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# TOWARDS METHODOLOGY FOR USER EXPERIENCE MEASUREMENT IN ON-LINE SERVICES

**Abstract:** This paper presents results of a user-based study, aimed at identification and assessment of non-technological factors shaping long-term user satisfaction in on-line services as well as prospective customer loyalty. The study has shown that *attractive price* appears to be critical to customer, next *feeling of security* and of *being well informed*. Next, *convenience* in using the service in terms of *time* and *workload* have been declared by users as of secondary importance. By showing the significance of non-technological factors "beyond usability" the study contributed to methodological development in research on user-perceived quality of on-line services.

**Keywords:** user-centred design, on-line services, on-line consumer behaviour.

## 1. Introduction

On-line services are used by individual consumers and by companies, and they constitute an important part of everyday activities in business and in private lives. Various websites and Web applications provide services that were formerly available only in physical world, like performing electronic transactions in e-commerce, reviewing interactive product catalogues or booking hotels and flights.

However, the notion of "on-line service" is not yet clear: in many publications they are also generally called "e-services", covering various services on-line within so much different areas like e-government, e-health, e-insurances, e-banking, e-business or e-education [Benyon et al. 2008; Dąbrowska et al. 2009].

Quality of on-line services depends only in part on technological advancements and on quality of information technology (IT) solutions. User-perceive quality is critically dependent on fitting the on-line service content to customer needs, to business context, and also depends on designers' creativity and innovation in developing competitive business solutions [Yang, Fang 2004; Da-Wei 2007].

Users interact not only with the website but also with the service content, which has been the main attractor for customers. Therefore when studying factors shaping

quality of on-line services, not only website usability should be in focus, but primarily service content, which creates – usually economic – motivation for regular visits.

Consequently, a large part of activities within the field of HCI (Human-Computer Interaction) is devoted to improving customer satisfaction and enhancing quality-in-use of e-business on-line services [Fui-Hoon, Davis 2002; Benyon et al. 2008]. These efforts include not only optimizing user interface and improving usability; they also cover upgrading customer relationships with service vendor as well as building competitive advantage of a given on-line service. However, most traditional attempts to measure user experience in IT systems were limited to classical usability factors and elements shaping users' emotions [Sharp et al. 2005; Mattila et al. 2007], usually neglecting economic factors affecting user behaviour in short- and long-term time horizons.

Therefore this study was inspired by the following question: Which user interface design elements (content, widgets, applets) should be explicitly recommended for the visual design of on-line services in order to stimulate expected patterns of consumer behaviour, including customer trust, attitude, willingness to buy and recommend the site to others?

This paper presents an attempt to answer this question and also aims at providing some contribution to a prospective methodology for designing on-line services.

## 2. Usability and user experience

Usability of interactive IT systems is defined by international standard ISO 9241-11 [ISO 9241-11] as the outcome of three components:

– efficiency: the degree in which users can achieve their goals in a specified context,
– effectiveness: the user-perceived relation between the outcome and efforts,
– satisfaction: the degree of user-perceived system likeness, attractiveness and willingness to use it again.

This definition holds true for most of interactive systems, like typical software or non-commercial websites. However, in e-business solutions, there are also economic factors which shape user experience, satisfaction and long-term willingness to use a specific system again – and whether to recommend it to others.

As aforementioned, this sphere was traditionally left out of classical usability studies, which were focusing only on "operational" quality of user interface, not including "user experience" aspects related to human economic behaviour. Factors representing user-perceived economic value (value of relationship with on-line service vendor, called "brand value" in e-business) have been rare in human-computer interaction design studies [Cockton 2006], except for e-business literature.

The impact of perceived economical value on the behaviour of users of IT systems providing on-line services was shown in [Sikorski 2008] by presenting a model of on-line services, showing how the services gradually develop, following enhancements in user expectations (Figure 1).

**Figure 1.** The model of on-line services development

Source: based on [Sikorski 2008].

Recent development in information technologies for e-business raises the importance of user satisfaction factors, especially those located "beyond usability", shaping user experience and human economic behaviour in on-line transactions. The literature on measuring user experience is flourishing [Tullis, Albert 2008; Hassenzahl, Tractinsky 2006], but it leaves economic factors aside. However, from the viewpoint of e-business design it is important to know which components of user interface (and on-line service in general) build valuable "bricks" of user experience, attracting customers and shaping their on-line behaviour.

## 3. Methodology and research procedure

Research methodology applied for this study was a combination of:
- analytical and conceptual techniques: usability experts working on case studies,
- user-based studies: usability evaluations of actual on-line services and a usability workshop with real users.

General plan of the proposed study consisted of the following steps.

1. Preliminary analysis:
- developing user-service interaction models,
- services decomposition (case studies).

2. User-based study:

2.1. Requirements workshop.

2.2. Usability test:
- pre-test questionnaire: identification of expected benefits,
- task-based user tests of selected on-line services (video-recorded),
- post-test questionnaire: user opinions.

2.3. Group interview: final evaluations.

3. Data analysis:
- verification of user-service interaction models,
- estimating priorities for economic factors,
- retrospective analysis of video-recorded user behaviour.

4. Discussion of results:
- categorization of user satisfaction factors,
- categorization of technological factors,
- linking specific user behaviours to specific user interface elements.

5. Conclusions
- guidelines on user interface design for on-line services,
- guidelines on business design for on-line services.

Presented research plan was executed in two major parts.

**Part 1. Preliminary analysis**

By analogy with user-system interaction models, a model of interaction between the service vendor, service website and the consumer (user) was developed as a conceptual framework for further research activity. This framework, focused on economic aspects of user behaviour, was assumed to consist of four layers:
- visual user interface layer, facilitating perceptual/manual operations,
- interaction layer, facilitating user-system dialogue progress,
- business process layer, facilitating subsequent steps in selecting, purchase and payment,
- relationship (economic value) layer, affecting willingness of consumer to come back, buy again and to recommend this service/website to others.

Subsequently, in order to identify technical components in on-line service websites, several case studies were analysed by usability and e-business experts. Three types of on-line services (in six examples) were analysed: financial, e-commerce, and tourist information services. Construction of these service websites was decomposed in order to list typical components (functions, features and attributes) necessary to support users when they interact with a website and its business content.

**Part 2. User-based study**

**Requirements workshop.** Subsequently, a requirements elicitation workshop was organized with five experienced users. This workshop was aimed at recognizing customer needs and expectations when using the on-line services. Basing on the results of the workshop, a tree of identified consumer needs when interacting with on-line service website was projected. Some of the needs were specified as mainly economic, because they originate from an unsolved consumer problem, with the potential solution to be purchased on-line. About 250 potential consumer requirements were identified (36 purely economic), from which nine main economic factors were finally selected for user-based study.

**Usability testing of on-line services.** Usability tests with actual users (38 users, divided into three groups, all regular users of at least one on-line service) consisted of the following steps:

A. “Pre-test” questionnaire

It was a paper questionnaire, in which users/customers were asked to declare their general expectations towards on-line services and their websites:

– open questions about expected economic benefits when using on-line services as well as about known difficulties and problems that may discourage users;
– nine main economic factors ("meta-requirements") were ranked as to their perceived importance by pair-wise comparisons.

B. Usability test of a specific on-line service

Three types of on-line services were selected to usability test with users – financial, e-commerce and tourist information service:

– users had to complete specific tasks using an on-line services: to calculate a loan, to buy an item in e-shop or to find most suitable hotel in a given location; the tasks were designed in a way stimulating economic thinking and deciding which option from a given set is the most attractive for you as a customer;
– during task execution users could experience actual usability problems of specific websites on-line services, as well as general experience they had when guided by the website through a decision process; produced task outcome from each user was compared against the right (optimal) solution;
– user behaviour during the on-line service testing was recorded using *Techsmith Morae* software for usability evaluations, and later analysed in detail to better understand customer intentions and decisions.

C. "Post-test" paper questionnaire

After completing the usability test users were asked to fill in a paper questionnaire:

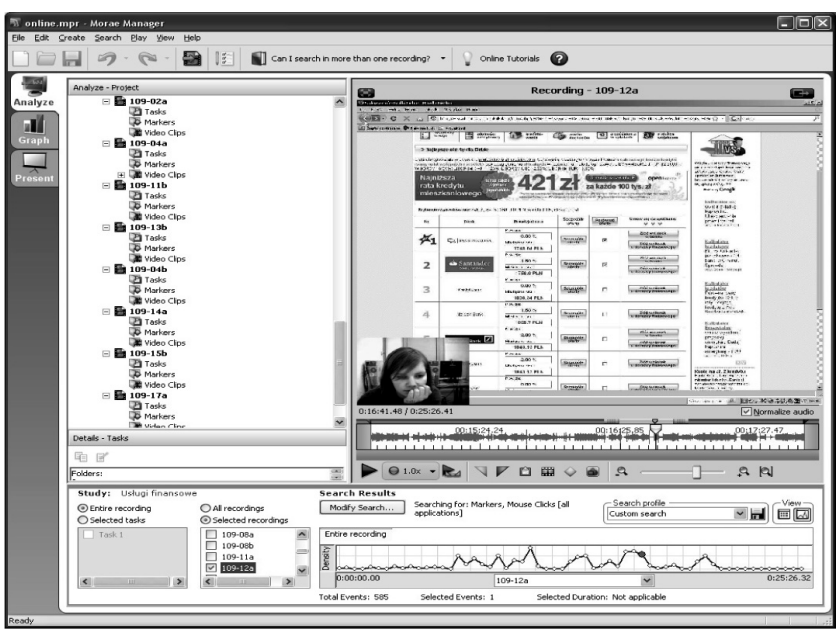


**Figure 2.** A sample screenshot from a Techsmith Morae software for analyzing user behaviour in interactive systems

– in open questions users were asked about specific criteria and preferences they had while solving the task;
– in open questions users were asked to classify perceived benefits and difficulties (experienced during the task) into areas: Visual, Interaction, Process, Relationship.

**Group interview.** After filling in the "post-test" questionnaire a short group interview was performed, aimed to share users' opinions and impressions which may not have been recorded in the paper questionnaires.

## 4. Results

Results obtained in this study can be roughly divided into four groups:
– identification of user economic requirements/expectations regarding on-line services,
– estimation of user priorities for economic requirements,
– allocation of user interface components to interaction layers,
– conclusions for further research and methodological enhancements.

### 4.1. User economic requirements – identification of economic factors

Case studies analysed by experts and requirements workshop revealed a set of user requirements to be included in the user-based study regarding on-line services. Altogether about 250 requirements were captured, describing expected direct benefits but also needs related to overcoming doubts, problems or difficulties users experience when accessing on-line services via websites. Requirements declared by users were sometimes too narrow, sometimes vague or too broad, and many of them appeared to have the same meaning in spite of different wording used. Sometimes also concrete elements of website were declared as requirements (e.g. product catalogue, etc.).

Due to a large amount of gathered requirements there was an obvious need to structure them into some more usable form. For this reason card-sorting technique was used by experts to aggregate the set of captured requirements into several clusters. Frequency of specific requirement declarations from users was used as the main criterion for qualifying the items for further analysis. Finally the experts extracted nine main factors ("meta-requirements"), which have economic nature because they relate to more general issues, and definitely not only to the features of user interface or usability of a particular website.

Table 1 presents the structure of main economic factors F1-F9 finally extracted for the further steps of the study. They are the "user experience factors" relevant to economic expectations of on-line service users. All main factors were composed by numerous subfactors (more narrow requirements) – some of them are listed in the right column of the table, as declared by users in the questionnaires.

**Table 1.** User experience factors and their description

| # | Economic factor | Description |
|---|---|---|
| 1 | Attractive price (F1) | product price should be attractive and preferably adjustable by configuring product options |
| 2 | Low additional expenses (F2) | low costs of product delivery, toll-free contact channels, no unexpected or hidden costs |
| 3 | Convenient access to service (F3) | convenience, guidance, support and help on all stages of service/ website operation |
| 4 | Sufficient information provided (F4) | sufficient information about the service and its vendor, available products and their characteristics, products recommendations, as well as about how to proceed with ordering process (shopping guidance) is provided |
| 5 | Security of access to service (F5) | security of data, of payment and of service usage is assured by vendor |
| 6 | Short time of website operation (F6) | perceived as short: the time needed to learn how to use the website, to get access to the service and to complete all required operations |
| 7 | Low physical workload (F7) | no need to leave home to access/use the service |
| 8 | Low mental workload (F8) | no information overload, service process transparency, controllability and automation |
| 9 | Benefits from marketing incentives (F9) | access to customer programs, product brochures, gadgets, multimedia and promotions |

## 4.2. User requirements – prioritization of economic factors

The results from pair-wise comparisons of economic factors are shown in Table 2. The bottom row shows average priorities, calculated for each economic factor F1--F9. These values will be used to show the hierarchy of importance (user priorities) for factors F1-F9. The data should be interpreted that for instance the factor F1 "Attractive price" is the most important for 79.6% of users.

**Table 2.** Priorities resulting from pair-wise comparisons of factors F1-F9

| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 |
|---|---|---|---|---|---|---|---|---|---|
| F1 | – | 0.158 | 0.237 | 0.368 | 0.447 | 0.158 | 0.132 | 0.132 | 0.000 |
| F2 | 0.842 | – | 0.632 | 0.658 | 0.684 | 0.500 | 0.263 | 0.184 | 0.053 |
| F3 | 0.763 | 0.368 | – | 0.737 | 0.605 | 0.474 | 0.184 | 0.184 | 0.079 |
| F4 | 0.632 | 0.342 | 0.263 | – | 0.579 | 0.474 | 0.184 | 0.211 | 0.053 |
| F5 | 0.553 | 0.316 | 0.395 | 0.421 | – | 0.395 | 0.289 | 0.237 | 0.105 |
| F6 | 0.842 | 0.500 | 0.526 | 0.526 | 0.605 | – | 0.432 | 0.316 | 0.026 |
| F7 | 0.868 | 0.737 | 0.816 | 0.816 | 0.711 | 0.568 | – | 0.500 | 0.132 |
| F8 | 0.868 | 0.816 | 0.816 | 0.789 | 0.763 | 0.684 | 0.500 | – | 0.184 |
| F9 | 1.000 | 0.947 | 0.921 | 0.947 | 0.895 | 0.974 | 0.868 | 0.816 | – |
| **Average** | **0.796** | **0.523** | 0.576 | 0.658 | 0.661 | 0.528 | 0.357 | 0.323 | 0.079 |

The priorities show not only frequency how often the priority was declared by users as the most important factor, but also they show relative importance of these factors for users. Figure 3 shows user priorities calculated for factors F1-F9.

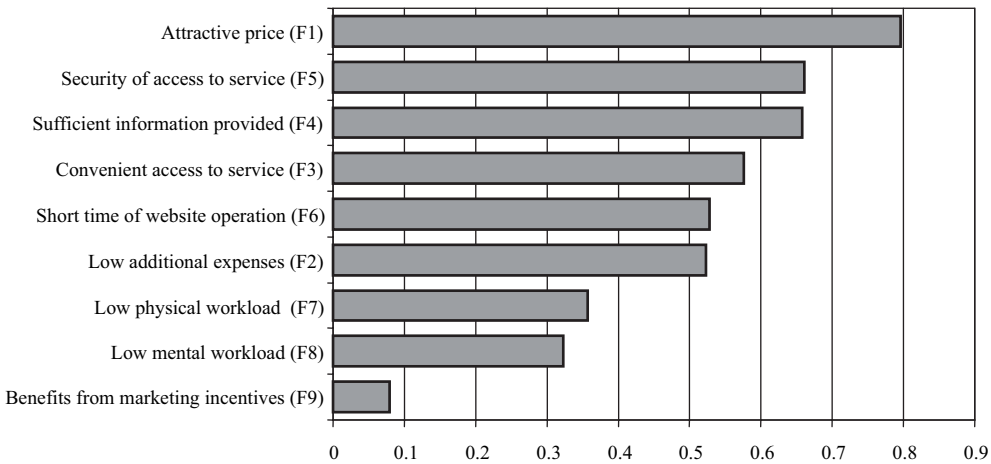


**Figure 3.** Priorities resulting from pair-wise comparisons of factors F1-F9

Priorities for economic factors declared by users show clearly that "Attractive price" is dominant motivator to use on-line services, then "Security" and "Sufficient information". It is interesting that marketing incentives seem to have no influence on attracting users to use on-line services. Physical and mental workload are also of lower priority, however, their meaning relates not only to fatigue when operating the website, but also to more general convenience-related issues.

### 4.3. Allocation of user interface components to interaction layers

As a result of open questions where users were asked to classify concrete benefits and difficulties (perceived during the task execution), they surprisingly were focusing mainly on technical components providing economic satisfaction from the relationship with the vendor (Table 3).

Presented classification will be useful for developing design guidelines for on-line services, in order to include non-technical user experience factors to quality assurance in the project.

In particular, the "relationship" part presents user experience factors of economic nature, responsible for a business success of on-line services and of e-business sites in general. The "relationship" part contains also factors affecting user-perceived credibility of the on-line vendor, which is essential for regular returns to the site and for developing valuable long-term business relationship.

**Table 3.** Allocation of user interface components to interaction layers

| Interaction layer | Design features |
|---|---|
| Visual | – easily readable screen elements,<br>– websites screen layout consistency,<br>– ongoing visual support (visual tips, flags, icons, maps, etc). |
| Interaction | – easy navigation,<br>– automated operations,<br>– multiple views of the product |
| Business process | – search support,<br>– comparing support,<br>– logical sequence of steps,<br>– confirmations in operations (instant feedback, feel of control),<br>– payment transaction flow,<br>– user profile, login, etc.,<br>– tracking service progress (insight into the process) |
| Relationship | – always attractive prices (attractive prices every day),<br>– preview of basket, preview of payment,<br>– product configuration customization,<br>– recommendations and customer opinions,<br>– choice of methods for placing orders,<br>– choice of methods for payment,<br>– choice of methods for delivery,<br>– fair terms of use,<br>– assurance about security, credibility and trust,<br>– related offers, special offers for special customers,<br>– customer programs,<br>– freebies and marketing incentives. |

## 5. Conclusions and further work

Although it was merely a pilot study, aimed at proving proposed methodology, it showed that user-based usability tests an user surveys provide an interesting insight how customers react to the content of on-line service and to the components of its user interface.

This study has also shown that it is possible to adopt a big part of exiting user experience evaluation techniques for the human-computer interaction discipline (HCI) to economic sphere of user behaviour. As long as we do not have any predictive models of consumer behaviour, HCI toolbox (that means user-based laboratory tests, surveys and observations) will probably remain major research methods for optimization of user interface and interaction of on-line services.

Because the technological part of on-line service is invisible for the user, main success factors for on-line services are:

– proper addressing user's economic needs and expectations in IT design and in relevant business model,

– introducing innovative solutions making easier and more attractive interacting with on-line service, and providing valuable relationship for the users.

Figure 4 shows that proposed design methodology will include all already existing design elements of interactive systems, but it will cover also "value" elements, relevant to user-perceived value of relationship with specific on-line service vendor: value of relationship is supposed to be the main factor attracting users to return to the site and use the on-line service again, in both commercial and non-commercial contexts.

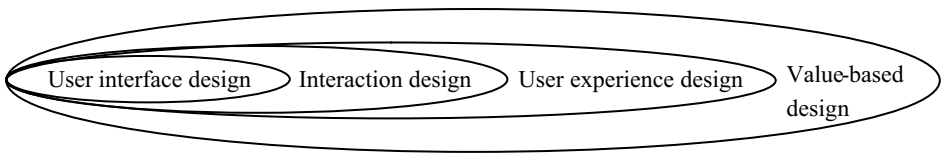


**Figure 4.** Proposed enhancements in design methodology for interactive systems

This enhanced methodology treats an on-line service website not as a technical construction but as a business solution, addressing economic requirements of consumer. Relevant guidelines for designers will be provided, which expand the design scope and provide positive user experience also in economic terms.

This article discussed economic factors shaping customer satisfaction in on-line services and affecting long-term loyalty to the service vendor in two perspectives:

1. Identification of relationships between customer needs and the website/service components:

– nine main economic factor, and their relative importance for surveyed sample of users were identified;
– main user interface components were allocated for specific layers consisting interaction between user and on-line service.

2. Methodology applied in this study was expanded from purely interaction design perspective towards economic factors shaping user experience. These factors so far have been rarely present in the practice of developing e-commerce websites, despite economic requirements, related to the service content, business terms, branding and trust, are crucial for businesses dependent on positive user experience and customer loyalty.

In conclusion, results obtained from this study have shown that non-technical elements shaping user experience in interactive systems create an important part of a successful business solution built on contemporary internet technologies. However, it is not the technology itself, but user-centeredness of design, which is crucial for the business success on a competitive market of on-line services.

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## ROZWÓJ METODYKI POMIARU JAKOŚCI ODCZUWANEJ USŁUG ON-LINE

**Streszczenie:** Artykuł prezentuje wyniki badań, których celem była identyfikacja czynników kształtujących jakość postrzeganą wybranych usług on-line udostępnianych przez Internet oraz ocena wpływu czynników kształtujących lojalność ich użytkowników. Badania wykazały, że czynnikami najbardziej istotnymi są: *atrakcyjna cena*, następnie *poczucie bezpieczeństwa* oraz *wyczerpująca informacja*, a w dalszej kolejności *wygoda* korzystania z usługi w kategoriach czasu oraz wysiłku. Pokazując znaczenie pozatechnologicznych czynników kształtujących zachowania użytkownika, artykuł ten formułuje postulaty dotyczące dalszego rozwoju metodologii badania jakości usług on-line, wykraczającej poza tradycyjnie rozumianą użyteczność usługowego serwisu WWW.