
Situated & Social Feedback in the City

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Abstract

In this paper, we investigate the use of public display as a situated feedback medium that is able to reveal the relationship between local activities and their global impact, within the context of the urban environment the display is located in. The increasing amount of urban datasets made available to the public today has become a valuable resource to allow city inhabitants to understand the true impact of their daily life. But the

complexity, specificity, interrelatedness and scale of these datasets pose serious challenges in terms of how to engage all stakeholders in such relatively complex issues that are nonetheless relevant to the everyday experience of the public environment. We propose a concept in which smart metering, situated data visualization and immediate feedback are tightly interrelated. The concept aims at transforming urban data into persuasive messages that encourage inhabitants to relate daily activities with their impact, while also providing data-driven evidence for these claims.

Keywords

information visualization, interaction, persuasive technology, ubiquitous computing, situated computing, remote sensing.

ACM Classification Keywords

H.1.2 [MODELS AND PRINCIPLES]: User/Machine Systems --- Human factors, Human information processing, Software psychology; H.5.2 [INFORMATION INTERFACES AND PRESENTATION]: User Interfaces; J.5 [ARTS AND HUMANITIES]: Architecture; K.4.3 [COMPUTERS AND SOCIETY] Organizational Impacts.

General Terms

Human Factors, Design.

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Introduction

Many of our daily activities within a city have become digital traces that are continuously sensed, recorded and stored, including aspects such as energy consumption, traffic flows, pollutants emissions or communication flows. Thanks to advances in modern sensing technologies, all this can be done with a level of granularity that often allows to distinguish unique local characteristics [1][2]. As these datasets tend to be mainly used for improving the planning and delivery of city services (e.g. lowering waste of resources, increasing efficiency and safety), they are made only available for expert city planning and management purposes. We argue that the communication of such urban datasets to the population has the potential to become a useful tool in increasing public awareness of environmental sustainability. More specifically, we propose the use of urban display as an opportunistic feedback medium: a public display allowing passers-by to understand information that is *situated*, i.e. it is relevant and contextualized to its immediate surroundings. Electronic displays are becoming increasingly ubiquitous in today's experience of public space, although the vast majority serves mainly commercial, artistic or entertainment purposes [3]. In contrast, our concept foresees that public displays will take on functionalities that are socially relevant to the fabric of their environment, and even encourage local support or cohesion towards shared values or goals.

Thinking Globally, Seeing Locally

Presenting the link between one's actions and their real-world impact in an understandable way is related with various complex factors, including time-variance (i.e. what is valid now, might be different tomorrow), multi-dimensionality (i.e. different factors interfere

simultaneously), and scale (i.e. the minimal effect of the behavior of one person versus that of a whole population). As such, many individual actions have a tangible effect on the scale of the city only when considering the multiplying effect of the *aggregate*. Accordingly, initially unrelated effects have the potential to build up or augment each other over time, making simple and individualized cause-and-effects rules almost impossible to convey. Put differently, what a single person does locally, now and on his own accord, is often hard to relate to its true impact, in the long term, in its aggregate and on a larger urban scale. The use of data visualization can form a compelling solution in this regard, as it allows for the analysis, interpolation and, ultimately, the presentation of complex causal relationships in an understandable way [4]. Using visualization as a persuasive tool has been accomplished before, although most such initiatives have been focusing on realistic simulations of potential outcomes, such as for conveying the implications of climate change [5]. *Realistic visualization*, however, tends to emphasize the visual aspects of change, which may exacerbate people's existing tendency to relate the urban experience solely to what they can 'see' in their own city. Instead, our concept focuses on the visual depiction of the hidden information streams that characterize the sense of place. Notably, such visualization should reach beyond the presentation of *actual* effects: it could as well present *potential* (positive) effects and should become the basis for social interaction, cooperation and collaboration among citizens [6].

Space, Place, Interface

Urban displays offer a suitable way of conveying a message in a truly situated way. A public display, like an advertising board or a media façade, is inherently

situated: not only it is fixed on a specific location, but it is also perceived as an integral part of a place's identity and character. Therefore, a public display that provides information about its surrounding space (versus today's common practice of simply announcing events about other locations) is an evident way of merging physical reality with its identity based on data. A typical example is public display of ambient temperature: any passer-by will relate this information to its location and his personal experience of the environment. Therefore, urban displays have the potential to map information into the experience of the urban landscape, without breaking the spatial experience (e.g. reading on a smart phone) [7], and without the need of an explicitly geospatial reference.

Cognitive Friction

Using an urban screen might make the message more situated, but not necessarily comprehensible. To reduce the cognitive load and to increase immediateness when receiving and understanding the message, we propose the use of metaphors that are specific and relevant to the location, versus the typical numerical or abstract indicators. *Specific and relevant* means related to people's everyday life: their goals, their interests, and the social and physical context they are used to interact with.

Closing the feedback loop: an example

To exemplify a possible implementation of the concept, we present two scenarios (see next page) embedding the three aforementioned principles:

- 1) to express the causal relationship action-effects (logical mapping);
- 2) to use situated visualization tools (physical mapping);

- 3) to use metaphors, making the message more concrete and relevant (mental mapping).

Conclusion

This paper presented an approach based on the assumption that citizens can be made aware of the impacts of their actions on their own environment using a persuasive visualization situated in the urban surroundings. Situated and social visualization, if designed in such a way that the positive results of the actions of any individual are clearly recognized, might succeed if scientific experimentation can show the causal links between such public feedback and the alterations of motivation or behavior.

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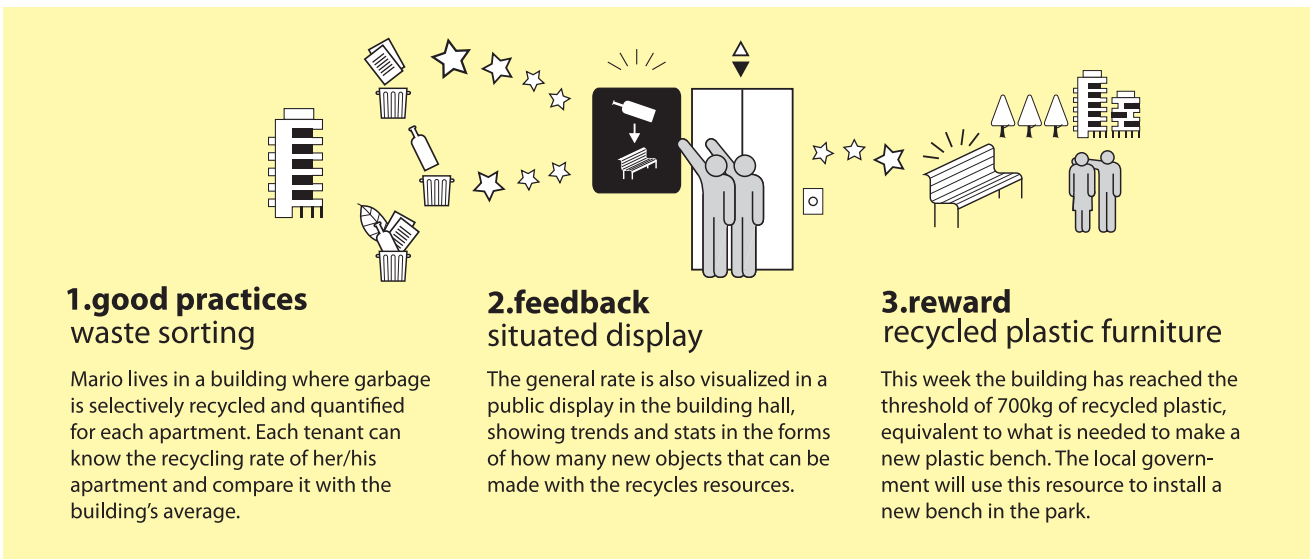


Fig. 1: Microscenario

In this microscenario, **logical mapping** is achieved presenting the *positive* and *potential* effect of turning used plastic into a useful resource. **Physical mapping** is achieved using a public display in the building hall: it is seen (primarily) by the tenants of the building and tells something related to the daily life in the building itself. While **Mental mapping** is achieved expressing a numeric indicator (Kilograms of recycled plastic) with a visual metaphor (new objects built out of that plastic) that is concrete and relevant to the personal/physical experience of the tenants (benches in the local park).

1. good practices
waste sorting

Mario lives in a building where garbage is selectively recycled and quantified for each apartment. Each tenant can know the recycling rate of her/his apartment and compare it with the building's average.

2. feedback
situated display

The general rate is also visualized in a public display in the building hall, showing trends and stats in the forms of how many new objects that can be made with the recycles resources.

3. reward
recycled plastic furniture

This week the building has reached the threshold of 700kg of recycled plastic, equivalent to what is needed to make a new plastic bench. The local government will use this resource to install a new bench in the park.

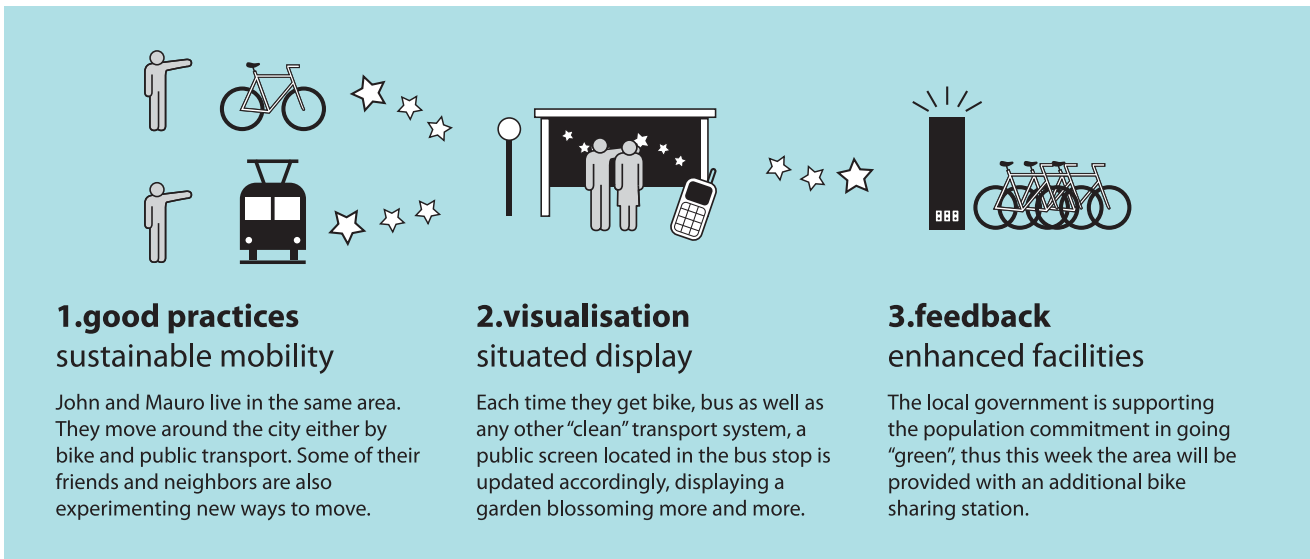


Fig. 2: Microscenario

In this microscenario, **logical mapping** is addressed by the positive effects of a more sustainable mobility, in terms of improved habitat quality. **Physical mapping** is achieved using a public display in the bus stop: it is seen (primarily) by people living in the area and visualizes the sustainable mobility performance within the area. **Mental mapping** is achieved representing the habitat quality through the metaphor of a blossoming garden.

1. good practices
sustainable mobility

John and Mauro live in the same area. They move around the city either by bike and public transport. Some of their friends and neighbors are also experimenting new ways to move.

2. visualisation
situated display

Each time they get bike, bus as well as any other "clean" transport system, a public screen located in the bus stop is updated accordingly, displaying a garden blossoming more and more.

3. feedback
enhanced facilities

The local government is supporting the population commitment in going "green", thus this week the area will be provided with an additional bike sharing station.