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Emotional user experience: Traits, events, and states☆

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ABSTRACT

Emotional experience has become an important topic in human–technology interaction research and design. Nevertheless, such research and design often lacks a proper explanatory basis and methodologically robust operationalisation. In this article, a conceptualisation of emotional user experience is formulated based on the appraisal theory of emotion, where the goal congruence of the interaction events and the task-independent individual traits are thought to underlie the user's emotional response. A laboratory study with $N=50$ participants conducting ordinary computer tasks is reported. The results suggest that subjective emotional experience depends on a number of factors relating to individual differences in coping and task events. Emotional user experience, as analysed according to a competence–frustration model of emotion, is dependent on the user's technological problem-solving tendency, frustration tendency, pre-task self-confidence, and task performance.

1. Introduction

1.1. The appraisal process and emotion in human–technology interaction

Subjective experience has recently received much attention in human–technology interaction research and design. Moreover, terms such as *user experience* have been introduced to emphasise the importance of the feelings that users experience as they interact with technological artefacts (Bødker, 2006; Hassenzahl, 2010; Desmet and Hekkert, 2007; Norman, 2004; Wright et al., 2008). Most scholars in the field agree that emotion is one of the main dimensions of user experience (Bargas-Avila and Hornbæk, 2011; Hassenzahl and Tractinsky, 2006; Norman, 2004; Saariluoma and Jokinen, 2014; Thüring and Mahlke, 2007). However, a psychologically valid theory of emotional user experience is still lacking (Saariluoma and Jokinen, 2014). This shortcoming is especially visible in empirical studies, where theoretical operationalisation of emotional user experience would be required (Bargas-Avila and Hornbæk, 2011). One problem resulting from the lack of a complete and theoretically sound operationalisation of emotional user experience is that more room is left for pre-scientific intuitions to affect the design of experiments and new interaction technologies (Saariluoma, 1997). With clearer systematic operationalisations, human–technology interaction researchers and designers could better explicate and conceptualise their intuitions concerning such elusive concept as subjective experience, thus benefiting the field from both the perspective of basic research and applied design (Saariluoma, 1997; Saariluoma and Jokinen, 2014; Saariluoma and Oulasvirta, 2010).

The capacity of psychological theory to explain why people have certain emotional experiences or behave in certain ways is one of the most critical prospects for conceptualising emotional user experience in psychological terms (Saariluoma, 2004). While the prospect is obviously important for scientific pursuits, it is also important in the design process, as showing how and why certain experiences occur in human–technology interaction lets designers create concepts and test their ideas theoretically, giving a formal basis for design solutions. This is highly important, for example, in experience-driven design (Hekkert et al., 2003), where being able to evaluate concepts theoretically in the very beginning of the design process is essential. In the same manner, as an engineer utilises scientific concepts and laws while making construction plans, an interaction designer needs to be able to utilise psychological concepts and theories concerning human–technology interaction (Saariluoma and Oulasvirta, 2010).

Although there is much discussion about measuring emotion and user experience, many researchers and designers still think that the operationalisation of valid user experience measurement instruments is not possible (Law et al., 2014). This is understandable for two reasons. First, emotion is still a debated topic in psychological theory. Interest in emotion has always been a part of philosophical and scientific inquiries, but the theoretical and experimental psychology of the last century focused mainly on other aspects of human mental life, especially on the information-processing aspect of human cognition (Baddeley, 2007; Power and

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Dalgleish, 1997). Only recently there has been a proliferation of emotion research, but despite this increased interest, fundamental disagreements on what emotion actually is still exist (Barrett, 2006; Izard, 2007; Scherer, 2009). Disputes arise between positions, such as there is a set of biologically hard-wired basic emotions (Izard, 2007), emotion is the result of a complex process of cognitive computation (Scherer, 2009), and conscious emotional experience is a conceptual and cultural reflection of a core physiological valence–arousal structure (Barrett, 2006; Russell, 1980). Many of these and other perspectives on what emotion is have been considered in human–technology interaction research (Lichtenstein et al., 2008; Mahlke and Minge, 2008), and it seems that it is too early for interaction researchers to side with a single psychological theory of emotion. In this article, appraisal theory is utilised (Scherer, 2009), but its use reflects its practical value in understanding emotional user experience as a process more so than an exclusive commitment to its meta-theoretical foundations.

The second apparent reason for reluctance to theorise and operationalise emotional user experience stems from the foundational notion that user experience is holistic (Hassenzahl and Tractinsky, 2006). This notion entails that user experience is all encompassing, contextual, and non-reducible, which makes a dimensional analysis of user experience and its subsequent operationalisations conceptually difficult (Boehner et al., 2007). The objective study of subjective experience indeed has methodological challenges associated with both the nature of consciousness and the quality of experience. Subjective experience is private and immediate, and it seems impossible or at least extremely difficult to put experience into explicit words and to analyse it objectively (Dennett, 1988). However, it is maintained here that emotional user experience can be theorised in psychological terms and that valid operationalisations of it can be used to measure emotional experience during or after technology use. This assumption, of course, entails a theoretical and a methodological question: what is emotion, and how can it be studied?

The standardised definition suggests that *user experience* is an individual's response to the use of technology (ISO 9241-210; Law et al., 2009), and, in such definition, it is therefore assumed that experience – emotional or otherwise – occurs in a process (see also Roto et al., 2011). A psychological theory of emotional user experience would hence benefit from an approach that would explain emotion as likewise occurring in a process. Suitably, one of the influential theories of emotion, *appraisal theory*, states that emotion can be understood as a cognitive process (Power and Dalgleish, 1997; Scherer, 2001, 2009). Appraisal theory proposes that emotion arises as a function of meaning structures, which are used to evaluate, or appraise, the personal significance of an event (Frijda, 1988; Lazarus, 2001; Scherer, 2005, 2009). This proposition focuses on the subjective interpretation of the event when explaining emotion, a perspective that is in line with the general user experience discourse. Hence, it further supports the use of appraisal theory as the theoretical framework for a psychology of emotional user experience.

While the process of appraisal consists of multiple levels, layers, interconnections, and phases (Scherer, 2009), two main appraisal types can be explicated (Lazarus, 2001; Lazarus et al., 1970). The first, *primary appraisal*, refers to the evaluation of a situation from the perspective of personal goals and values. Primary appraisal establishes the subjective significance, or meaning, of an event: whether or not the event is relevant to the individual's goals, and whether the event is pleasant or not. In *secondary appraisal*, the subject's ability to cope with the consequences of the event is assessed; that is, what is the subject's control over the event, and how can the subject adjust to it. These two forms of appraisal are responsible for changes in autonomic physiology, action tendencies, motor expression, and subjective feeling, which produce relevant emotional responses to events (Scherer, 2009). In this paper, appraisal theory is utilised to derive hypotheses concerning goal-congruency of interaction events, and individual differences in coping traits, both of which are closely related to the appraisal process. The experimental investigation will focus on how traits, events, and states influence the appraisal process, which explains emotion responses during human–technology interaction.

To understand how people consciously experience their emotions, a distinction between an implicit emotional process and explicit representation of emotion is necessary. The appraisal process is largely unconscious; it occurs without our explicit knowledge of it (Scherer, 2009). However, we are conscious of our emotions and are able to explicate our emotional experience. In the appraisal model, conscious experience of emotion is called *feeling* (Scherer, 2005, 2009), which can be defined as a mental representation of an emotional experience (Saariluoma and Jokinen, 2014; Scherer, 2005). Mental representations are entities that are about something, and, in this case, they are about emotional states. The emotional content of a mental representation refers to the conscious experience of emotional states. Some of the states occur more frequently than others do, and these are called *modal states* (Scherer, 1994, 2005). Modal emotions such as anger, fear, or joy are not assumed to be from a small set of physiologically hard-wired emotions, as posited in the theory of basic emotions (Scherer, 1994, 2005; c.f. Ekman, 1992; Izard, 2007). Basic emotion theory is nevertheless useful in operationalising and understanding the most important emotions associated with human–technology interaction, because research in its framework has a long tradition of identifying and describing these emotions (Saariluoma and Jokinen, 2014).

Emotional contents of mental representation are the methodological key to both the study of emotional user experience, and explanation of emotion in human–technology interaction (Saariluoma and Jokinen, 2014). Assuming that mental representations cause other mental states and behaviour (Fodor, 1985), the emotional contents of mental representation can be used to explain thinking and behaviour. In human–technology interaction, the user appraises the events of the interaction. This is a continuous and mostly unconscious process, but the user is able to mentally represent emotional states and thus have a conscious emotional experience. The contents of these representations can vary, but, as discussed previously, a certain set of modal (or 'basic') emotions is familiar to all of us and frequently useful in describing our feelings (Ekman, 1992; Saariluoma and Jokinen, 2014; Scherer, 2005). Emotional user experiences can therefore be investigated by asking the users to verbalise or otherwise indicate the emotional contents of their mental representations in terms of these modal emotions. Protocol analysis (Ericsson and Simon, 1984) and questionnaires (Saariluoma and Jokinen, 2014; Schorr, 2001), for example, are established means of obtaining information concerning the contents of mental representations.

1.2. The competence–frustration model of emotional user experience

Any appraisal process starts with an event, which starts the cognitive process in which the subjective relevance of the event and the person's coping capacity are evaluated (Scherer, 2005). An example of such an event and subsequent emotional response in human–technology interaction is the positive correlation between task performance and user satisfaction (Hornbæk and Law, 2007). Generally, successful events during the use of technology are appraised as pleasant because they are congruent with the goals of the user.

On the contrary, frustration, anxiety, and confusion arise when there are obstructions in the interaction, and these are appraised