'Broken Expectations' from a Global Business Perspective

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Abstract
Especially in the past few years, there has been an increase in the rejection rate of interactive consumer electronics products in the field, not due to broken hardware or software, but due to 'broken expectations' of users. However, operational methods to capture triggering contextual reasons are not functional in the industry. In addressing this gap, we propose systematic analysis of qualitative user feedback data resources from the field by utilizing our Disconfirmed Expectations Ontology (DEO). DEO provides for an efficient means to elicit relevant -but currently unrecognizable- feedback from the field to communicate that to the respective units in a product development process. We further demonstrate the utilization of DEO on a rich qualitative data set regarding the Apple iPhone™.

Keywords
Soft Reliability, business value of usability

ACM Classification Keywords
H5.2. User Interfaces: Evaluation/methodology.

Introduction
Misalignments between explicit or implicit product capabilities and user expectations affect the overall acceptance and adoption of a new product. Especially in the past few years, it has been observed in the field that these misalignments increasingly lead to rejection

of interactive consumer electronics products that are actually working well according to their technical specifications [7]. A wide-spreading industrial phenomenon relating to such cases is known as “No Fault Found”, or NFF, which is used to label products with no diagnosable fault but are still being reported to create problems for users in the field. NFF cases have first been recognized explicitly within modern high-end consumer electronics industry (Figure 1) (e.g., home entertainment systems) and more recently within the mobile phone industry: In 2006, NFF returns cost the global mobile industry $4.5 billion [8]. Moreover, NFF cases have already started dominating over the product issues that are due to diagnosable problems [5]. It has become an ever more pressing need to understand the factors that yield NFF from a business perspective and to adopt operational methods to timely treat them.

We have introduced *Soft Reliability* in [5], as a conceptual basis for formulating reasons that trigger NFF. Our Soft Reliability (SR) view is an enhancement to the current quality and reliability analysis operations that are mainly product-component based and logistics driven; and as such, it complements the traditional Hard Reliability view, which focuses on broken hardware and software, but not ‘broken expectations’ of users [1]. In [5], we particularly promoted the idea of making optimal use of user feedback collected at call centers, in addressing NFF cases due to lack of SR. In this paper, we discuss the potential of also other valuable field data resources that can be utilized. We report on some recent findings of applying our updated SR analysis approach to richer feedback data from a field study, which allows for demonstrating the effect of time in passing through the ‘phases of use’ [2] of the Apple iPhone™. In doing so, we focus not only on the negative feedback of users as an assessment of quality, but also their positive remarks as an indication of the “unique selling proposition” for this product. The subsequent three sections highlight, respectively:

Figure 1. Rapid growth of “No Fault Found” cases in modern high-volume consumer electronics over time [5]

- **Operationalizing field feedback:** The presentation of available user feedback data resources within the industry, which can be analyzed with our Disconfirmed Expectations Ontology (DEO). As such, DEO provides a basis for an operational method to treat unidentifiable NFF cases by systematically capturing SR issues both during and after product development.

- **Analyzing disconfirmed expectations based on empirical data:** The demonstration of how a rich qualitative data set regarding the Apple iPhone™ can be analyzed utilizing DEO.

- **Evaluating effects of time on Soft Reliability:** The discussion of temporality of SR and its management in business processes.

Operationalizing Field Feedback

Rich qualitative feedback from actual users in the field is crucial to better align real contextual needs and preferences with product capabilities. In a typical industrial setting, various data resources exist for obtaining field feedback, with varying degrees of richness regarding qualitative user accounts:

Service centers are where returned products are examined strictly for violation of technical product specifications. Data logged at service centers lack content regarding the user and use context [4]. **Helpdesk**s are where users call up to consult agents mostly about their questions and complaints. Data logged at helpdesks by agents have qualitative descriptions of the -typically negative- user feedback, with variable detail [4, 5]. **Internet** proves to be an emerging source of user feedback data, where users exchange rich qualitative accounts of products -both positive *and* negative- on public or private product-forums, or post on web-based helpdesks of manufacturers, or co-design through initiatives of third party companies (e.g., www.redesignme.com) or of manufacturers (e.g., http://www.dellideastorm.com). **Test** data logged at field studies and tests during product development and also afterwards, usually have qualitative accounts of users depending on the focus of the study, with variable detail [6]. **Trade** data logged by dealers are mostly sales and logistics focused and lack qualitative descriptions as to, e.g., why a certain product is returned.

In practice, it is a major challenge to manage these five main data resources in an integrated way: While the possibility of automatically utilizing Internet data resources for gathering structured contextual design information is not yet established, all available data resources are being underutilized in favor of fulfilling short-term business goals on an individual level, but not learning from them to improve overall business operations and hence product design quality.

In the context of increasing NFF, the listed data resources can at best be enhanced with richer user accounts at the time of collection, and analyzed jointly to complement one another. In [5], we introduced our user-centered failure classification model as a generic and extendible tool to analyze different sources of user feedback data, and further demonstrated its use on helpdesk data. In [6] we demonstrated its use on test data during real product development. We now demonstrate the use of an *extended* version of that model, as developed into our generic Disconfirmed Expectations Ontology (DEO) (Figure 2), on detailed qualitative test data after product development.

Taking each individual user feedback as the unit of analysis, DEO intends to provide an efficient and effective means to link relevant user remarks to their respective originator activities in a product development process. It should be noted that Product *Success* concepts of DEO have been derived from Product *Failure* concepts. Moreover, among the Product *Failure* concepts, Within Product Capabilities concepts assume a sequential order as they relate to time-dependent initial ‘phases of use’ [2], i.e., (i) *awareness* of capabilities, (ii) *motivation* to use, (iii) *orientation* for figuring out how to use; whereas Beyond Product Capabilities concepts are loosely ordered to indicate comparable implication on the less time-dependent and more progressive latter ‘phases of use’, i.e., *adoption* in daily life, and *incorporation* for extended use.

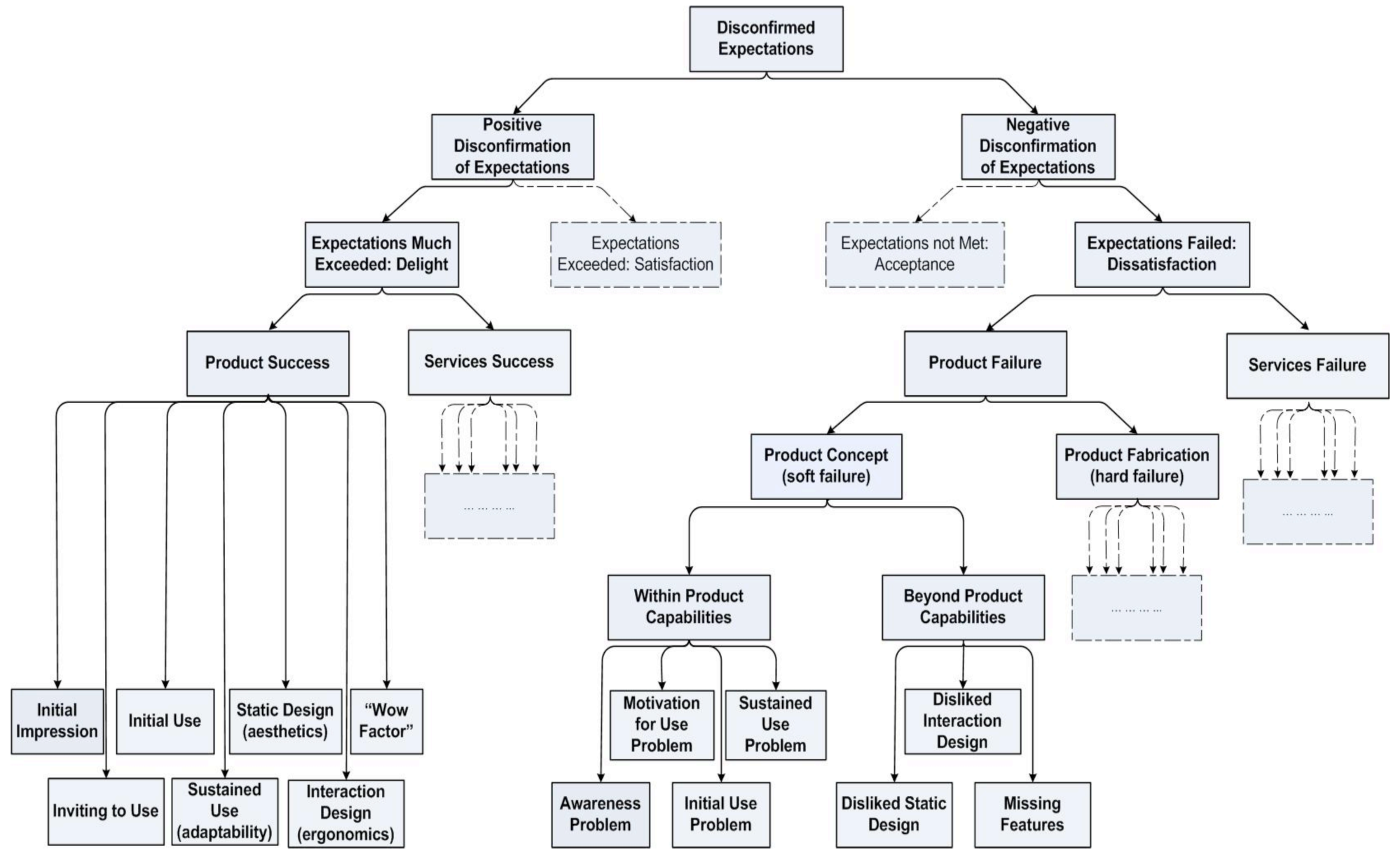

Figure 2. Disconfirmed Expectations Ontology (DEO) is for capturing negative and positive SR issues from detailed user feedback data to be (i) prioritized based on occurrence frequency, and (ii) communicated to relevant stakeholders in product development. Note that this figure shows only parts of DEO used for analyzing the dataset from the iPhone study. In the case of, e.g., helpdesk data analysis, the Services parts of DEO; and in the case of, e.g., service center data analysis, the Product Fabrication parts of DEO are also included.

Study & Findings

The data we analyzed using DEO comes from a field study that followed 6 individuals during the first four weeks upon the purchase of the Apple iPhone™. The participants had similar profiles so that time-effects on disconfirmation trends of the iPhone could better be revealed. The data comprised detailed feedback of participants collected using the Day Reconstruction Method. In total, 506 feedback entries were recorded, each of which could be identified with a single concept from DEO during our analysis. Due to the nature of the field study, Services related concepts were not used. Our motivation in analyzing this dataset with DEO was three-fold; (i) to demonstrate the detailed analysis power of DEO when applied to *rich* user feedback data, (ii) to validate negative *and positive* disconfirmation analysis findings on a product that is already well-established in the field (i.e., the iPhone is a successful product not only during initial but also over prolonged use), and (iii) to specifically demonstrate *time-effects* in product adoption during prolonged use.

The analysis results (Figure 3) led to detailed findings covering also the lowest level concepts of DEO: Regarding negative disconfirmations of participants (Fig. 3, left chart), the iPhone's existing capabilities are mostly recognized (hence the low occurrence frequencies during early use phases), but some expected features are either totally missing (17%, "missing feature") or disliked in the way they exist (16%, "static design"). Re positive disconfirmations, (Fig. 3, right chart), mostly the interactivity capabilities

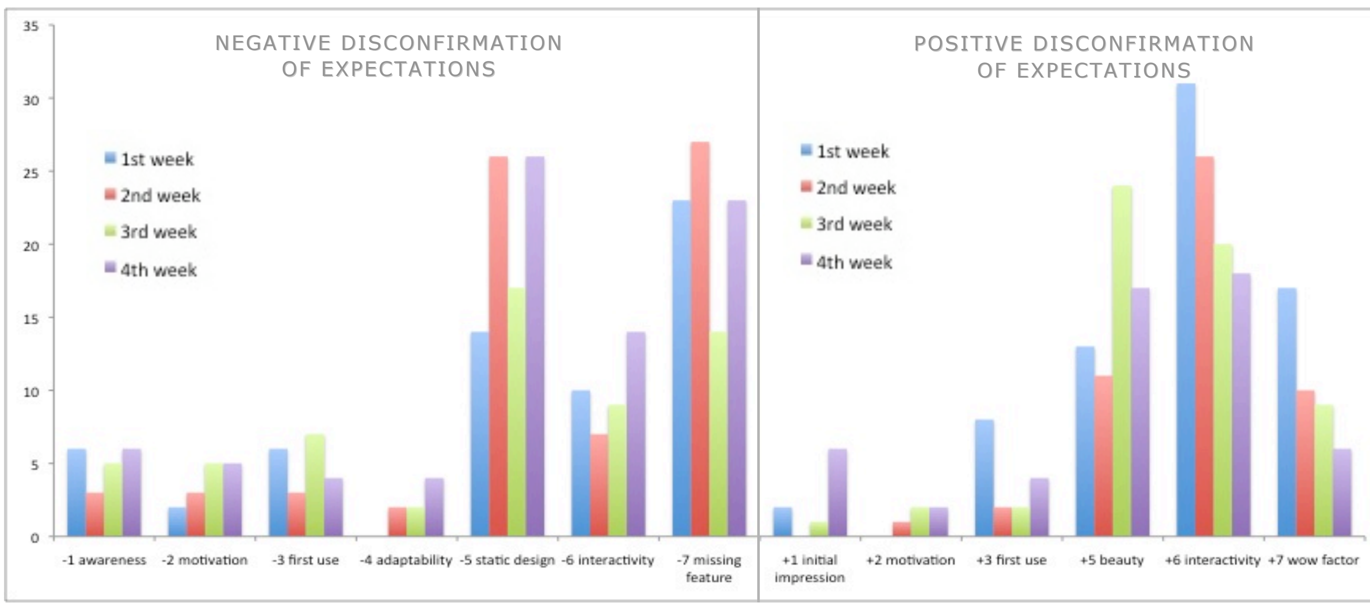

Figure 3. Based on DEO, iPhone's success can be attributed to its non-problematic early use phases and to its interactivity capabilities

are appreciated (19%, "interactivity"), followed by the static design of deployed features (13%, "beauty").

On the whole, with the 19% occurrence frequency, the positive interactivity quality dominates over all other disconfirmations and so presents itself as the "unique selling proposition" of the iPhone. In addition, there is an 8% "wow factor", i.e., appreciated features that users had not even anticipated, and only few problems with early use phases, both of which can be seen to contribute to the success of the iPhone. Furthermore, the prolonged use of the iPhone over four weeks revealed that the reported appreciation of the interactivity, and the wow factors, eventually reduces, while the appreciation of the static design of deployed features (i.e., "beauty") increases. The correlation may be due to developing emotional attachment to the iPhone (i.e., including personal/social identification with the product) based on earlier experienced instrumental qualities (i.e., interactivity and unanticipated additional features) [3], but needs deeper investigation.

Discussion

Temporality of Soft Reliability is inherent by definition, since "reliability" is defined as "quality" over "time". Accordingly, negative as well as positive soft "qualities" should be *comparatively* analyzed over the phases of use as induced by "time" for a *comprehensive* evaluation of the SR of a product. We have demonstrated this analysis on a single data resource for the iPhone. In order to operationalize such analysis at a larger scale from a business perspective, it should be conducted repeatedly over time (during both development and maintenance) on available and emerging user feedback data resources from the field in an integrated way. Prediction models and mechanisms for SR can thereby be developed in turn.

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