

Towards a UX Manifesto

COST294-MAUSE affiliated workshop

Effie Law, Arnold Vermeeren, Marc Hassenzahl, & Mark Blythe (Eds.)

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ACKNOWLEDGEMENT

First of all, we are grateful to the organizers of HCI 2007, who have provided us the valuable opportunity to hold our workshop “**Towards a UX Manifesto**” in conjunction with the conference. Thanks must also go to the authors of the workshop’s papers, whose contributions serve as rich sources of stimulation and inspiration to explore the issues of interest from multiple perspectives. The quality of the contributions could further be ensured and improved with the generous help of the program committee members (Table 1). Their effective and efficient review works are highly appreciated.

Table 1: List of the reviewers of the workshop “Towards a UX Manifesto” 2007

Name	Affiliation	Country
Følstad Asbjørn	SINTEF	Norway
Mark Blythe	University of York	UK
Gilbert Cockton	University of Sunderland	UK
Marc Hassenzahl	University of Landau	Germany
Paul Hekkert	Delft University of Technology	the Netherlands
Effie Law	University of Leicester/ ETH Zürich	UK/Switzerland
Gitte Lindgaard	Carlton University	Canada
Virpi Roto	Nokia	Finland
Arnold P.O.S. Vermeeren	Delft University of Technology	the Netherlands
Peter Wright	Sheffield Hallam University	UK

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Towards a UX Manifesto

Effie Lai-Chong Law
University of Leicester, UK
Computer Science
University Road,
Leicester,
LE2 4UN
+44 116 2717 302
elaw@mcs.le.ac.uk

Arnold P.O.S. Vermeeren
TU Delft, NL
Industrial Design Engineering
Landbergstraat 15
NL 2628 CE Delft
+31 15 2784218
a.p.o.s.vermeeren@tudelft.nl

Marc Hassenzahl
University of Landau, DE,
Economic Psychology
Fortstraße 7
76829 Landau
+49 6341 280 261
hassenzahl@uni-landau.de

Mark Blythe
University of York, UK
Computer Science
Heslington, York
YO10 5DD
+44 190 4434764
mblythe@cs.york.ac.uk

ABSTRACT

In this workshop we invite researchers, educators and practitioners to contribute to the construction of a coherent Manifesto for the field of User Experience (UX). Such a UX manifesto should express statements about issues like: Fundamental assumptions underlying UX (principles), positioning of UX relative to other domains (policy) and action plans for improving the design and evaluation of UX (plans). The UX manifesto can become a reference model for future work on UX.

1. BACKGROUND & MOTIVATION

Is the research and practice on User Experience (UX) maturing since it has popularized the HCI community and the industry more than a decade ago? Is there a unified view about **principles** of UX? Are there any well-defined **policies** where to position UX in a map of the Information Technology (IT) landscape, which is populated by usability, human factors, interaction design, software engineering, marketing, and other domains? Are there any sound **plans** how to refine methodologies on designing for, evaluating and teaching UX? In fact, such set of Principles, Policies and Plans constitute what we coin «UX Manifesto», which is deemed important for the maturation of this emerging domain by providing the foundation, objectives, and action plans for the future work of UX. Principles inform the formation of policies, which in turn feed into plans as courses of action (Fig. 1).

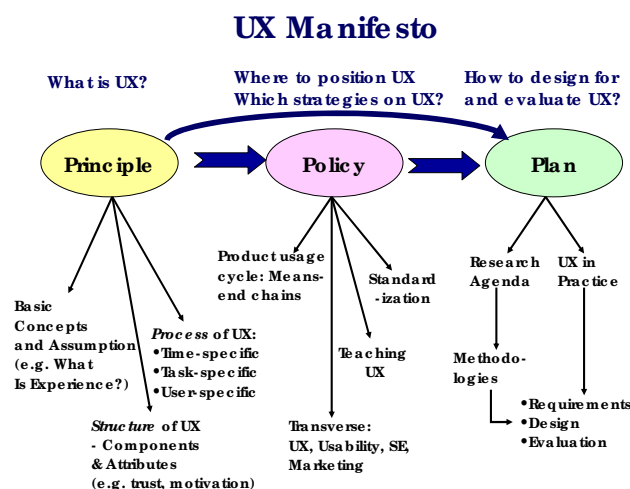


Fig.1: The three pillars of a UX Manifesto

1.1 Principles

The term “Principles” denotes fundamental assumptions underlying UX. It addresses questions of what an experience is (in the context of interactive products and software), how it can be described or - from a designer' perspective - how it can be fabricated?

Two seemingly exclusive positions emerged from discussing these questions: one phenomenological/pragmatist and one inspired by experimental psychology. The former is exemplified by McCarthy and Wright's notion of 'felt experience' [4]. It is based on Dewey's pragmatist view of experience. They argue against abstract models of experience and place emphasis on the situatedness and uniqueness of experience. In contrast, approaches inspired by experimental psychology tend to deconstruct experience into single components (e.g. motivation, trust, aversion, hedonics, fun, etc). The collection of components is further supplemented by processes, which address, for example, the temporal aspect of experience or the dynamicity of psychological states, and modulate experience. The concomitant questions are: Is there a core set of UX components (if yes, what are they)? Are these components orthogonal, hierarchical or causally linked? How does the relevance of each UX component vary with the particularities of a context? What are boundary conditions for a component-based UX model and what are the alternatives?

Although proponents of both approaches tend to overemphasize differences in the approaches, both are important and far from mutually exclusive. The pragmatist perspective advocates the detailed analysis of experience, offering rich insights into specific interactions, which can surely be used by designers. However, some in the field of HCI feel uncomfortable with relying solely on very small - but detailed - samples of experiences on which the design or evaluation of an interactive product is based. They rather look for more general principles and mechanisms – a few categories of "average" experiences. The strength of an approach based on aggregated knowledge is the potential simplicity of the resulting models. However, at the same time this – per definition – implies a reduction. This reduction has costs. First, the average model may not be predictive for any real

user and his/her experience. Second, averaged data and accordingly abstract principles are not vivid; they may appear shallow and may thus not be very inspiring for designers.

Obviously, to be fruitful in the field of HCI UX, it is a must to have both: ways to describe experiences in detail and all their complexity – especially as an inspiration for designers - and ways to average experiences, to build models to reduce complexity and to guide the detailed enquiries. In other words, integrating the advantages of both approaches rather than treating them as mutually exclusive is the challenge of future UX theorizing.

1.2 Policy

The term ‘Policy’ primarily addresses the positioning of UX relative to other closely related but distinct domains. For instance, distinctions between usability and UX have been drawn [2]. Usability is a necessary but insufficient condition to make a user smile, but UX, when desirable, can do so. Positioned in this way, usability is subsumed by UX. But some argue that UX is just an extension of usability to accommodate fuzzy quality attributes such as emotion and fun. The link between UX and software engineering lies in the definition of quality models that address a mesh of functional and non-functional quality factors (e.g. reliability, security, accessibility) determining user acceptance. There is also a link to the domain of industrial (electronic) product design which traditionally focuses on integrating sub-outcomes of attributes and consequences into the overall value of a product. As noted by Cockton [1], UX can be considered at least as one of these sub-outcomes. While usability standards (e.g. ISO 9241) have some visible impacts on the research and practice of usability, questions concerning the necessity and utility of such standards are recurrent. Hence, whether specific standards for UX should be developed is debatable. Besides, as UX has added a new dimension to HCI and interactive product design, it should be explored how UX can effectively be taught as well.

1.3 Plans

Theoretically UX is incoherent; methodologically UX is not yet mature either. Questions like “How to design for UX?” and “How to evaluate UX?” are easy to ask but difficult to answer. Answers may be sought in terms of devices that may improve the UX (see the articles by Timco et al., Følstad, and Hole in [3]) and of techniques (see Geven’s article in [3]) and tools (e.g. TUMCAT [see Vermeeren & Kort’s in [3]) for analyzing, designing, engineering and evaluating UX. In brief, developing theoretically sound methodologies should be high in the UX research agenda. Besides, there are critics that UX is only used as a marketing slogan. It is intriguing to gather real case studies to illustrate how UX is actually handled in the professional world of interactive product design in

terms of requirements analysis, design, engineering and evaluation.

2. THE MAIN GOAL AND OBJECTIVES

The overarching goal of the workshop is to invite inputs for the construction of a coherent **UX Manifesto** constituted by the three pillars: Principles, Policy and Plans. This goal is divided into a number of objectives:

Principle

- To work on a unified view on UX by integrating different theoretical perspectives;
- To develop a generic UX model comprising the structure (i.e. core components; static) and process (i.e. situational factors; dynamic) of UX;
- To identify boundary conditions under which a generic, component-based UX model is applicable and identify alternatives otherwise;

Policy

- To identify the transversal relationships between UX and the related fields by fleshing out their communalities and distinctions;
- To understand the role of UX in the means-end chains between product attributes, usage consequences and product values;
- To explore the necessity and potential utility of developing UX standards;
- To identify effective teaching strategies for UX;

Plan

- To develop theoretically sound methodologies for analyzing, designing, engineering and evaluating UX;
- To understand UX in practice through case studies, thereby identifying factors that may facilitate or hinder the incorporation of UX into interactive products;

3. PARTICIPANT & SUBMISSIONS

Altogether 12 submissions authored by 22 contributors have been accepted for the workshop. They are academic and industrial researchers from different European countries, including Denmark, Finland, Germany, Ireland, Italy, the Netherlands, and UK. All submissions have been peer reviewed by at least two members of the program committee. For each submission, contributors have been required to include a “Reflection Section” to derive from their analytic or empirical work their own version of Principle, Policy and Plan as constituents of a UX Manifesto. Apparently, participants understand the three terms differently, and our challenge is to negotiate and consolidate the divergences to draw a consensus.

4. WORKSHOP PROCEDURE

A so-called *Green Paper* is drafted based on ideas to be extracted from the submissions of this workshop. It consists of three main parts: (i) grid analysis; (ii)

citation analysis; and (iii) manifesto analysis (details see Blythe, Hassenzahl, Law & Vermeeren, this volume). It is presented in the workshop to invite for comments and further inputs.

In the workshop, the following activities are conducted:

- (i) Presentation of the Green Paper
- (ii) Presentations of accepted submissions
- (iii) Group Discussions: Participants are divided into small groups to consolidate a group-based UX Manifesto and discuss other topics of interest
- (iv) Plenary Reporting: Each group presents their UX Manifesto
- (v) Future work: Discussion about the strategies how to proceed from the workshop

5. PROGRAM COMMITTEE

- Mark Blythe, University of York, UK
- Gilbert Cockton, University of Sunderland, UK
- Asbjørn Følstad, SINTEF, NO
- Marc Hassenzahl, University of Landau, DE
- Paul Hekkert, Delft University of Technology, NL
- Effie Lai-Chong Law, University of Leicester, UK
- Gitte Lindgaard, Carlton University, CA
- Virpi Roto, Nokia, FL
- Arnold Vermeeren, Delft University of Technology, NL
- Peter C. Wright, Sheffield Hallam University, UK

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- [3] Law, E., Hvannberg, E. & Hassenzahl, M. (2006). *Proc. of the workshop "User Experience – Towards a unified view"* in conjunction with NordiCHI' 06, 14-18. October, Oslo. Online at: <http://www.cost294.org/>
- [4] Wright, P. C., McCarthy, J., & Meekison, L. (2003). Making sense of experience. In M. Blythe, C. Overbeeke, A. F. Monk, & P. C. Wright (Eds.), *Funology: From Usability to Enjoyment* (pp. 43-53). Dordrecht: Kluwer.

TABLE OF CONTENTS

An Analysis Framework for User Experience (UX) Studies: A Green Paper <i>Mark Blythe, Marc Hassenzahl, Effie Lai-Chong Law, and Arnold P.O.S. Vermeeren</i>	pp.1-5
Towards the Evaluation of UX <i>Ardito C., Costabile M.F., Lanzilotti R. & Montinaro F.</i>	pp.6-9
The Hedonic/Pragmatic Model of User Experience <i>Mark Hassenzahl</i>	pp.10-14
Gaining Insights into User eXperience <i>Linda Hole and Oliver Williams</i>	pp.15-18
Don't Have to Know What it is Like to be a Bat to Build a Radar Reflector – Functionalism in UX <i>Daniel Kerkow</i>	pp.19-25
User Experience: Usability, Aesthetics and Emotions in Human-Technology Interaction <i>Sasche Mahlke</i>	pp.26-30
User Experience from Product Creation Perspective <i>Virpi Roto</i>	pp.31-34
Making User Experience a Business Strategy <i>David Sward and Gavin Macarthur</i>	pp.35-42
User Experience and its Relationship to Usability: The Case of e-Commerce Web-site Design <i>Mark Springett and Tim French</i>	pp.43-48
User Experience (UX) and Usability Measures: Correlations and Confusion <i>Effie Law and Kasper Hornbæk</i>	pp.49-56
Conceptualizing and Measuring UX <i>Joke Kort, Arnold P.O.S. Vermeeren, and Jenneke E. Fokker</i>	pp.57-64
User Experience Research as an Inter-discipline: Towards a UX Manifesto <i>Peter Wright and Mark Blythe</i>	pp.65-70
Refining our understanding of men and women's preferences <i>Gloria Moss, Gabor Horvath, and Rob Gunn</i>	pp.71-76

AN ANALYSIS FRAMEWORK FOR USER EXPERIENCE (UX) STUDIES: A GREEN PAPER

Mark Blythe*
University of York, UK
Computer Science
Heslington, York
YO10 5DD
+44 190 4434764
mblythe@cs.york.ac.uk

Marc Hassenzahl*
University of Landau, DE,
Economic Psychology
Fortstraße 7
76829 Landau
+49 6341 280 261
hassenzahl@uni-landau.de

Effie Law*
University of Leicester, UK
Computer Science
University Road, Leicester,
LE2 4UN
+44 116 2717 302
elaw@mcs.le.ac.uk

Arnold Vermeeren*
TU Delft, NL
Industrial Design
Engineering
Landbergstraat 15
NL 2628 CE Delft
+31 15 2784218
a.p.o.s.vermeeren@tudelft.nl

ABSTRACT

In this paper we describe an analysis framework for analyzing UX studies. The framework consists of three approaches: Grid Analysis, Citation Analysis, and Content (Manifesto) Analysis. We apply these approaches to analyze the submissions to the workshop “Towards a UX Manifesto”. Some preliminary findings are presented. We aim to apply this framework to other UX studies in the future and to refine it accordingly.

1. GRID ANALYSIS

As UX is a broad topic, the related studies address different focuses and concerns. These studies can be analyzed along different dimensions. The four workshop co-chairs have brainstormed to identify some dimensions, which are listed as follows:

1. Cognitive vs. Phenomenological/Pragmatic
2. Humanities methods vs. Social Science methods
3. Design vs. Evaluation
4. Doing vs. Being
5. Work-oriented vs. Leisure-oriented activities
6. Individual-based (ego-experience) vs. Social-based (co-experience)
7. Formal vs. Informal (analytical vs. descriptive)
8. Gestalt vs. Elemental
9. Mono-modal user interfaces vs. Multi-modal user interfaces
10. Understanding (what is it?) vs. Methods and techniques (how to deal with it?)
11. Measuring elements vs. Holistic approach
12. Aim for specified UXs vs. Creating circumstances to allow interesting UXs to emerge
13. Inspire vs. measure
14. General knowledge vs. Example cases

Presumably this list will be modified if another batch of four researchers carries out the same exercise.

These dimensions were grouped and five aspects were thus identified: Theory (#1, #8, #11), Purpose (#3, #12, #13), Method (#2, #7, #10, #14), Domain (#4, #5), and

Application (#6, #9). For the sake of brevity, each aspect was represented by one dimension (Table 1), forming a grid. We attempted to define the five dimensions.

Table 1: Five analysis aspects and associated dimensions

Aspect	Representative dimension
THEORY	Reductive - - - - - Holistic
PURPOSE	Evaluation - - - - - Development
METHOD	Quantitative - - - - - Qualitative
DOMAIN	Work based - - - - - Leisure based
APPLICATION	Personal - - - - - Social

Reductive vs. Holistic: Reductive approaches aim to simplify the complexity of experience for the sake of description and operationalisation (i.e., to measure individual elements that play some role in UX), whereas holistic approaches aim to integrate various aspects of UX, including emotions, affect, aesthetics, hedonism, experiences, developing a big picture or an overarching framework of this research area.

Evaluation vs. Development: Approaches can implicitly or explicitly focus more on the systematic determination of merit, worth, and significance of something (Wikipedia), which basically is an analytic endeavour often including measurement, or they can focus more on the process of creating (designing, developing) something, where getting inspiration plays an important role.

Quantitative vs. Qualitative: The traditional division between these two types of approaches is applicable to UX studies as well.

Work-based vs. Leisure-based: Though the boundary between work and leisure is becoming blurred, the distinction can still lie in whether we need to attain an instrumental goal in the end. Is it more challenging to design for pleasure when the activities are leisure-rather than work-oriented? The pleasure-threshold of work-oriented activities may probably be lower than

* The author names are sorted alphabetically. Contributions of individual authors are equal.

that of leisure-oriented activities, assuming that this parameter varies with the expectation of the user.

Personal vs. Social: It is related to the unit of analysis. Traditional approaches focus on individual experience whereas emerging approaches address group experience being co-constructed in a collaborative setting

In the peer review process, each submission has been reviewed by two reviewers. All the reviewers, who are

experienced researchers in UX, have been asked to rate the submissions under review along the five dimensions with a 7-point Likert scale. However, we did not provide the reviewers with the above definitions because of the assumption that all of them should have more or less similar understanding of the two poles of each dimension. Nonetheless, they could comment on the ratings given.

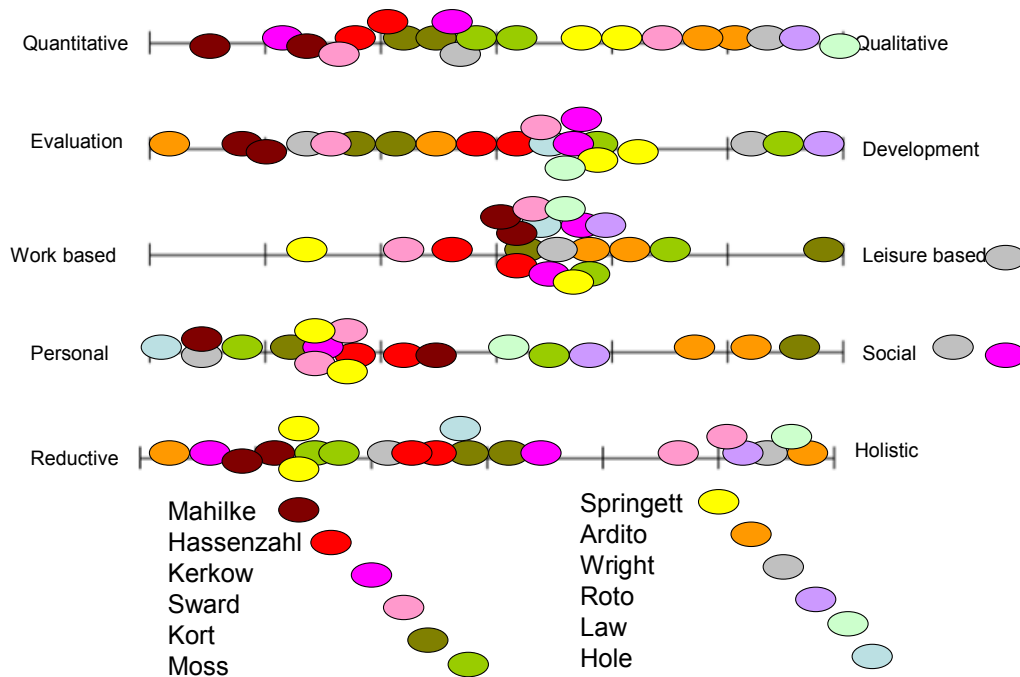


Figure 1. Results of grid analysis (NB: Off the scale dots indicate no rating from that reviewer)

It is interesting to note that there was quite a diversity of ratings between the various papers which is interesting. There was quite an even mix of quantitative to qualitative but slightly more at the qualitative end. Again there was a spread along evaluation and development with most in the middle somewhere. There were no clearly work-based submissions. Most were rated more towards leisure. Most of the submissions were rated as more personal than social. There was a pretty even spread between reductive and holistic approaches.

Inter-rater agreements seem reasonable. Hassenzahl's paper (i.e. the bright red dot) was categorized almost identically along all the five dimensions by the two reviewers. In contrast, the two reviewers of Ardito et al's paper converged on three of the five dimensions, but diverged moderately on "Evaluation vs. Development" and substantially on "Reductive vs. Holistic". Otherwise, the ratings of the other papers converge on these two dimensions. It may imply that

the reviewers generally have common understandings of the poles of the grid.

2. CITATION ANALYSIS

Citation analysis and content analysis are commonly used bibliometric methods, which are used to study or measure texts and information. Historically bibliometric methods have been used to trace relationships amongst academic journal citations. Citation analysis (CiA), which involves examining an item's referring documents, is used in searching for materials and analyzing their merit. CiA also uses citations in scholarly work to establish links to other works or other researchers (Wikipedia).

The 12 submitted and accepted workshop papers used a total of 302 citations (an average of 25 per paper). The majority were journal articles (115, 38%), which underlines the predominantly academic nature of the workshop's endeavour to define user experience.

Interestingly, 95% (286) of the citations were referenced only once. Only seven citations were used by at least three contributors (see Table 2 for an overview). Those were either review papers or papers presenting particular models. Only one paper (Lavie & Tractinsky, 2004) was predominantly empirical. Apparently, most authors start out from a very small number of "standard" references and quickly draw upon their own individual set of references. This indicates a severe lack of overlap in the underlying theoretical

basis and emphasizes the need for a shared view – the main objective of the present workshop.

These results may indicate the still fragmentary status of the domain UX. However, it could also be an artifact of the current workshop, which explicitly requires contributors to provide their understandings and visions of UX.

Table 2: Papers and books cited by at least three different contributors

Source	Type	Citations
Hassenzahl, M. & Tractinsky, N. (2006). User Experience - a research agenda [Editorial]. Behavior & Information Technology, 25, 91-97.	Journal, review	8 of 12
Hassenzahl, M. (2003). The thing and I: understanding the relationship between user and product. In M.Blythe, C. Overbeeke, A. F. Monk, & P. C. Wright (Eds.), Funology: From Usability to Enjoyment (pp. 31-42). Dordrecht: Kluwer.	Book chapter, model	5 of 12
Jordan, P. (2000). Designing pleasurable products. An introduction to the new human factors. London, New York: Taylor & Francis.	Book, model	4 of 12
McCarthy, J. & Wright, P. C. (2004). Technology as Experience. Cambridge, USA: MIT Press.	Book, model	4 of 12
Norman, D. (2004). Emotional design: Why we love (or hate) everyday things. New York: Basic Books.	Book, model	4 of 12
Forlizzi, J. & Battarbee, K. (2004). Understanding experience in interactive systems. In Proceedings of the 2004 conference on Designing interactive systems (DIS 04): processes, practices, methods, and techniques. New York: ACM.	Conference, model	3 of 12
Lavie, T. & Tractinsky, N. (2004). Assessing dimensions of perceived visual aesthetics of web sites. International Journal of Human-Computer Studies, 60, 269-298.	Journal, model, empirical	3 of 12

3. CONTENT (MANIFESTO) ANALYSIS

As mentioned earlier, content analysis (CoA) is a common bibliometric method to analyze scholarly work, though CoA is essentially applicable to a wide range of contents (Krippendorff, 2004). In the current context, we specifically applied CoA to analyze the UX Manifestoes (i.e., Principles, Policies and Plans), defined in individual workshop papers. We did not adopt any existing CoA scheme. Instead we used sort of grounded bottom-up approach to identify commonalities and divergences on the manifesto issues. In the following analysis, we refer to individual papers with their identifier (Table 3).

Table 3. Workshop papers and identifiers

ID	First author and title of submission
P1	Ardito: Towards the evaluation of UX
P2	Hassenzahl: The hedonic/pragmatic model of user experience
P3	Hole: Gaining Insights into User eXperience
P4	Kerkow: Don't have to know what it is like to be a bat to build a radar reflector – Functionalism in UX
P5	Mahlke: User experience: usability, aesthetics and emotions in human-technology interaction
P6	Roto: User Experience from Product Creation Perspective
P7	Sward: Making User Experience a Business Strategy
P8	Springett: User Experience and its relationship to usability The case of e-commerce web-site design
P9	Law: UX and Usability Measures: Correlations and Confusion
P11	Kort: Conceptualizing and measuring UX
P12	Wright: User Experience Research as an Inter-discipline: Towards a UX Manifesto
P13	Moss: Refining our understanding of men and women's preferences

3.1 Principles

Characteristics of UX, definitions of UX

P6 cites a number of UX definitions, and then describes characteristics of UX. P4 also comes up with a number of properties. Other papers provide models or frameworks of UX (e.g. P2, P4, P8, P11, and P13), thereby implicitly providing boundaries.

Richness of particular, situated, lived experiences vs. measuring and abstracting experiences into components, taking snapshots of experiences and averaging experiences

Many papers deal with the distinction between (or continuum from) on the one hand lived, particular, situated experiences, and capturing the richness of these and on the other hand abstracted, measured, snapshots of experiences or averaged accounts or descriptions of experiences. This distinction (or continuum) is apparent in many of the papers (e.g., papers P2, P3, P5, P8, and P12 explicitly deal with this distinction).

Some papers that deal with measuring experiences and with taking snapshots or averaging experiences and that do not explicitly deal with the other side of the continuum, still acknowledge that UX is dynamic and talk about the importance of dealing with (phases in) the process of how experiences come to life (e.g., P6, P7, P8 and P11 explicitly deal with this).

In addition, two papers take an intermediate position on the continuum, by not de-composing UX into components and not dealing with all particularities and situatedness, but by using patterns (e.g., P1 and P3).

In general most authors do not seem to argue that UX cannot be measured at all (e.g., P9), but do state that it cannot be measured in its totality, in all its richness. However, that is not a new thing in science. To some extent human sciences always measures abstractions, and realizes it thereby loses some of the richness of the original data. On the other hand the concern of many is that by abstracting away the richness of particular, situated lived experiences one throws away the child with the bathwater. Thus techniques are needed for capturing richness in specific situations. Both stances seem to have their place in the field of UX.

Usability and technology acceptance vs. UX and instrumental vs. non-instrumental

Many papers deal with some way of distinguishing instrumental goals from non-instrumental goals; sometimes in relation to how usability and UX relate to each other (e.g., P2, P5, P6, P8, P9, P11, P12, and P13). In general UX is seen as more comprehensive than usability, but also leaving out the objective usability part (e.g., P6 and P11). UX is also seen as

complementary to technology acceptance models (P6).

Underlying Theoretical Frameworks

Most of the papers are underpinned by some theoretical frameworks, which may be subsumed by the umbrella terms like “experience”, “emotion”, “aesthetics”, or “affect”. They include motivation theory (P1), self-theory (P2), appraisal theory (P3), functionalism (P4), semiosis (P8), consumer and marketing theories (P7, P13), and measurement theory (P9). A more general reference framework to which most papers explicitly or implicitly refer is *situated cognition theories* (e.g. P12), which has instigated the disputes between cognitivist and phenomenological approaches in late 1980s and early 1990s, and propagated to the contemporary research work in HCI.

3.2 Policy and Plans

Requirements for UX techniques and models to be developed

In order to arrive at models or techniques for the field one policy is to first describe what is required from such models or techniques.

A number of papers explicitly or implicitly deal with what would be required from UX techniques and models (e.g., P2, P4, P8, P11, P12, and P13). P4 argues that before modeling one should first determine what the purpose of the model is. P2's statements that the appropriate level of describing an experience is determined by the problem at hand is in line with that. P2 and P8 also state that in general one can expect that designers may need the richness of lived experiences, whereas evaluators need a higher level of abstraction and need measurement, probably based on semiotics.

Furthermore, P4, P6 and P11 state that models or definitions should try to somehow relate experiences to product properties.

P12 states that techniques and methods should be developed that can capture the richness of experiences. P11 also states that any model on UX should also deal with the process of how an experience comes to life. Although P7 and P8 do not explicitly argue for the need for such a model, they do come up with such a model, and thus can be seen as also arguing for the need for such models.

Make measurable, improve measurement, and standardize it

Many papers argue that to advance the field of UX it is necessary that measurement techniques and measures be improved, for instance, P3, P4, P5, P6, P7, and P11. P4 argues that standardization of measurements and the use of a common model is necessary. P6 on the other hand argues that

standardization should not take place until the field is more mature. The paper suggests using a living definition on Citizendium or Wikipedia.

P4 and P11 argue that the basis for furthering the field could be in doing a lot of empirical work on UX while all the time measuring/evaluating success.

Team up with others and integrate

A number of papers state that in order to advance the discipline it is necessary to collaborate with other disciplines: P4 argues that academy and industry should collaborate and share data, P7 states that within companies User-centred Design (UCD) should integrate with business disciplines like marketing, and develop shared understandings and a shared way of thinking about experiences. P11 states that UX researchers should work in close collaboration with product designers. P6 states that the scopes of usability, technology acceptance and UX should be broadened to include the scope of worth-centered design.

Educate

Two papers mention something about education as a way of furthering the field.

P3 mentions that one should educate designers in the art of designing for personal priorities of users.

P12 states that there is a need for a broader HCI education that offers the foundations by which students can experience inter-disciplinarity and develop skills for inter-disciplinary thinking.

UX evaluation in early design phases

P6 states that research is needed on UX evaluation in early design phases.

4. CONCLUDING REMARKS

The work on UX cannot be concluded by the current workshop. Neither is the analysis work demonstrated above. In fact, the workshop opens up more issues that the community of UX researchers will strive to find answers for. Specifically, the analytic framework presented here will further be refined and be applied to a large scope of UX studies. The preliminary results reported, albeit small in scale, already reveal some interesting observations and also imply the still fragmentary nature of the domain. Clearly, we need to experience more.

REFERENCE

Krippendorff, K. (2004). Content Analysis: An Introduction to Its Methodology (2nd ed.). Thousand Oaks, CA: Sage.

Towards the evaluation of UX

Ardito C., Costabile M.F., Lanzilotti R., Montinaro F.

Interaction, Visualization, and Usability Lab

Dipartimento di Informatica, Università di Bari, Italy

Via Orabona, 4, 70125 Bari (Italy)

{ardito, costabile, lanzilotti}@di.uniba.it

ABSTRACT

Various attempts towards providing theories or framework of User eXperience (UX) have been done. They are concerned with the analysis of users' sensations and emotions as well as perceptions and behaviour. The diversity of these approaches indicates the complexity and the richness of the UX. We are currently investigating methods to evaluate UX in electronic games, thus our main contribution to the workshop is on the *plan* dimension, namely on evaluating UX and on understanding UX in practice through case studies.

Author Keywords

User Experience, Educational Game, evaluation pattern.

ACM Classification Keywords

H.1.2 [User/Machine Systems]: Human factors; I.3.6 [Methodology and Techniques]: Interaction techniques.

INTRODUCTION

Over the last years, the field of Human-Computer Interaction (HCI) has become increasingly concerned with user experience (UX). One of the most interesting contributions from the field of UX to classical HCI is in fact the attempt to include subjective attributes like, for instance, aesthetic, emotional, and social aspects in a design space which has previously mainly concerned with ease-of-use.

Various attempts towards providing other theories or framework of UX have been done [12, 17, 19]. All of them are concerned with the analysis of users' sensations and emotions as well as perceptions and behaviour. The diversity of these approaches indicates the complexity and the richness of the UX.

We believe that designing for experience includes but it is much more than designing for efficiency. While efficiency

is focused on attributes such as fast, easy, functional, error-free, UX involves feelings and thus focuses on beautiful (harmonious, clear), emotional (affectionate, lovable, erotic), stimulating (intellectual, motivational), and also on tactile (smooth, soft), acoustic (rhythmic, melodious) in case of multimodal interfaces. In understanding how interaction shapes experience, time plays an important role in consciousness and in designing actions so that users like not just the outcome of the actions but the feeling of executing them. An example is the experience of a man and woman while dancing.

According to Hassenzahl and Tractinsky, UX is influenced by "user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.)." [12].

In our recent work on games to support learning history at an archaeological park we have concentrated primarily on motivation, and in general on the whole experience of playing a game in archaeological park, as well as its learning effectiveness. Research indicates that well-designed electronic games can meet some of the psychological needs of students and motivate them to learn [20]. This suggests the use of electronic games for educational purposes rather than simply for pure entertainment. In particular, electronic games on cellular phones, more than any other interactive technology, have become a significant part of young people contemporary culture.

Games can stimulate in young students an understanding of history that would otherwise be difficult to engender [7]. In this context, play can arouse the emotions of young visitors, stimulating their imagination and curiosity. There are various advantages in using the game-play method to teach history [7]: 1. play is amusing and fun and what is enjoyably learned is less likely to be forgotten; 2. play requires different skills to be deployed simultaneously, and each player can practice those skills felt to be most congenial; 3. play encourages group activities, stimulates collaboration, helps with conflict management and is an excellent tool for individuating relational problems.

The electronic excursion-game is designed to support middle school students during the visit of historical sites [2]. It is structured like a treasure hunt to be played by a class of students: it combines the excitement of both chase and solving the case with the joy of freely exploring a place and discovering its hidden secrets. The aim of this system is to improve students' whole experience of playing a game in an archaeological site as well as its learning effectiveness, by exploiting several advantages provided by mobile technology.

We are currently investigating methods that may evaluate the users' experience with such games, thus our main contribution to the workshop is on the *plan* dimension, namely on evaluating UX and on understanding UX in practice through case studies.

EVALUATING GAMES

We have conducted a field study whose aim is to evaluate several aspects that the user experience involves, such as motivation, engagement, the social interaction that refers to the collaboration among the students of each group and to the competition among the groups. Different techniques are used for studying these various aspects:

- Direct Observation and Video Analysis, for examining the behaviour of the students during the game execution
- Focus group (after the game), for capturing from the participants their first impressions and their opinion on the performed game
- Three questionnaires: one at the end of the game, to measure game experience; the second one at the end of the debriefing, to measure students perception of the game usefulness for the learning; the third one at school, to measure the learning effectiveness, that regards the acquired knowledge during the game about the history
- Essays and drawings analysis, to further investigate experience.

At the time of writing this position paper, we are analysing the results of the data collected in the field study and we hope to come out with indications that can be generalized to the evaluation of UX with didactic games. Our approach exploiting different methods is in accordance with the results of a recent workshop “Methods for Evaluating Games – How to Measure Usability and User Experience in Games?” held in conjunction with the 4th International Conference on Advances in Computer Entertainment Technology on June 12th in Salzburg, Austria. The discussed contributions have highlighted that currently there is not a specific method for evaluating UX, but a mix of methods should be used with the consequence of being very resource consuming, including people, time, money. Cost-effective techniques, such as inspections, are desirable, but participants agreed that heuristic evaluation is not appropriate because involving users will certainly

provide the most interesting indications about the overall experience with the system.

A recent study by Kohler et al. investigates a possible use of patterns that might provide solutions to motivational or other hedonic aspects [13]. The study refers to motivational patterns for designing for fun in a specific application business context. It presents an example of a motivational pattern, the Task Status Display (TSD), derived by the pattern suggested by Tidwell in [21], called Status Display. The results of the study demonstrate that TSD has a positive effect on motivation, which emerges from two aspects: 1) helping users to stay focused on their goal, or even providing an alternative, more interesting “substitute goal”, and from 2) providing feedback to improve performance [15]. The conclusion is that these patterns can be used to “engineer” motivation for enhancing the experience of the user when interacting with the system.

We found the Kohler et al. work very inspiring. Indeed, a design pattern not only suggests solutions for the design, but it can also be taken into account to verify, during the evaluation phase if the system correctly complies with such pattern. As a consequence, evaluation patterns can be derived from design patterns, thus permitting the use of the inspection technique we have developed, based on the use of evaluation patterns, that can guide evaluators during their inspection, in order to make it more reliable and still cost-effective.

THE PATTERN-BASED INSPECTION

The concept of pattern, as a cognitive tool to capture human expertise and to make it re-usable, was introduced by the architect C. Alexander, applied to architecture and urban planning: “...Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem in such a way that you could use this solution a million times over...” [1]. Patterns are now used in many other contexts. In software engineering, design patterns are a fashionable topic and are increasingly used to describe design experience for object-oriented programming [10] and for hypertext fields for describing navigational and structural features [5, 11, 18]. In Human-Computer Interaction, design patterns are exploited for describing high-level principles of good interface design, such as immediate feedback, proper affordances, judicious use of sound and animation, protection from accidental mistakes, gentle error messages, and so on. For a novice designer, it's hard even to remember all these principles and it's sometimes difficult to make the tradeoffs among these principles when they come into conflict. Design patterns find the best solution by guessing, or by resorting to other means [6, 9, 21, 22].

We developed an inspection technique that exploits a kind of evaluation patterns, called Abstract Tasks (thus the technique is called AT inspection), that guide the inspectors during their work [14, 16]. Essentially, evaluation patterns make possible to maximize the reuse of the evaluator's

expertise. Their goal is to capture usability inspection expertise, and to express it in a precise and understandable form, so that it can be easily “reproduced”, communicated, and exploited.

In comparison with a classic inspection, such as heuristic evaluation, the use of evaluation patterns during the inspection provides several advantages: 1) they are defined by observing expert inspectors who performed various inspection, thus capturing evaluators' expertise; 2) they provide information about application domain, tasks and users, since this information is provided in the activity description item; 3) they enforce standardization and uniformity, by suggesting a language inspectors will use for writing their evaluation report; 4) they reduce time and cost needed for an accurate inspection, as it has been demonstrated by controlled experiments in which the AT inspection has been compared with other evaluation techniques, namely heuristic evaluation and user observation [4, 7].

Referring specifically to point 2 above, it is worth noting that evaluation patterns convey necessary information to the evaluators about application domain, tasks and users. In the heuristic evaluation, to get this information, evaluators must undergo some form of training.

AT inspection has been used for evaluating different types of application in various domains, e.g. museum hypermedia [16], information visualization tools [3], and e-learning systems [14]. Some controlled experiments have been performed to demonstrate the validity of this technique when compared with other techniques. Specifically, for validating the AT inspection for hypermedia systems, 28 novice inspectors have been divided in two groups. They have been asked to evaluate a commercial hypermedia CD-ROM applying the AT inspection or the traditional heuristic evaluation [8]. In another controlled experiment reported in [4], 73 participants, divided in three groups in a between-subjects design, evaluated a commercial e-learning system applying the AT inspection for e-learning systems, the heuristic evaluation, or user-testing. Results of both experiments have shown an advantage of the AT inspection over the other usability evaluation methods, demonstrating that evaluation patterns are effective and efficient tools to drive evaluators and improve their performance.

REFLECTION SECTION

Our contribution to the workshop is on the *plan* dimension, since we discussed issues related to UX evaluation of electronic games.

UX is a complex concept that requires specific evaluation techniques in order to consider all its aspects. These techniques can be very resource consuming, including people, time, money. Cost-effective evaluation techniques are of a great importance. Our proposal of the pattern-based inspection is a contribution in this direction.

We are only at the beginning of a long path, since several steps are necessary for the definition of evaluation patterns capable of capturing the complexity of the UX concept. First of all, a good set of principles, i.e. fundamental assumptions underlying UX, must be defined, and this is one of the goal of this workshop. In our experience with didactic games, *motivation* and *engagement* are fundamental principles. These principles will be the basis for defining appropriate design patterns to drive the construction of systems that can provide a significant user experience. Evaluation patterns exploited by the proposed inspection technique will finally derived from the available design patterns.

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The hedonic/pragmatic model of user experience

Marc Hassenzahl

University of Koblenz-Landau, Economic Psychology and Human-Computer Interaction
Im Fort 7, 76829 Landau, Germany
hassenzahl@uni-landau.de

ABSTRACT

The present paper describes the hedonic/pragmatic model of User Experience (UX) and discusses its implications.

Author Keywords

User Experience; hedonic; needs; model; affect

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Many different perspectives on User Experience (UX) exist (see Hassenzahl & Tractinsky, 2006, for an overview). The present paper will describe the hedonic/pragmatic model of UX (e.g., Hassenzahl, 2001; Hassenzahl, 2003) and discuss its implications.

THE HEDONIC/PRAGMATIC MODEL OF UX

The hedonic/pragmatic model of UX assumes that people perceive interactive products along two different dimensions. *Pragmatics* refers to the product's perceived ability to support the achievement of "do-goals", such as "making a telephone call", "finding a book in an online-bookstore", "setting-up a webpage". In contrast, *hedonics* refers to the product's perceived ability to support the achievement of "be-goals", such as "being competent", "being related to others", "being special".

An individual's assessment of pragmatics calls for a focus on the product – its utility and usability in relation to potential tasks. Assessing hedonics, however, calls for a focus on the Self, i.e., the question of why does someone own and use a particular product. Here, more general human needs beyond the instrumental come into play, such as a need for novelty and change, personal growth, self-expression and/or relatedness (see Ryan & Deci, 2000; Schwartz & Bilsky, 1987; Sheldon, Elliot, Kim, & Kasser, 2001 for general lists of human needs). The

hedonic/pragmatic model explicitly distinguishes three different facets of hedonics (Hassenzahl, 2003): "Stimulation" (novelty and change, personal growth), "identification" (communication of identity to relevant others, relatedness) and "evocation" (provoking memories, symbolizing). This list is not exhaustive, but meant as a parsimonious list of the key drivers of hedonics. Alternative lists of needs underlying hedonics are available (e.g., Malone, 1984; Logan, Augaitis, & Renk, 1994; Jordan, 2000; Gaver & Martin, 2000).

The model further assumes that people have implicit notions of the relation between particular attributes (e.g., simple–complex, ordinary–novel) and pragmatics or hedonics, respectively (in the sense of means-end-chains, see Reynolds & Olson, 2001). Simplicity, for example, may signal high pragmatics, whereas novelty may suggest high hedonics. Or to put it differently: Simplicity suggests fulfillment of do-goals, whereas novelty suggests fulfillment of be-goals.

The hedonic/pragmatic model assumes that people view both aspects as more or less unrelated (Hassenzahl, 2001). For instance, a mobile phone's particular features will trigger the formation (perception) of a number of attributes (e.g., simple, novel, admirable), which in turn are viewed as being either related to be or do-goals. Some attributes of the phone suggest that making a telephone call will be easy, others that friends will be very jealous because of the phone's coolness and beauty. A relation between both is only rarely made – pragmatics and hedonics are perceived as distinct aspects.

WHERE IS THE EXPERIENCE?

Experience is tied to actual usage situations (Forlizzi & Battarbee, 2004). A convertible in one's garage is not the same as driving open-topped through lush hills on a beautiful summer evening. The latter is experiential – it involves all kinds of emotions, sensations, and thoughts – whereas the former is a potential for experience only. Actual experience is important, but very difficult to address. This is due to its complex, situated and temporal nature.

The hedonics/pragmatics model attends to actual experience in four different ways, without, however, actually making experience an explicit part of the model. First, it is assumed that product perceptions are influenced by actual experiences. Users/owners may have an idea of the product's ability to satisfy do and be-goals based on a first

impression, but experience will modify any perception. In other words, measures of hedonics/pragmatics will inevitably reflect a summary of actual experience. Note, however, that this summary can be systematically biased (Hassenzahl & Sandweg, 2004).

Second, one may probe perceptions repeatedly during the experience to get an idea of how they change over time. Figure 1 shows a profile of pragmatic and hedonic perceptions obtained during an usability test by an according questionnaire (e.g., Hassenzahl, 2001) .

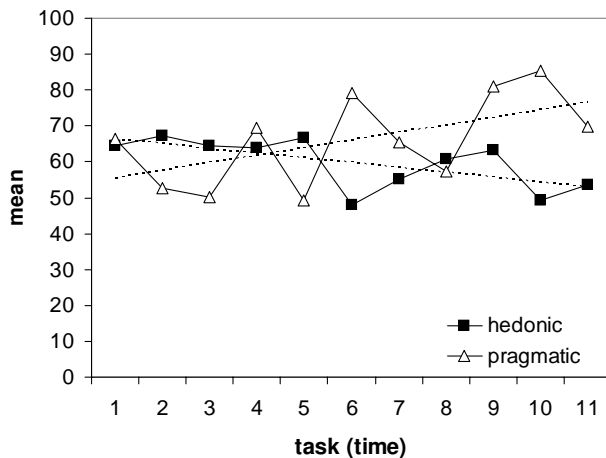


Figure 1: Change of pragmatic and hedonic perceptions over the time of an usability test (N=6)

The profile shows, how the initial perception of hedonics decreases over time (maybe due to habituation, disappointment), while pragmatics increase (maybe due to habituation, learning). In addition, it becomes apparent that pragmatics is much more influenced by tasks (varies more) than hedonics. The profiles itself are a description of experience, albeit admittedly impoverished (i.e., only looking for two aspects) and averaged across single individuals. Nevertheless, they can be used for further analyses (on different time scopes), which go way beyond common practices in Human-Computer Interaction.

Third, the hedonic/pragmatic model explicitly differentiates between perception and global evaluation (good–bad, satisfaction). In other words, one may perceive a product as primarily hedonic; this must not necessarily imply that it is liked or wanted in a particular situation. It is as easy to think of situations, where hedonics are irrelevant (e.g., trying to use a parking meter before shops close), as it is to think of situations, where hedonics are very relevant (e.g., in social situations) or even pragmatics irrelevant (e.g., when playing around with a new product). In other words, separating evaluation from perception acknowledges that the relevance of do and be-goals may vary with situation. Instead of assuming a fixed hierarchy of needs, such as Jordan's (2000) pyramid of functionality, usability, and pleasure, where each aspect is a necessary precondition for

the subsequent, the hedonics/pragmatics model rather thinks of it as a situation-dependent ranking of do versus be-goals (see Sheldon et al., 2001).

Four, to account for the impact of the user's general state, two different usage modes are defined: goal and action-mode. In goal-mode, the achievement of particular do-goals is in the fore. The current goal has a certain relevance and determines all actions. The product is therefore just "a means to an end". In action-mode the action is in the fore. It determines do-goals "on the fly" driven by be-goals; resulting do-goals are "volatile". Using the product can be an "end in itself".

Not surprisingly, individuals set in goal-mode (e.g., by giving them tasks) appreciate pragmatics, whereas individuals set in action-mode (e.g., by instructing them to do what they like) don't care (Hassenzahl, Kekez, & Burmester, 2002). Refer to Hassenzahl and Ullrich (2007) for further effects of having or not having a goal on actual user experience.

To summarize: although product perceptions are at the heart of the hedonic/pragmatic model of UX, at least four additional aspects of the model address experience.

SOME IMPLICATIONS OF THE HEDONIC/PRAGMATIC DISTINCTION

Carver and Scheier (1989) argued for a hierarchical model of goals, where subordinate do-goals are derived from and instrumental to superordinate be-goals. Indeed, individuals may be not interested in making telephone calls *per se*, but may rather think of whom to call. Nevertheless, the pragmatics of the product is assessed without a strong link to be-goals. Simplicity, for example, suggests the ability to make telephone calls whenever needed, but not a particular suitability of the phone to make romantic phone calls (to feel related to others). Thus, although do-goals (making a telephone call) are the product of superordinate be-goals (being related to others), individuals may make a clear distinction between both aspects.

Note, that individuals' separation of do- and be-goal- related attributes does not necessarily dismiss the whole idea of a hierarchical relation. Quite the contrary, the notion that be-goals are higher up, i.e., closer to an individual's Self, has an interesting implication: individuals may become more attached to a product with more (stronger) hedonic attributes. Imagine a primarily hedonic product, such as the souvenir in figure 2 (next page). It triggers pleasant memories of one's honeymoon, which feed into an important be-goal, namely being related to others. It does *not* suggest the fulfillment of any do-goal (besides using it as a reading lamp or door stopper). However, the object is personally relevant and people may become emotionally attached (Belk, 1988). Now imagine a standard dishwasher. It performs a clearly defined do-goal and may be assessed in terms of effectiveness and efficiency. Although superordinate be-goals may trigger the need for clean

dishes, the product is perceived as primarily pragmatic. Clearly, there is also a strong attachment to a dishwasher (I personally wouldn't survive without one), nevertheless this attachment is rather functional than emotional (Belk, 1988).



Figure 2: An illuminated gondola from Venice (picture by Uwe Dettmar, Frankfurt Main, Germany)

In other words, people may become attached to the particular object (in the case of the hedonic souvenir) or to the mere function the object performs (in the case of the pragmatic dishwasher). The implications are straightforward: whereas souvenirs are only rarely given away, dishwashers are easily replaced by newer or cheaper models.

The literature on Consumer Research¹ supports the idea of differential attachment to primarily hedonic versus pragmatic objects. Dhar and Wertenbroch (2000) found a larger so-called endowment effect for primarily hedonic objects compared to primarily pragmatic objects (e.g., M&Ms versus UHU glue stick). The endowment effect describes a gap between the perceived value of an object, depending on whether one is about to acquire it or has to give it away (with a higher value in the forfeiture situation). This upvaluation is explained by loss aversion, which in turn may indicate stronger attachment to the product.

Okada (2005) found that people simultaneously presented with an hedonic or pragmatic option (two 50\$ vouchers, one for a dinner, one for the grocery), chose the pragmatic although the hedonic was valued more. This was explained by justification. In other words, although hedonic objects may be more valued, pragmatic objects are more likely to be chosen.

¹ Note, however, that the definition and theoretical basis of hedonics in this literature slightly differs from the one presented herein. Whereas the present model understands hedonics as the suggested fulfillment of be-goals, consumer research emphasizes aesthetics, affect and pleasantness *per se* (see Batra & Ahtola, 1990).

In a similar vein, Hsee and colleagues (2003) found that people focus on the most central functions of products (e.g., the picture quality of a TV) and discount the importance of other, more peripheral aspects (e.g., sound of a TV), which are nevertheless important for later experience. Thus, when buying, people may focus on the pragmatics of an interactive product (e.g., its usability) and discount the importance of the more peripheral hedonic aspects (e.g., its beauty), although ugliness will heavily impact the later product experience.

There is also an interesting link between affect and hedonics/pragmatics. Yeung and Wyer (2004) found product evaluations to be affected by momentary mood (positive, negative) only if the product was hedonic. In the case of a primarily hedonic product, people seem to rely on their feelings towards the object, when evaluating. In the course of this process, incidental mood (i.e., unrelated to the product) may be misattributed to the product.

Admittedly, none of these findings address interactive products. Future research must transfer them to the context of UX. Nevertheless, they demonstrate the simple, yet explanatory powerful nature of the hedonics/pragmatics model.

ESSENTIALS FOR A UX MANIFESTO

The hedonics/pragmatics model is clearly a reductionist model of UX, which relies on a small number of distinct constructs (hedonic/pragmatic perceptions, global evaluation, time, situated relevance, and modes) to make UX measurable and manageable. It is nevertheless powerful, despite its simplicity. In addition, especially measurement (or evaluability) is a standard requirement of any concept, which does not entirely dismiss the roots and traditions of Usability Engineering. In this sense, the proposed model is – despite going beyond common practices of Human-Computer Interaction – a very traditional one.

Based on the present model, a minimal definition of UX must address two perspectives on "experience".

- *Experience*: as the complex interplay of situation, individual and product over time. It is a moment-by-moment view, with a focus on time and change. An experience is unique, situated, and complex.
- *Meta-experience*: as summaries of experiences on different abstraction levels (reductions). They refer to particular, memorable moments only, with a focus on integration and the neglect of time and change. In addition, they may focus on particular aspects of the experience only (e.g., product perception, emotions attributed to the product). A meta-experience is averaged and simplified.

In the context of Human-Computer Interaction both perspectives seem valuable approaches to inherently different problems. Meta-experience may be rather the subject of basic research or evaluation, whereas the

description of experiences may be more important for the context of design. Both are valuable, and should not be pitted against each other.

SUMMARY: PRINCIPLE, POLICY, PLANS

Principles. I hope to have made clear that the distinction between the full-fledged description of a particular experience and the abstraction, reduction, averaging to a meta-experience is not an antagonism. Both are rather end points of a continuum, maybe called abstraction. The appropriate level of abstraction is best determined by the problem at hand, not by ideology. In other words, design may benefit from the detailed descriptions of experiential episodes, whereas evaluation may need a higher level of abstraction.

Policy. I believe UX to differ fundamentally from usability, because of its focus on (a) positive aspects of the user-product relationship (e.g., enjoyment rather than frustration), (b) the incorporation of hedonic (non-instrumental) aspects and (c) the focus on the understanding and management of the subjective side of product use (rather than objective performance criteria).

Plans. Although UX differs substantially from usability, I opt for an attempt to integrate UX into user-centered design as we know it rather than trying to change everything at once. This clearly calls for the development of according methods, which can be applied during the development process.

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Gaining insight into the User eXperience

Linda Hole
Bournemouth University
School of Design, Engineering & Computing
Talbot Campus
Poole, Dorset BH12 5BB
+44(0)1202 965251
lhole@bournemouth.ac.uk

Oliver M. Williams
Bournemouth University
School of Design, Engineering & Computing
Talbot Campus
Poole, Dorset BH12 5BB
+44(0)1202 965503
owilliams@bournemouth.ac.uk

ABSTRACT

There is little doubt that we need to better understand the effect that interactive experiences have on their users. The recent stream of research into emotion in HCI has aimed to collect information about the emotions evoked by product use. Methods to collect this emotion data have been firmly rooted in traditional techniques, including self-report. These methods typically collect information on the user's affective state at the end of the experience. This research addresses the need to glean information on the changes in affective state during the interactive experience. A psychological model of appraisal theory has been identified as a potentially useful approach for monitoring emotions arising during product use.

Categories and Subject Descriptors

H.1.2 [Models and Principles]: User/Machine Systems - human factors, human information processing.

General Terms

Measurement, Design, Human Factors, Theory

Keywords

Affect, Appraisal, User Experience, Mobile Devices, Event-based, Emotion Sampling Device

1. INTRODUCTION

Everybody's doing it: designing for the user experience (UX). It's not always given the same name, however: for example, in marketing, it's known as the consumer experience. From a practitioners' perspective, UX is concerned with improving the design of anything people experience: websites, applications, products, environments. Experiences are highly valued, and, consequently, many products are now marketed as *experiences* rather than just *products*. "Having a high quality user experience is one of the most important goals for a consumer electronics product." [19:p190].

No matter what "it" is called, across numerous disciplines people are trying to capture it. The user experience field is multidisciplinary, drawing on knowledge and techniques from a range of academic and commercial areas. It has been

described as an umbrella *topic* by some [2, 17], and a '*felt life*' by others [25]. Anderson's umbrella covers 14 disciplines, including usability and interaction design [2]. McCarthy and Wright [24] have proposed a framework of four threads of experience:

1. Compositional - the elements of an experience
2. Sensual - how the design / texture / atmosphere makes us feel
3. Emotional - how emotions colour the experience for us
4. Spatio-temporal - the effects of place and time on the experience

The complexity of an experience makes it a unique event hard to repeat and even harder to create deliberately [12]. The focus for some researchers has been to try to identify the elements of a user experience [e.g. 19, 18]. Others believe that understanding the emotional or affective responses people have to products, services, and systems is essential to creating good designs. [9, 10, 32]. There is however a general consensus that for successful UX design the fundamental knowledge must include what users think and want, how they react, and the hidden reasons for their responses [19].

The research described here focuses on users' affective responses. The challenge is to design an emotion-sampling device to capture event-triggered reactions to a series of discrete situations which, when combined, constitute the complete user experience. The next section provides a brief overview of previous work on sampling the user experience.

2. EXPERIENCE SAMPLING

The notion of capturing a record of events in people's lives is not new [33]. In psychotherapeutical situations, participants are asked to complete questionnaires, and keep diaries to register thoughts, emotions and situations whenever they occur [8]. These self-report techniques have been used beyond the study of individuals' behaviour, to situations in organizational settings. Self-recording of everyday life events can be initiated by three types of prompt: interval-contingent; signal-contingent; event-contingent [33].

Csikszentmihalyi and Larson's Experience Sampling Method (ESM: see [14]) is an established self-report technique. Zelenski and Larsen examined emotions in the ongoing daily lives of their participants using ESM: participants reported three times per day for a month on how much they were experiencing various basic emotions [34]. ESM has also been used in studies to examine mood in the organizational context [26]. More recently, this approach has been used to collect data on the users' interactions with ubiquitous computing systems, in the natural context (see [7], which also provides a useful overview of this methodology). Participants are provided with a questionnaire booklet and an electronic pager

which is activated several times a day: upon receiving an 'alert' (random, scheduled or event-based), the subject completes a questionnaire in the booklet. ESM does not require participants to recall their experiences: this reduces the cognitive biases of other recall-based self-report techniques [7]. However, other difficulties can arise, especially with scheduled alerts, which enable the participant to 'collect their thoughts' in anticipation of the next alert. In recent studies, the ESM questionnaires have been ported to mobile, hand-held devices (such as PDAs) for ease of data collection [6, 8].

de Sá *et al.* provide a commentary on the use of mobile, handheld devices for the successful collection of psychological data [8]. Consolvo and Walker used PDAs as a tool for questionnaire data collection when applying the Experience Sampling Method to ubiquitous usability evaluation [7]. Iachello *et al.* used event-contingent experience sampling, to survey people in real life situations about ubiquitous computing (ubiquitous) technology [16].

Whatever the context of use, and mode of delivery, the ESM formats require users to label their emotions. In the next section we examine the problems of emotion identification and labelling, and suggest an alternative solution.

3. AFFECT AS INFORMATION

According to Plutchik, an emotion is not simply a feeling state, but a complex chain of loosely connected events [27]. Thus a series of discrete situations which evoke short emotional reactions can become the cause of a more enduring emotional state [1]. Hassenzahl and Tractinsky [13] considered the notion of collecting information on users' emotional states as consequences of interactive experiences. In the recent stream of research to identify the emotions evoked by technology, most emotion studies have focused on this approach, which can be referred to as 'affect as information' [4].

Plutchik observed that several emotions may be experienced at the same time [27]. A difficulty also arises because using language to report emotions introduces ambiguity, it does not make it easy to describe mixed emotions, and the meaning of emotion terms is often obscure [27]. Plutchik commented that we often resort to metaphor to attempt to describe emotion, because, for example, many people are not sure about the differences between fear and anxiety, guilt and shame, or envy and jealousy [27].

Chen also reflected that subjects cannot usually duplicate their affects through their verbal descriptions [6]. They are likely to lose track of their experiences and the feeling of affects before they can completely describe them. Also, the snapshot of those feelings fade away before they can be reported; when answering questionnaires by retrospective recollection, subjects tend to miss subtle dimensions of consciousness [6]. Furthermore, retrospective methods to collect users' emotions cause problems because when reflecting on their experiences to formulate a response to a retrospective questionnaire item, people give more weight to peak moments and they strongly attend to how an episode ended [14].

There is also the issue of emotional intelligence, and the ability to both identify and label emotions [11]. A person may initially recognize the occurrence of an affective experience, but they then must distinguish between the emotions so that they can give it a label verbally. Ubiquitous digital appliances are now available to a heterogeneous user group, with ever

increasing wide backgrounds, literacy levels and skills [3]. Although it is obvious that a good user experience will begin to reduce the digital divide [5], in order to capture the quality of user experience with digital products, representative samples of users from this heterogeneous user group will be needed as participants, and some users may not have the self-awareness required to report their affect information.

To overcome these difficulties, we have identified appraisal theory as an alternative approach [15]. The use of cognitive appraisals removes the need for emotional awareness and the verbal labeling of emotions [11], and acknowledges the possibility that a person may be experiencing a mix of emotions at the same time [27]. Also, cognitive appraisals occur with each discrete situation [1], resulting in event-driven data collection, which captures the emotions brought about by a sudden change in circumstances.

We believe that in order to gain insight into the interactive experience, we need to capture people's experiences *during* their interactions with digital products, i.e. 'affect as experience' [4]. The next section explores the potential of appraisal theory to enable us to do so.

4. AFFECT AS EXPERIENCE

The 'affect as experience' approach sees emotions as dynamically experienced, and constructed in action and interaction [4]. It moves the focus to helping people to understand and experience their own emotions, and leads to new design and evaluation strategies for devices [4].

Appraisal theory has the potential to identify emotions *during* product use. The theory is based on the premise that the distinct emotions are produced by evaluating events in the environment as positive or negative. Although cognitive appraisals of events are granted to sometimes be unconscious, the emotions that result from those appraisals are typically viewed as necessarily conscious. However, with the use of cognitive appraisals there is no need to identify and label these emotions.

The appraisal model developed by Roseman *et al.* uses a series of questions whose answers lead along different pathways to identify 17 different emotions [29]. A common set of appraisals in different combinations appear to be involved in the production of multiple emotions, and each of the distinct emotions seems to be directly associated with a distinctive *pattern* of appraisals [23]. The model is presented elsewhere [15], but the appraisal questions would be as follows:

- Did you expect the event to happen?
- Did you want the event to happen?
- What caused the event to happen?
- How much control did you have over the event happening?
- What was the probability of the event happening?
- Did you want the event to stop or continue?

We present these questions as a translation of the analytical questions from the psychological model. It is felt that the accessibility of these simple questions, and the presentation of scales for the user's responses, will provide people with a tool which is both simple to use and easy to respond to. There are no psychological 'barriers' for the user to worry about. For example, most people often censor their own thoughts and feelings for the consumption by others [27]. Culture, education and age can also influence a person's responses; the

need to present oneself in a favourable light would easily distort the data collected via self-report.

The questions can be presented to the user via an Emotion Sampling Device (ESD): the user can access the ESD software via a mobile phone or PDA. When the user experiences a positive or negative event during their interactions with technology, they can report the event by answering this simple set of questions. The software monitors their response pathways to identify the set of emotions evoked by the interactive event. The resulting data will provide a view of the ongoing interaction, including both peak and negative moments during the use period.

The user will have been interrupted by the occurrence of the event, which provides the opportunity for an event-contingent report: it is human nature to want to speak about affective events soon after they have happened. They can report the event, and then answer a few simple questions about it before returning to their interactive experience. They will not need to reflect on the event to the extent of having to identify how they felt, what they felt, and what they will say on a questionnaire. The ESD thus offers a simple and straightforward tool to monitor the user experience. The next section considers the need for an appropriate method to enable researchers to assess users' interactive experiences.

5. ASSESSING USER EXPERIENCES

The need for event-contingent experience sampling, to survey people in real life situations about ubiquitous computing technology has been identified [16]. The move from desktop-based, stationary use settings to mobile uses in dynamic contexts has caused usability engineers to rethink their evaluation approaches [21, 31]. Understanding usage environments requires designers to step out of the lab and follow people where they use these applications [16].

However, although field-based evaluations seem like an appealing, even indispensable, approach for evaluating the usability of electronic appliances, field work does present difficulties [21]. For example, mobile devices are designed for individual use within a personal body space and therefore, observing the interface actions of the user is physically arduous [22]. Furthermore, home application usage, such as interactive TV, occurs in private environments [28], making access to users difficult, if not impossible. Researchers who have studied the use of home technology have remarked that establishing contacts with home users is more difficult and that different methodologies were needed to gather information [20].

Dormann observed that there are aspects of personal choices and values that cannot be easily subjected to the usability engineering approaches for task-based systems [10]. In a study of mobile device use, Sarker and Wells identified a stage within the use process which they call Assessment of Experience: they found that users appear to assess their experiences on at least three dimensions: functional, psychosocial, and relational [30].

This expansion of usage factors beyond the typical usability evaluation areas of effectiveness, efficiency and satisfaction has also been addressed by Scholtz and Consolvo's ubiquitous computing evaluation framework [31], which subsumes the usability factors within Interaction, one of 9 Evaluation Areas, which also include Appeal. When dealing with applications which produce emotional experiences enjoyed for their own sake, it is important to acknowledge

that individuals differ in the way they apprehend and react to emotions [10].

The issue of data collection in field-based studies may be effectively addressed with the ESD, which is currently at the prototype stage. Whilst other researchers continue with their attempts to encapsulate aspects of UX in a definitive document, we believe that a valid, alternative, starting point is to use the ESD to attempt to gain insights into what UX means to individuals in real life. By collecting profiles of users' interactive experiences, we hope to be able to contribute to the theoretical debate with data from real users, using real products, in real usage environments.

6. DISCUSSION

Returning to the debate on whether UX is a *topic* or a *felt life*, it sometimes seems as though we have stepped back in time to the early usability debate, when we considered whether product usability could be achieved with a checklist of attributes. Back in the 90s, usability was approached from both 'bottom up' (product attributes) and 'top down' (quality of product use). Whilst it may be possible to identify specific factors which affect visual appeal [32] and then check for their existence, it would be far harder to generate design principles for the completely successful user experience.

We seem to be revisiting an old debate with a new generation of devices. For however long this 'new' discussion lasts, one fact will remain: people will love, hate or simply tolerate the electronic products in their pockets, homes and cars. We need to capture the love/hate/tolerate moments during product use, to gain some insight into the hidden reasons for users' responses [19]. We hope that the Emotion Sampling Device will help to find the hidden reasons.

7. REFLECTIONS

With regard to UX Principles, we believe that each person's experience differs: it consists of different elements depending upon the person and the type of experience. We assume that any combination of elements can form an experience, and that it is primarily important to capture these elements, rather than trying to complete a specification based on elements that a user may not feel are at all relevant.

Our Policy for dealing with UX is one that aims to identify the important contributing elements in the first instance, and then to amplify/accenuate these elements of the experience. We accept that a much more personal touch must be taken when dealing with something that is inherently personal, and that it is perception that must be modeled, not background groupings that must be satisfied.

Our Plan would be to educate experience designers in the art of designing for personal priorities, rather than specification lists. Time should not be spent on fulfilling specifications from the designer's view: these elements may be of no concern to the user. Instead, designers should concentrate on identifying specific elements relevant to human concerns, and aim to increase the success of these elements.

8. ACKNOWLEDGMENTS

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Don't have to know what it is like to be a bat to build a radar reflector – Functionalism in UX

Daniel Kerkow

Fraunhofer IESE

Fraunhofer-Platz 1

Daniel.Kerkow@iese.fraunhofer.de

ABSTRACT

In this paper we propose a functionalistic definition of User Experience. First we relate the concept of qualia, as it is used in the discussion of subjective experience in philosophy of mind to the rather technology- oriented term User Experience. We focus on a position in functionalism, which supports us in claiming an alleviated definition of the properties of subjective experience. Then, measurement-theoretical considerations motivate the outlining of four UX- related quality models, as they are typically applied in systems and software engineering. Finally the need for a goal- and purpose- oriented framework is discussed.

ACM Classification Keywords

HCI, User Experience, Quality in use, Quality, Software & Systems Engineering,

INTRODUCTION

In the discussion around the term User Experience (UX), engineers meet anthropologists and designers, analyzing the phenomenon of subjective experience during the usage of an interactive product [1,2,3].

Representatives of the anthropologic discipline argue that a subjective usage experience has some „private, unique“ properties, which are hard to explain and not reducible to objective physical or cognitive explanatory models. Representatives from engineering disciplines search for those physical, objective parameters that enable to (repeatable) influence UX to a certain extent during the development of interactive systems [4].

It seems almost natural that the discussion about UX brings up a similar controversy as the dialogue between physical materialism and representatives of the mysteriousness of the quality of subjectively experienced mental states. In the discussion of the latter, the term qualia [5] has arisen in the beginning of the 20th century to express "the qualitative or phenomenal features of sense experience[s], in virtue of having which they resemble and differ from each other, qualitatively, in the ways they do." [6, p. 367)]. Qualia refer to the introspectively accessible, phenomenal aspects of our mental lives. The so called 'what it is like' character of mental states, to which Nagel [7] refers to, in his publication "what is it like, to be a bat?".

So why bother with philosophy of mind in the context of a rather technological question such as UX? There can not be found much work relating the philosophical term of qualia to the technology-related term UX [8;9;10,11]. Evidence on the relevance of qualia for technology can be found in [12, 13] where the product line named "qualia" is discussed. This product line was created by Sony 2003-2005 to showcase their best technology at that time and was designed to elicit an emotional response.

In the following sections, we will shortly outline typical viewpoints related to the concept of qualia, in order to take a (weak) position in (teleo-)functionalism [14]. The latter supports us in proposing an alleviated definition of the properties of subjective experience, which were proposed in the former. Then, measurement- theoretical considerations lead to the claim for goal-oriented quality models, as they are used in Systems Engineering.

QUALIA

In this section we shortly outline some of the arguments pro and contra the existence of such „private, unique“ properties, in order to prepare a position in functionalism.

The knowledge argument

Jackson introduced 1982 the so called "Knowledge Argument" [15]. The basis is a thought experiment about the "brilliant scientist" Mary, who had studied EVERY physical fact about color, and has so acquired all the physical knowledge about color. She only never has seen any color herself, since she has been – for which reason ever- living all of her life in a blackandwhite- room. The question, Jackson rises, is what would happen to Mary once she is released from that room, and for the first time in her life she would see and experience color. Jackson argues that since she learns a new fact about color, even though she knew all physical facts, there must be additional non-physical facts: the qualia.

There are three popular contra arguments:

1) What Mary learns is not an additional fact- she already knew ALL facts- about colors, but a new skill to handle the already known facts [16]. This would define qualia as procedural knowledge instead of declarative knowledge or in other words know-how instead of know-what.

2) Tye [17] argued similarly. According to him, Mary only gets a new representation of the already known facts. His position is based on representationalism and dualism.

3) Dennet [14], as a representative of functionalism takes Jackson literally: If Mary really knew all facts, she knew all facts, not only those facts, which anyone knows nowadays. Dennet agrees that nowadays it is impossible to explain everything about experience, but one day in the future we will have better explanatory models. According to that, nothing would happen, once Mary was released to the colored world.

Inverted or nonexistent qualia

Representatives of the inverted or nonexistent qualia view, argue that one will never know, based on objective external measurement (such as subjective ratings, or behavioral observations), how exactly a person experiences a situation. A typical case used as thought experiment is the perception of color. When a person visually experiences the sky in a certain way and gives this experience the name blue, the same person can perfectly live and communicate with others about “blue things”, regardless whether another persons visual experience of the sky comes closer to the first persons experience of e.g. green grass.

Quintessence

Even though some philosophers say humans might never be able to solve the qualia- question, others, such as Nagel or Dennet [7;14] believe in future scientific progress. They argue that analogous to the Geocentric World View, in which many astronomic phenomena were temporarily inexplicable, modern science lacks of a “next step”, to be able to explain consciousness-related phenomena.

Authors such as Lormand [18, p. 127] specify the next steps more explicitly: “What we need is a comparable objective way of specifying the dimensions along which the contents of inner perceptions or reflexive experiences can vary. [...] Given a general theory of reference such as a causal or correlational theory, the trick would be to discover which properties of experiences [...] cause or correlate in the relevant way with inner perceptions or reflexive representations.”

Mogi [13, p. 1] postulated: „It is likely that a solution of the origin of qualia, if one is possible at all, is going to be a difficult one. [...] Since we have all conscious experience, and we intuitively understand what the redness of red is, it is easy to fall into the fallacy that it is possible to discuss the problem of consciousness using daily concepts and terms from folk psychology. But that is far from the case [...].

He further concludes that “[...] it is a good thing to be at least qualia-aware without pretending to be able to tackle, let alone solve, the problem. “

Properties of qualia

Derived from the controversy of qualia, authors as [14,18] summarized a basic set of properties that are implicitly or explicitly attributed to the phenomenon of qualia. We will shortly mention these properties here, to be able to discuss them (and the concept of qualia) for the context of engineering of interactive systems.

Property 1: Ineffable: (inexpressible; incommunicable). “Since one cannot say to another, no matter how eloquent one is and no matter how cooperative and imaginative one’s audience is, exactly what way one is currently seeing, tasting, smelling and so forth, qualia are ineffable” [14, p. 2].

Property 2: Intrinsic: (nonrelational; reaction-independent). “[Qualia] do not change depending on the experience’s relation to other things.” [14, p. 2].

Property 3: Direct: (immediacy, intimacy, acquaintance, noninferentiality). Qualia are directly or immediately accessible to the consciousness of their experiencer – by introspection, without the kinds of inference one needs about the mental states of other people. [18, p. 127]

Property 4: Unanalyzable: (atomic, simple, homogenous, grainless). “What it’s like (normally) to see red does not [...] reduce to what it’s like to see [...] anything else” [18, p. 127]. Qualia cannot be reduced to e.g. a typical “red” experience plus a typical “round” one.

Property 5: Reliable: (infallible, incorrigible). “[...] One’s experience is more reliable than one’s access to other empirical facts” [18, p. 127].

Property 6: Private: (subjective). It is impossible to compare qualia interpersonally. It is impossible to confirm or falsify the hypothesis that a person has a specific experience. External indicators, such as the stimuli that caused the experience or the behavior and further mental states that the experience may cause, do not prove that a person experiences specific qualia.

THE USEFULNESS OF THESE PROPERTIES FOR SYSTEMS ENGINEERING

If we comprehend UX as a concept that has the same (above mentioned) properties as qualia, then these properties seem to inherently prevent UX from being scientifically analyzed or being useful for engineering systems. If UX is defined as an enigmatic concept, engineering disciplines can stop thinking about it and its usefulness for product design right here.

But if we, -without denying the specialty and uniqueness of qualia and consciousness- would dare to soften those properties to some extent and give the concept of UX a less extreme definition, then we can start to think about exploiting it in order to systematically build more enjoyable products. Those who dare the softer definition be invited to rethink the meaning of these properties for engineers of interaction intensive products in the following section.

Ineffable vs. Simplified:

Taking into account the arguments pro qualia, they really are ineffable. We will probably never know what it is like to be a bat, or how cauliflower tastes to our neighbor. For engineering, this means that something that can't be described is basically impossible to get hands on.

While Dennet [14] argues that it should be principally possible to communicate an experience, if it wasn't as complex as it is, Tye [17] counters that no matter how good one describes a visual experience, a blind person will never be able to know how it is to see, and it is not because of its complexity.

If we could, without having to deny the specialty of (the qualia of) UX, just find a few dimensions that apply to most of the experiences (such as good vs. bad) and understand UX not as a huge set of ineffable non-repeatable characteristics, but rather as something that is possible to be discriminated, we could pragmatically use this description to make decisions during an engineering process. Russell's circumplex model [19] for example uses mainly two dimensions to describe all kinds of emotions: Valence and Arousal.

Intrinsic vs. Influenceable:

When we drink a glass of lemon juice, it will be intrinsically sour. If in between two mouthful of juice, we decide to eat the two cocktail cherries that were served together with our juice, we will most probably realize, that our juice became even more intrinsically sour. To claim this taste as non-relational to anything seems not to be useful.

If Hollywood is able to influence people's emotions, even if it is unlikely that a movie scene affects *all* spectators in the same way, systems engineers should also be able to understand the triggers for product experience.

And if wine tasters developed the strategy to eat a piece of bread in between two tastes, in order to buffer the influence from one taste experience on the next, engineering should be able to find ways how to manage the habituation towards UX relevant product quality. Software Engineering can take advantage of well elaborated findings on Total Quality Management in subjectivity and experience- focused domains, such as the tourism industry [20,21].

Engineering in this sense means to construct product properties that lead to a repeatable effect on the perceived user experience. Therefore we should gain a good understanding of what is influencing the experience, no matter if single quales, mixtures of quales [18] or representations of the latter cause this reaction-dependency of UX.

Direct vs. Interpreted

Do you know how you feel, before someone asks you? Basically, this property seems not to hinder the construction of UX. The fact, that qualia are directly accessible to

consciousness only means that the experience does not depend on beliefs, or any other mental force. [14] discusses cases, in which qualia seem to be biased, similar to biased cognitions. Tye [17] supports this to a certain extent by postulating the co-existence of qualia and „rationalia“. For engineering, the influence of inference, beliefs and cognition on experience are important moderating context factors that have to be understood for the analysis of the causal influence of product characteristics on subjective experience.

Unanalyzable vs. Discriminable

Dennet [14] challenges the property of unanalyzability and introduces the case of a student of music, who learns to discriminate notes, tones and instruments within music. He argues that where before there was a unique experience of listening to music, now the student is able to discriminate different (sub-) experiences. Further the student is able to describe the music to others in a way, it can be repeated independently from person, time and space. Dennet argues [14, p. 71]: „If I wonder whether your blue is my blue, your middle C is my middle C, I can coherently be wondering whether our discrimination profiles over a wide variation in conditions will be approximately the same. And they may not be; people experience the world quite differently. But that is empirically discoverable by all the usual objective testing procedures.“ Tye [17] counters that discriminating differences does not mean analyzability. He uses perception and attention as explanatory means: „increasing attention on an experience can increase the complexity of inner-perceptual representations“

For engineering, the ability to discriminate relevant differences and the ability to specify them in a way they can be reconstructed, independently from person, time and space is enough to be called „analyzable“, the mental components involved in the discrimination process are not of interest here, they could be important as a moderating context factor, just as discussed for the prior property.

Reliable vs. Biased

This property seems to be related to „Intrinsic“ and „Direct“. Tye [17] expects qualia to be not more reliable than any other kind of perception of inference. Qualia that are part of experiences within a dream are not less an illusion than other „ordinary perceptual illusions“. Dennet [14] supports this by claiming that „qualia are constructed out of judgements“.

The relevance of this property for engineering has already been discussed within „Intrinsicness“ and „Directness“.

Private vs. Intersubjective

It does not seem useful to build software- products for private“, interpersonally „incomparable“ experiences, unless such products would be able to sense and adapt its properties to the private „what it is like“. So if a product aimed to elicit a specific experience (e.g. redness), in the

future it would have to possess the ability to recognize the user's private experience and adapt its properties to increase the probability of such redness. Currently, constructing products aiming to adress qualia only seems beneficial, if there is such a thing as interpersonal comparison or in other words intersubjectively shared user experiences. In such terms, instead of being *private*, we will comprehend UX as a property that is subject to the mathematical and statistical principles of measurement theory. Then, UX for a specific product will have a specific value that can be measured intersubjectively and engineering can come up with a claim such as: „For most (e.g. 68%) of the users, the UX of a specific product is between x and y". According to this perspective, UX of a specific product has and subjective measurement means to have a "true" value (with a certain probability), a "true" variance (with a certain probability) and a certain measurement- error. Objective measurement at the opposite means having a "true" value, a certain measurement- error, but no "true" variance.

The intersubjective perspective will allow engineers to correlate product properties with probabilities of UX-values [4] and increase, in a mathematical sense, the probability to elicit the desired effect on subjective experience – of course with a (predictable) probability to fail (to face those users that are beyond the above mentioned 68% of the frequency distribution).

GOAL-ORIENTED OR TELEOFUNCTIONALISM

The term teleofunctionalism was phrased by Dennet [14]. In systems engineering, teleological is frequently used as equivalent to goal-oriented, goal-based or purposive; it means that systems engineering applies a method where the attributes of the goal of an activity are used for the specification of the system. In such sense, all engineering is, by definition, teleological and oriented on a goal.

According to the teleofunctional view, postulating such a concept as UX must follow a purpose, especially if it ought to be used in an engineering world. Greenfield [22, p. 1] even claimed in slightly provocative words (commenting sonys QUALIA- product line): "But why [...] toss around obscure terms from the study of the phenomenology of consciousness [...], when all you're really trying to say is, "We want you to feel special enough about this product that you'll overlook the surreal profit margin on it."

It is doubtful that a common set of goals and purposes for the concept of UX can be found. For sure typical business goals such as market share, profit or company image will-most of the time- trigger the investment in properties that influence UX during engineering. It is also probable to postulate a set of goals from a user's perspective, such as being more effective, productive and satisfied, or from a socially responsible perspective, e.g. to deliver value [23]. In the following section we will present some of the goal-oriented quality models that are currently used in Software Engineering to define, characterize and construct a specific set of quality aspects. Rather than postulating the one and

only quality model, we should aim to find useful models for certain purposes. Engineering's mission is to find ways to raise the probability of reaching those goals to a maximum.

Table 1 sketches a few arbitrary exemplary purposes and relates them to the quality models mentioned in the next section.

Table 1: Relating an exemplary set of purposes to different quality models

Exemplary purpose/ Quality model	QiU	TAM	AMUSE	e4FUN
Predict usage	-	+	+	-
Prioritize features	-	-	+	-
Change users attitude	-	-	-	+
Measure perceived quality	+	+	+	+
Predict customer value	+	+	+	+
Align business goals with user goals	-	-	-	+

QUALITY MODELS

Software engineering (SE) aims to make the quality of software systems predictable in early phases of development and repeatable during the usage of these systems. Usually, quality is reduced to a specific set of components, which define the type of quality. In the following sections we will shortly mention different approaches that address the subjective experience during the usage of an interactive system and therefore seem to be related somehow to the concept of UX.

Quality in Use

The most accepted and prevalent model in SE that has conceptual familiarity to UX is Quality in Use (QiU), which has been introduced by Nigel Bevan during the development of ISO9126 [24]. QiU according to the standard is a composition of the aspects:

1. *Effectiveness* (ability to achieve specified goals),
2. *Productivity* (appropriate amount of effort spent to achieve specified goals),
3. *Safety* (acceptable level of risk) and
4. *Satisfaction* (satisfying the user in a specified context).

Basically, QiU- characteristics can not directly be manipulated during development; developers have to measure and manipulate them indirectly via the (objectively

measurable) internal and external quality characteristics of the objects available during development.

TAM

The Technology Acceptance Model (TAM) was developed by Davis [25], in the context of management science. It's purpose within product management is the overall evaluation of a product regarding attitude conformity and usage expectation from the user's perspective. Thus, TAM is based on theories that confront the expected usefulness of a technical product with the degree of difficulty in approaching this usefulness, namely the ease of use. In recent investigations [26] intrinsic aspects are also being considered. Summarized, Technology Acceptance is reduced to:

1. *Usefulness*

2. *Ease of Use*

3. *Intrinsic Aspects*

In engineering TAM is of limited use for construction, due to its black box view on product characteristics. Its purpose is mainly on evaluation of the acceptance of products.

AMUSE

The AMUSE quality model [27] is theoretically founded in both models mentioned above and was additionally influenced by the understanding of user satisfaction in the medical industry. In order to measure user satisfaction, a questionnaire was developed and evaluated according to its structure, its validity and its reliability. The components of the AMUSE model are listed below.

1. *Effectiveness,*
2. *Productivity,*
3. *Joy and Appreciation*
4. *Trust*

In contrast to the QiU- Model [24], the AMUSE model underlies substantial empirical analyses and is constantly improved on the basis of the data collected. Previously published findings of structural equations [27] show the restricted predictive power of AMUSE. It is capable to uncover between 60 and 65% of self reported overall satisfaction. Because this limitation can only be known on the basis of empirical data, the limitation of other models, such as QiU is unknown. Although the TAM model has a solid empirical basis, its applicability for engineering is limited due to its blackbox view on quality, while the AMUSE quality model is directly embedded in an engineering method that supports the prioritization of features in early phases of development [27].

e4 FUN

The e4 FUN model [28, 29] approaches the concept of joy during the usage of interactive systems in a cognitive behaviorist manner. It completely abstains from subjective experience and focuses on behavioral and cognitive effects software properties have on users. Hence, fun-of-use in the e4 FUN model is not about feeling happiness, but about motivation, attitude, creativity, concentration and willingness to work. It is divided into the following four dimensions:

1. *Execute- FUN is when nothing hinders me:* Here, the application should not prevent the user from accomplishing his task, but allow for an effective, efficient and adequate working, that is, usability. This dimension is mainly founded on models of human cognition and human failure.
2. *Engage- FUN is when I meet my motives:* The key concept of this dimension is motivation, Users shall be (re-) motivated and engaged during interaction.
3. *Induce- FUN is when I change attitude:* Here, users' attitude should change towards a predefined goal. Its key concepts are attitude and persuasion.
4. *Expand- FUN is when I get illuminated:* The main concept in this dimension is creativity. The target behavior for the users would be to acquire new tasks or goals by developing novel and creative ideas or usage scenarios the product has not been designed for.

In Engineering, for each of the dimensions described above, the authors propose triggers for interaction design that facilitate at least one of these cognitive or behavioral goals. These triggers and associated design patterns are being empirically evaluated in the FUN-project [30].

CONCLUSION

The aim of this paper rather than providing a holistic model of UX is to understand UX as a useful concept for product design. The following sections will summarize principles, policies and plans on a way towards a common understanding of UX.

Principles

Without questioning the richness and uniqueness of User Experience, we propose to abstain from the ineffable, intrinsic, direct, unanalyzable, reliable and private properties experience surely has. Instead we propose a different interpretation of these properties that leads to a higher usefulness for engineering due to its measurable and predictable characteristics.

We propose to define UX as a concept with the properties: simplifiable, influenceable, probably biased (dependent of context and belief), discriminable, and intersubjective.

These dimensions follow a goal- hierarchy (Figure 1), which on the top level allows defining the *purpose* of the UX model (e.g. typical business goals or ethical goals).

Other levels in the hierarchy describe the *behavioral, cognitive and emotional* consequences for a user and the *quality models* that capture associated *measurable phenomena*. All these levels are to some extent influenced by *product properties* that have on the one hand objective characteristics, but are on the other hand subjectively perceived. Since the perception of product properties is biased by differential states and traits, such as beliefs and expectations, but also from situation and context, we help ourselves by integrating the construct of a *perception filter* into a potential UX model such as proposed in [20].

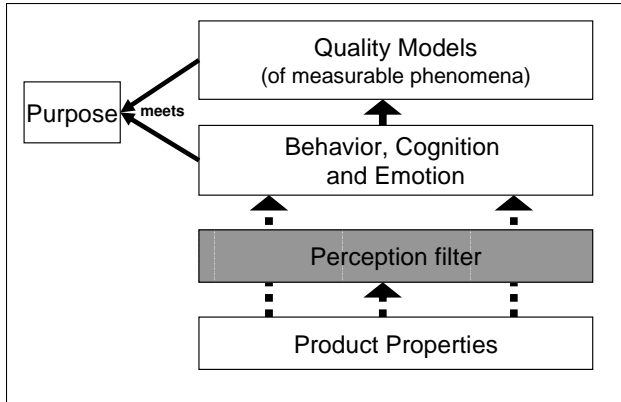


Figure 1: Purpose Driven UX Model

Policy

It seems to be necessary to define a set of possible purposes and decide which of these purposes are welcome in a field of UX and which are not. Only based on those purposes it can be decided, which ontologies are allowed in and which are rejected from a standard UX model.

In any case, a concept of UX that ought to be used in the engineering of interactive systems has to be measurable in different levels of development. Early specifications need to be verified and validated, as well as intermediate artifacts and final products. Measurement devices with well known predictive validity are necessary. Predictive models that capture domain specific knowledge of the variance of the “true” value will be necessary to be able to assess and increase the probability to manufacture products that lead to a pleasant UX.

The relationships between product properties and behavior, cognition and emotion must be analyzed empirically among a large set of products. Academy and industry have to cooperate applying a standardized set of metrics, a common model and ways to share data.

Plans

Future research in the field of UX will determine a framework to identify the desired behavior, cognitions and emotions of a user of interactive systems, based on specific top- level goals (purposes).

Empirical evidence of the relationship between behavioral, cognitive and emotional consequences and properties of a product (an interactive system) will have to be systematically collected.

(Sets of) Measurement devices have to be selected or developed, to be able to assess success and cope with iterative development.

Engineering processes that make use of the necessary artifacts, tools and knowledge will ease the acceptance of UX in industrial contexts.

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User experience: usability, aesthetics and emotions in human-technology interaction

Sascha Mahlke

Berlin University of Technology
Franklinstrasse 28/29 – FR2-6, 10587 Berlin, Germany
sascha.mahlke@zmms.tu-berlin.de

ABSTRACT

This paper describes the outcomes of a project that focused on the integration of non-instrumental qualities like aesthetic and symbolic aspects and emotional user reactions with traditional, instrumental-focused approaches to users' experience of interaction. A research framework is described that conceptualizes user experience as a phenomenon consisting of instrumental and non-instrumental quality perceptions as well as emotional user reactions. Methodological consequences are discussed in particular for the measurement of users' non-instrumental quality perceptions and their emotional reactions during the interaction. Additionally, three studies are reported that addressed various assumptions made in the research framework empirically. Concluding, a reflection section discusses principles, policy and plans for user experience research.

Author Keywords

User experience, non-instrumental qualities, aesthetics, symbolic aspects, emotional user reactions.

ACM Classification Keywords

H5.2. Information interfaces and presentation: user interfaces: user-centered design.

INTRODUCTION

To date, approaches to the evaluation of interactive systems have mainly focused on tasks and goals, their efficient achievement, and the cognitive information processing involved. In the past few years, various ideas have been discussed that go beyond the notion of efficiency and that aim to better understand how people experience technology. In this regard, two important concepts have been explored: non-instrumental qualities and emotions [3].

Non-instrumental qualities can be described as quality aspects that address user needs that go beyond tasks, goals and their efficient achievement. Different approaches to non-instrumental qualities can be found in the literature. Jordan [6] argued for a hierarchical organization of user needs and claimed that along with the functionality and usability of the product, different aspects of pleasure are important to enhance the user's interaction with it. Further analyses studied selected non-instrumental quality aspects

of interactive systems in detail, such as hedonic quality [4] and visual aesthetics [7].

Recently, the term emotional design has received significant attention [16]. Desmet & Hekkert [2] went a step further by presenting an explicit model of emotions according to product perceptions. Zhang & Li [21] studied the concept of affective quality as the ability of interactive systems to cause changes in the user's affective state.

In this way non-instrumental quality aspects and the role of emotions were studied individually for a more in-depth understanding. However, to assess interactive systems regarding the user experience as a whole these various aspects have to be integrated to fully understand and compare users' experiences of interaction with different systems.

Although various studies were reported that contribute to a better understanding of the role of non-instrumental qualities or emotional user reactions as part of the user experience, only a few approaches exist that integrate instrumental and non-instrumental qualities as well as emotional user reactions into one framework. Rafaeli & Vilnai-Yavetz [18] studied the interrelations between instrumental and non-instrumental quality aspects as well as emotions in a non-interactive domain. Tractinsky & Zmiri [19] transferred this approach to the area of websites. The project described here aims to carry on these first steps and aims to lay a more elaborate theoretical basis, use a broader methodological approach and provide further empirical results on this research problem. For pursuing this approach, three building blocks are addressed:

- a model specifying the major components of user experience and their possible interrelations,
- a set of methods to measure these components, and
- a number of empirical studies applying these methods to test the model by analyzing which factors influence the relevant aspects of the user experience.

THE USER EXPERIENCE RESEARCH FRAMEWORK

In Mahlke & Thüring [14] we describe an integrated research approach to the experimental study of emotional user reactions in consideration of instrumental and non-instrumental quality perceptions of interactive systems (Figure 1). A model is presented that defines instrumental and non-instrumental quality perceptions as well as emotional reactions as three central components of the user experience. Characteristics of the interaction impact these three components. Interaction characteristics primarily depend on system properties, but also user characteristics and context parameters can play an important role. The actual consequences of the user's experience of an interaction, meaning the overall judgments of a product, usage behavior or user preferences of alternative systems are defined as outcomes of all three central components of the user experience, namely emotional user reaction as well as instrumental and non-instrumental quality perceptions.

This research framework is used as a basis to study the interrelations of important aspects of the user experience [20]. In comparison to other user experience models [e.g. 4], this framework explicitly defines emotional reactions as an integral component of the user experience and not as a consequence. Accordingly, cognitive and emotional aspects constitute the user experience. Next to system properties, context parameters as well as user characteristics are considered as relevant influencing factors. Furthermore, the model distinguishes three main categories of non-instrumental qualities and incorporates aesthetic aspects. Emotional aspects are considered based on a multi-component approach from emotion psychology [13].

METHODOLOGICAL ASPECTS

As non-instrumental quality perceptions and emotional user reactions are relatively new topics, there are no established methods for measurement available as in the area of usability research. That is why another focus of the project is on methods to measure non-instrumental qualities and emotional user reactions.

In Mahlke [8] various approaches to the study of non-instrumental quality aspects were reviewed. Summarizing, in most existing approaches two distinct categories of non-instrumental qualities are differentiated. On the one hand, aesthetic aspects are discussed. These refer primarily to the visual aspects of a product, but can also consider other sensual experiences like the haptic or auditory aspects of product use. The other category refers to a symbolic dimension of product appearance. Symbolic aspects refer to an interactive product's meaning in the communication with others. Based on this differentiation, we integrated questionnaire scales on visual aesthetics, haptic quality, auditory quality, and symbolic qualities and applied them in a study on non-instrumental qualities of mobile phones [11]. The results suggest that both aesthetic and symbolic qualities are important for users' overall judgment and that a detailed view on specific sub-dimensions can contribute to a better understanding of a product's quality.

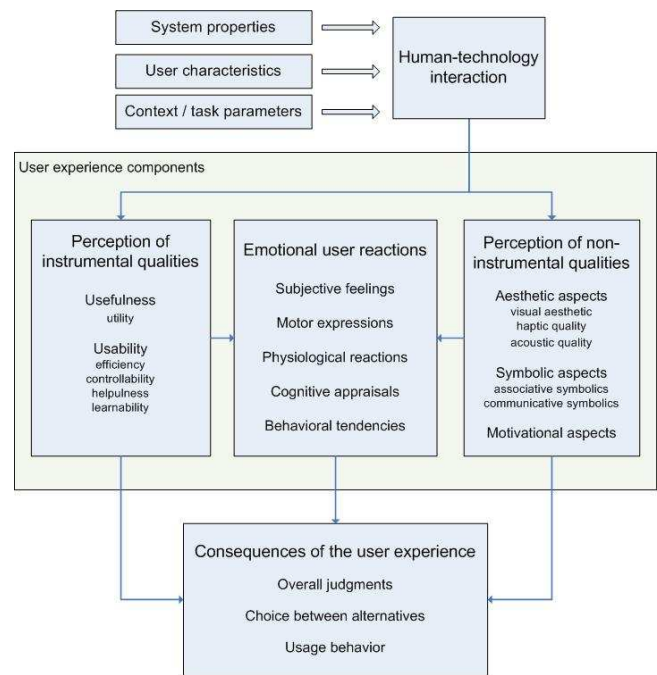


Figure 1. User experience research framework.

Regarding emotional user reactions we applied a multi-component approach from emotion psychology to the area of human-technology interaction [13]. We conducted a study to compare and integrate different approaches to emotion measurement. Based on the multi-component approach to emotions different aspects of emotions in an interactive context were investigated: subjective feelings, physiological activation, motor expressions, cognitive appraisals, and behavioral tendencies. We used questionnaire methods to assess subjective feelings and cognitive appraisals, measured heart rate and dermal activity as physiological reactions, applied electromyography (EMG) to learn more about facial expressions and analyzed performance data to get an insight into behavioral tendencies. The results suggest that a combination of methods that assess different components of emotional reactions provide a comprehensive basis for analyzing emotions in human-technology interaction.

EMPIRICAL RESEARCH

In three studies the methods discussed in the previous section were applied to test certain assumptions of the research framework.

Study 1

A first study was conducted using the research framework as the basis for assessing user experiences with existing products [9]. Four existing portable audio players were chosen for the study. All were from the same manufacturer, so we did not have to deal with the influence of brand. Nonetheless, players differed in terms of various design aspects.

Thirty individuals participated in the study and tested each product. Four short tasks were given to the participants for each product. After accomplishing the tasks, participants filled out a questionnaire that assessed ratings on different experience dimensions (usefulness, ease of use as instrumental qualities; visual aesthetics, haptic quality, and symbolic quality as non-instrumental qualities) and emotional user reactions (only subjective feelings). After using each of the players, participants made a ranking list of the players.

The results showed that instrumental quality aspects, i.e. the usability of the system had a main influence on the emotional user reactions, but also that the non-instrumental aspects play a significant role. All three components had an influence on overall judgments.

Study 2

For the next study, simulations of portable audio players were designed to influence the perceptions of instrumental and non-instrumental qualities experimentally and independently [14]. To produce two versions with different impact on the perceived instrumental qualities, the information presentation on the display was varied. With respect to system features that should influence the perception of non-instrumental qualities, we manipulated the visual aesthetics by creating two different body designs. The variations resulted in four different combinations: (a) 'high usability' and 'high aesthetics', (b) 'high usability' and 'low aesthetics', (c) 'low usability' and 'high aesthetics', (d) 'low usability' and 'low aesthetics'.

Forty-eight individuals participated in the study. All participants tested two of the simulations. Five short tasks were given to the participants for each version. Before accomplishing the tasks, subjects rated the visual aesthetics of the version. During task completion, heart rate and dermal activity as physiological measures as well as an EMG to assess facial expressions were applied. After completing each task, participants filled in a scale to measure subjective feelings. When all tasks were finished, the usability of the system was rated, and finally the two system versions were ranked.

The results showed that the variations of usability as well as aesthetics had the predicted impact on the perception of both types of qualities. Systems with features leading to a high degree of usability and attractiveness received better ratings than their impaired counterparts. The results of the subjective feelings questionnaire revealed that the effect of usability was greater than the one of visual aesthetics for both the valence and the arousal of the subjective feelings. Consequently, the system of high usability and appealing design was experienced as most satisfying, while the system of low usability and least attractiveness was most annoying. Since no statistical interaction of usability and aesthetics was found, both factors contributed to these emotions additively. The data on facial expressions and physiological reactions supported this interpretation, though

it must be noted that we did not find differences in all measured variables. Finally, the overall judgments pointed in the same direction as the ratings of perceived qualities and emotions, and revealed a greater impact of usability on the overall appraisal of the systems.

Study 3

In the latest study, again four simulations of portable audio players were used that differed in usability and visual aesthetics [12]. Furthermore, contextual parameters were varied. In a goal-mode participants had to accomplish given tasks, while they had the same amount of time to explore the system on their own in an action-mode [5]. Additionally, data was collected in two cultural settings (North America and Europe) to address differences in user characteristics. Besides, users' centrality of visual product aesthetics was considered [1]. Regarding emotional user reactions, we focused on subjective feelings and cognitive appraisals.

Results show that specific system properties independently influence the perception of instrumental (i.e. usability) and non-instrumental qualities (i.e. visual aesthetics). Especially the perception of instrumental qualities was shown to have an impact on the users' emotional reactions (subjective feelings as well as cognitive appraisals). Furthermore, Study 3 demonstrated the relevance of user characteristics and contextual parameters. The influence of centrality of visual product aesthetics on the interrelations of user experience components was demonstrated. Furthermore, the usage situation as an example of context variation showed additional impact. The results make clear that it is important to take the interactive system's properties and also characteristics of the user and the usage situation into account when designing and evaluating interactive systems.

CONCLUSIONS

The research framework on user experience and the outcomes from the preliminary work on methods to measure non-instrumental qualities and emotion were applied in three studies to better understand the interrelations of antecedents, important components and consequences of the user experience. The framework and methods can be used as a basis for further research on the user experience. The results of the three studies show the importance of all three components of the user experience, namely instrumental and non-instrumental qualities as well as emotional user reactions, and give first hints about their connections. Furthermore, they demonstrate the influence of three categories of influencing factors in detail: system properties, user characteristics and context parameters.

In a last step of the project, the assumptions regarding the research framework on user experience, the methodological recommendations and the results of the empirical studies will be summarized in recommendations to support the design and evaluation of interactive systems during the development process.

REFLECTION SECTION

Based on the discussed work in the area of user experience research, this section addresses the main themes of the workshop: principles, policy and plans.

Principles

It is obvious that the approach to user experience described in this paper is based on experimental psychology. In the research framework, components are defined that are supposed to interact with each other to form the user experience. Methods are proposed to measure each of the components and their sub-dimensions. It is assumed that the user experience can be studied by combining results regarding these various components. However, one aim of the project was not to focus on one specific aspect of the user experience, but to combine at least some of the relevant components of the user experience in one approach.

Hassenzahl & Tractinsky [3] defined three threads of research in their user experience research agenda: needs beyond the instrumental, affect/emotion and the experiential character of UX. The research approach described here focuses on the relation between traditional, instrumental approaches to interactive product quality and two of these threads: non-instrumental qualities and emotional user reactions.

However, situatedness and temporality as two other aspect of the user experience are mostly neglected. Only context parameters are investigated as one aspect of situatedness. The dynamic character of the user experience is not considered. Dynamic aspects of the user experience – on a small scale from minutes to hours as well as on a larger scale from days to months – are one major aspect for future user experience research.

The integration of phenomenological perspectives and cognitive science inspired approaches is from my point of view a big challenge for user experience research. Marc Hassenzahl and I already discussed this question and agreed that an answer is important [10]. However, at the moment I have no good idea how to combine the perspectives; for example, relating the approach described here to the framework by McCarthy & Wright [15]. Nonetheless, I think that a solution is necessary to avoid a situation in that energy is wasted in discussions between these two perspectives instead of promoting the concept of user experience in discussions with people who doubt the relevance of the concept at all.

Policy

From my point of view, asking the question of ‘what is the experience like for the user?’ is the basic question underlying all user-centered design [17]. User experience research, as I understand it, gets directly at the question of the quality of the user’s experience.

As already described in the research framework above, usability can be seen as one important aspect. However,

user experience is exclusively concerned with the user’s perception of a system’s usability. Designing for high performance – as usability is often defined today – does not necessarily have to be associated with a user’s perception of usability. If performance is relevant for the user in a specific usage situation, it is relevant for her or his experience in this situation as well – but it has not to be. The same is true for other quality aspects like reliability, security or accessibility. If these quality aspects are relevant for the user, they affect the user experience – if not, they do not.

Emotional product design can be seen as another field of research that is overlapping with user experience research and design. However, from my understanding emotions are only one aspect of the user experience. Therefore, they are also one design criterion, but not the only one.

UX standards and related product attributes are a complicated topic as long as the concept of user experience has not been defined properly. In general, user-centered design processes like ISO 13407 should be suitable to design for a positive user experience, as they are to design for usability. However, design criteria will be different and these depend on a sound definition of the concept.

Plans

Taking a componential approach to user experience makes it easier to answer at least the question of how to evaluate UX. Componential frameworks like the one described above define certain components of the user experience and make proposals how to measure these aspect. Nonetheless, the question remains if by measuring the components separately the sum of the experience can be assessed.

A design for user experiences can only be achieved if a good idea of how to conceptualize the user experience exists. This is a precondition for thinking about design for user experiences. However, to take a user-centered design approach to user experience that iterates between design and analysis/evaluation phases, it is necessary to have one theoretical foundation of user experience for both design and evaluation.

Furthermore, a user’s experience of the interaction with an interactive product, service or system may be only one part of her or his overall customer experience with a company. Some approaches to experience design claim to incorporate all aspects of the customer experience into experience design processes. However, I think that it sensible to focus on the user experience of interaction as one aspect of the overall experience because only this part of the experience can be influenced by the design of the interactive product.

To summarize, from my point of view UX is not an absolutely new perspective on interactive system design. It just takes the claim of user-centered design to the extreme. If a usage situation is designed considering the user experience, all cognitive and emotional needs of the user have to be kept in mind.

ACKNOWLEDGMENTS

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User Experience from Product Creation Perspective

Virpi Roto

Nokia Research Center

P.O.Box 407, 00045 Nokia Group, Finland

virpi.roto@nokia.com

ABSTRACT

This paper describes some viewpoints for user experience from a large corporate. Nokia manufactures mobile devices, towards which people often have strong emotions, so user experience is highly valued inside the company. Nokia has a long history in designing for, evaluating, and managing user experience, and is well aware of the challenges in these activities. It is relatively easy to investigate UX with existing products, but it is much harder to investigate UX with an early concept idea or a single new feature that does not actually work yet. It requires understanding the fundamentals of user experience.

REFLECTION SECTION

As user experience (UX) covers many research fields, and each discipline has different viewpoints to UX, shortly explaining my route to UX research hopefully helps to understand my viewpoints in this workshop. I come from HCI field, with computer science education but a long career in usability of software and hardware systems. My main motivation is to make user experience easy to manage in a product creation process, so that customers would be happy and loyal users of the resulting products. I am also hoping to include value of an experience (Cockton 2006) inside the definition of user experience, as it is the long-term value of the system that makes our customers loyal.

I grew confident for the need of user experience years ago, starting from the design perspective: some people just love their gadget because of its industrial design. They do not care too much about usability, as long as the look pleases them. Second, in long-term field studies, we often notice users give feedback about social and emotional aspects, not only about utility and usability of the tested system. Third, when conducting user needs studies in contextual inquiry manner, the findings point us to needs that are well beyond efficient task accomplishment. Why a family man prefers a mobile phone to a PC for browsing the Internet at home? Why do we see so many fancy phones on the tables of a popular Indian café? I have examined the theories behind UX in my PhD thesis (Roto 2006), and since then I have been working e.g. on the UX elements that help in UX evaluation. Understanding the underlying user needs, both pragmatic and hedonic, is the key in providing good systems for customers and thereby in business success.

PRINCIPLES

Before we can gain a common understanding about UX and make science out of it, we should be able to formulate a definition that everyone can agree on. There are a number of UX definitions out there; below a few of them.

“All the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they’re using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it” (Alben 1996)

“The overall experience, in general or specifics, a user, customer, or audience member has with a product, service, or event” (Shedroff, online). Shedroff defines experience separately as “the sensation of interaction with a product, service, or event, through all of our senses, over time, and on both physical and cognitive levels”.

“Every aspect of the user's interaction with a product, service, or company that make up the user's perceptions of the whole”. (UPA 2006)

“All aspects of the end-user's interaction with the company, its services, and its products.” (Nielsen-Norman group, online)

“The overall experience and satisfaction a user has when using a product or system.” (Wikipedia, online)

“A result of motivated action in a certain context.” (Mäkelä & Fulton Suri 2001)

“A consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.).” (Hassenzahl & Tractinsky 2006)

Subjectiveness: Few definitions communicate even the very fundamental fact that user experience happens inside the person. Lesson one in differentiating user experience from usability is to understand that usability is a product attribute but user experience is personal, subjective feeling

about the product. A good definition would explicitly say what kind of mental state user experience is, e.g. a sensation, feeling, emotion, emotional bonding, or attitude. This depends on how momentary and instantaneous we see UX is.

USER experience: Many researchers do not want to talk about user experience but plain experience (e.g. Forlizzi & Battarbee, 2004) so the definition should state how *user* experience differs from experience.

- User experience involves a product/service (or a system in general), whereas experience does not require it. Watching a sunset is an experience, not user experience.
- User experience involves interacting (or the possibility to interact) with a system at some point, whereas 'experience' does not require it. Smelling, or even seeing, neighbor's cake is an experience, not user experience, until the neighbor invites you to take a piece.
- It is debatable if eating the cake creates a user experience or just an experience: am I a 'user' of the cake? I claim we can talk about user experience whenever there is interaction with a product, even though the product is not interactive. A cake does provide user experience, because I interact with it: I touch the cake and feel how soft it is, and biting the cake gives delicious taste as 'feedback'. That is how I interact with the cake.

Expected UX: Before a person starts to interact with a product, she has expectations for it. The smell and look of the cake gives her the first idea about the cake, and neighbor's description of the cake adds detail to the expectations. But until the interaction starts, we cannot talk about user experience. Similarly, we cannot talk about user experience right after seeing an advertisement of a product. I call the experience before actual interaction as 'expected user experience', not user experience (Fig 1). Brand image, other people's opinions, advertisements, test reports, and earlier experiences with similar products form the expectations. The expected UX plays a key role when the actual user experience takes place, as the person will evaluate the goodness of UX against the expected UX. From the moment when the product gives feedback to user's action, through whichever sense, we can start to investigate UX.

Beyond interaction: Most UX definitions claim that UX takes place while interacting with the product. This means UX is seen as a momentary emotion, and so, can be evaluated with psycho-physiological measurements. Although I see the importance of these measurements for highly experiential products such as games, I think the interaction focus is a too narrow view to user experience. My user experience with a shirt changes when I read that a pop star wears the same shirt, or when my friend says the

shirt manufacturer exploits child labor. So, product user experience changes even when I am not interacting with the product, but just get new insights about it or its manufacturer. From the industry perspective, it is the long-term user experience that matters in business success, not a momentary emotion that might, in the end, be meaningless to the user. I see Overall UX to consist also of the phases outside interaction (Fig. 1). According to these lines, UX is the attitude and emotional bonding towards a product, rather than a transient emotion during interaction.

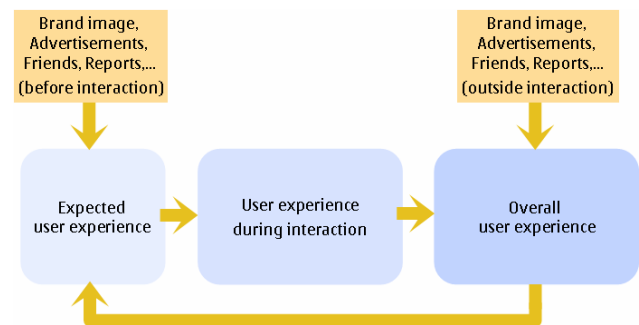


Figure 1. Phases of UX

During interaction: Although UX happens also outside the interaction phase, interaction is definitely an important phase to affect product UX. Investigating the interaction phase is important in order to improve a product, as there we see which features and components create good UX and which do not. To understand UX during the interaction phase, we need to see the effect of the three components to UX: user, context, and the system being used (Hassenzahl & Tractinsky 2006). To improve product UX, our focus is on the system component. Still, context and user cannot be forgotten, but in order to provide the best UX, the system should adjust to the current context as well as to user's current needs and expectations.

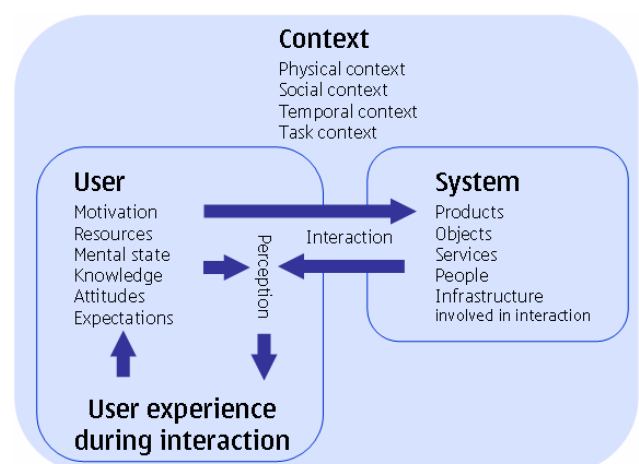


Figure 2. UX during interaction

Granularity: As discussed already above, we can analyze UX on different granularity levels. An example of a detailed granularity level is the UX of a single key click, e.g., was the key easy to press; was the tactile, auditory, and visual feedback pleasurable? A higher level of granularity is a use case: did the user achieve what he wanted by using the system the previous time, and did s/he enjoy that use case? On the highest level, we can investigate the relationship between the product and the user, even after s/he has replaced the product with a new one. All these different granularity levels provide useful information about UX, and can be used for different purposes. If we want to improve a specific product detail, we can create several alternative designs of that detail and apply the smallest granularity level to evaluate the different designs. If we want to understand which features work well for different users in different contexts, we apply the use case analysis level. If we want to understand the value and importance of a product to the user, we apply the overall relationship level. It is interesting to study how the smaller user experiences correlate with the overall UX.

Measurability: Although UX is a complex concept, it must be measurable on the different granularity levels and on the different phases of UX lifecycle (Fig 1). It would be beneficial to have a set of UX elements that apply to all kinds of interactive products/ services and could be used to measure if a product/service provides good user experience or not. This helps running UX evaluations routinely with an agreed, standard set of attributes and thereby see trends and differences between different products. We should pick 4-8 elements, both pragmatic and hedonic (Hassenzahl 2003), to describe the measurable characteristics of UX with all kinds of products and services. More elements can be added to different product categories as needed. I propose to include the following elements:

- Utility – does the product serve its purpose
- Usability – is the product easy to use
- Enjoyment – is the design & interaction enjoyable
- Pride – is the user proud about the product

POLICY

In this chapter, I examine how UX relates to usability, technology acceptance models, and worth-centred design.

I see usability to form one part of UX, although the objective measures of usability, such as number of errors and time to complete a task are irrelevant for UX. UX covers the subjective parts of usability only, so a large part of efficiency is outside UX (Fig 3), as it is dependent on *user's perception* about how effectively he could reach the goal.

Technology acceptance models concentrate in the early phases of UX lifecycle: the expected UX and the UX in the first times of interaction (see Fig. 1). The focus is in the phase where a person either starts to use a system or not, so the acceptance lifecycle stops to the point where the user

accepts the system and starts to use it actively. In contrast, UX starts only from the first interaction phase, and continues as long as the user remembers the product.

Acceptance does not necessarily mean good UX. A user may accept a technology just because there is no better technology available to fulfill a need. The user experience may be poor even if the user starts to use a technology. While the components in technology acceptance models are also relevant for UX, UX consists of something more, e.g. of pleasure or joy.

The discussion about the scopes of usability, acceptance, and UX should be broadened to include the scope of worth-centered design (Cockton 2006). I think the current UX research does not take the value aspect seriously enough, but just expects that each experience is meaningful for and wanted by the user. I would like to extend the term UX to include worth (Fig 3).

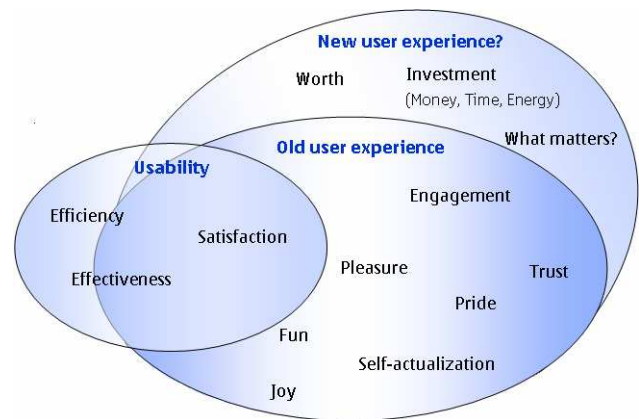


Figure 3. The scope for UX

Should UX be standardized? A commonly agreed and shared UX definition is important for teaching, researching, and managing UX. Having UX standardized would help in the short run, but we would be tied to the standard for the rest of our lives. This might be dangerous for the developments of UX. If we know enough of UX to standardize it, I do not object. Still, this is Internet age, and things are changing rapidly. Could we live with an online definition, and have it available for public in Citizendium.org (reliable, new version of Wikipedia)?

PLANS

Many of the user-centered design (UCD) methods are applicable also to UX design. The design should start by user needs study, that is, by investigating users in real context. There are many ethnographic methods that investigate user needs in their normal setting, including Contextual Inquiry, Spying, and Online ethnography. Based on the user needs, we can derive the design drivers (or UX targets) and more specific requirements for a feature or a product.

As in UCD, iterative design and evaluation should form the key for the process, but evaluating UX in the very early phases of product creation is tricky. As UX is dependent e.g. on the expectations, motivation, and context, it is often hard to get user feedback on an early concept. Is it possible to evaluate just one part of the system when the other parts are not in place yet? The earlier we want to evaluate UX, the lower granularity level we need to choose. UX evaluation in the early phase of product creation process requires more research.

Once the product is on the market, it is beneficial to evaluate UX with people who have taken the product into use of their own free will. These users have had their expectations and motivation to invest into the product, so this is the most reliable phase to investigate UX. The granularity level for the UX evaluation is rather high here, and quantitative methods like questionnaires work fine in this case. Of course, it is too late to improve the product at this point, but the findings can be used for the coming product versions.

CONCLUSION

In this paper, I have stated my perspective to UX, which is influenced by my background in usability and by my work in a large corporate that manufactures mobile devices. I am interested in the model of UX from the product creation perspective, and the psychological aspects inside the user are not in my competence, unfortunately. I noted that UX involves interaction, and discussed how expected UX and long-term UX relate to UX during interaction. This temporal dimension of UX is important to see especially when evaluating UX. Another dimension is the granularity level of UX: Overall UX consists of many smaller experiences. Just averaging the small experiences to the overall user experience would be too simplistic, as some experiences are the more meaningful, or valuable, in forming the overall UX than others. Foreseeing the importance of different small experiences would help in evaluating UX as early as possible in the product creation process.

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Making User Experience a Business Strategy

David Sward

Intel Corporation
Arizona State University Polytechnic
National University Ireland Maynooth
david.s.sward@intel.com

Gavin Macarthur

Innovation Value Institute
National University of Ireland Maynooth
gavinmacarthur@yahoo.co.uk

ABSTRACT

This paper urges the User Centered Design (UCD) community to broaden its perspective to deliver the user experiences demanded by consumers. The challenge for UCD is to integrate with other business disciplines; pool organizational resources; and drive a user-centric approach throughout the organization. This results in UX being embedded in business strategy and emerges as the basis for everything the company does. This paper presents a set of interrelated strategies to assist in delivering a sustainable competitive advantage through compelling user experiences. These include linking UX to the bottom line of the firm; implementing a User Experience Design (UXD) Program; and managing the UXD capability.

Author Keywords

User experience design, user-centered design, business value, competitive advantage, marketing.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Technology has revolutionized the way people conduct business, expanded market places, and created a multitude of business opportunities. As a result users have never been so sophisticated with respect to the products they demand. As firms have rushed to satisfy market requirements this has only served to increase competition [45]. Today products and services stand in the wings – they alone no longer satisfy the market. To compete for center stage organizations must continually deliver compelling user experiences [54, 46].

The UCD community must recognize that user experience (UX) is the embodiment of their discipline. It is UCD's domain, but it is a shared one; where success will come from partnering with other business units. Once the experience is created the "value" delivered must be measured and the UXD capability systematically managed to form the basis of a sustainable competitive advantage [58].

This paper outlines how UXD can be used to create a sustainable competitive advantage; that UX pulls from various business disciplines; and makes the argument that this should be recognized and rather than compete for resources, they should be pooled to achieve a single organizational vision. This realization is vital for companies to compete in the experience economy, one in which customers will pay a premium for the experience provided [46].

To support this vision the UCD community should work on three fronts to generate broad based agreement on an executable plan. The effort should address developing an industry accepted definition, integrating user-centric design with related fields, and developing a well defined set of strategies to execute the vision.

USER EXPERIENCE

User experience; customer experience; consumer experience have striking similarities, but terms and meaning differ depending on the author's discipline [55, 34], and consequently the relevance. If you are involved in Human Computer Interaction (HCI) UX is your agenda, but is customer experience? Many authors discuss the effects, the importance, and barriers to improving the experience without actually defining it [15]. Some consider that UX is an "emergent discipline... without a formal body of knowledge" [34] and some regard that it encompasses all aspects of the end user's interaction with the company and the merging of the services of multiple disciplines [43, 35, 62, 58]. Difficulty in finding agreement on the term could also be due to the fact that it means different things to different organizations [40].

There has been a considerable amount of published work on UX. Efforts include work in understanding UX as it relates to e-commerce design activities [20, 14, 10]. UX is associated with a wide range of meanings and concepts when compared to traditional usability; including aesthetics, hedonics, contextual, and temporal variables [19]. Some researchers focus heavily on the emotional aspect in the assessment of UX [2]. Jordan [31] proposed a needs abstraction model for UX conceptualization, suggesting that products should engage people at three

distinct levels: functionality, usability, and UX. Hassenzahl and Tractinsky [24] take a comprehensive look at what is meant by UX, noting the fast acceptance of the term despite no clear understanding of the meaning. Swallow et al. [57] note that recent work on theoretical models of UX show that it is complex and difficult to define succinctly. While others question the expansion of basic concepts like usability to UX given the lack of agreement on an accepted definition of the concept [41].

User Experience Defined

The definition of UX presented here has its roots in UCD - a philosophy that places the user at the center of all design activities. UCD seeks to humanize our interaction with technology. Figure 1 shows the relationship between UCD and UXD. UXD extends UCD to incorporate all aspects of the end user's interaction with the product or service and the organization that supports it. Experience begins with an awareness of the product or service and includes all aspects of the end user's interaction.



Figure 1. Relationship between UCD and UXD.

UX is the value derived from interaction(s) [or anticipated interaction(s)] with a product or service and the supporting cast in the context of use (e.g., time, location, and user disposition). User value can be actual value (e.g., efficiency and effectiveness), perceived value (e.g., trustworthiness, emotions, satisfaction, aesthetic, social rewards, behavior, entertainment, etc.), or a combination of both. UX is best viewed in terms of the following components: (a) marketing and awareness; (b) acquisition and installation; (c) product or service use; (d) product support; and (e) removal or end of life.

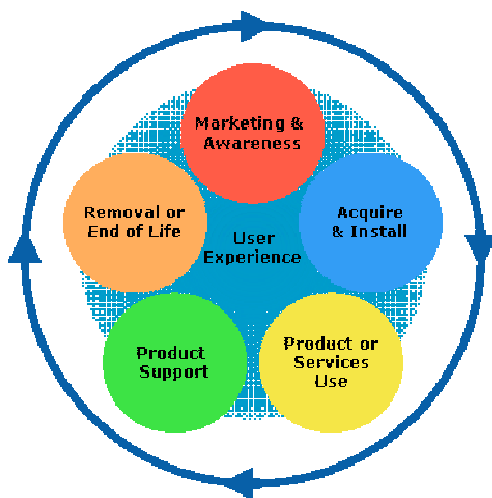


Figure 2. User experience components.

UX has a lifecycle with each component referring to a particular aspect of the user's experience; the importance of each component to the user will vary throughout the life of the product or service (see Figure 2). In addition, the experience will differ based on the product or service (e.g., online gaming vs. enterprise applications vs. e-commerce websites). Users may not encounter every aspect of the experience at the same time, since the experience can unfold over time and through multiple interactions:

- Marketing and Brand awareness focuses on the image portrayed to users before they interact with the product or service, including advertisements, staff interaction, aesthetics, word of mouth, etc.
- Acquisition and Installation includes elements like packaging, first-time setup, integration with other solutions, registration, billing, and so on.
- Product or Service Use can be accurately represented using the concepts of quality in use [28] in that it should be effective, efficient, and satisfactory in the context of use.
- Product Support can include training, support, updates, problem resolution, warranties, and ongoing maintenance.
- Removal/End of Life is the final interaction and possibly the first experience with a replacement product or service.

The user's experience with a product or service is ideally the outcome of a user-centric design process; not a design process in itself. The process an organization engages in is a matter of choice, but the result should encompass the five components. Delivering a good experience requires a wide range of disciplines, such as marketing, ethnography, industrial design, graphics designers, human factors engineering, software engineering, hardware engineering, interaction designers, information architects, and business process analysts, to name a few.

USER EXPERIENCE AND RELATED DISCIPLINES

The UCD and HCI communities focus on the user and it is not surprising that these communities feel UX is their domain. The business community, however, has a customer focused approach that is communicated and practiced throughout the organization as the basis for corporate strategy [44, 16, 1, 36, 32]. Marketing is also a discipline cited for its passion for the user/consumer/customer. Drucker [16], a staunch advocate for a customer focused approach, lamented that so few organizations were willing to use marketing as a basis for strategy. A reason for this could be that like UX, "Marketing" is often poorly defined, wrongly interpreted, badly implemented and while widely discussed little is done to systematically consolidate opinions [1, 42].

Furthermore, theories over what marketing is and its relevance to organizations has become so fragmented that it

has turned into a generic label with multiple meanings [42]. In an attempt to reflect market movement and illustrate its evolution, marketing has coupled its name with trends such as Societal Marketing, Relationship Marketing, and E-Marketing [42]. Experiential Marketing [54] is considered applicable for the new millennium as “the nature of Marketing and what it is seen to represent has been changed and adapted to conform with requirements of the relevant decade” [42].

Blending Marketing and HCI is not a new. In the 1990’s as organizations moved to take advantage of the virtual market place designers and marketers were melded together in a way not previously done. The success of an e-commerce site was now a marriage between understanding user requirements from two separate disciplines with the same goal, creating a winning UX.

The market is calling for further action as we enter the experience economy. The key to this economy is the premise that people will pay a price premium for a “memorable experience” [47]. The success of airlines such as Eos specializing in flights between London and NY who have considered every element of the UX from how to deal with your arrival; comfort within the airport and during the flight; to ground transportation to your final destination [13]. The outstanding success of Starbucks coffee [54] stands as testament that commodities can be translated into profitable entities once you start designing an experience and stop focusing on an isolated product.

The immediate challenge is for UX to become an organizational focus; this requires that “a shared understanding of how to think about customer experience” be built [15]. Furthermore, UX is not “owned” by one discipline [5] and there is agreement that who owns it is not as important as who is going to take the lead [25]. A multi-disciplinary approach is a core tenet of UCD, but the team has to expand beyond the immediate family of skills tightly related to UCD. To get alignment across disciplines a working definition of UX, like the one presented in this paper, will require strong collaboration between disciplines. Success will require more than just an agreed-on definition; it will require the right collection of resources and strategies and a clear understanding by all employees and business partners as to the company’s strategic intent [23] in order to achieve a competitive advantage through user experience design.

Assembling the right resources to deliver user experiences is aligned with work in the strategic management field. This resource-based view of strategy arises from the premise that firms achieve or enhance a distinctive and defensible position (i.e., competitive advantage) by assembling combinations of resources that are scarce and difficult to replicate [3].

USER EXPERIENCE STRATEGIES

UX design and competitive advantage are not new concepts. The two however are not often linked to UCD in any systematic fashion. Explicitly outlining and exploiting this connection is vital for companies to compete in the experience economy.

Internal rivalry for scarce resources and external competitive forces squeeze budgets year after year. Many of the products and the groups that develop them are viewed from a cost center mentality. The lack of knowledge with regard to what is valued, inappropriate allocation of funds, and constant cost validation breeds a culture that stifles innovation as organizations view justifying their existence as their primary objective. Organizations begin to nurture the belief that growth is only achieved by finding the next great new idea [50].

Getting the maximum value from a technology investment is as much about how you manage it as it is about deciding to do it. From a business perspective this is about harmonizing; organizing; managing [11], and identifying value delivered [49, 60]. Link this to UX design to deliver what the market wants and you have the basis for a competitive advantage [58]. Understand how to do it continually and you have a sustainable competitive advantage to assist the corporate strategy [48, 22].

To execute this vision the UCD community must step away from approaches that focus on tactical justifications. We need to broaden our vision of the discipline; see ourselves as integral to the business strategy; become proactive in delivering on organizational objectives; integrate with other business disciplines; and lead a user-centric business orientation throughout the firm. To achieve this UCD should focus on a defined set of interrelated efforts. Strategy one focuses on understanding the value delivered by solutions, strategy two focuses on getting UCD skills embedded in the organization, and strategy three focuses on effectively managing the UXD capability.

Strategy One: Implement a Business Value Program

Organizations need to employ a consistent, repeatable, and objective process that measures value delivered as defined by the customers and users. There are many approaches for quantifying returns. In e-commerce management, using a systematic value-driven analysis approach is aligned with maximizing value creation and minimizing loss to increase business performance [21].

Sward [59] outlines a Business Value Program that is focused on two core ideas:

1. Define product and service value in the language of the customers and users.
2. Link product and service success to the impact on the firm’s top and bottom line.

Executing this strategy is a pre-requisite to demonstrating that products and services impact firms. It facilitates

alignment and development of strategic partnerships with customers and users. It also demonstrates that UCD assists in achieving firm level objectives and understands how to impact the bottom line.

Measuring business value is similar to cost justifying usability [4], but cost justifying usability differs in several important ways. A series of tactical justifications is not a long-term strategy to drive change in how UCD is employed. Work by Lund [39], Rosenberg [52], and Lindgaard [38] summarize a number of other limitations with cost justifying usability. The focus of these efforts should be on measuring the total value delivered in order to understand how it relates to delivering a competitive advantage, not on justifying the inclusion of resources on a project.

Strategy Two: Implement a UX Design Program

If a UCD team is not in place, one should be formed before trying to tackle UXD. Schaffer [53] has an excellent step-by-step guide on building a UCD program. The UXD program is focused on proactively designing, developing, and measuring the UX delivered and managed. Firms deliver the greatest business value when they design user experiences that directly satisfy the user and enable the organizational objectives. For a product or service to have a good UX, necessary activities must be performed by a multi-disciplinary team during all stages of design and development.

Another way to envision the goal of a UXD program is shown in Figure 3 and Figure 4. Figure 3 depicts an organization with each group deploying products and services, and managing or not managing the UX that results. In this case the user's experience is fractured; it is unlikely that it will be a positive cohesive experience.

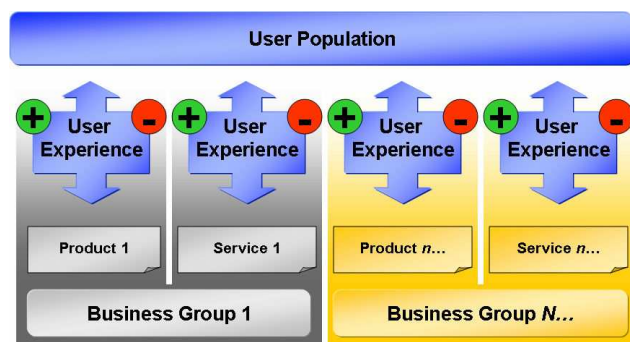


Figure 3. Unmanaged user experience.

Figure 4 shows the desired state, in which organization delivers a UX that is managed across groups. In this case, the user's experience is consistent across the organization. To achieve this, the user's experience has to be designed, deployed, and continually managed. This is more than delivering consistent user interfaces or standards applied to applications. Consistent user interfaces may influence the experience, but they cannot define it. Another way to see this managed UX approach is to understand the relationship

with related efforts like cross channel marketing or customer relationship management efforts that seek to manage the interaction of the firm with the customer.

Implementing a UXD program continues the transition to user-centric organization and implementing a business value program is a good way to get this process started. It is at this stage that the culture shift starts to manifest itself in how the organization thinks about supporting the customers and users.

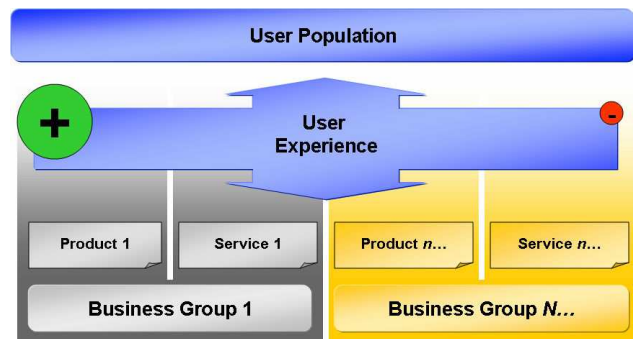


Figure 4. Managed user experience.

Strategy Three: Manage and Grow the UXD Capability

Strategy three focuses on effectively managing, growing, and enabling transformation of the UXD capability to meet changing market demands. This is done by a) measuring the UX with products and services; b) measuring the UX across an interrelated set of products and service, c) measuring the ability of an organization to repeatedly produce compelling user experiences; and d) measure the organizations ability to deliver UX against that of its competitors.

Assessing products and sets of products delivered by an organization measures the resulting UX, the outcome of a user-centric design process. Organizational assessment addresses a group's capability to engage in human-centric design to reliably deliver compelling user experiences. Linking product level assessments and the organization's capability to overall market performance provides an indication of the business value that UXD is delivering to the firm.

Product or Service Assessment

Product or service level assessment requires the creation of a User Experience Index (UXI) that is consistent with an expanded definition of UX. Broad based measures like the System Usability Scale (SUS) [6, 18] and Software Usability Measurement Inventory (SUMI) [33] are universal, but have less diagnostic power when compared to deep measures; which are not broadly comparable since they are based on local experience goal setting for a product; making these deep measures more powerful for risk identification and design decisions. In order to inform product design a necessary outcome at this level is comparisons across and within products. Valid cross product comparisons require the same assessment tool, as

do comparisons to previous versions of products or competitor's products.

For example, early stages of experience assessment (e.g., formative evaluation) are more likely to use product specific questions to diagnose localized design issues, feeding back to requirements. On the other hand, using a broad based assessment tool in formative evaluations will have less specificity with respect to potential changes, but will allow global comparisons between designs and possibly predict market performance (see Figure 5). Valid cross product comparisons will require using the same assessment tool, as would comparisons to previous versions of products.

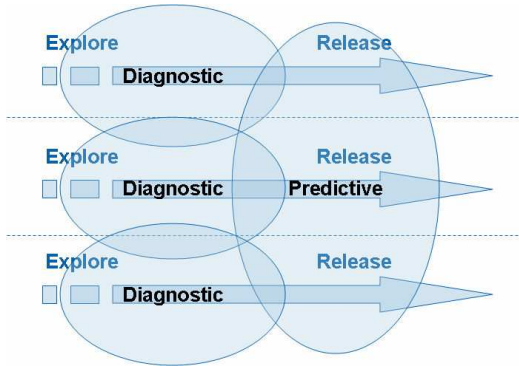


Figure 5. Assessment Location in Design.

A question that arises at the product level is that of domain specific experience assessment. Is the assessment for an enterprise product or a gaming product? These have very different value propositions according to the definition of UX in this paper. UX also has a lifecycle, with each component taking on different levels of importance, so the stage in the experience lifecycle must be taken into account. Finally, how do aspects that are within the definition, but potentially are not part of the user's experience, play into the assessment? For example, enterprise applications often use a forced distribution model so marketing and awareness might not be included.

In addition, there is a growing need for thinking about, and acting upon the experiences of others in ways that are not currently met through conventional approaches to user experience as a social phenomenon, and a market of vast potential. By conceptualizing 'value' as a product or outcome of experience, the actual experiences of users of various artifacts, applications and products in multiple settings can be understood and compared in an innovative fashion, yielding a broadly applicable and adaptable UXi. Accordingly, we are deploying an ethnographic research method to investigate how and why designed things come to have their particular meanings for those who 'interact' with them in the context of culture. This anthropological approach can contribute ideas and material to the "hybridized" research activities of the new wave of multidisciplinary design and development teams envisaged by Forlizzi and Battarbee [19].

Assessment of Product and Service Sets

For organizations that deliver multiple products and services or that have highly interrelated products and services (e.g., financial services); understanding the experience that the organization delivers is important. There are two questions to consider with respect to experience assessment at this level. First, is the experience the summation of the individual UXi scores? Second, is the experience the summation of these individual UXi scores, in addition to another assessment that looks at the entire product and service set delivered by the organization?

Organizational Assessment

Measuring the UX delivered for products and services provides insight in to how it is being managed, but will not answer how capable an organization is at UXD. Assessment at this level can take many forms; Jokela et al. [30] have provided a comprehensive review of approaches. It is important to separate this level of assessment into process assessments [27, 26] and maturity assessments that examine management attitudes [17]. Existing approaches [17, 29, 27, 26] tend to focus on UCD in terms of how well a product team engages in the process and have an assumption that a product is already selected. They also have a bias toward an "outsider in view" of the development process with respect to UCD involvement.

Maturity Level	Major Characteristics
Optimized	Optimize processes, an executive drives UX to respond to business changes and sets firm strategies.
Managed	Managed UXD process with UX recognized leadership, UX is owned by the organization, and UX architecture impacts strategic planning.
Defined	Process metrics to manage UXD and engagements, portfolio owner is accountable for UX, and business process integration with input on product portfolios.
Repeatable	Process metrics for practices in UXD group, PM is accountable for UX, and UXD lifecycle integration with input on product planning.
Initial	Base UX practices, UXD professionals own the UX and are integrated with development teams.

Table 1. User experience capability maturity model.

With this in mind, the Innovation Value Institute at the National University Ireland Maynooth is developing a UX Capability Maturity Framework (CMF). The UX CMF (see Table 1) is a formal approach to assessing an organization's capability to engage in UXD across these dimensions: (a)

user-centric processes; (b) staffing and training; (c) organizational alignment; (d) management commitment; and (e) strategy and visioning. Understanding and managing the capability is central to continually delivering user experiences to result in a sustainable competitive advantage for the firm.

Competitive Advantage Assessment

The results from the assessments are most beneficial when linked to UX success, value delivered, and the firm's competitive position in the market. Research from the web services arena shows that providing a compelling consumer experience is linked to a firm's competitive advantage [51], but this research also has results supporting the view of Information Technology (IT) as a commodity input. This study indicates that some elements of the consumer experience, such as the user interface, are easy for competitors to replicate and therefore this element in isolation did not contribute to firm's market position, supporting Carr's [9] assertion that IT is becoming a commodity. However the same study found that when looking across multiple dimensions of consumer experience, the firm's ability to provide compelling consumer experiences contributed to the firm's market position. This could be seen to support the resource-based approach [3] for designing user experiences as the best strategy to maintaining a sustainable competitive advantage. This interesting contradiction requires further investigation.

REFLECTIONS ON USER EXPERIENCE

The experience economy has arrived and of paramount importance is the user experience. Confusion over UX definitions has created ambiguity as to how to deliver the new market expectations. Furthermore the lack of clarity in definitions appears to be a result of business, technical, and economic disciplines' fervent interest, but with no clear path to execution.

This paper has attempted to reduce confusion by providing a working definition of UX by concentrating on factors that constitute the makeup and delivery of a compelling experience. This recommends building the experience around five vectors to reduce confusion and encourage practical, measurable, effective progress.

No one discipline owns the term. Delivering compelling user experiences requires expertise from several business domains, technical fields, and company wide support. New concepts and approaches need a driver and no discipline is better poised to drive a user experience orientation throughout the organization than UCD. The UCD community should take up the challenge to partner with and appreciate its relationship within the business community. UCD must promote and demonstrate that following the user-centered philosophy is critical to delivering corporate success. The framework and strategy is available to

implement a UCD approach to drive a sustainable competitive advantage.

CONCLUSION

This paper urges the UCD community to broaden its perspective to deliver compelling user experiences. The challenge is for UCD is to agree on a common definition of UX; integrate with business disciplines; pool resources; and drive a user-centric approach into the organization. The goal is to get this line of thinking embedded in business strategy to form the basis of a sustainable competitive advantage. This vision can be achieved through the following interrelated strategies: (a) linking UX to the bottom line of the firm; (b) implementing a UXD Program; and (c) managing the UXD capability.

ACKNOWLEDGMENTS

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User experience and its relationship to usability

The case of e-commerce web-site design

Mark Springett

Interaction Design Centre, Middlesex University
Ravensfield House,
The Burroughs, Hendon
London NW4 4BT, UK
++44 118 9882541
m.springett@mdx.ac.uk

Tim French

Informatics Research Centre,
3rd Floor, Philip Lyle Building,
University of Reading,
Whiteknights, Reading, RG6 6AH, UK
+44(0)1234 400400
Tim.french@beds.ac.uk

Abstract

This paper discusses the nature of the relationship between user-experience factors and usability for instrumental tasks, with particular reference to trust factors in e-commerce. The initial argument describes key user experience tenets such as flow as extensions of previous work rather than wholly new considerations in HCI. Jordan's four types of pleasure in product use are considered as 'dimensions' by which to categorise the influence that user experience has on interaction. A model is presented that merges usability with other experience factors in a description of user encounters with business to customer websites. The paper concludes with a discussion of developments in the theory and practice of user experience design.

Keywords: Flow, e-commerce, pleasure, trust, semiotics

1. Introduction

The premise of this paper is that e-commerce designers create sites for goal-driven action and that emotional and experience factors have the potential to disrupt progress towards this goal. This is not to refute other more positive takes on the user-experience phenomenon [e.g. 15], but is simply a useful way of considering potential design flaws. The interface plays a role in enticing goal formation through qualitative emotional stimulation, and plays a key role in the sustaining and persistence of a goal. In this sense these factors are very much the same as traditional usability factors, having a similarly functional or dysfunctional effect on dialogue.

Finneran and Zhang [5], Novak [15], and others describe and model components of good user-experience. Among the common themes is flow [2]. The antecedents of flow combine traditional tenets of usability along with new considerations in the context of user experience. There is reference to feedback for example, which is acknowledged by Norman [14] and others as a key component of interaction.

The phrase 'user-experience' is largely thought of as describing a field of research emerging in the mid 90s. However, the experience of computer use has been referred to in the HCI literature since the emergence of WIMP interfaces and direct manipulation in the 1980s. Shneiderman [17] describes seven qualitative aspects of interaction with direct manipulation systems including 'mastery of the system' (and the confidence to retain mastery) and ease in learning the system. Indeed the notion of flow which is ubiquitously cited as a key tenet of user experience appears to bear a significant resemblance to the

more established notion of 'direct engagement' described in [8]. The key to direct engagement is described as:

'the feeling of involvement directly with a world of objects rather than communicating with an intermediary'.

In this sense the more recently applied concepts of 'flow' and of psycho-pleasure [10] seem to be descendents of the literature hailing the success of the Apple Mac and similarly 'engaging' products. It can also be argued that Jordan's concept of 'physio-pleasure' has a similar grounding. The adeptness of the tool produces a qualitative sense of control, similar to the qualitative contrast between using a sharp rather than a blunt knife. Significantly, descriptions of the 'direct engagement' phenomenon were applied to instrumental, task-based products.

Physio-pleasure and psycho-pleasure are two of the four product related 'pleasures' cited by Jordan. The other two, socio-pleasure and ideo-pleasure introduce idea from product design and marketing that have better-known associations with products such as cars and clothing. Socio-pleasure reflects a circuit of 'selfness' channelled through the social world. For example, socio-pleasure could be exemplified by a piece of clothing that identifies one as a member of a socio-economic group. Ideo-pleasure has some intersection with socio-pleasure but is in essence a reflection of personal values. An individual may carry a heavyweight newspaper, reflecting a commitment to consumption of serious rather than trivial news. However, this may belong more to the socio-pleasure dimension if a copy of a gossip magazine is secreted within it.

Jordan's schema is a very useful tool for understanding user experience from a first-person perspective. This is useful in a very direct way in the design of products such as cameras, where the designers would like to get 'into the head' of the target user and provide a design that suits them. The relevance of this to consumer products is reasonably clear. Whilst one can argue that products such as cameras are instrumental to a task, they are leisure products, and the user experience factors are intrinsically the use of that artefact. Many interactive 'products' contrast with the camera example, both in their intrinsic nature and in their commercial role. This paper considers the applicability and utility of Jordan's schema to e-commerce sites. E-commerce websites are mediators and not absolute ends in themselves. As pointed out in [12], there is a need to design these artefacts with user-experience factors as a key design goal. However the role of user experience seems to be of a different nature from purely leisure products. The values and goals of the user are not intrinsically in the use and deployment of the artefact, but beyond that in ends such as

product procurement, banking and financial services. Compounding this is the fact that they are more complex, with a vast space of possible interactions. Therefore enquires into the key user experience issues are of a significantly different nature. From the point of view of web-site designers and users alike, the aim is to complete a journey through to a transaction and beyond to the satisfaction of business and consumer goals.

The next sections consider the utility of Jordan's schema when applied to the design of artefacts that are instrumental to user and organisational goals rather than having user experience factors as goals in themselves. In doing so the schema is applied as four affective 'dimensions', allowing for the fact that reactions in each dimension could be negative, and have impact beyond the hedonic dimension.

2. Assessing the affect of the hedonic on instrumental tasks

Revisiting the accounts of qualitative HCI in [17] and [8], satisfaction appears inextricably linked to the instrumental dimension, rather than being purely hedonic. The hedonic elements are about control, power over the device, a feeling getting what one wants without impediment. Good interaction is when this synergistic optimum is achieved, bad is when it is lacking and causes 'noise' that interferes with the flow. Much of HCI design and evaluation is about identifying the sources of 'noise' and eliminating them through design iteration. The user-centred design process is on one reading a method that takes inspirational design thinking and refines it so that the purity of thinking survives problems of misrepresentation or poor fit to the knowledge and skills of its target user. This may read like a naïve interpretation of iterative, evolutionary design. On another reading the evolution of systems is about the emergence of design inspiration and innovation through a bottom-up process. Neither pole is exactly right. The process involves perhaps tighter cycles of inspiration, innovation, embodiment and the 'gate-keeping' exercise of liberating potential solutions from noise. The removal of low-level usability bugs is acknowledged as a key part of this process. In the physio and psycho dimensions the removal of user-experience bugs is part of the optimization process, and linked to usability goals. Closing the gulfs of execution and evaluation is tantamount to providing a psychologically and physically satisfying experience in the process of fulfilling a task.

It is useful to examine the other two pleasures, socio and ideo, under the same microscope as the psycho and physio dimension. In doing so we can consider another dimension of user experience, that of e-commerce trust. The nature of consumer trust in e-commerce is in part rational and in part affective. Rational trust involves the user checking sources such as the recognised trust seals and kite marks that can be taken as sureties and guarantees protecting against corrupt and exploitative behaviour from the organisation. However this combines with affective factors in the user's decision to trade with an organisation. Recent research seems to confirm the pivotal role of affective factors in trust formation and propagation for e-commerce and other trust-dependent sites such as online sources of expert information. Studies reported in [6] and [4], showed that factors such as style, aesthetics and the navigation model were strong influences on trust. Studies reported in [16] found that media choices and combinations affected user judgements about the expertise offered on alternative sites, whilst a study of e-health sites reported in [18] found that affective factors were

significant in forming user trust in, and selections of information from alternative sites.

How then do we characterise the socio and ideo dimensions in relation to trust factors? To do this we use examples from a study of e-banking trust perceptions reported in [7]. Examples from this study show what could be interpreted as 'ideo' reactions through physio and psycho reactions. Some home page images were reported initially as 'disturbing' but on elaboration led participants to question the integrity of the organisations as conveyed through the chosen design. This suggests that the 'ideo' dimension is in part shaped by the more primal physio and psycho responses. In another example, a number of participants gave negative reactions to homepages showing cartoons. This prompted negative responses including 'unprofessional', 'inappropriate' and 'not bank-like' from subjects. There appeared to be a strong link between this reaction and negative trust scores elicited in the study.

Let us consider the relationship between trust, a user-experience attribute that is clearly linked to instrumental factors, and flow which is a quality that appears *prima facie* to be a pure user-experience goal in itself. It can be argued that flow requires trust re-enforcements. A trust threshold needs to be reached initially and is hard to re-establish after a trust 'mismatch'.

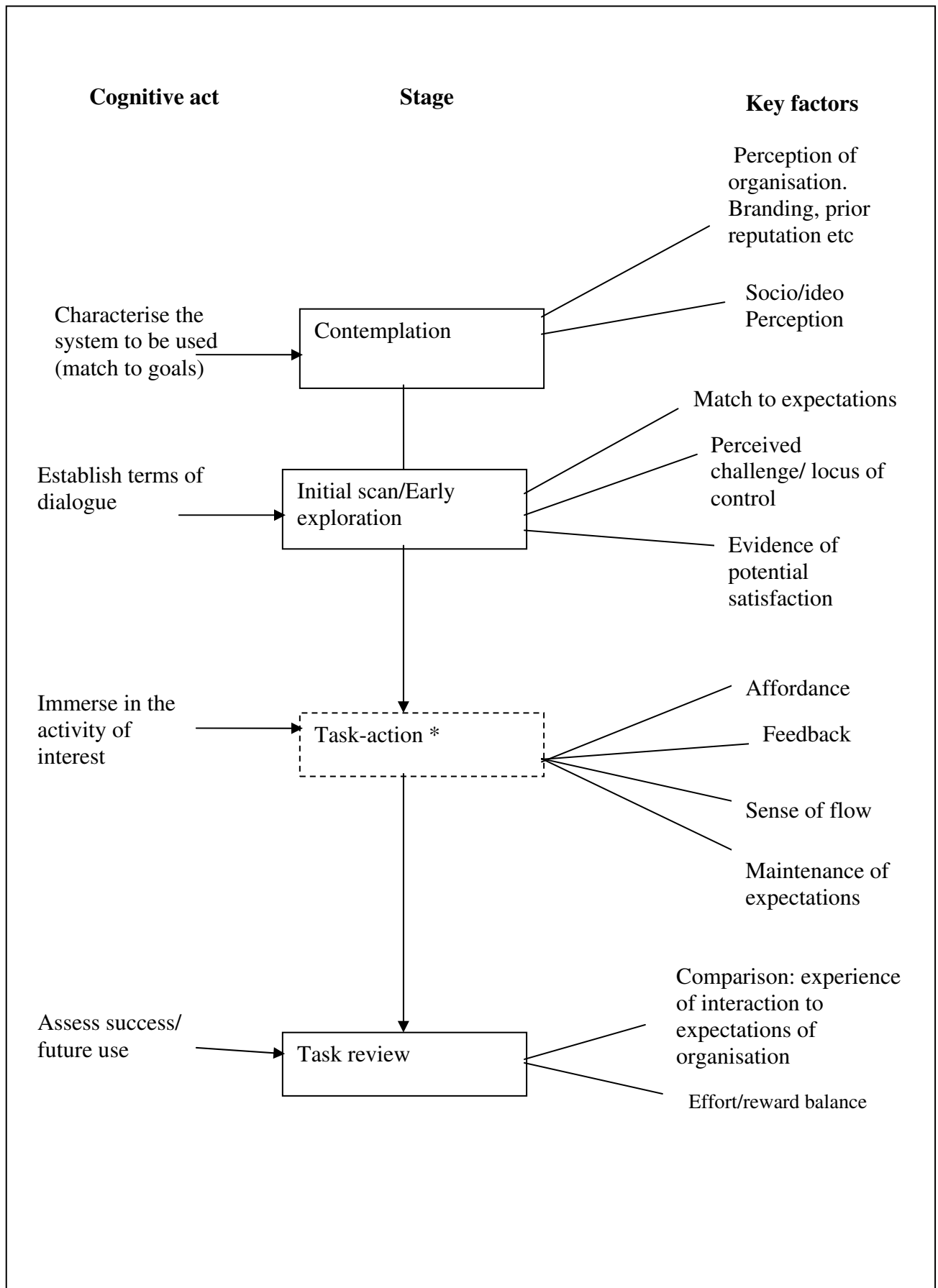
The 'breakdown cycle' has similarities to breakdowns of usability. Some usability errors (e.g. hidden security features and guarantees) may be direct contributors to trust breakdowns. In a similar way a poor user experience, such as encountering an image that is disturbing, or a badly designed system message, may affect the user's sense of their relationship with the organisation.

3. A Model of user experience in instrumental e-commerce tasks

i. Overview

The model in figure 1 shows four critical stages, related to key user-experience factors. The first is prior to initial action when it is first perceived. The user tends to make an initial value judgement based, for example, on the home page of a web site. A number of attempts by web designers to create innovative looking homepages have caused this problem. The second phase is early exploration. The user's first few attempts at action are critical. The third is during interaction, where the user's goals are interrupted by 'mismatched' system output. The fourth is on completion of a task (as opposed to a sub-task'). In phase three the optimal 'flow' condition [2] is the ideal. The model describes a journey from prior expectations through early exploration of a system through to post-task review after interaction has taken place.

Figure 1: A Model of User-experience factors in e-commerce interaction tasks



ii. Contemplation

Users typically approach interaction with some anticipation and expectation forged from some relevant. This could include previous experience with that type of technology or technology in general. It has a further dimension where an organisation with a certain brand or organisational identity is involved. In terms of Jordan's scheme of product related pleasures, the socio and ideo dimensions may already be influencing expectations at this stage. This may be conditioned by anything from cultural symbols to implied meanings emanating from the way the background is designed on a particular screen. For example, some business-to-customer web sites have been criticised for having white backgrounds simply because it looks too nakedly technical and users have been known to find this intimidating.

iii. Initial scan/Early exploration

This refers to the very early manipulations of the system as the user gets the 'feel' of interaction. The user is, in effect, searching for the terms of dialogue in early interaction. Clearly the grounding for this is set at the initial scan stage, where 'greeting messages' or something similar can be displayed in order to set the tone of interaction. This initialisation of dialogue includes familiarising the user with the mode(s) of interaction in the system as well as the 'tone' in which interaction is to be conducted. For example, any web sites favour using a 'personable' narrative as if a guide were talking the user through the site. The role of this design element is to establish a tone for the dialogue. Three main elements of this are identified, namely perceived challenge, perceived locus of control and engagement.

Perceiving the interface initially either prior to or after the formation of a goal involves an act of interpretation beyond the purely goal-directed. One possible account of this is the concept of Semiosis [see 1,3]. Semiosis is described as the deconstruction of the interface to detect 'acts of signification'. This clearly is something like what occurs when an artefact is first perceived. For example, a site that involves secure financial transactions may fail due to perceptions of it as untrustworthy. This lack of trust may emanate from an adverse reaction to the cultural symbols as perceived. This accommodates accounts of the way in which such signs have been shown to differ between cultures [see 9, 11].

Both perceived and actual control affects the user's sense of the relationship between themselves, the system and the designers (or rather the organisation for which it is designed). The power and freedom to explore is a major contributor to this. For example, browsing catalogues at one's own pace, or the appropriate provision of support for price comparisons (timely support) gives a sense of the user being 'served' by the system.

It is useful to understand user interpretations of the interface as interpretation of interface 'signs'. It is important to see perceived and actual meanings of text, symbols and layout aspects as distinct because they can refer to different properties of the interface. The first property is the cognitive ergonomic dimension of usability. The second is the affective and interpersonal dimension. A system may be robust and trustworthy but not appear that way due to some aspect of its presentation. Equally, a business can be honest and trustworthy, but perceptions of this can be undermined by individual deconstructions of interface tokens.

iv. Task action

Affordances and feedback are references to usability factors,

and clearly their relationship to flow is a relatively straightforward one. Flow is dependent on an absence of usability impediments. However, flow could survive relatively small problems, including easily corrected problems that often occur during constructive task-action. In the affective dimension breakdowns may occur where the expectations of the organisation are undermined by the discovery of an interface feature, or by events within a dialogue.

Consistency or inconsistency of dialogue tone may be a profound influence on experience. However, where the user has developed a sense of a customer/vendor relationship mediated through interaction and prior factors an abrupt change in tone is likely to have a disruptive effect. Let us consider the example of a response to a password error with the message 'you do not appear to be registered on this site'. In terms of its denotation it may be functionally adequate. It is a piece of feedback by which the user can reason that the entered information was incorrect. However the system response exudes an ignorant dismissiveness. The emotional effect of this inappropriate language will, at that point, couple with a sense of frustration that inevitably results from an unsuccessful action. Therefore this simple act of feedback connotes a displeasing attitude, and the resentment could lead to a major breakdown. Monk [13] refers to good 'interpersonal awareness' as key to good user experience. This principle holds for the one to one human-machine relationship that exists typically in web-site although the author was speaking principally about groupware.

v. Task Review

A combination of rational and affective factors influences the user's review of interaction, and assessment of their relationship with the organisation. Events or incidents during interaction may have the effect of altering the user's sense of who they are dealing with, for example whether the sense of the organisations identity formed from awareness of the branding or advertising matches the experience. The user may have observed material reasons for questioning the integrity of an organisation, for example that the design is hiding information about surcharges until a purchasing commitment is made. This is an example of a fairly rational concern about the presence of relevant information. However, as suggested in studies in [7,16,18] affective factors also have a very significant influence. The use of colour, of pictures or styles of textual presentation could affect the impression that the user has when reviewing an interaction sequence.

The user will also assess the effort involved against the instrumental goal-related success achieved. This is partly to with the hedonic experience, the sense of engagement that the task engenders. A grating drab experience is likely to exaggerate the sense of an adverse effort-reward ratio. A simple analysis of the number of steps to a goal does not tell the complete story. Engaging or pleasant, flowing interaction has the effect of lessening the sense of effort or burden. The amount of burdensome user action demanded by a task, against engaging interaction will determine the user's sense of whether the effort-reward ratio is satisfactory. Where expectations are high because of advertising or corporate image (e.g. www.elephant.co.uk 'it's simple it's easy, it's fast') expectations may be focussed on those claims, putting pressure on the organisation to deliver against those proclamations.

vi. Summary of Model

The model describes the way in which expectations, early impressions and engagement in interaction are linked, with the possibility that any interaction event may positively or negatively reinforce user perceptions of the tool and the organisation for which it is a vehicle. Pleasing traversals through the interaction space are likely to enhance the user's affinity with the device and through this to the organisation. Conversely, a single bad or disturbing experience may diminish the relationship not only with the artefact but with the organisation. This could be a combination of interactive events that appears to contradict the nature of the dialogue and in turn the integrity of the organisation. This could easily be an unintended impression emanating from an unexpected source. For example the terse techno-speak that is familiar to computer literate individual used to reading system messages in various versions of windows may be thought of as lacking a good interpersonal touch. This contrasts with the 'personable' dialogue that user-experience designers and content writers try to provide. An event that results in interruption by one such message may effect a change in the user's attitude towards the organisation, perhaps arousing suspicion about that organisation's sincerity. This mirrors a process described by authors applying semiotic theory to e-commerce applications [1]. The value of viewing an interface through the semiotic lens as a set of computer based signs, is that the notion of an interface (text) can be clearly separated from an infinite set of text interpretations by readers or indeed originators (designers). Thus, the semiotic viewpoint clearly separates the notion of a text (i.e. an interface) from the notion of its creation by a designer, and interpretation by a set of users. That is to say, syntax and semantics are not be confused. A given set of signs may induce an entirely different set of reactions according to arousal, cultural origin and cognitive style of the user.

4. Towards service-specific models: The case of e-property sites

The generic e-commerce model in Figure 1 shows the customer coming to the site with some sense of the brand, is driven by instrumental goals. However, further work in this area is likely to reveal that more specific domains within e-commerce may have different dynamics, and the dynamics of user-experience may be of a different nature (in other words the structure of relationship building between organisation and individual). Therefore future models would need to be aware of and reflect these differences.

Property websites provide a useful example of a contrasting structure from that described in Figure 1. The customer is likely to purchase items rarely, and the decision to purchase may be a very long-term 'slow-burning' idea. This often manifests itself in relatively whimsical dry-runs of the selection process, or even fantasy, where the individual imagines being richer, or having the chance to live somewhere more exotic. Also, users may simply be interested in the state of the market or several local markets. So they may make many visits to property sites that are not in any strict sense goal-directed or instrumental to a current need. Nonetheless, it may be through these seemingly frivolous visits that brand preference and loyalty may be established. Therefore, hedonic factors in the use of the site seem to come to the fore in a slightly different way. Memories of good experiences in interaction and the comfortable familiarity of a favoured site make users inclined to use for the real transaction when that need comes around. This may affect key decisions about how the designer contemplates the structure of interaction.

For example, it may be unwise to try to get commitments and tie-ins (e-mail exchange, registration) as the user tries to explore properties, restricting the user's ability to explore in a non goal-directed but task-like fashion. It will be of no consequence in the current session but can repel potential customers. Design thinking in domains such as this could be usefully orientated to supporting 'playful' interaction despite being primarily for buying and selling.

5. Wider applications of Semiotic models to user experience

Semiotic theories afford ways of finding deep explanations for events and their consequences for user attitudes and behaviours. The utility of semiotic modelling is based on two key characteristics of a product, the space of interactions, and the significance of the user-organisation relationship. In any product with a fairly complex set of interactions there are numerous ways in which the users' sense of their relationship with the product can be changed by an event. Semiotic models support reasoning about such effects. This is particularly true where the relationship between the user and the entity that the artefact represents is a significant element. Semiotics provides explanations of how the dialogue between user and system plays a role in establishing and maintaining staple elements of the user-organisation relationship. In turn it can explain how design features and interaction events may undermine it. The case examined here is e-commerce trust, but this could extend to any artefact that acts as a carrier for an organisation's identity, principles, philosophy or social cache.

6. Reflection of user experience – Principles, Policies, Plans

User experience can be seen as having two distinctive characters depending on the nature of the product. One is user experience as a goal, and the other is user-experience as a means. Many products have user-experience as a goal. This would be evidenced in a good requirements elicitation exercise, and be an overall aim of the design. The experience is an end in itself. By contrast, user experience as a means is complex and often has much to do with the user's sense of a relationship with an organisation (certainly in the case of e-commerce). The experience factor is key to instrumental goals such as buying and selling. In this case designing good user experience is secondary to the main goal, and some of its components are different.

User experience as an end seems to bear strong resemblance to craft goals in product design (in the psycho and physio dimensions) and marketing goals (in the socio and ideo dimensions). Therefore it is unsurprising that craft knowledge from product design and techniques from marketing are being imported to the design of products. Typically these products are 'single-utility' or support a relatively small number of repetitive actions. User experience on business-to-customer web-sites or e-government or anywhere else where the primary aims are instrumental and not hedonic can be seen differently. Engineering good user-experience must be seen in the context of the instrumental goal. This poses issues for requirements capture and evaluation as experience factors are not specifically the reason for interacting with the product.

The elicitation of users personal values seems to be relevant to understanding user experience. Values are culturally situated, and linked to expectations. Human attitudes are highly contextual. For example, cartoons on web-sites per se are unlikely to get the same negativity as they appear to do in the context of e-banking.

Evaluation of the user experience can emanate from inspections with users, eye-tracking and protocol analysis. The strongest indicator of a product's efficacy remains empirical study of it in use, either in experimental or naturalistic settings. However new theoretical treatments are necessary to interpret the information that comes from exercises such as protocol analysis, eye-tracking study or card-sorting. Semiotics provides a useful framework for understanding the way that individuals deconstruct and interpret features of the artefact, how they relate to that artefact and to the organisation that it represents. Interpretation of user-experience needs to account for the factors that influence user interpretations in the four dimensions (corresponding to Jordan's four pleasures). In the socio and ideo dimensions user reaction has a complex set of socially mediated causes and consequences. Therefore experience must be understood within this wider context.

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Measures of Usability and User Experience (UX): Correlation and Confusion

Effie Lai-Chong Law

University of Leicester, UK/

ETH Zürich, Switzerland

elaw@mcs.le.ac.uk / law@tik.ee.ethz.ch

Kasper Hornbæk

Department of Computer Science

University of Copenhagen, Denmark

kash@diku.dk

ABSTRACT

In this paper two reviews are presented: one on the relations among the three traditional usability constructs and the other on the relations between usability and aesthetics. The former recaps a meta-analysis of 73 empirical studies in HCI (Hornbæk & Law, 2007), showing weak correlations among effectiveness, efficiency and satisfaction. The latter sampled only 7 relevant studies, showing the diversity of evaluation methods and measures used to evaluate usability and aesthetics. Findings indicate that there are still a number of definitional and measurement issues in HCI.

INTRODUCTION

“To measure is to know”;

“If you cannot measure it, you cannot improve it”;

“When you cannot measure, your knowledge is meager and unsatisfactory”

These dicta of Lord Kelvin (a.k.a. Sir William Thomson) on measurement are frequently quoted to justify the quantification or operationalization of theoretical concepts in physical sciences, computer science and engineering as well as social sciences (e.g., Bulmer, 2001). The field of human-computer interaction (HCI), as an amalgamation of these disciplines, tends to adhere to this scientific paradigm of measurement, in spite of controversies over the measurability of some psycho-social constructs as mundane as beauty, happiness, frustration, and pain. Indeed, HCI inherits from social sciences the contentious issue about the place of measurement. While some HCI researchers and practitioners strongly advocate the necessity and utility of measurements (e.g., *interactions*, 2006), some others are ambivalent about the role of numerical values in our (deep) understanding of complex interactions between humans and machines. Basically one could measure anything in any arbitrary way, but the compelling concern is whether the measure is meaningful and valid to reflect the state of nature of the object in question. Some HCI researchers and practitioners refute measurement based on their defiance of reductionism, i.e. they argue that human experiences and feelings (or embodied interactions) should not and cannot be reduced to numbers. Such an argument reflects the decades-long dispute between the cognitivist and phenomenological approaches (Winograd & Flores, 1987; Dourish, 2001).

Paradoxically, the definition of measurement per se is debatable as well. On a broad level, measurement is defined as “an *observation* that reduces an *uncertainty* expressed as a quantity” (Wikipedia, our italics), with the emphasis that it is more than simply assigning a value to an object. The contention lies in what is counted as observation. For instance, in the realm of usability the observation can be objectively taken by usability professionals or introspectively/subjectively by users, with the goal of lessening the uncertainty about the level of quality-in-use of the interactive system in question. The age-old arguments over objective vs. subjective measurements persist through HCI, especially for non-performance, experience-based constructs such as emotion (e.g., Spagnolli et al., 2003; Wilson and Sasse, 2004). The dispute lies not only in which of the two types of measures is more appropriate but also in whether and how they are related and under which conditions.

As usability is seen as integrating quality in software, in interaction and in value (Law et al., in press), it is measured diversely with a plethora of methods and instruments. Aligning with the second dictum cited above, usability measures are supposed to have the role of providing data for improving the system under scrutiny. Usability measures should also allow comparisons between the original and revised versions of a system and between competitive products (i.e., summative evaluation).

In accord with a widely referenced standard ISO 9241-11 (1998), usability measures are categorized into three major aspects, namely effectiveness, efficiency and satisfaction. On a higher level, usability measures seem standardized; usability studies normally report data on at least one of the three usability aspects. On a lower level, however, there exist so many different ways to instantiate usability measures that it seems impractical to standardize them, though attempts have recently been taken to taxonomize them¹. For instance, error rate is a common measure of

¹ Hornbæk (2006), based on his meticulous review of more than 180 HCI publications, identifies 54 types of measures for effectiveness, efficiency and satisfaction. Sheffah et al’s (2006), with their QUIM model, synthesize 127 specific measures into 10 factors, expanding the scope of the conventional three-pillar usability to include trust, safety, accessibility, etc. Presumably,

effectiveness, but how error is defined and gauged is contentious (Sauro & Kindlund, 2005). Even more elusive is user satisfaction (Lindgaard & Dudek, 2003), which is measured with a range of homegrown rating scales, despite the availability of standardized counterparts (Hornbæk & Law, 2007), which are deemed inappropriate by some researchers to address the particularities of contexts in their studies. Indeed, the ever increasing interest in researching User Experience (UX), which, can be seen a form of user satisfaction defined in a more refined way² (e.g., fun, enjoyment, pleasure, anxiety, and annoyance), has led to a new set of methods and measures (cf. submissions in several UX workshops, e.g., CHI'06, NordiCHI'06, and a journal special issue; Hassenzahl & Tractinsky, 2006), rendering usability measures even more diverse and relations among them even more confusing.

In contrast to physical sciences, in HCI we lack a system of units (cf. weight, length, and capacity) that relates all of the variables to a common set of logically primitive qualities. Such a lack of a system of measurements may suggest that theories in HCI are fragmented and that our knowledge is largely correlational rather than theoretical (cf. Duncan, 1984). Indeed we lack a theory to elucidate or predict the relations between usability measures; the inconsistent findings about the correlations between performance and preference remain largely unexplained.

Next, I recap the major findings of a recent meta-analysis (Hornbæk & Law, 2007), which corroborate as well as contradict some of the earlier work. Then I illustrate the similar inconsistency observed in the relation between usability and beauty – an evasive notion instigating debates in the HCI community. Finally, I present my UX Manifesto which focuses on the measurement aspect.

CORRELATION STUDIES OF USABILITY MEASURES

The research question: *How usability measures are related?* has driven a line of empirical studies. Bailey (1993) pioneered to investigate how measures of preference and of performance could be related. In the meanwhile, Nielsen and Levy (1994) conducted a meta-analysis of 57 papers, aiming to identify the relation between objective performance measures and subjective preference measures. The results showed that 75% of the cases these two measures were correlated in a way that performance could be predicated by preference ($r = .44$). However, this finding was challenged by Frøkjær et al. (2000), who, based on their single empirical study and review on a selection of CHI conference papers, concluded that the three usability aspects – effectiveness, efficiency and satisfaction – were not correlated as expected. Similarly, Kissel (1995) and

Yeo (2001) showed the weak correlation between subjective and objective usability measures, which was attenuated by moderating variables such as users' computer experience and familiarity between the tester and testees. In spite of these incoherent findings, some recent work (cf., Sauro & Kindlund, 2005; McGee, 2004) have been undertaken to collapse usability measures into a single one, assuming that certain objective and subjective measures are correlated, thereby legitimatizing their combination. However, this assumption is shown to be refutable.

Having inspired by the earlier work, we (Hornbæk & Law, 2007) have performed a meta-analysis of usability measures by investigating how usability measures correlate in a set of empirical studies selected from a sample of representative HCI conference and journal papers. To address the shortcomings of other related correlation studies (e.g. no access to required statistics) we use the raw data of the studies, which enable thorough and uniform calculations across studies.

Findings of Meta-Analysis on Usability Measures

Altogether 73 datasets were analyzed. The domain of the studies was categorized according to the ACM classification systems. 12 domains were thus identified with "input devices and strategies" ($n = 16$) being the highest. Figure 1 shows that 36 out of the 73 studies (49%) had measures of all the three usability aspects; 30 studies (42%) had measures of the combination of effectiveness-efficiency, effectiveness-satisfaction or efficiency-satisfaction. Seven (9%) of the studies collected measures of only one usability aspect.

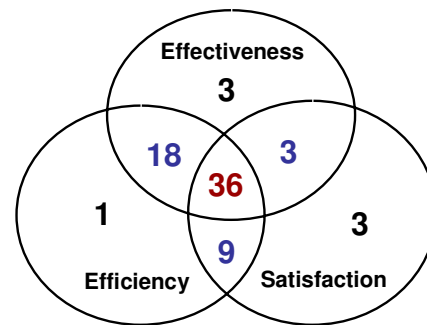


Figure 1: Venn diagram illustrating the number of studies measuring effectiveness, efficiency, and/or satisfaction.

Measures used

The measures taken in these studies were categorized according to ISO 9241-11 and to the taxonomy developed by Hornbæk (2006). Note that a usability aspect, say efficiency, can be gauged by different measure *types* (e.g., time) and their subsuming measure *tokens* (e.g., task completion time or time to event). A measure token (say error rate) can be gauged differently with respect to the specific tasks performed in a study. Measure tokens of satisfaction, in particular, are difficult to classify because they are collected using a variety of questionnaires, scales

this line of work aims to develop deeper understanding about the usability construct and more robust measures of its components.

² Whereas some researchers argue that UX is an extension of usability, others argue that usability is subsumed by UX.

and levels of granularity, which seem only bounded by the imagination and creativity of their authors.

Table 1 illustrates the distribution of the nine types of effectiveness; the peak token is error rate (i.e. 35 instances, 47% of all the studies reviewed included this measure). The same distribution can be seen for the measure tokens of efficiency, where the peak token is task completion time (76% of all the studies reviewed). These findings indicate that some convergence concerning selection of usability measures exists.

Table 1: Distribution of effectiveness / efficiency measures

Effectiveness		Efficiency	
Error rate	35	Task completion time	56
Binary task completion	15	Time till event	10
Spatial accuracy	7	Deviation from optimal path	7
Quality of outcome	5	Time in mode	5
Completeness	5	Use frequency	5
Recall	4	Information accessed	2
Precision	1	Others	2
Expert's assessment	1	No of usability problems	1
Helps sought	1	Input rate	1
		Mental effort	1

Studies contain a variety of satisfaction measures. Twenty-five measure tokens were identified when enumerating them at the finest (or third) level of the taxonomy from (Hornbæk 2006). When they were grouped into the coarsest (or first) level, there were six groups (see Table 2).

Table 2: Distribution of satisfaction measures

Satisfaction	Freq.
Satisfaction with the interface	34
Specific attitudes towards the interface	22
Users' attitudes and perceptions	16
Preference	13
Standard questionnaire	12
Others	9

The most popular measure type is “satisfaction with the interface”, which can be further broken into two measure tokens: ease-of-use (24 measures) and context-dependent-questions (10 measures). In contrast, the measure type “specific attitudes towards the interface” is more diverse, including annoyance, confidence, control, discomfort, frustration, fun, learnability, liking, and want-to-use-again. Further, the measure type “others” include tokens that are emerging (e.g., trust and beauty), vaguely defined (e.g., responsiveness) or encompassing (e.g., some sub-attributes of quality-in-use described in ISO 9126).

Correlation between effectiveness and efficiency

The average correlation between effectiveness and efficiency across the 54 studies is **.247** (confidence interval, CI95%, $\pm .059$); This suggests that more efficient

performance, such as faster task completion, is associated with more effective performance, such as fewer errors (a **small to medium** effect (Cohen, 1969). In practical terms, 87% of the studies have a positive correlation between effectiveness and efficiency. Furthermore, we find that while task complexity³ does not by itself lead to changes in relations between usability measures, complexity of measures do.

Correlation between effectiveness and satisfaction

The average correlation between measures of effectiveness and satisfaction across the 39 studies is **.164** (CI95%: .102-.226); a **small effect**. In other words, 86% of the studies show a positive correlation between effectiveness and satisfaction. This observed inconsistency between objective and subjective measures could be due to cognitive and social bias, for example, the role of prior experience (Taylor & Todd, 1995) and social desirability effect (e.g. Arnold & Feldman, 1995).

Correlation between efficiency and satisfaction

The average correlation between efficiency and satisfaction across the 45 studies that report one or more measure of these aspects is **.196** (CI95%, $\pm .064$); a **small to medium effect**. However, it appears relatively uniform across studies as 81% of them have positive correlations.

Satisfaction measures

Surprisingly, only 12 out of 106 instances of satisfaction measures (11%) employed standard questionnaires. We calculated Cronbach's α for standard questionnaires and for homegrown ones. Results show that homegrown questionnaires have a lower reliability ($\alpha = .736$; $n = 20$) and a greater variation in reliability (range = .21 - .92) than standard ones ($\alpha = .814$; $n = 16$; range = .73-.95). Besides, six homegrown ones fail to reach the commonly accepted minimum reliability of .70. The low reliability may be attributed to poor questionnaire design.

Three studies in our sample measure satisfaction both at the level of an individual task *in* the study (e.g. ASQ, Lewis, 1995) and at an aggregated level *post*-study (e.g. CSUQ, Lewis, 1995), typically once for each interface. The correlations between in- and post-study measures are medium to large, with r s ranging from .38 to .70. Besides, 10 studies measure both preference and some other aspect of satisfaction, and the correlation between the former and the latter is large, with a mean r of .49.

³ We coded task complexity on a three-point scale based on Rasmussen's (1983) framework: low complexity tasks were skill based (e.g., clicking on objects), medium complexity tasks were rule based (e.g., navigating an information space), and high complexity tasks knowledge based (e.g., drafting privacy policies).

Discussion

Our study suggests several conceptual problems in current models of usability. First, error identification can be seen as a highly subjective process as evaluators may diverge on what constitutes an error. Second, we find inconsistencies in classifying workload. It is measured similarly to satisfaction measures and correlate strongly with such measures, but some authors consider it an efficiency measure. It also raises the question whether workload estimation is a means for measuring pain as opposed to measuring pleasure that the HCI community is currently pursuing. Third, we find a difference between users' experience of interaction/outcomes and objective measures. For studies that collect both measures of the same phenomenon, we find no correlation. While some models accept fundamental differences between subjective and objective measures (Hornbæk, 2006), others do not (Nielsen & Levy, 1994). Fourth, diverse instantiations of usability measures suggests the malleability and extensibility of the notion of usability. Among others, the user experience (UX) movement has argued to broaden the notion of usability, rather than narrowing it. We find mixed results related to this issue, because some aspects of users' experience seem orthogonal to performance measures and some shows substantial correlations. Further work is called forth to investigate if correlational studies could help describe the relation between user experience indicators and traditional usability measures. Indeed I have been exploring this topic and present some related thoughts afterwards.

USABILITY, PREFERENCE AND BEAUTY

One challenging comment on our meta-analysis of usability measures: *Which theories suggest there be relations between **performance** and **preference**?* Yet I have not yet identified some convincing theoretical models that explain or predict under which conditions/contexts significant correlations, be it negative or positive, between objective and subjective usability measures should be expected. I look up the literature in the realm of marketing, consumer psychology, social as well as cognitive psychology, and, interestingly, they tend to, directly as well as indirectly, refer to the notion of aesthetics.

Dillon and Morris (1999) put forward their P3 model - a user's *perception*, based partly on his understanding of the capabilities of a system (*power*) and his own ability to exploit these capabilities (*performance*), influences the user's tendency to deploy the system. Note that power is an objective assessment of a tool's utility (irrespective of a user's ability to exploit it) and that during the course of deploying the tool a user's performance (i.e. usability engineering constructs) cyclically shapes his subjective perceptions of its value (i.e. TAM⁴ constructs). The P3

model argues for the necessity to measure all the three components (cf. a similar recommendation by Frøkjær et al. 2000), because the performance and perception are essentially different constructs, which may even contradict each other in certain situations. Apart from re-acknowledging the importance of measuring objective, behavioral and affective aspects of interaction with technology, the model does not offer any insight into the question of why these measures are (not) correlated in which conditions.

Based on some theoretical models in the psychology of art and design, Moss (2007) puts forward a normative model about the relation between performance and preference. Specifically, performance is defined as the nature of the product being influenced by its creator's or manager's personality, nationality and gender, whereas preference is a customer's reaction to the product based on his self-concept. The congruence between the two constructs is strengthened when the product, which reflects its creator's characteristics (e.g. aesthetic and emotional proclivity), tends to parallel and mirror its customer's (i.e. the mirroring principle). Such congruence leads to increased attention and thus increased purchasing.

Dillon & Morris and Moss coincidentally refer to some (own) existing work on aesthetics, which is potentially extended and synthesized to validate their respective models. For instance, Moss hypothesizes the effect of segmentation variables, e.g. age and gender, on differential preferences of the same product.

The preference-performance discrepancy has recently instigated in the HCI community the interest in aesthetics, which, together with other design attributes, can affect preference other than performance. Further, aesthetics was empirically found to be a determinant of users' enjoyment, perceived ease-of-use and perceived usefulness. However, inconsistent findings about the relation between usability and beauty are no less confusing than those between preference and performance; the sources for (non)-correlations are yet unclear. As shown in Table 3, where a selection of seven recent research studies (since year 2000) on the usability-beauty relation is analyzed, different evaluation methods and different measures are used for these two design attributes. For instance, some rely entirely on subjective measures (e.g., Hassenzahl, 2004) whereas some employ a mix of objective and subjective measures (e.g., De Angeli et al., 2006). It is plausible that the detected relations are the artefact of the experimental designs. Ben-Basset et al (2006) address this issue by looking into contextual factors: momentary incentive and competitive environment. The relevance of their work is that the results shed some light onto the hitherto inexplicable weak relationship identified in the HCI literature between system performance and subjective evaluation. Users are normally asked to judge a system when the judgment has no consequence for them. Hence, it is highly probable that users' judgments/preferences are

⁴ TAM= Technology Acceptance Model, originally proposed by Davies (1989), consists of perceived ease of use, perceived usefulness and intention to use.

influenced by the visual aesthetics of the product to be owned (auction bid). This finding is somewhat corroborated by Hassenzahl's (2004) conjecture about hedonic-identification (i.e. the social value of beauty).

Furthermore, De Angeli et al., (2006) explain users' seemingly contradictory overall judgment as halo effect, i.e., how general attitudes towards an entity (cf. the notion of goodness in Hassenzahl [2004]) can override or mask specific attitudes towards its components. Judgment is context-dependent; aesthetics have a strong halo effect for preference when the usage context is less serious (e.g. games) whereas usability has a strong halo effect for information quality when the usage context is serious (e.g. formal learning in classroom).

Apart from Lavie & Tractinsky's (2004) attempt to develop a measurement instrument of *perceived* aesthetics, it seems that no work has (yet) been undertaken in the field of HCI to measure aesthetics *objectively* with quantifiable parameters (cf. the empirical studies of arts). There is an advocacy to compute a ratio between the objective task completion time and its subjective counterpart (Czerwinski et al., 2001) as a novel usability measure; a similar strategy can be applied to aesthetic value, though it will probably be more challenging.

Furthermore, two potential factors are worth to explore, namely duration of interaction and task complexity. Indeed, Hassenzahl (see this volume) presents some interesting empirical observations how pragmatic and hedonic perceptions change over time. As task complexity is proved to influence usability perception (Frøkjær et al., 2000), presumably this factor plays a critical role in aesthetics perception as well. In the seven studies reviewed (Table 3), apart from those where there are no real interaction (no usage) with the system or the related data are missing, the duration of interaction varies from 7 minutes to about three hours. We categorized the tasks that the participants were required to carry out in terms of their complexity (see footnote 3), most of them are medium – the performance tasks are not so complicated but judgmental tasks can be perceived somewhat cognitively challenging.

REFLECTION SESSION

The above reviews show the weak relations among the three traditional usability measures and the unclear relations between usability and aesthetics. These observations also indicate that there exist some deeply entrenched definitional and measurement issues in the field of HCI. While the measurability of usability and UX constructs seems irrelevant as they are proved measurable, the reliability and validity of such measures are of compelling concerns. While effectiveness and efficiency measures are relatively established, though there are still controversies on how certain constructs are measured (e.g. errors), satisfaction is more problematic, given the reliance on homegrown scales whose low reliability is attributable to poor design. Visual aesthetics, as a strong determinant of user satisfaction, is

measured in various ways as shown by the seven studies (Table 3), ranging from content analysis, heuristic assessment, and one-/several item(s) homegrown questionnaires. Clearly, there are still a lot to do in this fragmentary area.

Here below I attempt to specify the three Ps of my UX Manifesto, focusing on the measurement issues.

Principles

- Given the assumptions that improvement is informed by measures and that measurement implies mapping between sets of values and states of nature, it is well justified to measure usability and UX attributes;
- Preference-performance discrepancies and usability-beauty contradictions uncovered by correlational studies could be experimental artefacts (cf. Monk's [2004] fixed-effect fallacy; single-item questionnaire), and could also be psychological phenomena such as halo effect, social desirability, and calculative judgments based on economic as well as social value. These seemingly counterintuitive observations probe us to better understand users' evaluations of products, from both theoretical and empirical perspectives;
- Measurements of user satisfaction and UX seem to be an artistic rather than a scientific endeavour, with the scope being limited by the imagination and creativity of researchers. Such a diversity of measures not only causes confusion but also fragmentation of the field. Efforts for validating and standardizing these measures are called forth;
- To reduce usability measures into a single measure is bound to lose information, because objective and subjective usability measures may not correlate or even contradict. Similarly, evaluations of UX should not rely on subjective measures – the current predominant type; it is important to develop reliable and valid objective measures (i.e. psycho-physiological and biophysical);

Policy

- To recognize the necessity and utility of measurements for usability and UX constructs;
- To investigate usability and UX measurement issues as two strands of research inquiries while keeping an eye on their intricate interactions;
- To broaden the UX measurements beyond subjective constructs to include objectives ones, leveraging the contrasts between these two types of measures to better understand UX constructs;
- To agree on strategies to resolve definitional and computational issues in usability and UX, for instance, by

building a measurement model to identify the dimensions underlying users' evaluations of interactive systems;

Plan

- To differentiate the closely related terms “user satisfaction”, “user preference”, and “user experience”; some researchers tend to use them interchangeably whereas others tend to distinguish them precisely.
- To deepen the understanding of the relations between preference and performance and between usability and UX measures with reference to the psychology of users, developers, designers and managers, especially the influence of contextual factors on their attitudinal and thus judgmental changes;
- To identify the scoping of evaluation methods for usability and UX (i.e. which method is best performed at when by whom for what purpose); several dimensions of measurement to be addressed: (i) temporality (in- and post-study), (ii) complexity (proved to ameliorate the

relation between measures), (iii) objectivity, (iv) sampling of users and products (to safeguard against the fixed-effect fallacy);

- To identify alternative preference elicitation methods beyond conventional questionnaire to address contextual factors such as product ownership;
- To perform meta-analysis of empirical studies on the relations between usability and aesthetics, given the increasing number of work on this specific topic;
- To sustain the research interests and efforts on UX with a special interest group (SIG), not only focusing on measurements but also on theoretical underpinnings of UX, teaching UX, and transfer of expertise and experience between academic and industrial work on UX.

Table 3: Comparisons of seven empirical studies on the relations between usability and aesthetics

Author/ Source	Evaluation Methods/ Duration of Interaction	Product/ Task Complexity	Measures	Main findings on usability(U)- aesthetics(A) relation	Rel. U-A	Statistics Reported
De Angeli, Sutcliffe & Hartmann, DIS 2006	Users were asked to perform information retrieval tasks with websites of two different interaction styles: menu-based vs metaphor-based/ 3-hour session	Informative website/ Medium-High	(i) Usability: performance, usability problems, subjective scale; (ii) Memorability; (iii) Aesthetics: heuristics and questionnaire; (iv) Information quality scale; (v) Engagement scale; (vi) Overall preference	Usability measures and expressive aesthetics were significant predictors of overall preference; users tend to discount negative attributes in their preferred interaction style; framing effect of user judgment	Yes	logistics regression analysis
Lindgaard & Dudek IwC 2003	Open-end interviews (content analysis); Users were asked to inspect the given websites and comment on them/ 10-minute for each website tested	B2C websites Low-medium	(i) Perceived usability; (ii) Aesthetics; (iii) Emotion; (iv) Likeability; (v) Expectation, and (vi) WAMMI standardized satisfaction scores	Perceived usability and aesthetics did not co-vary; aesthetics and satisfaction correlated	No	t-test statistics
Hassenzahl HCI 2004	Users were asked to rate each of the MP3-player skins with the given questionnaires; pre- and post-usage evaluations were measured/ Study1: 15-min (no usage); Study2: 30-min (with usage)	MP3-player skins Study1: low-medium Study2: medium	(i) Perceived hedonic-identification and hedonic-stimulation; (ii) Perceived pragmatic quality (i.e. usability); (iii) one-item scale for beauty; (iv) one-item scale for goodness; (iv) subjective mental efforts	no or only a weak correlation between aesthetic quality and pragmatic attributes of the product; aesthetic appreciation is not strongly affected by experience	No	Pearson correlation
Schenkman & Jönsson BIT 2000	Users were asked to view the given websites and rate them pairwise and individually to evaluate similarity, preference and other design attributes/ No time limit; no real interaction	13 websites of different domains Low-medium	(i) Similarity (pairwise website); (ii) Preference (pairwise website); (iii) complexity, legibility, order, beauty, meaningfulness, comprehension, and overall impression scales (indiv. website) [Multi-Dimensional Scaling (MDS)]	Beauty was a primary predictor of overall impression and preferences of websites	Yes	MDS analyses; Multiple regression;
Lavie & Tractinsky IJHCS 2004	Exploratory research via 4 studies; users evaluated their impressions or experiences of using the given websites/ No data on time	10 websites of different domains or languages/ Vary with studies: low to medium	Subjective scales on aesthetics, usability, playfulness and service quality	Correlation between usability and classic aesthetics is higher than that between usability and expressive aesthetics	Yes	correlations
Ben-Bassat, Meyer & Tractinsky, TOCHI 2006	Complex mixed methods design; users were asked to read usage instruction, (enter data, (bid an auction)), rate usability and aesthetics of the system/ 7 to 12 min	Computerized phone book Low-medium	(i) Objective performance (accuracy of entries); (ii) subjective preference; (iii) auction bids (economic measure); (iv) subjective ratings for usability and aesthetics	Experience with the system and monetary incentive had NO effect on user preference; auction bids had significant effect on usability but NO effect on aesthetics.	No	ANOVAs
Chawda et al. HCI 2005	Semi between-subject design (3 visualization techniques x 2 search tasks)/ No data on task completion time	Search tool Medium	(i) Objective performance (errors, completion times); (ii) pre-/post-use usability questionnaire (SUS); (iii) pre-/post-use aesthetics questionnaires;	Strong relationships between pre-use aesthetics and pre-use usability, same for the post-use. No correlation between objective usability measures and aesthetics	Yes	correlation

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Conceptualizing and Measuring User eXperience

Joke Kort
TNO Information and
Communication Technology
Eemsgolaan 3
9727 DW
The Netherlands
joke.kort@tno.nl
+31 (0)50 585 7751

Arnold P. O. S. Vermeeren
TU Delft
Industrial Design Engineering
Landbergstraat 15
2628 CE Delft
The Netherlands
a.p.o.s.vermeeren@tudelft.nl
+31 (0)15 278 4218

Jenneke E. Fokker
TU Delft
Industrial Design Engineering
Landbergstraat 15
2628 CE Delft
The Netherlands
j.e.fokker@tudelft.nl
+31 (0)15 278 9677

ABSTRACT

In this paper we describe our preliminary ideas about a User eXperience (UX) framework, reflecting our thoughts on the different experience processes and components that create UX. We have applied this framework by looking at how the results of an earlier performed UX field trial match the UX framework and made some suggestions for planned future research.

Author Keywords

User experience, user experience measurements, design, field trial, event logging, sensing, experience sampling.

ACM Classification Keywords

H.5.2 User Interfaces: Evaluation/methodology; H.5.3 Group and Organization Interfaces: Computer-supported cooperative work; Evaluation/methodology; H.5.m Information interfaces and presentation (e.g., HCI) Miscellaneous.

INTRODUCTION

ICT product design is shifting from supporting a user's everyday tasks towards creating products that are an integrated part of a user's everyday life. When technology is integrated in a user's everyday life aspects like satisfaction, entertainment, enjoyment, a sense of community and identity play an important role [1]. These qualities are not properties of technology; they are outcomes of the process of a user-product interaction in a specific context and a user's sense making of this interaction. The outcome of this process is often referred to as the User's eXperience (UX).

In the last decade a large research effort is put in defining and operationalizing the concept of user experience. However questions such as "How to design for user experience" and "How to measure or evaluate the user experience" are still very difficult to answer.

In this paper we present our preliminary UX framework. This framework is not a working definition of user experience but a reference window in which the many aspects that play a role in constituting an experience can be placed. We hope it will help to identify some of the major issues that need to be solved in experience research, design and evaluation.

Our framework poses different requirements for measuring UX as well. These requirements and the measurement tools that are designed accordingly are briefly addressed in the paragraph 'UX research, measurements and methods'.

We conclude this paper by mapping a UX study and the results of a field trial performed earlier this year on the framework. Thus, we can find out how the framework applies in practice and come up with suggestions for further research in the domain of UX.

UX FRAMEWORK

In literature the term user experience is used to indicate many different things ranging from experience as a holistic concept including 'what men do and suffer, what they strive for, love, believe and endure, and also how men act and are acted upon, the ways in which they do and suffer, desire and enjoy, see, believe, imagine. It recognizes in its primary integrity no division between act and material, subject and object, but contains them both in an unanalyzed totality' [2]. There are also more de-compositional approaches in which an experience is divided into components such as trust, loyalty, usability, satisfaction, hedonic aspects, etc. and in which these aspects and their compositional structure are the focus of experience research. Neither of the above approaches have been able to truly operationalize the concept of experience and questions such as 'how to design for and evaluate an user's experience' remain largely unanswered.

In our view both experience paradigms are valuable and we have tried to incorporate them both into one framework. The holistic approach may be found in the process of how an experience comes to life, the end result of a user's sense making at a specific moment in time. During this sense making different experience aspects are recognized (pragmatic approach) as playing an important role in generating the end result, the UX. To truly understand and quantify user experience we need to obtain insight in the different UX aspects and their structure and role in creating an experience as well as the sense making process.

In our view a user interacts with product elements designed to create a specific experience. Through the process of sense making a user experience comes to life and continuously develops and changes over time. A user experience is unique and situated in this sense. To gain insight in UX, we need to study the sense making process, the experience aspects as well as how these relate to design elements that are intended to create specific experiences over time.

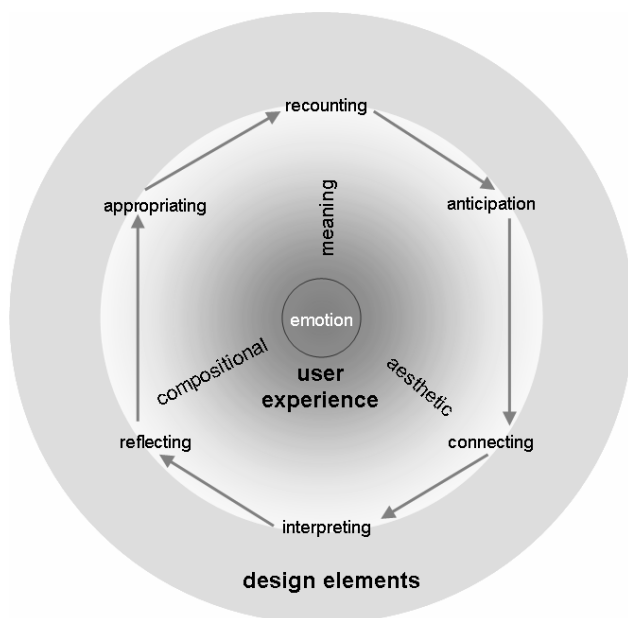


Figure 1 UX Framework. The outer circle distinguishes general phases in the (non-linear) process of sense-making, resulting in user experiences. The three user experience aspects in the center may lead to emotions/feelings and can be related to how specific design elements are experienced.

Our framework draws heavily on frameworks as formulated by Wright & McCarthy [1], and by Desmet and Hekkert [7] as well as on our own earlier research [3]. In our framework we try to incorporate design elements (as Desmet and Hekkert do) in order to establish the relation between design and UX; also we draw a relation of these to the process of sense-making described by Wright & McCarthy. Our framework is by no means an

operational framework, but should be viewed as our thought exercise in sense making of UX. In the following sections our framework is addressed in more detail (see figure 1 for an overview).

Design elements

Design elements are the elements of which a product consists. A product designer intends to make a product convey a certain character through its attributes (e.g., pragmatic and hedonic) [4], or create kinds of design (e.g., behavioral, visceral and reflective [5]) using interactive elements, action possibilities [1], narrative structures [1], intended use, function, look, feel, sound, color, forms, intended message and the intended meaning of a product or its use. Design elements map to the three user experience aspects we identified or viewed as relevant, inspired by Wright and McCarthy [1] and by Desmet and Hekkert [7]: compositional aspects, aesthetic aspects and aspects of attributing meaning.

User experience aspects

User experience aspects are aspects or lower level experiences that a designer intends to create through the use of design elements. We acknowledge three different experience aspects related to the four experience threads of Wright & McCarthy. The spatio-temporal thread is incorporated in the other threads, since the characteristics of this thread are, according to us, covered by the other user experience aspects. Furthermore the threads as mentioned by Wright & McCarthy are given a slightly different meaning to create a clear link between design elements, experience aspects and the sense making process. The threads sensual and emotional aspects are re-named in accordance to what Desmet and Hekkert call aesthetic experience and experience of meaning. We view Desmet and Hekkert's emotional experience as a resultant aspect: as feelings that can be influenced by any of the three design-related aspects mentioned before.

Compositional aspects

Compositional aspects are experience aspects a designer tends to create by structuring the interaction with the product. This experience aspect is closely related to usability, pragmatic and behavioral characteristics of a product such as predictability of the product and the interaction possibilities and results or outcomes it provides. Design elements influencing compositional experience aspects are action possibilities, narrative structure, supported intended use, supported functionality, etc. Compositional aspects can result in feelings of understanding how a product works, what has happened and what will happen next, where the user is, the feeling of making progress, moving forward in a satisfying way, etc.

Aesthetic aspects

Aesthetic experience aspects relate to a product's capacity to delight one or more of our sensory modalities [7]. Thus it is closely related to look, feel, sound, color, forms, and their specific composition. Aesthetic experience aspects may lead to basic feelings such as thrill, fear, excitement, unease, awkwardness, the perception of speed, time and boundaries.

Aspects of meaning

Aspects of meaning are experience aspects a designer intends to create by realizing a user's higher order goals. As Desmet and Hekkert state it, here cognition comes into play. Through cognitive processes we are able to recognize metaphors, assign personality or other expressive characteristics, and assess the personal or symbolic significance of a product [7]. This relates to higher order goals like needs and desires that are in line with for example self-realization and continuous personal development, self-expression, etc. Aspects of product meaning and product interaction can result in feelings such as anger, joy, satisfaction, fulfillment, fun, bliss, closeness to one's own identity or image, inspiration, regret, etc.

Relations between compositional aspects, aesthetic aspects and aspects of meaning.

The relation between compositional aspects, aesthetic aspects and aspects of meaning is that they are each representing and incorporating properties of design elements to create experiences at a specific experience level. Compositional aspects tend to cover the pragmatic and functional properties. The aspects of meaning on the other hand tend to cover the fulfillment of higher-level user goals, and relate to properties like expressiveness. The aesthetic aspects are connecting function and higher order experience aspects through for example the look and feel of the product.

Sense making

According to Wright & McCarthy sense making is a non-linear process (in terms of cause and effect) consisting of one or more of the following sense making processes: Anticipation, connecting, interpreting, reflecting, appropriating and recounting.

Anticipation

Anticipation according to Wright & McCarthy means that we do not just experience, but bring our previous knowledge and sense making of experiences to the current situation. When using an interactive product we have expectations about the experience we are to find on all three experience aspects. We expect predictable interaction and outcomes, expect to experience e.g. excitement or true value in line with our higher order goals and this we anticipate on.

Connecting

According to Wright & McCarthy in connecting, material components have an impact on us to generate some response, pre-linguistically, without us giving meaning to it. An example of an experience resulting from this type of sense making is experiencing a sense of speed, thrill or openness created by design elements supporting aesthetic aspects.

Interpreting

Giving meaning to an unfolding experience implies for the different experience aspects to relate to our goals, desires, hopes, fears and our previous experiences. We reflect on our expectations and alter them to be more in line with the new situation, when required. We interpret for example the product interaction based on our expectations of available actions and what will happen when actions are performed. Based on our interpretation of interacting with a product we can experience excitement or a feeling of anxiety or unease because of the product and its interaction not being predictable. This, in turn, can lead to e.g. emotions like the desire to remove oneself from the situation or a willingness to continue.

Reflecting

In reflecting we make judgments about our experiences, we evaluate them on their value compared to other experiences, leading to feelings such as satisfaction with the progress made during product interaction, feelings of boredom, excitement or of achievement.

Appropriating

In appropriating we compare our experience with previous and future experiences and make it our own. This comparison may change our sense of self as a consequence of the experience when we e.g. had a new experience. We try to identify ourselves with it or we can not identify ourselves with it.

Recounting

Like reflecting and appropriating, recounting goes beyond the immediate experience by considering it in the context of other experiences. Having appropriated an experience we often recount it to others, thereby reliving the experience and finding new possibilities and meaning in it. Experiences are re-evaluated in this way.

From product interaction to experience

Anticipating, connecting and interpretation are sense making processes that are closely related to product interaction (they often arise before and during product interaction) and are situated and unique in this sense. Reflecting, appropriating and recounting are sense making processes that can start during product interaction but often go on after product interaction as well, resulting in different evaluations of experiences as obtained during

product interaction. The process of sense making shows that experiences are very dynamic in that they are continuously changing and from before the actual product usage are developing into more complex, higher level experiences.

UX RESEARCH, MEASUREMENTS AND METHODS

The framework gives a reference window to look at the sense making process, the resulting UX, its underlying experience aspects and their underlying design elements. However, it does not position UX in a quantifiable manner. To become able to quantify UX a lot of research still needs to be done in detailing the framework and establishing clear-cut relations between the sense making process, experience aspects and design elements. Methods for designing and evaluating UX need to be developed, current measurement tools need to be validated on their suitability to measure UX and new measurement tools need to be created [3].

In earlier work [3] we described the development of the TUMCAT platform (Testbed for User experience measurements of Context Aware mobile applications). A measurement platform that provides new measurement tools for in-situ UX research. In the following we will describe a field trial of an interactive product in which a combination of current, common UX measurement methods and TUMCAT measurement tools were used. Note, that this field trial was conducted prior to the development of this framework. Nevertheless, our goal here is to map (post-hoc) the UX research questions and results of this field trial on the framework described earlier to see if current research can be placed within the framework and to explore further development of the UX framework and methods for UX evaluation.

Case study: Tribler field trial

In this paragraph we describe one of the pilots (which took place within the Freeband project iShare) that is performed with TUMCAT measurement tools.

iShare project

The objective of iShare is to develop and evaluate systems in which resources are shared. Current peer to peer networks (p2p) are a good example of these kinds of networked systems. Yet, the success of any P2P system fully depends on the level of cooperation among users. iShare proposed applying knowledge from (social) psychology on altruistic behavior for developing features that can induce better cooperation [6].

Tribler is a peer-to-peer television (P2P-TV) system for downloading, video-on-demand and live streaming of television content, as well as of other kinds of files [6]. The system gives users access to all discovered content and other users in the network, but also provides the means to browse personalized content with a distributed

recommendation engine and an advanced social network that each user creates implicitly and explicitly. An advantage of having trustworthy friends in Tribler is that these can speed up the downloading process by donating their own idle bandwidth. In order to evaluate if cooperation is successfully induced, data about the actual usage of Tribler and how users experienced working with the software was collected and analyzed.

General research questions for Tribler

For this specific test, iShare was interested in finding out to what extent people appreciated Tribler's functionality. The test would have to focus on what people would do with Tribler, how often they would do that, as well as for what reasons. iShare also wanted to know to what extent people were successful in doing the things they wanted to do and what problems they experienced in trying to do so (i.e. usability). Finally, iShare wanted to know people's experiences in using Tribler's functionality.

Field trial setup and implementation

For the TUMCAT test, research questions were detailed in terms of the specific functionality in which iShare was interested. Based on these detailed research questions, TUMCAT logging (automatically capturing user actions) and sensing (automatically capturing the user's virtual context) [3] software code was built into the Tribler software. The detailed research questions focused on the following topics:

- Downloading: *How much (recommended) files do people download? How do they experience downloading? Why did they choose specific files from their lists of recommendations? How often do people remove files from the download history? Why did they do that?*
- Seeding: *How often do people keep a (completed) file available for others to download? Why do some people leech instead of seed? Why are they not willing to seed? Are they aware of it when they are seeding? Do they do it deliberately? What are their expectations with regard to seeding?*
- Moderation: *How often do people rate files or mark them as fake? What do people expect and experience when rating or marking content?*
- Social reach: *How often do users invite, add, or delete friends and peers? What do people think that friends and other peers are for in Tribler? And what are their experiences with friends and other peers in Tribler?*

The TUMCAT software code (embedded in the Tribler client) automatically sends logging and sensing data from the test participant's PC or Macintosh to TUMCAT's logging and sensing server. Prior to the test, the

researchers had defined in what situations they would like to gather subjective information from the user through experience sampling (ES) [3]. Experience sampling questions were formulated in advance and were linked to specific events that could be logged by TUMCAT. When such an event was logged triggers were generated at the logging and sensing server and were then automatically sent to the ES server. This server then automatically triggered the TUMCAT code in the Tribler client to open a browser window with a question. In a text field in the browser window the user could then type an answer and submit it to the ES server. Additional subjective data was gathered through a feedback button in the Tribler application. Users were free to use this button whenever they wanted. If they pressed the button, a small window would appear in which they could enter any text they wanted and submit it to the researchers.

Tribler test procedure

Test participants were recruited from a list of people who (at an earlier stage in the iShare project) had filled in a questionnaire on file sharing software, through posters and flyers distributed at universities, high schools and research institutes, and through personal contacts. A total of 27 people participated in the test, all having experience with file-sharing applications and having broadband connections to the internet. Communication between test participants and researchers took place almost exclusively through email. One person participated from Shanghai, China, whilst all others participated from various places in the Netherlands. Via email test participants were invited to download the instrumented version of Tribler and to use it for a maximum of five weeks. They were informed about the fact that their behavior would be logged, that the content and names of downloaded files would not be visible to the researchers and that they could expect some questions to now and then show up during Tribler usage. They were informed that in case the researchers would find out about any downloading of illegal contents they would be excluded from the test and would not receive the reward of €25. Furthermore, the site from which Tribler could be downloaded contained some links to websites providing legal content for downloading. No further instructions were given on what to do with Tribler.

Field trial test results

In five weeks time, 292 Tribler sessions were logged. During that time, the feedback button was used 22 times, by 14 users and 81 ES questions were asked: 75 were answered by 19 users; 6 were not answered (3 users).

Below, the results from the TUMCAT test will be discussed by topic.

Downloading

Logging and sensing: On average the users started 1.3 downloads per active day, of which 0.3 files were completed. Four out of 27 users never started downloading files.

Experience sampling: 18 users responded with a total of 30 answers to the ES questions "Recently you have downloaded a number of files. How did you experience the process of downloading files?" Answers to this ES question referred to various aspects of downloading included: *speed* of downloading (8 positive, 3 neutral/normal, 6 negative; sometimes answers were given in comparison to similar software), general experience (1 *unexciting*, 10 *good*, *nice*, etc.), level of activity of trackers and downloads should be higher (5), *ease of use* (4 good), suggestions for *improvements* (3 *use of colors* in main screen, *minimize to system tray*), effect on *speed* of computer or on internet activity (2 negative), *availability* of (legal) content (1 not enough), *reliability* of downloading (1 positive). Two out of 27 users removed a file from their download history. One of them removed only one file and stated as the reason for that: "It did not download and was *not very interested* in it. I think it will improve the recommendations closer to the remaining files." This indicates that this user had acquired a *basic understanding* of the recommendations engine. The other participant did not answer the ES questions. 10 Out of 27 users started one or more downloads from their recommended downloads. One user started 40 downloads from his list of recommendations. A total of 34 answers were given to the ES question "You have chosen to start downloading a file. Can you tell us what made you chose this specific file?" In 24 cases the answer referred to them judging the content of the file to be *of interest to them*, *based on the title of the file*. In three cases there was a reference to the number of seeders and/or leechers (which provides an indication on the chance of getting a *successful* download) and in four other cases the choice was said to be based on the fact that it was in the list of recommendations and had a specific recommendation value. This indicated a proper *understanding* of the list of recommendations. In two cases a file was said to be selected *just to try out* the function. In one case, a specific file was said to be chosen as part of a *strategy* to get more similar recommendations. Again this indicates a proper understanding of the recommendation system.

Feedback button: Via the use of the feedback button a number of issues were mentioned by users, including *speed* (2 positive, 1 negative), *impact* on internet activity (1 positive) and on CPU usage (1 high); *problems and misunderstandings* (5 in main screen; 1 in recommendations; 2 in geographic overview feature; 1 in

finding legal files; 1 in not resuming file that was started with other client).

Seeding

Logging and sensing: Eight out of 27 users never had or kept a completed file until the end of a session. Among these eight users are the four users who never started downloading at all. Ten out of 27 users kept a file until the next session and then removed it. Ten out of 27 users kept a file available for others to download for more than one consecutive session. These are the only potential seeders.

Feedback button: Via the use of the feedback button, *suggestions* were made for what to do with files that were completed: 2 about easy or automatic clearance of downloaded files from main screen. This indicates that they were *not aware* they should or could keep completed files available to others.

Moderation

Logging and sensing: Three out of 27 users rated one or more files with 1-5 stars, among whom 1 user rated 17 files. No user marked files as fake.

Experience sampling: 1 User explained that he thought that would have an effect on what recommendations he would. The other two users assumed that the rating they gave would somehow become visible to other users and that they can use that information to decide whether the file would be *interesting* to them or not.

Social reach

Logging and sensing: Two out of 27 users added one friend. Seven out of 27 users added peers as friends, among whom one user added three peers as friends and one user added two. Three out of 27 users invited one friend; one user deleted two friends from his list.

Experience sampling: Reasons mentioned for 'adding a peer as friend' included: 3 about peer has similar files as user and this may increase download speed ("He turned out to have two files I was downloading. So the (...) files he shares are in common to mine.", "Maybe, when using a friend, downloads may go faster in some way?"), to get recommendations again after my PC crashed, and to try out how the friends function works.

Feedback button: one user asked about an issue related to 'peers as friends'. This user *suggested* it would be useful to have a possibility to chat with an interesting peer or to have communities of peers with similar interests (e.g. sci-fi). Also this user wondered whether he would become *visible* in the list of peers of others and therefore asked where he could set a nickname for himself.

Field trial results and the UX framework

Though the field trial just described did not make use of the framework just presented (it did not exist at the time), it is interesting to see how the results map on the UX framework and how on the other hand the framework could guide researchers to formulate UX research questions.

The UX research interests in this field trial were focused on very specific design elements or Tribler functionality such as downloading, seeding, moderation and social reach. The use of this functionality was monitored via logging and sensing and ES provided the means to gather subjective data indicating how specific design elements were experienced.

User experience aspects in Tribler

The field trial results indicate that most of the results focus on the compositional experience aspects, for example the understanding users have about the workings of specific functionality within Tribler and the feeling of making progress (e.g. download speed, availability of files and reliability of the software, downloads and the recommendation system). On the aesthetic level speed is a topic often mentioned (e.g. speed of downloads, pc/processor and internet connection). On an emotional level downloading files was mentioned to be unexciting. On the level of meaning, some online identity concerns were mentioned by a user who wanted to change his nickname. Furthermore the suggestions made via user feedback indicate some compositional aspects that could be better supported by changing specific design elements such as the color of downloaded files (color coding), minimizing Tribler to the system tray, automatically removing completed files from the main window, etc).

Concluding, almost all results obtained during the Tribler field trial can be placed in the UX framework and connections between experience aspects and design elements can be made, which can give us new insights in the UX framework and creates the possibility to enhance it. On the other hand formulating UX research questions could be guided by reasoning about different experience aspects and how these relate to design elements. In our experience it is quite difficult to formulate UX research questions without any reference to a model or theory. We think that gaps in measuring the user experience (e.g. experience aspects such as the aesthetic aspects and aspects of meaning) can be better addressed with the help of the UX framework.

Sense making in Tribler

We identified some sense making processes in the test results of the Tribler field study: anticipation and interpreting. In the results there are some indications that participants anticipate specific functionality and have ideas about what they should be able to do with the

Tribler software, sometimes based on the use of comparable software (e.g. the perception of download speeds and suggestions for improvements of the Tribler software such as color indications for download status, minimization of the client to the system tray, etc). From the results indicating a certain understanding of the workings of Tribler and its specific functionality we find that users have interpreted their actions and the results obtained with Tribler compared to their own goals (e.g. downloading specific files to influence the recommendations one gets), the resulting experience is however unclear.

Observing the Tribler research questions it is predictable that most of the field trial results focus on the user's experience of specific functionality within Tribler and not on the processes of sense making. Though the different sense making processes can help is to a large degree to gain insight in how specific experiences come to life and thereby can give an indication of what you could change in experiences, how and through which design elements, formulating research questions that give us this insight is difficult. We hope that the UX framework will give some guidance in this sense as well, by stimulating thoughts about sense making processes and how they might reflect on the experiences and design elements.

FUTURE RESEARCH

Recently, new field trials have started and are about to start with current UX methods such as questionnaires, interviews, usability studies and TUMCAT measurement tools. Research questions for these field trials are formulated based on the thoughts presented in the UX framework and we thereby will try to further enhance the UX framework and apply and test different measurement methods at the same time.

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UX MANIFESTO

In this section our input for a possible UX manifesto are discussed, based on the three P's: Principles, Policy and Plans.

Principles

In our search for answers to the question of 'how to design for and evaluate an user experience' the framework described in this paper has become our starting point. The framework can be described with its three key characteristics: 1) it deals with user experiences, product design elements, and how these relate to each other; 2) it is based on a holistic view on UX, described in the form of the process of how an experience comes to life (the sense-making process); 3) it is also based on a de-

compositional view on UX, framing UX aspects that underlie the sense-making process.

Policies

We think that usability can to some extent be seen as part of the broader concept of user experience (e.g., the satisfaction component of usability), but also as leading to specific user experiences (e.g., through efficiency and effectiveness in interactions). In terms of our framework, usability mainly relates to the compositional aspects.

We think that the main (general) research question in the domain of UX should be 'how to design for and evaluate an user experience'. To answer that question it does not suffice to only study user experience as such; serious attempts should also be made to study how product elements can be designed such that they can influence the user experience in a desired way. Thus much of the research in the domain of UX should be done in close collaboration with the domain of product design. At the same time, research attempts should be made to make UX measurable, so that it can be determined to what extent attempts to evoke specific UX's have been successful.

Plans

Our starting point for studying UX is to develop a platform for a large variety of tools for measuring UX aspects 'in the field'. Recently we have started building and using this platform. The platform and the measurement tools are iteratively developed further based on a number of case studies, in which the UX evoked by (generally prototypes of) products are measured and fed back into the design process of those products. As the products are brought in from various projects other than the TUMCAT project, each new case study potentially brings along new input for how to further develop the platform. At the same time, for conducting the case studies, measures of UX have to be developed for each new project. This process is helped by the framework while at the same time it provides input for further developing or adapting the framework and making it more operational.

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User Experience Research as an Inter-discipline: Towards a UX Manifesto

Peter Wright

Sheffield Hallam, UK University
P.C.Wright@shu.ac.uk

Mark Blythe

University of York, UK
mblythe@cs.york.ac.uk

ABSTRACT

A number of theoretical frameworks for understanding user experience have been developed in the last five years. While there are differences in these approaches they all attempt to move away from a narrow focus on usability towards more holistic accounts of experience with technology. We argue in this paper that the diversity of such approaches is indicative of the essential interdisciplinarity of user experience research which is a boost to innovative design rather than a problem. Yet a number of recent studies of user experience including tutorials, workshops and papers have been based mainly on methods aimed to improve usability. This paper outlines additional interdisciplinary techniques that support richer conceptions of user experience. We briefly describe some of the tools for data collection more closely allied to diverse conceptual foundations of user experience research. Finally we offer some principles or propositions that may help shape user experience research as an interdiscipline.

1 THE TURN TO EXPERIENCE

As this workshop and a plethora of recent publications and tutorials testify, user experience has become a pivotal concept in Interaction Design and Human-Computer Interaction. Its emergence has turned a critical light on discourses associated with the traditional values of designing for usability and user-centred design, which tend to privilege function, universal insight, a degree of separation between user and context, and the reification of both. But practitioners and researchers are sometimes less than clear about the implications of privileging experience in their attempts to understand and intervene in human-computer interactions. Part of the problems is that experience is difficult to define precisely. However it has a history of use in ordinary conversation and in philosophical discourse that provides interdisciplinary common ground in HCI research.

The philosopher Martin Jay [20] discusses the diverse uses of the concept of 'experience' from the Greeks to the poststructuralists. As Jay puts it, "'experience' is a term rife with sedimented meanings that can be actualized for a variety of different purposes" (p.12). Both historically [e.g. 14] and within recent HCI research [e.g. 20] it has been used to highlight the shortcomings of a dominant position such as cognitivism, and to critically comment on

that which does not do full justice to what matters in people's everyday lives.

Etymologically 'experience' signifies an orientation toward life as lived and felt in all its particulars rather than as described in theoretical abstraction and universalizing accounts. It also expresses something of the openness and contingency of life as well as its wholeness. It also tries to accommodate both the intensity of a moment (*erlebnis*) and the journey of a lifetime (*erfahrung*). One of the primary reasons for deploying experience analytically has been as a corrective against dualism and reduction. Indeed it has been used most convincingly to describe particular modes of experience that stubbornly resist such reduction. Within the broad diversity of concerns and disciplines which interest current HCI research, we can imagine the value of a concept that can be used to protect the integrity and wholeness of virtual experience, the authenticity of digital art experience, and the value of modes of experience such as gameplay.

The difficulty with experience, and its generative potential, is precisely that it signifies intersections and ambiguities that matter to people and that have consequences for methodology. For example, the intersection and ambiguity between interior and exterior lives that allows us to develop rich descriptions of what it must be like to be enchanted by a game or an MMS message from a friend far away. Or the ambiguity with some experiences or feelings that can't really be explained or even described but that can be recognized by another. Although, to some, these may seem like concerns far too deep or ephemeral for user experience design, in a time when technology mediates the most intimate of human relationships they may be precisely what is needed. For Jay [op. cit.], the generative potential of experience as a concept is precisely in its recognition of these ambiguities in lived and felt life. Instead of trying to escape its ambiguities. It may be then that it is more fruitful for HCI research to learn to live with these tensions and paradoxes rather than try to eliminate them through reduction and operationalisation.

In this context then, it is important that any UX manifesto, resists the temptation to promote the discourses common in for example, cognitive psychology, computing and software engineering to be the sole or dominant discourse

or mode of thinking in user experience research and experience-centred design methodology. Rather the aim should be to develop a manifesto which acknowledges the value of diverse perspectives on this complex concept and uses this diversity to generate design innovation.

2 EXPERIENTIAL FRAMEWORKS IN HCI RESEARCH

A number of theoretical frameworks of experience-centred design have emerged in recent years. Some adopt a scientific and engineering perspective and take a broadly cognitivist, information processing approach to conceptualizing human experience [e.g. 30, 17, 26] others take a more phenomenological perspective [e.g. 15, 11, 22]. Whatever the theoretical orientation, these frameworks attempt to move from a focus on usability towards broader aspects of experience such as emotional appeal, cultural value and sense making. Morville [24] for example offers a modular account of experience which is made up of: usable, useful, desirable, valuable, findable, credible and accessible elements. Wright and McCarthy discuss four threads of experience which can be paraphrased as the emotional, the sensual, the intellectual and the biographical [for a more precise account see 36]. Phenomenological and pragmatist accounts find their foundations in the arts and humanities rather than the sciences. While approaches differ in fundamental ways there is a common core of concerns with context, embodiment, and the rich, sensual and emotional aspects of interaction with technology. Each of the theoretical perspectives developed in HCI has attempted to broaden the focus of research from concerns with ease of use, ease of learning and efficiency. Although usability remains a core aspect of user experience research it is no longer the only one.

FROM USABILITY TO USER EXPERIENCE ... OR NOT?

In the light of this stimulating and potentially groundbreaking theoretical diversity, it is perhaps disappointing to see that a recent CHI tutorial entitled “From Usability Testing to User Experience” listed tools for data collection and analysis which focused almost exclusively on the techniques of traditional usability testing [27]:

“Features:

- * Video recording and screen capture, storage and retrieval
- * Designing a Usability lab
- * Observational data collection
- * Automatic logging of user-system interaction
- * Multimodal measurements: eye tracking and physiology
- * Qualitative data analysis
- * Quantitative data analysis
- * Creating Usability test reports” [Ibid]

While no doubt this was a very useful tutorial, the above list presents techniques for analyzing qualitative and quantitative data conventionally used to improve

usability. It suggests that the dominant methodology is that of science and engineering and the richness of “experience” highlighted by Jay seems to have been reduced to behavioral logs and eye tracking.

In a similar way, many recent publications on the analysis of user experience have focused in the main, on usability. Kotringer et al’s [21] study of user experience is based on an expert walkthrough which identified usability issues that were verified with usability testing and a user survey. Booth and Sorenson [10] describe a method of predicting end user experience involving task-based usability tests and validation through expert rating. Costa et al’s [12] study of diamond buying online was largely based on a usability study examining the ease of use of a diamond search tool [Ibid]. In order to explore the user experience of a “blended reality” game Huynh et al [18] conducted a within-subjects experimental design along with interviews. This is a partial list of examples rather than an exhaustive survey of recent work on user experience but it serves to illustrate a continued focus on usability in work ostensibly addressing user experience.

These studies are of course all excellent and worthwhile, this paper is not arguing that usability is not an important aspect of user experience. But, an over-reliance on tools and techniques emerging from the science of cognitive psychology and designed to focus on usability seems to us to be unlikely to reflect the richer conceptions of user experience envisaged in the current theoretical literature. There may be a danger that the concept of experience may be tokenized and become just new name for usability research - old wine in new bottles.

It is perhaps unsurprising that lab based studies of usability should be prevalent in HCI given its historical links with departments of computer science and psychology. Methods for measuring particular aspects of technology use are well established and methods for collecting richer data are not so well understood. Yet in the past five years, not only has there been significant developments in our understanding of user experience, but also a number of data collection techniques resonant with this new understanding. Some of these are well known and frequently used in the CHI community but others are less well known.

EXPERIENCE-CENTERED DATA COLLECTION TECHNIQUES

There are a number of qualitative data collection techniques which focus on rich accounts of experience. These are largely drawn from ethnographic traditions and are widely employed in HCI. Undoubtedly the best known of these is Gaver et al’s *Cultural Probes* [16]. Here participants are given probe packs usually containing a camera and a list of fairly abstract things to take pictures of (e.g. something that means a lot to you) tape recorders for recording such ephemera as dreams and guest books for recording visitor’s comments. While these

are not intended to produce repeatable or reliable observations they focus attention on the particularity of the participant's lives and personalities [Ibid]. Boehner et al [9] note that the method has often been appropriated as a form of discount requirements analysis and suggest that it's original theoretical under-pinnings are often disregarded or undermined.

The original spirit of the exercise is playful and it is relatively cheap and quick which perhaps explains, in part, its popularity in HCI. But the increasingly wide context of computing technologies and the focus on experience may also account for its success. Data collection techniques based on probes frequently require creative input from participants, for example, labeling their home technologies as particular kinds of animal in a zoo [1] or creating collages to represent their experiences with mobile phones [23]. Such appropriations of the probes technique have paved the way for other playful methods of data collection that focus on experience.

Alan Newell and colleagues have attempted to dramatize the felt life of those they are designing for through *Forum Theatre* [25] This work has focused on older people. Actors speak with and observe older people in order to develop a character who they can then play in design sessions and forum theatre presentations. The actor plays the part of the older person and designers interrogate them in the context of scenarios. This has the advantage over talking to real users in that the actors may be more voluble in their dismissal of some ideas as they are less concerned with politeness than their real life counterparts would be. It also has the advantage of opening up a space for dialogue about intensely personal matters which would otherwise be very difficult to discuss. Although this technique is neither cheap nor easy it is finding footing in HCI as the field turns its attention not only to the home but some of the more vulnerable people living in it.

A similarly empathic method is Buchenau and Suri's "experience prototyping" [11]. Here designers making an interface for a blind person might for example, blindfold themselves in order to gain a sense of the experience that the user will have. Or they may put on a padded and weighted suit to restrict their movement so that they might gain an understanding of how it feels to be an older person whose movement is severely restricted [Ibid].

Most recently Gaver has appropriated evaluation methods taken directly from the arts and humanities in the use of cultural commentators. Film makers have for instance been commissioned to make documentaries about the installation of a new technology in a family home.

A concern with richer conceptions of user experience has also been manifested in the design of quantitative methods based on questionnaires [e.g. 33]. Methodologies have also been adopted which are more readily associated with literary criticism. In order to explore the aesthetic

aspects of an interaction design Olaf Bertelsen, for example, recently advocated a technique he calls Interface Criticism. Drawing heavily on semiotic approaches to literary criticism he advocates an expert appraisal of an interface in terms of for example, stylistic references, representational techniques and challenges to expectations [3].

PLAYFUL BIOGRAPHIES

Our own work with users might be described as 'playful biography'. It takes the form of engaging activities and games. During a *Technology Biography*, for example, participants are asked to reminisce about how their relationship with technology has changed through their lives [4]. How for example, etiquette and routines have changed with regard to television viewing [5]. Asking people to reminisce in this way can be quite engaging in itself and produces rich data. It can be very difficult to articulate everyday practices in response to direct questions like – how do you watch television? The immediate answer is, like everyone else! Asking participants to compare the past and the present can make the familiar strange. This "defamiliarisation" can be a useful stimulus for design thinking [2]

A user's experiences of a product does not start and end with their first interaction with it, rather they are shaped by our expectations of it [21] and their reflections on it. With this in mind an anticipation and reflection interview protocol was developed to evaluate *Riot!* an interactive play for voices in a public space [6]. Before *Riot!* the participants were interviewed about their attitudes to the city, art and technology, they were also shown the publicity generated for *Riot!* and asked to describe what they would expect to experience based on the poster. Using a headphone splitter a researcher accompanied each participant through the *Riot!* event and asked them to think aloud as they went along. In addition, immediately after the experience participants took part in a critical reflection interview and five months later they were asked to write an email account of what they remembered about their *Riot!* Experience. Comparing the different accounts allowed for a subtle and nuanced account that accounted for the very different reactions that particular users have to the same piece of work.

User expectations may be to some extent shaped or distorted by advertising. *Persona Matching* is a technique which uses commercial advertising and the subtle appeals it makes to our aspirations to select participants and construct tasks for user testing [32]. The Orange website advertised its new Smartphone with a series of scenarios in which a young mother, a businessman, and a student interacted with their phones in various ways. The personae were used to recruit participants as similar as possible to them. The scenarios were used to create tasks to be accomplished with the device in the real world. This not only subjected the techno-utopian claims of marketing

professionals to examination it also helped focus on the ways that expectation, experience and reflection can shape the stories we tell ourselves about technologies. As these activities were task-based they were further supplemented by “*Do Something*” challenges, these were open ended and ambiguous challenges to do something ... with the phone. Participants were given a list of adjectives such as *dangerous*, *sexy*, *flirty*, *annoying* and asked to choose five of them [Ibid].

Interactions with technology are increasingly matters of ethics. Do we, for example, download music on the net without paying for it? Although there has been some qualitative work in this area recently [19] most work on ethics in HCI is quantitative relying on questionnaires and Lickert scales. Such work has been criticized because it does not capture grey areas and moment-by-moment decision making. *Technology Scruples* was developed as a data collection technique to explore personal ethics in a non-threatening way [8]. The game scruples presents participants with ethical dilemmas, each player must guess what the other would do. For example: you are walking down the street and you find a wallet, do you keep it? This game was adapted to questions of what the recording industry have characterized as “digital shoplifting”. Like the original game it generated a great deal of discussion and debate giving access to kinds of sense making that would otherwise be very difficult to elicit [Ibid].

Although ethnographic work and the kinds of inventive qualitative data analysis techniques described above can generate rich data that focuses on lived experience this is often lost when deployed in scenarios. *Pastiche Scenarios* were developed to draw on fiction as a resource for design [7]. Pastiche is a form of writing that imitates and borrows from other works and styles. It appropriates characters, situations and plot lines to place it in a new context. Pastiche scenarios then draw on existing narratives in order to create richer and more resonant descriptions of users and technologies. Because the cultural sources drawn upon are rich and resonant, possible interpretations of the scenarios are multiple [Ibid]. Similarly *Experiential Narratives* [29] use a “stream of consciousness” style of writing to evoke rich scenarios that put felt life at the centre of the design process.

INTERDISCIPLINARY RESEARCH AND COLONISATION

There are a number of ways in which inter-disciplinary research is understood. One is to assume that the complexity and richness of user experience which is made visible through the arts and humanities can be reduced to a set of manipulable and measurable variables and therefore made tractable to a purely scientific investigation. One symptom of this is the imposition of abstract models and classifications onto rich and complex concepts like affect and emotion. An alternative and in

our view more productive approach to interdisciplinary research is to understand it as a form of dialogue in which each collaborating discipline brings to the design problem a particular expertise and sets of tools and in doing so create a new perspective that belongs to no-one. Often in interdisciplinary dialogue concepts theories and methods become appropriated and transformed to make them usable. This process of appropriation necessarily involves taking some things up and leaving some things behind [9]. A key issue is understanding what has been left behind and how that impacts on the validity of the tool.

There is a distinction to be made between interdisciplinary dialogue and colonization. Colonization occurs when one dominant discipline adopts the language of another without changing its own methods at all. Dialogue occurs when two communities come together each respecting the other as centre of expertise and value. Real creative thinking emerges in dialogue.

CONCLUSIONS

There are now a number of theories and frameworks that provide a richer conception of user experience. In addition, there are tools and methods that reflect this richer conception by encouraging dialogue and supporting interpretative flexibility in order to get at the felt life of people’s experiences with technology. Reducing user experience analysis to behavioral logs, guidelines, interview prompts, or evaluation criteria does not do justice to the understanding of experience that these theories and methods seek to provide. This richer conception is necessary for real progress to be made in user experience research and practice.

CRITICAL EDUCATION IN HCI

In order to make real progress in a discipline, it is necessary to develop a critical stance and this requires some distance between research thinking and practice. The gap between them provides the space for learning and innovation. Suchman’s [31] ethnomethodological critique of the cognitive paradigm in HCI provided such an opportunity for critical reflection and progress. The turn to experience that HCI has witnessed in recent years offers us a similar opportunity for progress in our discipline. In particular, it can provide a critical edge by which we can develop our conception of the *human* in human-computer interaction. But this is only possible if we do not allow concepts like *experience*, *embodiment* and *felt life* to be watered down, reduced or tokenized in applied research and practice. We hope this paper demonstrates that user experience is more than usability and that a number of techniques and tools that capture broader conceptions of experience have been developed. The radical interdisciplinarity that is presumed by experience design [see for example, 34] requires that we re-think how we train researchers and practitioners. There is clearly a need for a broader HCI education that offers the foundations by which students can experience

this inter-disciplinarity and develop the skills necessary for interdisciplinary thinking. Elsewhere this has been referred to as a “Liberal Arts of HCI” [34] This paper has argued that if accounts of user experience rely solely on techniques designed to test usability there is a danger that the opportunities for progress offered in the various theoretical accounts will be lost.

PRINCIPLES FOR UX DESIGN

The following propositions could be read as finalized principles for a UX manifesto. Alternatively, they could be seen as provocations for an interdisciplinary dialogue:

1. The complexity and richness of human experience should be acknowledged and analytical methods should be informed by this.
2. Experience-centred design encompasses: usability engineering, affective computing and emotional design, it is therefore necessarily an inter-discipline.
3. Interdisciplinary research proceeds through dialogue and collaboration and this requires each discipline to understand and support the expertise of the other.
4. It should be acknowledged that different disciplines do things differently for good reasons and that difference is important for innovation.
5. It may be that key aspects of human experience such as beauty, affect feeling, and meaning cannot be measured in their totality, but can be grasped, understood and used in design without measurement.
6. If methods are used which do seek to measure such aspects of experience, then the limitations of the measuring device and the consequent analytical inferences should be acknowledged and understood.

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Refining our understanding of men and women's design preferences

Gloria Moss

Research Fellow

Glamorgan Business School, and
Ecole Supérieure de Gestion (ESG), Paris
gmoss@glam.ac.uk

Gabor Horvath

Research Fellow

Glamorgan Business School
ghorvath@glam.ac.uk

Rod Gunn

Lecturer

Glamorgan Business School
rwgunn@glam.ac.uk

ABSTRACT

The World Wide Web is experiencing enormous growth and it is important that the design of websites mirrors the preferences of end-users. This paper reviews the evidence for differences in the production and preference aesthetics of men and women and describes a new study which presenting qualitative and quantitative data on male and female design preferences. This new study reinforces earlier findings and points to the need to take user preferences into account when framing websites or user interfaces. It is also points to the fact that notions of excellence are user-dependent rather than universal. This finding increases the importance of developing a user model that can guide optimised web or software development. Such a model is presented and developed towards the end of the article.

Author Keywords

Production design, Gender preferences, Web aesthetics

ACM Classification Keywords

H5.2. User interfaces

INTRODUCTION

The World Wide Web is estimated to double in size roughly every two to three months [12] and since 1998 Internet use has grown at a rate of 20% per year [37]. Factors that influence Internet usage are said to include socioeconomic status, interest in computers and social networking [29]. There are also studies [13,25] considering the possible impact of an other factor, namely web-design.

The search for the factors that will influence the usefulness, enjoyment and ease-of-use of the [36] and satisfaction [37] has led Human Computer Interaction (HCI) researchers to attempt to understand the elements (technical, visual and

content) in web design that are valued [33] and those that currently produce a deficit between expectations and experience. Although there are many definitions of HCI [5,31,34], the one fairly extensively used is of a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use, and the study of major phenomena surrounding them [11]. The search for these factors is a prize worth fighting for. Retailing research is driven by the notion that the physical form of a product is an important element in its design [2] and that it creates certain effects in buyers [17]. It has been found that products perceived as pleasurable are preferred [39] and used more frequently than those not perceived as pleasurable [14], leading to enhanced purchasing [6,7].

Those studies of web aesthetics that have sought to unravel the essence of good web design have been anchored in one of two paradigms. The first is the universalist paradigm [15], leading to the search for universal rather than segmented aesthetic values. There are three major studies of web aesthetics, all anchored in the universalist paradigm insofar as none have segmented the stimuli or respondent data [18,33,36]. Thus, in terms of the stimuli, there is an absence of data on website type or designer and in terms of the respondents, an absence of data on their age, gender or participation in particular markets.

The second paradigm is the interactionist paradigm which views aesthetic judgements as a function of individual perception [30] and therefore views data on the perceiver as all-important. An example is feminist research on advertising images which describes the ideal spectator as male and the standards in advertising measured in respect of reactions from this segment [35]. The interactionist paradigm links with the hedonic principle [10], an element of which is the identification principle. This principle addresses the human need to express one's self through objects (ibid) and links with the 'empathy principle' according to which aesthetic value does not inhere in objects but is the product of empathy between object, perceiver and artist [3]. This corresponds to the notion of mirroring, a notion with echoes in several literatures. Taking a process perspective, it translates into the view that products should be shaped around the 'unique and particular needs' of the customer [9]. According to

Hassenzahl [10], the hedonic or interactionist principle leads a person to respond favourably to Beauty where they have a stake in a product. Beauty considerations can, as part of a hedonic approach, be considered separately from practical considerations.

Earlier research also showed both that male and female graphic design preferences were distinct and that they operated such that each gender had a statistically significant tendency to prefer designs produced by their own gender [20,22,23,25]. These preferences were measured in relation to graphic as well as web design with the last study quoted here showing women's preference for websites produced using the female aesthetic to be stronger than male preferences for websites produced using the male aesthetic.

Explanations for differences in male and female design production and preference aesthetics have been found in the social-familiarity effect [23] as well as in evolutionary factors in visual-spatial abilities [25]. Extrapolating these results to male- and female-dominated markets, and building on the mirroring principle in marketing [4,9,16] suggests the need to create e- designs modelled on the aesthetics of the target market. In this way, an industry operating in a male-dominated market would need to produce websites displaying the masculine aesthetic while websites produced for a female dominated market would need to display the feminine aesthetic.

However, according to Moss [25] and Gunn et al [8] the majority of the commercial websites are clearly orientated to the male aesthetic. Another study [24] revealed that the majority of websites in the sample of 32 websites under consideration were produced by a man, or predominantly male team. This information, if representative of the website sector as a whole, reveals a sector which, in parallel with the related [38] IT sector, is male-dominated. According to recent research, one of the effects of the male-domination, vertically and horizontally, of the IT profession is the creation of a 'masculine computer culture' that produces a 'masculine discourse' and a prioritization of technical issues, both of which serve to deter women from entering the field [32].

Given the evidence of women's positive response to design anchored at the feminine end of the webdesign continuum, this masculine hegemony could have negative consequences on companies' ability to mirror the aesthetic preferences of women [13].

We have seen that various pieces of research, whether in the field of graphic or webdesign, revealed women to have a tendency to prefer designs produced using the production aesthetic associated with their gender [19,20,22,23,25,27]. The results for graphic and webdesign have many parallels which, given the congruence that unites different design disciplines [28], is not a surprise. All these results reinforce the importance, in policy terms, of adopting an interactionist, or hedonic approach to webdesign.

Lacking from all this earlier work is an examination and mapping of the constructs and criteria that underpin men and women's preferences. An exploration of these is the object of the Pilot study reported here. It aims to quantify the extent of each sex's preferences, understand the constructs that men and women use in formulating these preferences and introduce these findings into the user model presented at the end of the paper.

METHODOLOGY

In order to compare male and female design preferences we created a PowerPoint Show that presented photographic images of 6 pairs of items. One item in each pair was designed by a male designer, and the other one by a female designer. Among the items there were postcards, chairs, pillow cases, food packaging, drink cans and underground station designs. The gender of the designer of every item was known although in no way apparent to respondents. Nor were respondents aware that we were examining preferences in relation to the gender of respondent and designer.

The respondent group included managers, web developers and creative designers (8 males and 4 females) who were asked to:

- Indicate the item in each pair they preferred
- score both items on a scale of 0-10 (where 0= I hate it and 10=I like it very much)
- write a few words about what they liked/disliked about each item.

From the data obtained, we created diagrams showing the two genders' preferences as between items originated by men or women. Since the study involved only a small number of respondents, statistical analyses were not carried out.

RESULTS

Based on the results of earlier studies [19,21,23] we expected to find each gender showing a preference for the designs produced by people of their own gender. Our results confirmed this with some very interesting additional findings.

The Table 1 below shows the percentages of male and female respondents preferring the product designed by male (blue colour or column noted as 'male designer') or female (pink colour or column noted as 'female designer') designers.

	Male preferences, item designed by		Female preferences, item designed by	
	male designer	female designer	male designer	female designer

kid's chairs	87.5%	12.5%	50%	50%
pillow cases	75%	25%	0%	100%
drink cans	87.5%	12.5%	0%	100%
Xmas cards	50%	50%	25%	75%
food packaging	37.5%	62.5%	25%	75%
tube station	37.5%	62.5%	50%	50%

Table 1. Respondents' preferences

As we can see, in most cases the respondents show a preference for the designs produced by people of their own gender. However, in two cases (food packaging and tube station designs) male respondents preferred the female designs and in one case (drink cans) they have selected the products of male and female designers in equal proportions. There is only one case (kid's chairs) where the number of female respondents selecting male designed product was equal to those selecting female designed one. It is worth noting that there was no case when female respondents preferred the product designed by a male designer.

Overall, 60% of male respondents preferred male-produced designs and 75% of female respondents preferred female-produced designs (Figure 1). These results underline the earlier findings of Moss et al [26], related to webdesigns. As we have seen, this earlier study shows that females prefer all aspects of web pages which have a high proportion of female coefficients. By contrast, males are not as strongly drawn to male sites with a high proportion of male coefficients as females are to equivalent female sites, and men have no strong preference as between designs with a high proportion of male or female coefficients. Of even greater interest is the fact that males prefer the pictures that females place in their web sites to those in male-produced sites.

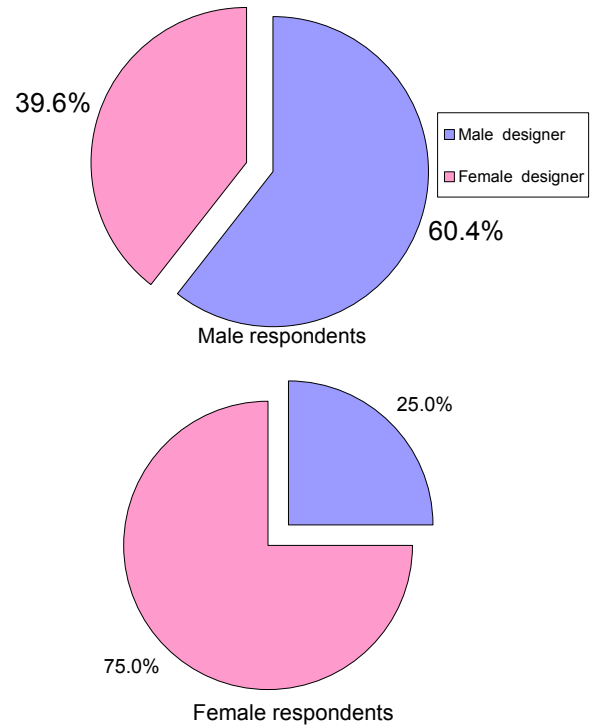


Figure 1. Overall preferences

Figure 2 shows further evidence of the stronger female design preferences. As we can see, both genders gave higher scores to the designs produced by people of their own gender. However, the scores given by male respondents to female designed products are much higher than those given by female respondents to male designed products.

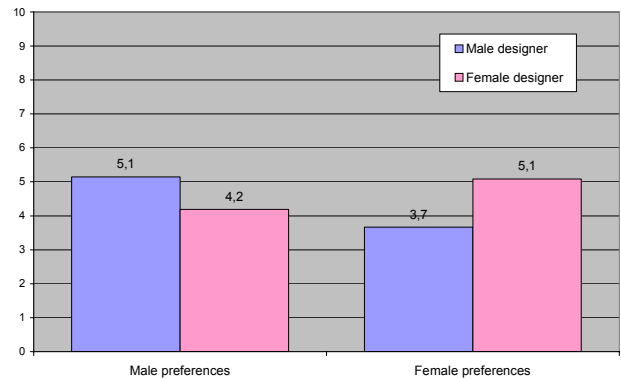


Figure 2. Average scores

The quantitative analysis was followed up by a qualitative analysis of the constructs and criteria underpinning the preferences and choices of the two genders. Table 2 below contains the constructs and criteria that were used most frequently in the qualitative responses respondents offered when reacting to designs:

	Male respondents	Female respondents
What I like about male designed products?	Simple Neutral colour Bold Strong Not busy Traditional	Colour (when it was red) Modern looking Nothing (!)
What I dislike about male designed products	Bit dark Cheap looking Colour (when it was red)	Colour Too plain, no pattern Dated
What I like about female designed products?	Bright, fresh Fun Clean lines Naïve	Colourful Detailed Rounded shapes Childlike
What I dislike about female designed products	Too childish Too busy Irregular writing	Bit too bright Bit busy

Table 2. The summary of answers

As we can see, female respondents prefer products with detailed design, bright colours, nice patterns and unconventional (child-like) typography. They did not like the simple, colourless, conventional male designed products. The male respondents, however, were quite happy with the bright colours and patterns of the products designed by female designers.

DISCUSSION

A pilot study was conducted to compare male and female product design aesthetics. The aim of the study was to confirm the earlier findings and determine the factors (graphical elements, shapes, colours etc.) which inform the preferences of the two genders. The results yield preliminary evidence of differences in male and female design preferences with each sex preferring the design production aesthetic associated with its own gender.

Based on the qualitative comments that respondents made about the design stimuli, the main features on which the preferences of respondents were based concern shapes (greater preferences of round shapes by female respondents) and colours (a strong tendency for females to prefer more colours and particular colours). Where typography was concerned, there is a tendency for females to prefer non-regular, less conventional typography.

How do these differences in product design aesthetic relate to web (software) design? We saw earlier, that preference tests using websites produced a strong tendency for each gender to prefer websites, and the elements of those websites, that used the production aesthetic associated with

their own gender. The two exceptions concern layout, where men are neutral in their preferences as between a male and female aesthetic, and pictures where men prefer pictures typifying the female production aesthetic [27]. In the next section, we will consider how to incorporate these findings into a model that can underpin teaching of user-interfaces as well as the design of optimised websites. Some of the findings of the interactionist research reported above can be converted into case studies that can be used in teaching.

INTERFACE DESIGN: DEVELOPING A NEW MODEL

Software developers and web designers, many of whom are male, are likely to favour user interfaces produced using the male production aesthetic. An earlier study [26] suggested that applying the mirroring principle (i.e. ensuring that products contain features that mirror the preferences of the target market) to the case of web design would mean designing web pages so that they contain features that typify the web productions of the target market. Extrapolating these results to the design of software targeted at female and /or male users, demands the availability of feminine type user interfaces as well as masculine ones.

Earlier research conducted in the interactive tradition has shown evidence both of a separate male and female web production aesthetic [25] and of a correlation between the aesthetics of production and preference [23].

The results presented in this article confirm that there are differences between male and female product design preferences. The results of the new study on preferences reported here – together with the findings of the earlier related researches – help refine the development of a user-interface model. This model can be used in teaching as well as in the practical development of websites optimised for their target markets so that they are shaped around the ‘unique and particular needs of the customer’ [9]. In the case of web design, this means designing web pages that contain features that meet the expectations and preferences of the target market. Since the majority of existing commercial websites (and the templates included with web builder softwares) are located at the masculine end of the aesthetic continuum rather than across the range of the spectrum [13], achieving this will demand a substantial change in current practice of webdesign. It will also demand the creation of new webdesign software.

A new user interface model

The results of the study reported here provide additional evidence of differences in male and female preferences. The results – taken together with the findings of the earlier related researches – show that producing optimal IT designs seem to necessitate ensuring that the design mirrors as closely as possible the production aesthetics of the target market (Figure 3). In the case of user interfaces – when

there are females among the expected users - this would mean including elements preferred by females (e.g. rounded shapes, more colours, irregular typography, etc.).

At the same time, the model takes account of the fact that there are obstacles to the creation of optimised designs.

These obstacles include universalist notions of excellence, based perhaps on the male design aesthetic, as well as designers and decision-makers within the organisation who support this aesthetic.

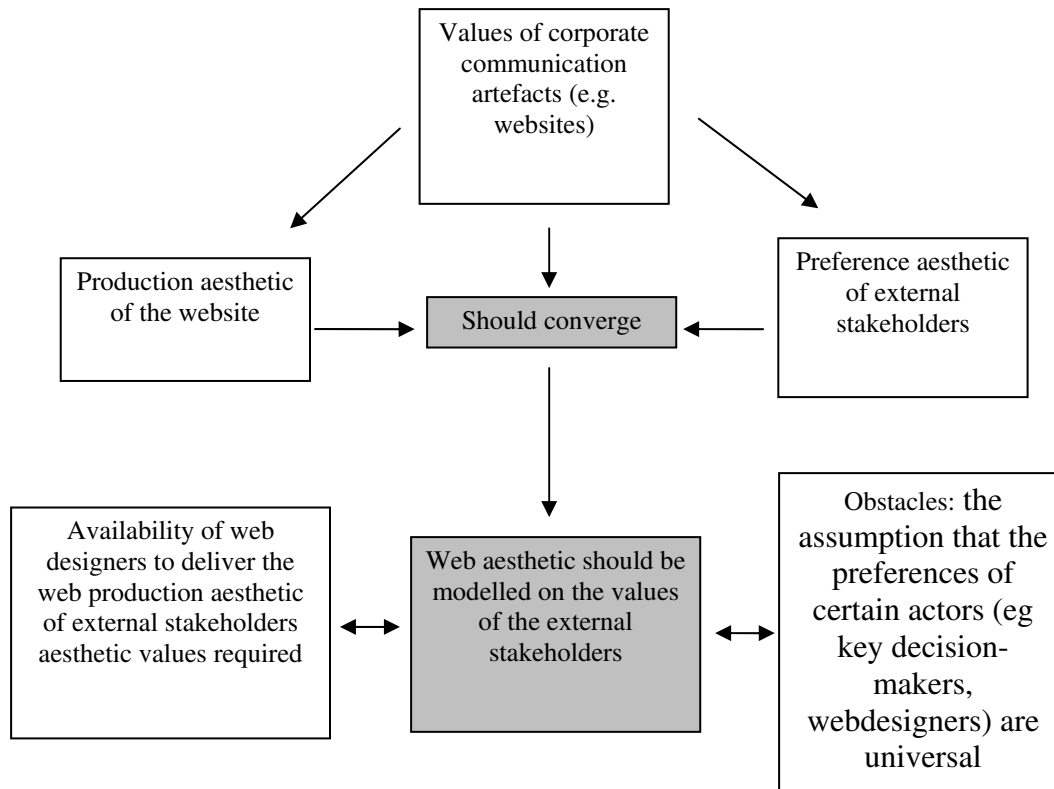


Figure 3. Model showing the match that should occur between web-design production aesthetics and the preference aesthetic of external stakeholders.

Future research

The findings reported here of a differential male and female design aesthetic beg the question as to whether the suboptimal use of design that we have noted in commercial webdesign may be a factor in women's relatively less frequent use of the Internet [1]. In order to answer this question, further research is needed on the extent to which the suboptimal use of design for female markets is generalized across sectors. In order to test the extent to which the male and female production aesthetic can be produced interchangeably by men and women, a study needs to be conducted on the extent to which aesthetic style is transferable or socialized between genders.

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