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How to behave as Alice in Wonderland–about boredom and curiosity

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ABSTRACT

In the context of cultural computing, we created a mixed reality environment that influences user affect and evokes predefined user behaviour. The theoretical challenge is applying persuasive design to virtual and augmented reality. Based on begin of the story 'Alice's in adventures in Wonderland' users play the role of the character Alice in a park scene (the first stage out of a total of six). The mixed reality environment ALICE is designed for users to experience the same sequence of emotional and behavioural states as Alice did in her quest through surreal locations and events. This particular study addresses the sequential arousal and interdependencies of two drives: boredom and curiosity. Based on literature, we introduce general design guidelines for arousing boredom and explain how boredom can result in curiosity. We report on the design and redesign of the park environment with the entrance to the rabbit hole. In an experiment effectively arousing boredom can be demonstrated. Based on the experimental results we redesigned the park environment. In a second experiment effectively arousing curiosity was shown so that the particular sequence of events (e.g. appearance of the 'White rabbit' robot) had a significant positive influence on the arousal of curiosity and on triggering and guiding intended user behaviour.

1. Introduction

Based on advanced entertainment technology a new paradigm for Human Computer Interaction (HCI) is emerging [48]: Cultural computing [56,75]. The term 'cultural computing' was coined by Naoko Tosa [73,77]. This new paradigm finds its roots in a combination of entertainment and Kansei mediation, a rich multimedia framework for both conscious and unconscious communication through emotions [48,71,72], moods, feelings, perceptions and experiences [65]. Cultural computing acknowledges the values and attributes of a cultural region [55] and uses these in interactive systems the user can engage with [76]. This is done in such a way that the experience through the interaction touches on unconscious core aspects of his/her own culture [56,58,59,74]. It is a design challenge that focuses primarily on a new kind of unconscious user experience as a possible mean for social transformation [61,63]. Through designing specifically for such kind of user experiences, cultural computing stimulates amongst others behavioural changes and self reflection by means of entertainment technology in a broad sense [47]. This article focuses in particular on the design of a part of the mixed reality installation, called ALICE [3]. We call this type of interactive installation 'mixed 'reality' [45] because this ALICE installation covers the whole virtuality continuum from augmented reality to augmented virtuality; for more technical details see somewhere else [7,29]. The main research challenge for this kind of mixed reality installations is the design of an environment that elicits, triggers and guides certain user behaviour based on a given narrative [17]. In our case this narrative was chosen from the book 'Alice's adventures in Wonderland' [16] because this narrative survived already for a long time and is still actual [15]. The selected parts of this narrative are recreated in six interactive stages, together forming our mixed reality environment ALICE.

In the first stage boredom and curiosity function as drives for mental and physical exploration, luring the character 'Alice' from a park environment into the rabbit hole (this article). In the second stage Alice falls down the rabbit hole. This fall seems so slow that Alice engages in a conversation with herself, disputing the relationship of herself within the space of earth. This stage questions the Western interpretation of time and space as fixed linear concepts [25], and the experience of microgravity for spatial perception [67]. In the third stage, Alice physically grows and shrinks as a result of eating a cake and drinking from a bottle located in a room she finds herself in. This stage questions the concept of environmental space and body size. After shrinking to the size of grass, Alice swims through her own pool of tears (stage four). During

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her swim, she talks to a mouse that swims with her. This experience represents genesis and evolution. In the fifth stage, Alice discusses her own identity with a caterpillar [38]. The emotions and events in the previous stages brought Alice into a state of confusion and made her question reality [13], becoming open for persuasion [24]. The caterpillar challenges Alice to reflect on her self-concept, which is essential for transformation [11,19]. Finally, in the sixth stage Alice talks to the Cheshire cat about logical reasoning. For a more detailed explanation about the reasons for choosing this particular narrative with these six stages and for getting a more detailed overview over the whole installation we have to refer to already published articles about this project [7,29,56].

This kind of mixed reality installation can be related to the perspective of persuasive technology as introduced by Fogg [24] because we want to elicit and guide predetermined user behaviour through adequately designed affordances [68]. Fogg coined the term 'captology' as an overlapping area between persuasion and computing technology, affecting user intention and behaviour. He differentiates between two levels of persuasion. The first is "the overall persuasive intent of a product" on a macro-level. The second involves parts of these products such as dialogue boxes that "incorporate smaller persuasive elements to achieve a different overall goal" on a micro level (pp. 17f). The persuasion all happens on a conscious level, at least Fogg does not mention the aspect of sub- or un-consciousness. Cultural computing broadens the perspective of persuasive technology by not only addressing user intention and behaviour, but also emotions and cultural values [75]. Cultural computing does not only address the established conscious communication, but works also specifically through the sub- and unconscious [48,60,61].

In sociology, Johnson [36] identifies the micro (individual actions or interactional systems), meso (organizational systems) and macro-level (societal systems). When drawing the analogy between persuasive technology and sociology, a similar structure can be identified. The micro level would then remain on the level of interactional systems such as dialogue boxes, tangible interaction objects or other human-system interaction elements. This level influences single actions. The meso level would incorporate Fogg's macro-level of products, as a set of interactional aspects forming organizational systems. As such, the meso level affects user behaviour and intentions as outlined by Fogg. The macro-level is then the societal systems level in the form of cultural computing, addressing cultural values and affecting among others the self-concept. This macro-level analogy is also supported by a description of modern societies "characterized by increasing levels of reflexivity or self-reflection and the development of procedures for deliberate implementation of change" ([36] p. 489). In the context of his article cultural computing can thus be seen as a macro-level implementation of persuasive technology for mixed reality environments.

This article focuses entirely on the first stage in which Alice is lured into the rabbit hole after a sequence of events and emotional states. According to the narrative at first Alice was sitting in the park and felt very tired of having nothing to do, thus s/he was bored. After the White Rabbit ran by her with his unusual appearance and in a hurry to get somewhere, Alice was 'burning with curiosity' and ran after the rabbit [16]. Both boredom and curiosity are powerful drives, not only in Western society, and the focus of our research is to offer the user a chance to experience and engage in the same sequence of emotional states as Alice. We explore how behavioural aspects can influence user affect and decision making. We design for experience, to guide user behaviour by arousing a specific emotion whilst trying to avoid explicit instructions, signs or orders whenever possible. In this project we follow the general design approach of triangulation: a mix of different research and design activities [57]; a particular application of this approach – although in a quite different domain – is provided elsewhere [2]. This article reports on the optimisation and [re]design of part of a mixed reality installation based on literature research and two empirical studies addressing boredom and curiosity.

2. Boredom and curiosity

2.1. Emotions

First, we will explain the nature of emotions [33], and in particular boredom and curiosity [9]. From a broad perspective, emotions can be classified as an affective state together with moods, sentiments and personality traits [23,26]. It seems widely accepted that humans use emotions to guide reasoning and decision making [46]; one can consider for instance intuition and gut feeling [62]. But the influence of emotions goes beyond intuition [12,51]. Literature reports interplay between emotions, memory, rational thinking, decision-making and behaviour [18,20,31,32,40,66]. Within this perspective we try to trigger user behaviour through inducing user affect [50].

2.1.1. Boredom

To begin with, we would like to clarify a common misconception: boredom is *not* characterised by a state of low arousal like sleepiness. On the contrary, a bored human being is agitated and restless; she can even be emotionally upset. Berlyne [8] discusses the causes of boredom and states that a lack of arousal potential (sensory deprivation) or predictable signals (monotony) both lead to boredom. So monotony can lead to boredom, however Ulich [78] rightfully points out that monotony and boredom are not the same. Monotony, he argues, is the result of always doing the same things, whereas boredom is a result from not having enough possibilities to be active. Rauterberg [54] is fully in line with Berlyne and Ulich by adding that monotony is a result of a learning process that turns repeated activities into automated processes, thereby decreasing the possibilities to be active given a fixed environmental complexity. Glicksohn [27] and Rauterberg [54] found that an overload of stimuli can actually have similar effects as sensory deprivation.

Berlyne [8] identified several variables that can affect arousal and thus have to be reckoned with in order to arouse boredom. Firstly, he points out the *intensive variables*, which define the intensity of a stimulus (e.g. size, chromatic colours and high-pitched sounds). Secondly the *affective variables*, or emotional stimuli: human beings tend to search for emotional experiences and excitement. Thirdly, he categorized stimuli that are for instance surprising, incongruous, strange or complex as the *collative variables.*

Another area regarding boredom is the phenomenon of waiting. Waiting mainly results in uncertainty and anger and the experience of the wait is influenced by its commonness, duration, degree of occupied time and the users' expectation [43,70]. And finally, "[boredom] comes about whenever, from the relative emptiness of content of a tract of time, we grow attentive to the passage of the time itself" ([34] p. 626). The development and validation of a measuring scale for boredom resulted in four factors ([53]): (1) lack of meaningful involvement, (2) lack of mental involvement, (3) lack of physical involvement, and (4) slowness of time.

2.1.2. Curiosity

Curiosity is a state in which one's interest is heightened, leading to exploration; a vital motivation in learning and knowledge gathering. Berlyne [9] differentiates between two types of state curiosity. The first is *epistemic curiosity* and is a result of intellectual uncertainty, it drives people to *specific exploration* (e.g. to acquire knowledge by asking questions). *Perceptual* curiosity on the other hand, is aroused by new or unusual stimuli, motivating *diversive exploration* (e.g. attentive listening) [30]. To arouse one's curiosity