?

Visualising for the everyday

As domestic data sculptures fulfil a role in the home similar to that of art, they are likely to be present for long periods of time. To ensure the sculptures will remain relevant over time, their design needs to be adjust accordingly. To encourage sustained usage over time, the sculptures could potentially be configured in different ways, providing different visualisations of the same data – thus preventing inevitable boredom with the display. Alternatively, the sculptures could be made out of cheap (and preferably environmentally friendly) materials that are disposable, allowing people to replace the outer layer of the physical visualisations and repurposing the technology. How can we prevent data sculptures from becoming unused over time, once the novelty wears off?

Conclusion

As more and more personal data is gathered and stored by individuals, a new challenge emerges: visualising this data for lay people. As physicality has a range of affordances, the exploration of interactive *domestic data sculptures* is highlighted in this paper as a potential method of communicating data in everyday settings. Despite the work done in the area of physical visualisations, tangible computing and ambient technology, several design challenges remain. In this paper, three of these challenges are described: visualising for the individual, home and everyday.

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