Processing emotional stimuli: The competition between positivity and negativity for eye movements and attention

Introduction

When a pair of positive and negative images is presented on a screen simultaneously, which image will capture your eyes and attention first? For instance, the "before and after" advertisement, commonly used in the health-related ad, usually compares two distinct situations residing on the extremes of the spectrum (e.g., an obese woman before and after she lost weight, a man before and after he is diagnosed with cancer, and so on). In this scenario, which picture will people look at first? Will the valence of that picture affect the emotion of people, which in turn influences the attitude towards the stimulus? Scholars have found that valence can trigger automatic processing, which leads to orienting sensory organs towards emotional stimuli and taking in information (Kensinger, 2004; A. Lang, 2006b; P. J. Lang, Bradley, & Cuthbert, 1997), but whether positivity will override negativity or vice verse is largely unknown. This question draws both academic and commercial concern. This paper argues that the concepts of *negativity bias* and *positivity offset* may explain the underlying mechanism and predict the result, and uses the eye tracking equipment to directly measure the cognitive processing over time.

Differential processing or visual salience?

Motivated attention

Emotional content is found to be able to motivationally bias attention. People have a limited capacity to process information bombard on sensory organs (A. Lang, 2000). Therefore, a primary function of information processing is to select certain information in either automatic or controlled ways for further processing (Lavie, Hirst, de Fockert, & Viding, 2004; Schneider, Dumais, & Shiffrin, 1984). When multiple information components compete for attention, emotional content, because of its motivational and personal relevance to people, is most likely to attract eye fixations and be detected more rapidly than other stimuli. Land and his colleagues argue that human motivational system consists of appetitive and aversive systems (P. J. Lang, Bradley, & Cuthbert, 1990). Emotion is viewed as action tendency evoked by these two motivational systems. Positive emotional content will activate appetitive motivational system while negative emotional content will activate aversive motivational system. The activation of

motivational systems leads to information intake and action preparedness. Scholars content that *visual salience* is one of the reasons to make emotional content pop out (Bradley, 2009; Ohman & Wiens, 2003).

Negativity bias and positivity offset

Visual salience alone cannot explain the competition between positive and negative emotional content and predict the result. *Differential processing* may be one of the key points to clarify this issue. The two motivational systems may influences action tendency in different ways (Cacioppo & Berntson, 1994; Cacioppo, Gardner, & Berntson, 1999; A. Lang, 2006a). The aversive system accelerates action tendency faster than the appetitive system when the level of arousal is high; this is called "negativity bias." The appetitive system has the higher level of action tendency than the aversive system when the level of arousal is low. Consequently, when positive and negative stimuli both appear and their level of arousal is high, people will look at negative stimulus first, which active the aversive system and produce "avoidance" response. If positive and negative stimuli both appear and their level of arousal is low, then people will look at positive stimulus first, which active the appetitive system and produce "approach" response. To test these ideas, two hypotheses are proposed (see table 1),

Table 1. The competition between negative and positive emotional content

		Positive stimuli	
		Low arousal	High arousal
Negative stimuli	Low arousal	Positive stimuli grab attention	Positive stimuli grab attention
	High arousal	Negative stimuli grab attention	Negative stimuli grab attention

H1a: When positive and negative stimuli both appear and their level of arousal is high, people will look at negative stimulus first.

H1b: When positive and negative stimuli both appear and their level of arousal is low, then people will look at positive stimulus first.

H2: The activation of the aversive system will result in negative evaluation of the ad, while the activation of the appetitive system will result in positive evaluation of the ad.

In addition, empirical studies also show that when the levels of arousal are different, no matter what valence the pictures are, high arousal pictures will usually capture attention (Mather, 2007; Mather & Sutherland, 2009). Therefore, when people are exposed to a pair of negative and positive images,

H3: People will look at high arousal stimulus first rather than low arousal stimulus.

Methods

Design. The design of the experiment was a 2 (Level of Negative Pictures: low or high) x 2 (Level of Positive Pictures: low or high) x 2 (Position: left or right) x 10 (Trial) within-subjects factorial design. Trial, was a repetition factor and represented the 10 trials in each category.

Stimulus materials. The stimuli for this experiment were 80 different images selected from the IAPS database. All stimuli were presented on the Tobii T120 17-in. monitor. MediaLab was used to display stimuli and record self-report data.

Dependent variables. The processing of emotional content is measured by eye movements, especially firs saccadic landing position, the total fixation duration, saccadic latency. Eye movements data were recorded using Tobii T120. Participants were also asked to evaluate the attitude towards the ad using a self-report scale.

Participants. A total of 60 undergraduate students enrolled in communications at National Chiao Tung University, Taiwan participated in the study.

Procedure. Upon arrival, participants were seated in a comfortable chair in front of a 17-in. computer screen and the distance bet3een the computer screen and participants was around 60 am. Participants complete the informed consent process first. There were 40 experimental trials. The order of 40 experimental trials was randomized. Each trials contained the following sequence. Participants were instructed to look at the fixation point first (3 seconds). Next an advertisement containing both negative and positive images was displayed

for 6 seconds. Then a black screen appeared for 3 seconds, and participants were required to fill out the self-report scale.

Results

The analysis reveals that Hypothesis 1 is partially supported. Negativity decides where eyes will look first. For Hypothesis 2, the results are mixed. It shows the expected tendency but is not statistically significant. Finally, Hypothesis 3 is supported. Arousal seems to have stronger influence on attention than valence.

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計畫成果自評部份：

第一年研究內容，證實 valence 與 arousal 兩者之間有交互作用存在，valence 與 arousal 分別在不同的情況，對注意力有較強的影響力，研究成果適合在學術期刊發表。但最大的挑戰，是在理論模式建立階段，若同時將 valence 與 arousal 放入實驗中，在假設推導上不足，所得結果對改善理論模式的貢獻也有限。建議應分別探究 valence 與 arousal，之後再一起考慮兩者的交互作用。

為建立一個完整的理論模型，解釋兩個面向對注意力的影響，並釐清何種心理機制、如何運作，接下來的方向會先控制 arousal，比較 valence 中正面與負面之間的影響力，以先掌握 valence 的作用。正負面訊息同時呈現，也是健康傳播中常用的廣告形式之一，研究也具實務應用價值。