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Biophilia and biophobia in website design: Improving internet information dissemination

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ABSTRACT

The Internet is increasingly a source of information for populations around the world, and thus theorizing that website design, which leads to enhanced recall of web-based information, has important theoretical and practical implications. On the basis of evolutionary psychology, biophilia and biophobia theories show how humans developed emotional responses to aspects of their natural environments so as to enhance survival by triggering approach or avoidance behaviors. Enhanced memory for biophobic elements such as predators and biophilic elements such as food would be further fitness enhancing. This study aimed to show how website design based on biophilia and biophobia theories can elicit emotions and improve recall of web-based information. An experiment was performed with simulated national park websites that contained images designed to elicit emotional responses. The emotional responses (e.g., valence and arousal) were associated with increased recall of information presented on the websites. The study contributes by showing that biophilia theory and biophobic theory can guide website design research and improve information recall.

1. Introduction

Governments are increasingly disseminating critical information to the public through websites [1], a phenomenon referred to as online information dissemination (OID) [2]. OID focuses on improving the public's knowledge of specific topics. However, the increasing number of informational websites and amount of web-based information makes it harder for people to remember web-based information and, hence, hinders governments from improving the public's knowledge. To address this problem, one can induce affective responses that research has found to be positively associated with recall of web-based information in online users [3].

Research on affective responses in information systems and human–computer interaction has increased in recent years [4]. Design scholars such as Norman have moved from usability-centered design (1983, 1993) to emotional design (2004) [5–7]. However, in her review, Zhang [4] noted that few if any scholars have systematically and theoretically examined affective phenomena in the context of information and communications technology (ICT), which indicates we need further theory-based work in this area.

Theorizing about affective concepts outside ICT shows promising developments. For instance, Kahneman [8] has recently developed the dual processing theory that depicts two modes of processing: intuition (system 1) and reasoning (system 2) (see [9]. System 1 processes are intuitive, fast, unconscious, and linked to emotion, while system 2 processes are conscious, slower, and more controlled. For example, a perceived threat (e.g., a snake) may cause one to quickly and instinctively experience fear, which, in turn, may lead to a flight (avoidance) or fight (approach) response. Dual processing theory is an evolutionary approach to understand affective concepts and views emotions as serving to enhance humans' survival. It sees system 1 responses as residing in the older parts of the brain; the amygdala (a part of the limbic system or "reptile brain") [10]. Kock [11] reviews information systems theorizing from an evolutionary perspective. Such theories provide a promising avenue for investigating emotional responses in the online context, and we adopt them in this study.

Biophilia theory suggests that humans have an "innate emotional affiliation with living organisms" and that exposure to natural elements that helped early humans to survive leads to positive emotions [12], p. 31). Biophobia theory suggests that exposure to natural elements that endangered early humans' survival leads to negative emotions [13].

Some studies have investigated biophobia effects on individuals. For instance, Kock et al. [14] investigated biophobia effects and showed that participants better recalled information from modules that were presented just before or after a screen presenting a snake in an attack position along with a hissing sound. However, the extent literature has

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paid little or no attention to biophilia effects in the online context [15]. As such, our study extends Kock et al. [14] by investigating both biophobic and biophilia effects.

In particular, we investigate the following research question

> Do website-design features that incorporate biophilia and biophobia effects enhance online users' information recall by evoking their emotional responses?

We performed an experiment with national park websites that contained simulated images of biophilic and biophobic elements in nature. The websites also contained information about safety precautions when visiting a national park. The outcomes we assessed were: (1) the emotional responses and (2) the degree of information recall. The biophilic and biophobic website-design features successfully induced emotional responses in participants and were associated with an increased recall of information.

This study contributes to both theory and practice. It extends the theory of website-design by theorizing the effects of both biophobia and biophilia-based design features on outcomes of web usage and testing these new theories in a laboratory experiment. It extends Kock et al. [14] by grounding design features firmly in theory that shows that biophilic and biophobic website-design features can influence emotions and information recall. Further, compared to Kock et al. [14], it better represents a real-life website, which commonly features images and textual information but not sounds such as hissing. We believe that these theoretically developed and empirically tested biophilic and biophobic website-design features not only contribute to ICT design theory in general but also extend theory of website-design in particular by offering researchers new avenues on which they can build when investigating website-design features with a focus on evoking emotions.

On the practical front, website developers and managers can use our findings for general guidance on how to develop websites and use both biophilia and biophobia effects to enhance information recall.

2. Literature review

2.1. Evolutionary theory, emotions, and information communication

Biophilic and biophobic effects have their roots in evolutionary psychology. The biophilia and biophobia hypotheses are based on an argument that the rewards and dangers associated with natural settings in human evolution were significant enough to give advantages to individuals who learned and remembered positive/approach (biophilic) and negative/avoidance (biophobic) behaviors for certain stimuli [13]. An important aspect of these hypotheses is that they do not just posit a relationship between natural stimuli and human responses but also argue that these responses have a partly genetic basis and, thus, likely occur across cultures—a significant issue when designing systems for widespread use.

Researchers believe that psychological traits that arise from evolutionary processes developed during the environment of evolutionary adaptation (EEA), a period from approximately 1.8 million years ago to the emergence of modern humans around 100,000 years ago [16]. Humans developed a genetic disposition to acquire and then consistently retain responses to natural elements and contexts that increased their chances of survival because they were related to primary necessities such as water, food, and security. Savanna-like environments with open grasslands that had abundant food supplies and lower risk from hidden predators had advantages for early humans, and considerable evidence supports the assertion that a major part of human evolution occur in savannas [13]. Persistent psychological traits arising from this evolutional background include positive emotional responses to natural elements such as open spaces, scattered small trees, uniform grassy surfaces, water, green vegetation, and flowers. Less preferred contexts include arid or desert environments where food and water would be sparse [13]. Conversely, persistent negative responses arose for threatening elements in nature such as harmful animal life, closed spaces, and heights. Considerable empirical support exists for both the biophilia and biophobia hypotheses, including the genetic component (e.g., see [13]).

The biophobia and biophilia hypotheses involve emotional responses and are consistent with a functional view of emotion, in which emotions serve an adaptive purpose (e.g., as in evolutionary and Darwinian theories) [17]. Emotions as subjective feelings motivate humans to perform actions. Perceptions of a threat lead to fear and then flight (avoidance) or fight (approach). Perceptions of stimuli that indicate a reward lead to positive emotions and approach behaviors [18]. These emotional responses can occur very quickly and at low levels of the human nervous system.

Further, research has linked the emotional responses in the two hypotheses to cognitive effects. Kock et al. [14] linked situations that lead to surprise to enhanced memorization, particularly where the surprise arose due to a perceived threat. Kock and Chatelain-Jardon [3] reason that surprise leads to enhanced memorization because a surprise situation such as a snake attack would have equipped hominid ancestors to better respond to an attack situation in the future. This theory proposes that evolution predisposed humans to easily learn and retain associations and responses that have aided survival when they encounter positive and negative stimuli (but not neutral). More generally, research across many fields has found that individuals pay more attention when a situation involves emotion-inducing stimuli. When an emotion-inducing stimulus has engaged an individual's emotions and attention, the individual may continue to pay attention at the location even after the stimuli has passed, which may encourage the individual to process subsequent non-emotional material that appears at the same location. Much empirical evidence supports this view (see [19,20]).

2.2. Nature of emotional responses

To study the biophilia and biophobia hypotheses further, it is helpful to consider the nature of the emotions implicated in more depth. In the consensual, componential model of emotion, an emotional response arises when one appraises the personal significance of a stimulus, which, in turn, leads to an emotional response involving physiology, subjective experience, and behavior [21]. Research largely categorized emotions based on two perspectives: the discrete and dimensional perspectives. The discrete perspective identifies several distinguishable emotions, such as anger, sadness, and contempt. The dimensional perspective, on the other hand, categorizes emotions along several fundamental dimensions: for example, valence, arousal, and dominance. In a review, Mauss and Robinson [21] found strong support for the dimensional model, which they say captures the "lion's share of variance" in self-report studies of emotion (p. 213). Note that Kock et al. [14] studied the response of fear-related "surprise" in relation to the biophobic effect. Although one can classify surprise as an emotion, its status is ambivalent, and others argue that it is a bridge between emotion and cognition and that cognitive assessments of likelihood and intuition shape it [22]. Dimensional perspective of emotion gives a clearer link to the biophilia and biophobia hypotheses, which both explicitly mention broader emotional responses in general rather than a single specific emotion.

In this study, we adopt the dimensional "circumplex model" of emotional responses, which depicts two primary dimensions of emotional response: valence and arousal [23]. Indeed, Zhang [4] has proposed this model as a basis for theorizing affective concepts in the ICT context. The valence dimension represents variation in levels of pleasure (e.g., unhappy to happy, displeased to pleased). The arousal dimension represents variation in levels of arousal (e.g., quiet to excited, sleepy to wide awake). Research has reported that arousal leads to the release of energy in body tissues, which, in turn, leads to subjective feelings of energy mobilization so that the individual can deal with threats and opportunities [24].

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