Experiential design landscapes as a design tool for market research of disruptive intelligent systems

Experiential Design Landscapes as a Design Tool for Market Research of Disruptive Intelligent Systems

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Our society is faced with a number of major challenges. As the most significant of these include the aging society, the related challenge of increasing cost of healthcare, and attaining a sustainable level of energy consumption, in light of the available resources. In many cases these major challenges cannot be solved by incremental solutions. Disruptive innovative solutions are often needed to create sustainable growth. Looking, for example, at the field of public health, we are currently faced with a situation where, if no fundamental change takes place, an increasing number of people will have to rely on increasingly expensive healthcare paid by a decreasing number of people. Introducing new propositions that will lead to a structurally more sustainable society is not easy; in most cases changes are required in societal processes that involve a wide range of stakeholders. Due to a high degree of structural uncertainty, the outcomes of such changes are by no means easily predictable. For industry it is therefore very difficult to introduce these disruptive innovations without a solid basis of evidence. This paper describes the newly developed method of Experiential Design Landscapes (EDL): a method where an infrastructure is created that, on one hand, stimulates the creation of new, disruptive, propositions in a semi-open environment where new these new propositions are used as agents to facilitate new and emerging behaviour and that, in parallel, enables the detailed analysis of the emerging data patterns as a source of inspiration for the design of future services and products. This paper describes both the methodological basis as well as the actual experiences of EDLs using a real-life test case.

THE CHALLENGES OF DISRUPTIVE INNOVATION

Designing highly innovative or even disruptive products provides serious challenges from a design management perspective. Since users have no frame of reference it is often not possible to ask them, using traditional market research techniques, for the requirements of these future products. The actual added value of these systems becomes only clear after a certain amount of time where the users learn to see the added value of the (services provided by-) these new products. Products can be used in unforeseen manners and the users adapt in a manner where new patterns may emerge, often unpredicted, on the level of (new) market segments or even on the level of individual users. Take for example healthy living. Companies are interested in developing and deploying technologies aimed at positively influencing users' attitudes and behaviours through so-called Persuasive Technology. They are able to create new propositions using the most recent concepts of Persuasive Technology but it is difficult to predict whether these concepts will lead to sustainable behavioural change and a healthy life. Products are designed with the intention that users will change their behaviour but, at this moment, this sometimes happens in quite unpredictable manners. New patterns may (and will) emerge that may, positively or negatively, affect societal patterns.

It is obvious that it is highly relevant for companies to discover, study, anticipate and design for these emerging patterns in an early phase. However, in current industrial practice the creation of disruptive innovations is often a matter of "trial and error". In spite of considerable design efforts many products see rejection on the market either because products are not sold in the anticipated quantities or, even worse, products are sold but are not used or even brought back because the products capabilities do not match the emerging user requirements. [Koca 2008]. The strong pressure on time to market has increased this problem over the last decades. Relative to the continuously decreasing "time to market" the time to understand the product in the market has hardly been reduced [Brombacher 2005]. Due to the increasing complexity of the products and the increasing complexity of the logistics of the feedback systems [Sander 1999] designers get less detailed information on the actual performance of their products in the field after a, relatively speaking, increasing amount of time. Recently there have been numerous attempts to considerably shorten this cycle. For example, attempts were made to involve customers directly in product innovation via co-creation [Thomke 2006] and to validate products in a near-real-life environment via Living Labs [Bergvall 2009] and many of these attempts have been successful.

In spite of these successes, however, there remains a class of increasingly relevant systems where these methods have failed; the so called "Intelligent Systems". Intelligent systems have the ability to adapt to individual users, often over a longer period of time. As a consequence it is likely that also users will adapt themselves to these systems. As a second consequence the diversity of product-market combinations can grow to the level of individual user/product(system) combinations while, in the mean time, all kinds of, often unpredicted, usage patterns may emerge. Well-known examples are systems like Google, Facebook and iTunes/iPods/Ipads/iPhones. Since the mission of the department of Industrial Design at

Eindhoven University of Technology is to “Create Intelligent Systems, Products and Related Services for Social Innovation” it is evident that there is a keen interest with the authors to understand mechanisms underlying disruptive innovations and to create models and systems to support and manage the relating design processes.

EXPERIENTIAL DESIGN LANDSCAPES

As stated in [IJsselsteijn 2006] the imperative of the transformation economy is to provide meaningful context-specific propositions built with long lasting profitable, ethical and fair business based upon multiple stakeholder collaboration and value sharing. The question is how to develop such propositions when focusing on disruptive innovative intelligent system and how to manage this process?

Designers of intelligent systems need a much faster and better insight to what is happening with their designs and products with respect to new patterns of use, in an, often increasingly diverse, market. Companies managing this process successfully may become the next Google, Facebook or Apple. This requires new approaches and methods for design processes and design management since they are and currently hardly available. Instead of going through a rather linear problem solving process (see Figure 1) a reflective transformative design process (see Figure 2) is desired [Hummels 2008].

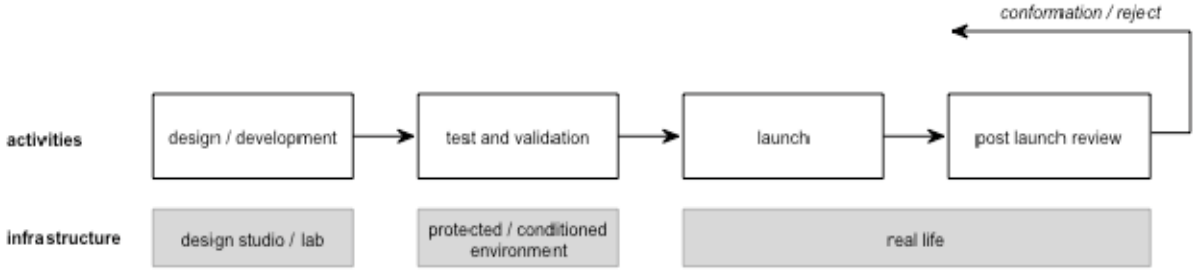

Figure 1: Traditional product development cycle

The challenge, compared to traditional market research methods, is that these emerging patterns can develop highly unpredictable with a level of diversity that can require the longitudinal study of user/system interactions at the level of unpredicted individual users. Fortunately, due to their embedded intelligence, these systems have the capability to register the emerging patterns and, if desired, communicate them to the parties involved. Such a modern infrastructure where new disruptive propositions are created and larger series of (prototypes of) intelligent systems are interacting with end-users in their (near) normal environment early on in the development process, and where in parallel the emerging patterns are studied with consent of these users and further developed, is called an “Experiential Design Landscape” (EDL). This paper describes the methodology underlying the principle of “Experiential Design Landscapes” (EDL).

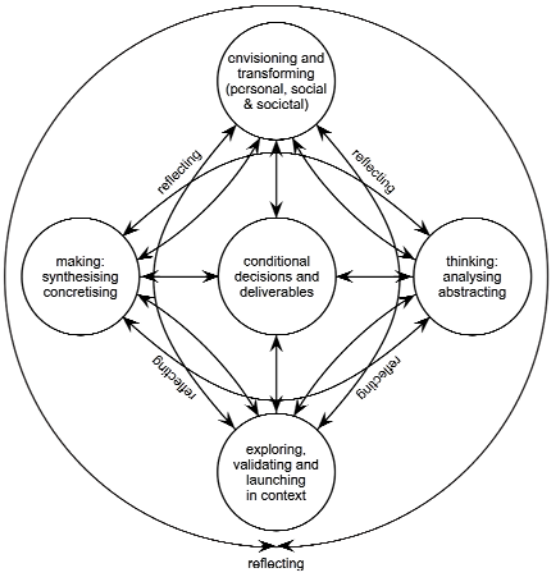

Figure 2: Reflective transformative development process

EXPERIENTIAL DESIGN LANDSCAPES; BASIC STRUCTURE

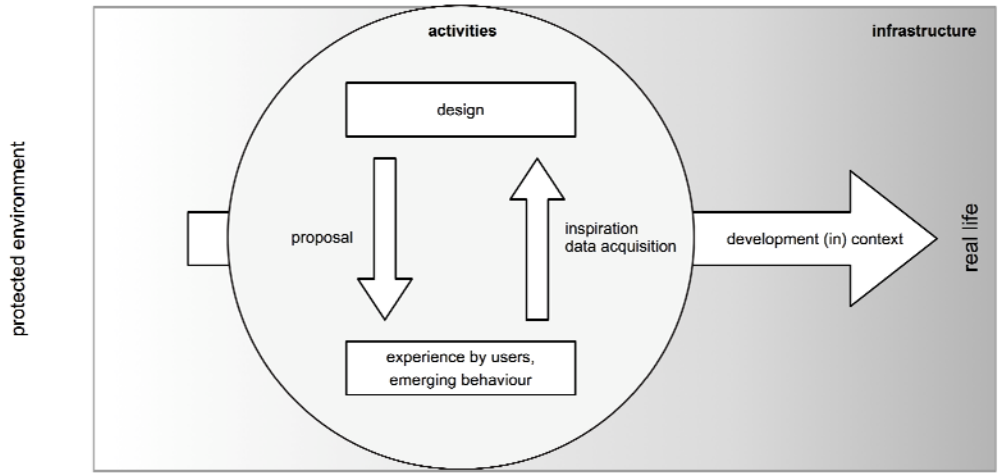

Figure 3: Experiential Design Landscape for the creation of intelligent systems

The Experiential Design Landscape is characterised by a near-real-life environment (the "outside") where a context is created in which designers (can be inspired to) create design proposals and where users have the opportunity to interact with these new concepts through experienceable prototypes, products and services for longer periods of time. The EDL consists of advanced observation equipment where the interaction between users and the design proposals in their environment can be observed via multiple modes of interaction during longer periods of time. The environment is, for the user, as close to real life as possible, but for legal and ethical reasons users are made aware that their actions are being observed for research purposes.

In this environment new “products” are designed; not only as a means to meet with a (in this case often largely unknown) user demand but especially as an agent to facilitate/enable new behaviour in interaction with the user. Since these emerging patterns can be highly unpredictable a detailed analysis is performed during the actual “product use” in order to understand and model emerging interaction patterns. Due to the, in the product, embedded intelligence the product itself plays a major role in acquiring the data and generating the models, as a kind of intelligent technology probes [Hutchinson 2003]. As a result of the fact that the products are connected to the in the EDL available infrastructure, very rich multi-modal data patterns can be generated that, after being processed into adequate formats, can serve as a strong means of inspiration for next generation designs.

The interaction is by no means restricted to interaction with individuals. If the agents, the data acquisition and the data processing are designed correctly not only “single-product-single-user” patterns can be analysed but also “multiple-products-multiple-users”. This makes an EDL highly suitable to create and analyse products that are intended (to change the behaviour of) social groups.

Due to the open structure of an EDL it is easily possible to extend the observation process outside a given physical structure. As long as it is possible to acquire the required observation data also user actions outside a given geographical structure can generate data. The only requirement is that the EDL should provide is some level of thematic coherence; if the context becomes too free it becomes difficult to interpret the emerging data.

This Reflective Transformative process is different to the existing living lab approach since “living labs” serve the purpose of analysing propositions largely known to the user in a well-defined context. In an EDL the entire design process is incorporated, from the early start when generating propositions to launching "production-ready" products and services in context. Moreover, the user is during the creation phase still unaware of what patterns will emerge in the future. Whereas in living labs users (and designers) are in most cases far more focused on what is happening in the interaction between an individual and a product.

EDL IN PRACTICE; A CASE STUDY

An EDL takes the physical form of an environment where rich interaction can take place between newly created agents (“products”) and end-users and where the (emerging) interaction of systems and users can be thoroughly observed. Due to the embedded data-gathering, data-processing and communications capabilities this does not need to take place on a centralized location and can take place during longer period of time. The data, obtained from the Landscape, is monitored and with techniques such as data-mining or, more recent, process mining [Rozinat 2010], unanticipated and emerging patterns are detected on a continuous basis. In this manner design synthesis and market analysis become one integrated highly dynamic design landscape.

The resulting information is analyzed in mixed teams of designers, social scientists, engineers and other (business) stakeholders in order to obtain new information and inspiration for subsequent design iterations. In this manner a highly dynamic system emerges where fast and very diverse iterations can be used to develop new emerging value propositions and the supporting intelligent systems in parallel.

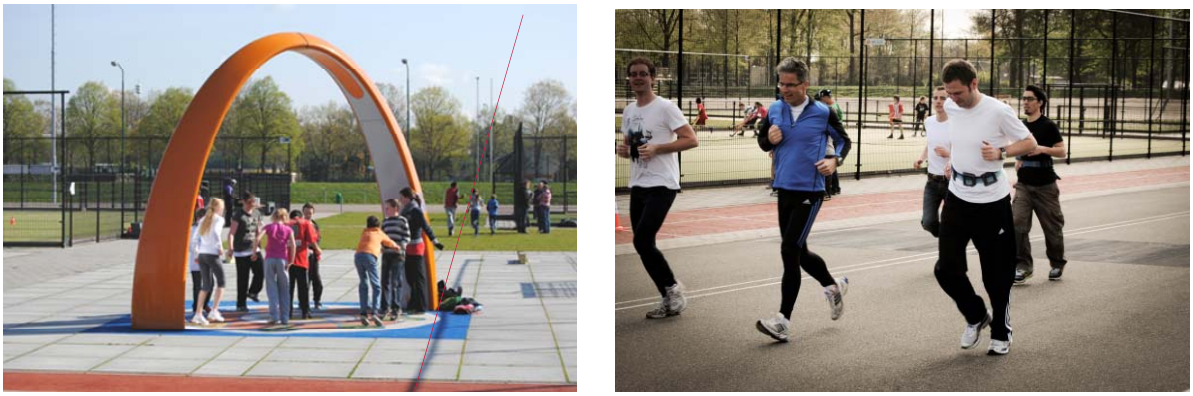

Figure 4: Part of the Experiential Design Landscape "Eindhoven Noord"[1]

The infrastrcuture of EDL "Eindhoven Noord" is designed especially to facilitate the development of new concepts in the field of "Health and Wellbeing". The EDL was created as a research vehicle on one hand and on the other hand as a means to create meaningful propositions in the context of this increasing social problem. The EDL is owned by the City of Eindhoven and is jointly operated by local government, research institutes and industrial partners. One of the main reasons to create this EDL was that the product creation model that many of the industrial partners operate, often did not result in the anticipated market success; it assumes that high-end products, developed for top sports gradually find their way to the market of "Health and Wellbeing".

The EDL "Eindhoven Noord" consists of a large sports and recreation complex, with a running track and a large space in the middle with several sports fields and playing grounds. The complex focuses on non-active people up to amateur sportsmen, and tries to encourage them to be physically more active. People can easily book specific accommodations and rent equipment like e.g. hockey sticks. The complex is often used for e.g. sports days for (school) children and company outings. But also individual people and children can make use of the freely accessible facilities.

The sports and recreation facilities of "Eindhoven Noord" are all in place, but the EDL method and infrastructure is fairly new at "Eindhoven Noord" and still under development. Most of the designing was still done at the university, although the users and their behaviour at the EDL inspired the participating designers and design students. Moreover, as a first step, we introduced for a period of almost half a year several products and prototypes in the EDL,

[1] Courtesy City of Eindhoven and Playful Interactions research from Tilde Bekker and Berry Eggen [Bekker 2009]

for example intelligent watches for high level and professional athletes, and the resulting data was analysed.

The first results show that firstly, the EDL can indeed find new behaviour. It appears that the intentions of the designers are not always fitting the ideas and creativity of the users during interaction, resulting in new behaviour. For example, during one of the studies, a group of high-level runners received a new intelligent watch for a longer period of time. Because one of the runners got injured, he gave the watch to his teenage son to encourage him to start running, which he did. Without the son knowing, at least in the beginning, the father followed him online and analysed his running behaviour. The manufacturer did not foresee these activities: the son running with the watch and the father observing and following him from a distance. The current watch and provided services could hardly adapt to this situation or anticipate it. But by incorporating this information in the design synthesis, the next version might or can.

Secondly, as expected, one can find through EDLs that people behave differently and have different desires, needs, motivation and skills. For example, to the surprise of the industrial partners, there is a clear difference between people exercising sport for performance reasons or for reasons of health and wellbeing. Certain products appreciated by one group, were not appreciated at all by other groups and also the emerging individual and social patterns showed large differences, which was not anticipated by the industrial partners, because classical survey techniques did not give them those insights.

Figure 5: Sports vs. "Health and Wellbeing"; different markets with different drivers

Thirdly, designing and building experienceable intelligent prototypes during the early phases of the design process, which are in the beginning merely 4D sketches, and which can be used for longer periods of use too, are asking for different skills and points of attention from the designer than more classical design proposals. Because users have to interact with these proposals in their near real life context, designers are facing with and have to anticipate

malfunction electronics of the interactive sketches, safety issues, prototyping drawbacks such as heavy batteries and the size of available parts, buggy software, etcetera. These issues bring us close to the legal and ethical boundaries of EDLs, which we are currently investigating. Disruptive innovation is always about exploring the unknown and since the emerging behavioural patterns can only emerge in interaction, the boundaries need to be explored, in order to have enough freedom to design but also stay within acceptable safety, financial and ethical boundaries.

Based upon these results from the EDL "Eindhoven Noord", the designers involved are currently using the obtained models and datasets to now develop products that are adapted towards the patterns that have emerged during earlier iterations. The now available data also helps the industrial partners to, on one hand, better understand the (lack of-) success of earlier products and to develop early insights into patterns that emerge in the market.

CONCLUSION AND FURTHER DEVELOPMENT

Although the concept of Experiential Design Landscapes is still under development, it already shows promising results. An EDL proves to be a valuable mechanism to enable the creation of new disruptive concepts in a market context. The combination of a reflective-transformative design process, a structural open system with strong involvement of end-users and the generation of high quality longitudinal multi-modal data is proving to be valuable not only for researchers but also for industrial partners. Although users are aware that they are involved in a design and research process, the structure of an EDL seems open enough to stimulate the emergence of unanticipated but realistic behaviour. Currently discussions are ongoing to determine, for legal and ethical reasons, what data can be gathered and which data not.

A second EDL, currently under construction, deals with the creation of outdoor Intelligent Lighting Systems in a residential area inside the city of Eindhoven. The difference between the EDL discussed in this paper and this new EDL is that, while in the first EDL, people actively enter an EDL and engage deliberately in the activities provided, in the second case people "can not escape" the EDL since it is part of the public space where the live or pass through. Initial discussions with both participants, with legal experts and with local authorities lead to a preliminary conclusion that, if the expected benefits (in this case in terms of "quality of life", "social safety" and "energy consumption") strongly outweigh the experimental nature of the EDL stakeholders support the creation and operation of an EDL in their direct environment. However, more data needs to become available before clear conclusions can be drawn in this context.

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Sabine van Gent has a background in Social Sciences and during her studies she focused on marketing, management and quality of services. She is Managing Director of the department of Industrial Design, as well as Managing Director of the Intelligent Lighting Institute at TU/e. She is interested in realising and managing infrastructures to support the design process of intelligent systems, products and services.

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Carl Megens graduated at the department of Industrial Design at Eindhoven University of Technology (TU/e) in 2009. For his graduation project Carl worked at Oxylane, France. Here he developed new intelligent product concepts for the Artengo brand to involve people into racket sports. After his graduation Carl started a PhD research project at the TU/e to further research how to design intelligent products and systems to involve and motivate people towards sports and wellbeing.

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Michel Peeters studied Industrial Design Engineering at Eindhoven University of Technology (TU/e) and graduated in 2008 at the adidas global headquarters in Herzogenaurach, Germany. For almost a year, he was part of the adidas innovation team where he worked on wearable sports electronics. After adidas, he started a PhD research project at TU/e on ‘Wearable Sports Electronics’ in strong collaboration with industry partners.

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Caroline Hummels is associate professor at the department of Industrial Design and Theme Leader Smart Environment, Health@TU/e. She has a background in Industrial Design Engineering. Her research, education and design activities concentrate on developing a holistic design framework to answer the overall question “How to design for personal, social and societal transformation through aesthetic interaction with open, disruptive innovative systems?" She developed various installations and products next to design techniques, processes and infrastructures.

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Lu Yuan is assistant professor in the Business Process Design group at the department of Industrial Design at the Eindhoven University of Technology. Her research and education activities concentrate on the intersection of business process design and industrial design, especially news approaches towards quality information flows and iterative design strategies, for intelligent systems and the global market. In this evolving field, Lu Yuan is focusing on aspects such as value chain design, value propositioning, new product development gaming, designing in international teams, blue ocean strategy and quality information flow.

Aarnout Brombacher

Aarnout Brombacher is dean of the department of Industrial Design. He has a background in Electrical Engineering and Engineering science, and he worked in industry for many years. He has extensive experience in industrial quality and reliability improvement projects and the development of quality and reliability analysis methods and tools. He is currently focusing on developing quality and reliability analysis methods and tools for designing disruptive innovative systems, products and related services.