# EXPERIENTIAL DESIGN LANDSCAPES: DESIGN RESEARCH IN THE WILD

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## ABSTRACT

Thanks to the emergence of new sensing and behaviour tracking technologies, design research can take place anywhere and anytime in the real world. When doing design research, a trade-off has to be made between experimental control and ecological validity. In this paper, we compare Experiential Design Landscapes (EDLs) with three more traditional research approaches that are frequently used in design research, i.e., Lab Research, Living Lab and design research 'in the field', and reflect on this trade-off. By means of an example, we discuss how EDLs deals with issues of 'generalisability' to the real world and the potential loss of experimental control.

## INTRODUCTION

The size and amount of computing power we carry with us is increasing everyday. More and more products and systems are becoming intelligent, networked and designed to be part of our everyday life and society. Through our smartphones we carry a wealth of sensors (e.g., acceleration, GPS) in our pockets and these are usually 'always ON'. In addition, our homes as well as public spaces are increasingly being enriched with embedded contextual sensors, including motion detectors, cameras, etc.. The widespread deployment of these technologies have created an unprecedented ability to track people and record behaviours and contextual variables in real-time, over extended periods of time, and within the living and working environments people inhabit in their everyday life. When design research can take place anywhere and anytime in the real world, this inevitably entails both consequences and opportunities for the nature of design experimentation. Whereas much attention will need to be devoted to the legal and ethical boundary conditions of recording, analysing, and utilising such personal and contextual data, the current paper sets out to explore a particular methodological issue in design research, that is, the trade-off between the level of control we can exert over contextual variables that may impact a particular (design) intervention, versus the ecological validity (or generalisability) of results found.

For designing highly intelligent products, systems and services, Van Gent et al. (2011) propose a method called Experiential Design Landscapes (EDLs) to develop and probe new radically innovative concepts towards societal transformation, with people in environments which are part of society (e.g., designated area in cities, sports parks etc.) and which are, from a user-perspective, not dedicated research spaces, such as university laboratories. EDLs use the ever-increasing intelligence in everyday environments and utilize this as smart sensor agent technology with behaviour recognition algorithms and data mining techniques to allow analysis of new behavioural and usage patterns that (may) emerge as a consequence of a variety of design interventions. EDLs thus allow real-time as well as longitudinal capture of individual, social, and environmental data and this way provide a much richer continuous characterization of (emergent) behaviour than previously possible.

When doing design research involving users, a trade-off is usually made between experimental control and ecological validity (Figure 1). Doing design research in a laboratory often results in lower ecological validity, limiting the extent to which findings can be generalized (or extended) to the real world, due to decontextualization. On the other hand, design research 'in the field' often results in a compromise on experimental control and a lack of generalization to theory (Koskinen et al. 2011; see also Black, 1955).

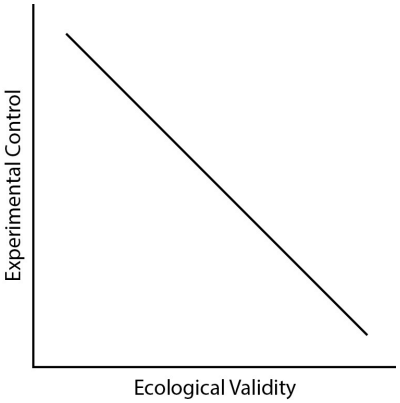


Figure 1: Graph illustrating the theoretical trade-off in design experimentation between experimental control and ecological validity.

In the following, we discuss how other research approaches involving users, i.e., Lab Research, Living Labs, and Design research 'in the field', deal with the trade-off. We reflect on each research approach with regard to their contextual control, social, environmental and temporal fidelity. Subsequently, by means of an example design project 'Social Stairs' we discuss how EDLs can challenge this trade-off. The paper ends with some concluding reflections and remarks on the 'Social Stairs' and a discussion on the generalisability of EDLs and the potential loss of experimental control.

## LAB, LIVING LABS AND DESIGN RESEARCH 'IN THE FIELD'

Laboratory studies in design research (in technical design disciplines) are very common, with its foundations coming from experimental psychology and the natural sciences. An experiment is aimed at testing the validity of a hypothesis, which usually has been formulated based on a theoretical prediction. Experiments provide insight into correlations and possible causal mechanisms (or cause-effect relations) by manipulating a particular factor, and measuring the effects of that manipulation. Experimental control is essential: any factor that may limit the accuracy or repeatability of the experiment or the ability to attribute the results to the experimental manipulation needs to be carefully excluded. Studying design in a laboratory thus means that a phenomenon, system, or artefact is taken from its natural environment and brought into the controlled arena of the lab. Thus, experiments typically abstract away from studying phenomena in their naturalistic context, as these contexts typically contain a large number of variables that are beyond the researcher's ability to predict or control (Koskinen et al. 2011).

It is partly on account of this belief that 'Living Labs' were introduced. Their aim is to study phenomena in their naturalistic context while maintaining experimental control. "The term 'Living Labs' often refers to both the methodology and the instrument or agency that is created for its practice. Living Labs are driven by two main ideas: 1) involving users as co-creators on equal grounds with the rest of participants and 2) experimentation in real-world settings. Living Labs provide structure and governance to user participation in the innovation process." (Almirall and Wareham 2008). Well known Living Lab examples are PlaceLab at MIT (MIT 2009) and ExperienceLab at Philips Research (Philips International 2013). Recent initiatives in Living Lab research show deployment in everyday life, that is, people's natural environments and parts of the public space and society (ENoLL 2013).

Design research 'in the field' is typically done in a naturalistic setting and aims to inform the early stages of design. Researchers follow to what happens to their design in context; how people and communities understand it, make sense of it, talk about it, and learn to use it (Koskinen et al. 2011). The foundations of design research 'in the field' come through social science and are often grounded in sociological theory. Design research 'in the field' can include so-called 'observe and record' ethnography (like in anthropology and other sister social sciences) and design ethnography with the focus on products and things, the use of mock-ups and prototypes through design action. Examples of design research 'in the field' can include contextual inquiry (Holtzblatt and Jones 2009) or cultural probes (Gaver et al. 1999), but also engaging with users and involving them in the product creation process through participatory design (Schuler & Namioka 1993), co-creation (Sanders 2005) and empathic design (Leonard & Rayport 1997).

## SOCIAL STAIRS

Social Stairs is an intelligent staircase in an EDL built at the university's main building that made sounds as you walked up and down. When people walked together on the 'Social Stairs', it would burst into a different, more orchestral chime echoing up the stairs (Figure 2). The concept at first aimed at decreasing people's sedentary lifestyle and increasing their daily activity throughout the day by making the stairs a more appealing place.

Through early probing it was found that people would engage and involve each other. Therefore, altered, louder and more diverse orchestral sounds were designed to address this social aspect. Doing so, the designers wanted to explore how people would behave when at the Social Stairs. Social Stairs was equipped with sensors (e.g., embedded environmental sensors), smart activity recognition algorithms, and data mining techniques. Through pressure sensors the use of each step on the stairs could be measured by the system. Next to this a concealed remotely accessible video camera was placed, allowing the design researchers to observe 'live' and in hindsight people's activities and behaviour in the EDL. Together with the data from the steps this provided the researchers real-time, longitudinal, in-situ recording of behaviour and context, and allowed a very rich continuous characterization of (emergent) behaviour prompting possible new design iterations.

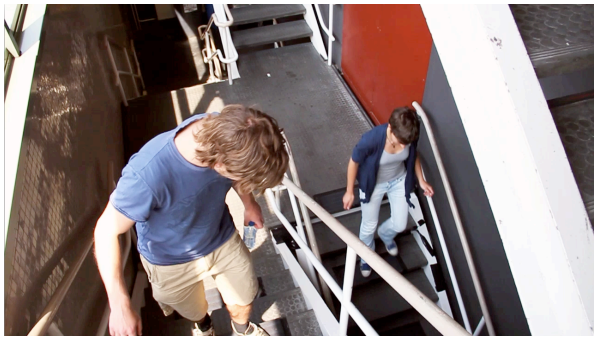

Figure 2: People working together on the Social Stairs, being treated with more diverse orchestral chimes that echoed up the stairwell.

Social Stairs provided the designers with long-term user data of 6 weeks (i.e., log data, interviews and video) that was utilized to continuously do design iterations but also to analyze and test whether the intended effects were actually met, or even new unforeseen behavior emerged. Through data fusion i.e. combining/fusing different types of data (e.g, steps data, observation videos, interviews etc.) they got insight in different types of behaviour. For instance, people invited others to join them at the Social Stairs and create a soundscape together. Other people were actively seeking opportunities to create a joint soundscape, by patiently waiting for a while in the stairwell. Unexpected behaviour also occurred; some people were meeting up in the stairwell on a daily basis, similar to a hangout, and formed groups (2-10 people) to create joint soundscapes of significant complexity. Others got to meet and interact with new people through the Social Stairs (Megens et al. 2013).

## DISCUSSION

### THE TRADE-OFFS

When we look at the trade-off between ecological validity and contextual control one can argue that lab research often experiences major difficulties in its generalisability to the real world. In short, the lab seems to decontextualize (Koskinen et al. 2011), thus negatively affects both environmental and social fidelity (Figure 3), and limits the ecological validity of results by constraining and altering the very activities and experiences one is interested in capturing (Figure 4).

| | Contextual control | Social fidelity | Environmental fidelity | Temporal fidelity |
|---|---|---|---|---|
| Lab Research | ++ | - | -- | +/- |
| Living Lab | + | +/- | + | + |
| Design research 'in the field' | -- | + | ++ | + |
| Experiential Design Landscape (EDL) | +/- | ++ | ++ | ++ |

Figure 3: Grading matrix where Lab Research, Living Lab, Design research 'in the field' and Experiential Design Landscapes are graded on contextual control, social, environmental and temporal fidelity.

Despite the fact that Living Labs, in particular the 'older' Living Lab initiatives, aim to mimic the real world as much as possible they are still a simulated (lab) environment. For example, the Experiencelab of Philips has a 'home' context where people are asked to make themselves comfortable, pretend it's their home and behave natural. Nevertheless, participants are fully aware that they are in an artificial situation, outside of their own everyday context, with their behaviours being probed and monitored, and with the typical role differentiations between the researchers and the researched (Gaver et al. 1999). Moreover, people are often pre-selected and invited to test pre-defined product functionalities or scenarios in context. The products and systems in such living labs are often 'only' used for a few days to a few weeks maximum. All in all resulting in moderate contextual control, social, environmental and temporal fidelity (Figure 3). However, recent initiatives in Living Lab research are taking place in everyday life, that is, people's natural environments and parts of the public space and society (ENoLL 2013). These developments as such can improve the ecological validity of the research results from Living Labs and their generalisability (Figure 4).

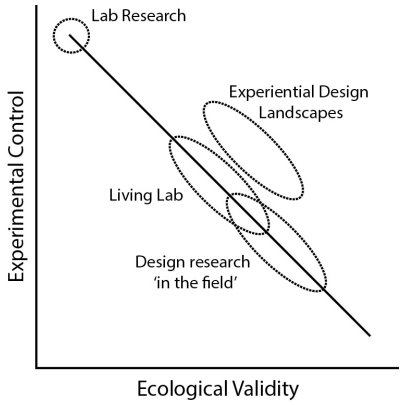


Figure 4: Graph with Lab Research, Living Lab, Design research 'in the field' and Experiential Design Landscapes, positioned in the trade-off between experimental control and ecological validity.

In the field, the control of variables is often problematic as it is a situation that is rich in uncontrollable contextual variables and unpredictable, emergent user behaviour. With respect to ecological validity this approach often performs quite well.

### GENERALISABILITY AND EDL

The relevance of experimental methods in the field of product design and development has been contested on the ground that control of variables, essential to experimentation, is problematic in a situation that is rich in uncontrollable contextual variables and unpredictable ("emergent") user behaviour. Whereas the elimination of context (e.g., in the lab) can generate reproducible and generalizable results, it limits the ecological validity of results through constraining and altering the very activities and experiences one is interested in capturing. Current developments in technology allow for new opportunities in measuring behaviour in their naturalistic context. Specifically, sensor-enabled, wearable and mobile devices, sensor-enriched

interactive products, and intelligent environments have become computationally more powerful and are increasingly commonplace. EDLs are specifically instrumented to study user behaviour in context, allowing real-time as well as longitudinal capture of individual, social, and environmental data. Through interacting and working with communities of users in their homes, in the streets, or at their places of work, over longer periods of time, researchers have a unique opportunity to gain an ecologically valid understanding of emergent behaviour prompted by new design propositions (Megens et al. 2013).

In this paper we discussed an example EDL, the Social Stairs, that was able to generate meaningful behavioural data 'in the wild' (i.e., in our everyday life). The Social Stairs, an interactive musical staircase outfitted with pressure sensors and cameras, allowed for the real-time and longitudinal capture of user data. This data, in turn, enabled the designers to continuously monitor the naturalistic use of the Social Stairs in real-time, analysing aggregate patterns of behaviours after only a few days of usage, adapting the Social Stairs (e.g., the type of musical feedback), and re-analysing the effects of such a design intervention. Based on such quick cycles of introducing design interventions and analyzing new behavioural/usage patterns, the designers in this project were able to explore the design space around 'motivating people to increase their daily activity', gaining insights into emergent and unpredictable user behaviours associated with such a novel design proposition (Megens et al. 2013). Hummels & Frens (2008) discuss similar quick design cycles of analysis and synthesis in their Reflective Transformative Design (RTD) process as 'envisioning & exploring' and 'making & thinking' when designing for societal transformation (like EDLs).

The Social Stairs is a natural environment, unscripted and open to experimentation by users and unexpected or emergent behaviour. However, because of the data-mining techniques and activity algorithms, the EDL allowed real-time multimodal tracking of environmental factors that would normally be a threat to experimental control. This way rich continuous characterization of (emergent) behaviour was provided while still preserving a high environmental, social and temporal fidelity.

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