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Feeling good, searching the bad: Positive priming increases attention and memory for negative stimuli on webpages



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ABSTRACT

Emotional impacts on attention arises in the form of externally and internally loaded forms. The former relates to the emotional valence of the sensory stimulus. The latter refers to the emotional state of the subject. We investigated their influence and interaction. Seventy-two subjects had been emotionally primed by a sequence of positive or negative images before they observed webpages of an online news portal. Each webpage contained positive and negative emotion-laden stimuli to be recalled in a memory test. We captured effects on overt attention, saccadic parameters, and explorative behavior. Furthermore, we related memory performance to characteristic gaze behavior. We found an attentional preference and a better memory performance for negative stimuli that was more pronounced after a positive mood induction. Importantly, increased attention correlated positively with recall performance on an individual level, but only after a positive mood induction. Moreover, the evaluation of the news-portal's hedonic quality and overall appeal, but not of usability, was affected by subjects' emotional states. We concluded that in contrast to previously reported mood-congruent preferences in young adults' attention, there are complementary effects of internally and externally loaded emotions with the tendency that positive priming increases attention and memory for negative stimuli.

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1. Introduction

“What we see and understand about the visual world is tightly tied to where our eyes are pointed” (Henderson, 2007, p. 219).

Attention bundles our limited cognitive resources to process local visual details of the environment in more depth than environmental characteristics that are not in the focus of our attention. Although the attentional focus is not necessarily linked to eye movements (i.e., covert attention), gaze-dependent shifts in attention (i.e., overt attention) undoubtedly play a central role in visual processing. Modern eye-tracking technique makes such overt shifts of attention easy to measure reliably and unobtrusively, helping us understand what we are looking at. Two classes of factors that influence gaze behavior are commonly contrasted. On the one hand, features of the visual stimulus, such as abrupt onsets (Yantis & Jonides, 1990), unique environmental features (Treisman & Gelade, 1980), and motion (Açık, Bartel, & König,

2014; Hamborg, Bruns, Ollermann, & Kaspar, 2012), attract attention in a bottom-up way. Image properties such as luminance, orientation, color, and saturation also correlate with gaze behavior (Kaspar & König, 2011a), but only a moderate amount of its variance can be explained by such properties of the stimulus. On the other hand, factors that potentially influence attention in a top-down manner have gained increasing interest. A fair number of studies demonstrated the influence of objects (Einhäuser, Spain, & Perona, 2008) and tasks (Einhäuser, Rutishauser, & Koch, 2008; Hayhoe, Shrivastava, Mruczek, & Pelz, 2003; Rothkopf, Ballard, & Hayhoe, 2007) on overt attention. Furthermore, emotions and mood states influence the spatiotemporal course of overt attention (Kaspar et al., 2013). Correspondingly, Farb, Chapman, and Anderson (2013) concluded that one central function of emotions is sensory gating. However, such impacts are manifold and sometimes results are contradictory due to the lack of a uniform conceptual definition of emotional impacts. Thus, it has been recently proposed (c.f. Kaspar, 2013; Kaspar & König, 2012) to explicitly distinguish between the emotional state of the observer (i.e., the internally located impact of emotion) and the effect of the stimulus valence (i.e., the externally located impact of emotion).

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This distinction becomes especially important under more ecological viewing conditions. Commonly, we are in a specific emotional or mood state while scanning the environment. At the same time, the environment offers locations and objects that differ in valence. Such a scenario can be found in our modern environment when exploring webpages of online news portals that incorporate negative as well as positive news. The present study picks up this scenario to investigate how internally and externally located emotional influences interact in young adults, whether the effects on attention transfer to memory of webpage content, and how the recipient's mood state affect the summative evaluation of a news portal.

1.1. Externally located emotional impact: news valence

A growing body of work suggests that responses to positive and negative information are asymmetric as negative information and events have a significantly greater impact on learning, judgment formation, attitudes, and cognitive processing (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Soroka, 2006). The strong impact of negative events on the latter has *inter alia* shown by Newhagen and Reeves (1992) who found retroactive inhibition of memory for content that preceded negative scenes but proactive facilitation of memory after negative scenes. Grünh, Smith, and Baltes (2005) also revealed that negative information receives processing priority in some contexts. Moreover, an analysis of event-related brain potentials revealed that during an evaluative categorization task extreme negative images produced greater brain activity than equally extreme positive images (Ito, Larsen, Smith, & Cacioppo, 1998). Accordingly, there is also evidence for stronger responses to bad news in contrast to good news in mass media (Soroka, 2006), supporting the slogan "Bad news is good news" from the perspective of media producers and journalists (e.g., Emsley, 2001; Eysenbach & Kummervold, 2005). Given this asymmetry, we expected the following:

H1a. On average, negative news images attract more overt attention and are visually processed in more depth than positive news images.

H1b. On average, negative news content is better memorized than positive news content.

H1c. Attention and memory performance are linked on the individual level in that increased attention also correlates positively with the amount of memorized content.

1.2. Internally located emotional impact: the observer's emotional state

According to Fredrickson (1998), positive emotions serve to broaden one's focus of attention in order to enlarge the momentary thought-action repertoire. Empirical studies using artificial stimulus arrays support this assumption. For example, Rowe, Hirsh, and Anderson (2007) found that happy mood versus sad and neutral moods increased the breadth of attention. Wadlinger and Isaacowitz (2006) similarly found that positive versus neutral mood broadened attention to peripheral positive stimuli. However, broadened attention as an adaptive response to a negative state has also been proposed (Garland, Gaylord, & Fredrickson, 2011), and the state of broadened attention is often associated with anxiety (Gruzelier & Phelan, 1991). Moreover, a broadened attentional focus—independent of emotional valence—seem to derive from affective states of low approach motivation,

while a narrowed attentional focus results from affects high in approach motivational intensity (Gable & Harmon-Jones, 2010). Furthermore, Wegener, Petty, and Smith (1995) pointed out that contradicting explanations for mood effects on information processing exist: on the one hand, the cognitive capacity hypothesis proposes that positive affective states make people less able to process incoming information as positive states would activate a bulk of positive memory processes that, in turn, occupy attentional capacity. On the other hand, the hedonic contingency hypothesis predicts that positive mood can be associated with a more in-depth information processing than neutral and negative mood, making us more attentive to the hedonic consequences of our actions. Similarly, the feelings-as-information framework by Schwarz (1990) suggests that a positive mood would reduce the motivation to scrutinize the environment because of an increased feeling of safety. Hence, there is mixed evidence and conceptual work regarding mood effects on attention. In this context, two important aspects have to be noted:

First, there is a considerable lack of agreement among researchers regarding a uniform conceptual definition of emotional impacts. In a comprehensive literature review, Gray and Watson (2001) pointed out that there seems to be at least the agreement that mood and emotion "both involve subjectively experienced feeling states; accordingly, they often have been lumped together under the broader label of affect" (p. 36). However, while the term emotion is often associated with discrete emotions such as anger or sadness, mood theorists mainly focus on dimensions describing unspecific mood states such as valence and arousal. Studies on emotion/mood influences on attention differ in this respect as some addressed specific emotions while others focused on valence and arousal. We will use the term *mood* in the following as we do not focus on distinct emotions.

Second, the kind of mood induction procedure applied in experimental studies differs considerably. This fact is problematic, especially with respect to a state of neutral mood. For example, Wadlinger and Isaacowitz (2006) induced positive mood by presenting the study participants with a small bag of candy, while in the control condition (presumably neutral mood), no treatment was applied. Herz, Schankler, and Beland (2004) used a waiting room manipulation to induce neutral mood. Moreover, while Shapiro and Lim (1989) used music, Grubert, Schmid, and Krummenacher (2013) used movie clips to induce neutral mood. This diversity of mood induction methods—especially with respect to neutral mood—may explain why negative mood had the same effect as neutral mood in some studies on the breadth of attention (e.g., Rowe et al., 2007), whereas other studies found similar effects of positive and neutral mood (e.g., Chipchase & Chapman, 2013). Given the various approaches to induce a mood state that is relatively neutral compared to positive and negative mood, the question arises about what kind of treatment produces an adequate control condition. This concern also applies to the stimulus material (externally located impact of emotion). Due to this unsolved issue, we focused on the contrast between positive and negative moods in the present study.

To conclude, in the present study we asked whether positive versus negative mood affects attention, while previous conceptual as well as empirical work provided evidence for a broadened attentional scope by positive but also negative mood. Due to inconsistent evidence, we exploratorily investigated the following hypothesis:

H2a. A positive versus negative mood state in the observer elicits a different spatially extensive exploration of webpages.

However, besides a potential main effect of the observer's mood state on the global attentional focus, one central question is how the observer's mood state interacts with externally located emotional

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