Learning and Individual Differences 44 (2015) 25–32

Contents lists available at ScienceDirect

Learning and Individual Differences

journal homepage: www.elsevier.com/locate/lindif

Divergent thinking and differential focusing of perceptual attention in visual serial search tasks

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ARTICLE INFO

Article history:
Received 12 February 2014
Received in revised form 21 May 2015
Accepted 29 May 2015

Keywords:
Divergent thinking
Perceptual attention
Differential focusing of attention
Focused and defocused attention
Intelligence
Elementary cognitive task
Cognitive inhibition task

ABSTRACT

Seminal creativity theories developed by Eysenck and Martindale bring distinguishing predictions to bear on relations between divergent thinking and attention. Drawing upon these theories, the current study was intended to investigate whether the differential focusing of perceptual attention accommodated within visual serial search tasks relates to divergent thinking. An elementary cognitive task was employed to simulate focused perceptual attention and a cognitive inhibition task to simulate defocused perceptual attention. The data obtained lend support to both theories: The attentional distraction scores were more consistent with Martindale's theory, and the attentional selection scores with Eysenck's theory. The theories of Martindale and Eysenck are considered as complementary rather than mutually exclusive, relative to the differential focusing of perceptual attention in visual serial search tasks with respect to divergent thinking.

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1. Introduction

The view that creativity includes various angles is broadly accepted (e.g., Eysenck, 1995; Martindale, 1999; Mumford & Gustafson, 1988; Runco, 2008; Simonton, 1999). For example, creativity is examined in relation to divergent thinking (e.g., Runco, 1999, 2008), intelligence (e.g., Sternberg & O'Hara, 1999), attention (e.g., Eysenck, 1995; Martindale, 2002), intuition (e.g., Simonton, 1980, 1999), and some personality traits such as psychoticism (Eysenck, 1995) and persistence (e.g., Simonton, 1999). The present study attempts to examine relationships of divergent thinking with attention in visual serial search tasks.

The view that creativity and attention are related constructs dates back at least to the 1960s. After Mendelsohn and Griswold (1964) pioneered discovering a link of creativity with incidental stimuli, attention was acknowledged a prominent topic providing guidelines for research relative to the cognitive basis of creativity. Yet it took several decades before an important theoretical breakthrough arose in this domain. Eysenck (1995) and Martindale (1995, 1999) proposed competing seminal theories animating interest in creativity and attention.

Attention is not a unitary concept (Schweizer, 2010; Stankov, 1983). It embraces, for instance, mental concentration, search, selective and divided attention, and vigilance (e.g., Moray, 1969). More generally, attention can be defined as the appropriate allocation of processing resources to relevant stimuli (Coull, 1998). Therefore, the most preferred way of studying creativity and attention consists in treating the latter as focused and defocused, or even predominantly defocused (e.g., Ushakov, 2006). Thus, adopting the concept of divergent thinking as articulated by Guilford (1956; 1968) seems appropriate for studying relations between creativity and focused/defocused attention. Indeed, since divergent thinking is the ability to generate many diverse ideas in various paths (e.g. Runco, 2008), it would, at least theoretically, correspond to defocused attention as deviating to some degree from an accurate focus. This does not mean that creative people are always in a state of defocused attention. Rather, they are more capable of switching between focused and defocused attention (e.g., Martindale, 2002; Zabelina & Beeman, 2013), and studying this flexibility can facilitate the understanding of the relationship between these states of attention. Certainly, divergent thinking is neither synonymous with nor sufficient for creativity. Divergent thinking is a kind of creative thinking, but the latter extends the former (Runco, 2008).

Both Eysenck (1995) and Martindale (1995, 1999) enter into the controversy about how attention relates to creativity. This debate continues until the present. The key point is that both Eysenck and Martindale apply data which are grounded on the target combined with distractor stimuli tasks to simulate focused and defocused attention. But they disagree about whether attention is "overinclusive" and then sticks to the target ignoring the distractors (Eysenck, 1995,

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http://dx.doi.org/10.1016/j.lindif.2015.05.007
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pp. 245–248), or distractive and then gets off target to the distractors (Martindale, 1995, 1999). As will be shown below, there is supportive evidence in favor of both assumptions.

Another issue is that attention can be divided at both conceptual and perceptual levels (Friedman, Fishbach, Förster, & Werth, 2003; Martindale, 1995). Besides, the perceptual level of attentional allocation for creativity is theoretically salient but empirically least examined and understandable. Actually, very few studies have obtained correlations of perceptual focused and defocused attention with divergent thinking. Moreover, the results are difficult to compare since the methodologies of the studies differ. Our concern in this article was therefore with investigating the relationship between a differential focusing of perceptual attention and divergent thinking. Predictions were derived from the creativity theories of Eysenck and Martindale, and our study attempted to some extent to make an empirical effort to resolve their disagreement.

The aim of the current study was therefore to investigate the relationship between focused and defocused perceptual attention accommodated within serial visual search tasks and divergent thinking.

2. Background

We place great importance on three crucial questions. First, the clarification and therefore articulation of focused and defocused attention are necessary. Second, the attention measurements should be considered with their theoretical meaning. Third, the relative paucity of empirical evidence sharpens the problem of how defocused and focused attention relates to divergent thinking. Identifying possible answers to these questions is an important step towards clearing the ground on which further study of the relationship between focused/defocused attention and divergent thinking can be raised.

2.1. Focused and defocused attention

The ability to focus attention is generally explained as being the ability to inhibit or filter out irrelevant stimuli and thoughts in order to be able to focus on relevant stimuli and thoughts.

The more stimuli are in the focus of attention the less attention to be focused (Martindale, 2002). Focused attention captures relevant information whereas defocused attention extends to both relevant and irrelevant information. Consequently, focused attention is narrowing as compared to defocused attention, which is widening. The assumption is that cognitive inhibition is a mechanism limiting the flow of information to the focus of attention. Thus, attention variation is usually obtained by using different task demands (Dorfman, Martindale, Gassimova, & Vartanian, 2008).

To simulate focused and defocused attention conditions, elementary cognitive tasks and cognitive inhibition tasks are ordinarily employed. Experimentally, elementary cognitive tasks (focused attention condition) include a simple target stimulus with no irrelevant information. Elementary cognitive tasks put minimal requirements on the participants. They perform simple mental operations with a target stimulus (relevant information) under conditions where no distractor stimuli (irrelevant information) are presented. Conversely, cognitive inhibition tasks (defocused attention condition) are intended to administer tasks so that attention is spread over several sources or stimuli, one of which is a target stimulus and the others are distractors (Martindale, 2002; Vartanian, 2009). The negative priming paradigm is an example of how a priming stimulus may inhibit the reaction to a target stimulus, like in the Stroop effect (Stroop, 1935). The priming is an irrelevant stimulus (referred to as a distractor), which participants are required to ignore while focusing on a target stimulus. If the distractor impairs performance in target detection, the distractor is said to have also been selected by attention.

2.2. Measures of focused and defocused attention

The speed of information processing is the most widely acknowledged measure of attention. Stankov (1983) points out that during the 1970s reaction time (RT) was a preferred method, proven to be sensitive to registering attention. In subsequent decades, psychologists have continued using this method. Interestingly, an inverse relation was found between the size of the focus and the efficiency of processing stimuli based on RT measures (e.g. Benso, Turatto, Mascetti, & Umilta, 1998; Kent, Howard, & Gilchrist, 2012). RT-based attention tasks are also used in creativity studies (e.g., Ansburg & Hill, 2003; Dorfman et al., 2008; Eysenck, 1995; Vartanian, Martindale, & Kwiatkowski, 2007). The findings support the view that information processing speed is indicated by faster RT under the condition of focused attention and by slowed-down RT under the condition of defocused attention.

In some studies, measures of response accuracy indicating attention adhere to the RT paradigm (e.g., Kent et al., 2012; Liu, Wolfgang, & Smith, 2009; Smith & Ratcliff, 2009; Treisman, 1977), and in other studies perceptual accuracy is involved instead of response speed (e.g., Pack, Carney, & Klein, 2013; van Damme, Crombez, & Notebaert, 2008). RT is a speed measure, but speed and attention cannot be equated. Confounding them may conceal the nature of attention itself (Stankov, 1983). This view opens the door to some advantages of information-processing tasks which require selective allocation of some limited processing resource (e.g., Anderson, 2014; Broadbent, 1958; Cowan, Fristoe, Elliott, Brunner, & Saults, 2006; Neill, 1977; Norman & Bobrow, 1975; Thornton & Gilden, 2007). However, we leave behind our interest in theorizing about capacity and limited resources as such, including their classification (e.g., Neill, 1977). Instead, we turn to the performance of tasks which can be taken to reflect the capacity or scope of attention. This can be indicated by the quantity of information processed and the accuracy of the processing, although RT is also widely used (e.g., Cowan et al., 2006; Hearns & Moss, 1968; Mendelsohn & Griswold, 1964; Shurtleff & Marsetta, 1968; Verghese & Pelli, 1992). However, the quantitative measures of capacity, has lacked compelling empirical evidence and is so far not elaborated enough as compared with the RT paradigm.

2.3. Attention and creativity

Martindale (1989, 2002) proposed a differential relationship of creativity with attention. He suggested that creative people are better than less creative people at shifting between focused and defocused attention as the situation demands. His theory has been tested out (Dorfman et al., 2008; Martindale, 2002; Vartanian et al., 2007). Creative potential (as measured by the Alternate Uses Test, Wallach & Kogan, 1965) and processing speed were positively correlated for interference tasks (Negative Priming tasks by Claridge, Clark, & Beech, 1992, defocused attention condition) indicated in slower RT, and negatively correlated for noninterference tasks (Concept Verification Test by Knorr & Neubauer, 1996, focused attention condition) indicated in faster RT. These data support Martindale's theory. In general, defocused attention involves a larger amount of information to be processed. As a result, creative people slow down their information processing. Conversely, focused attention narrows the amount of information to be processed, thus filtering out unnecessary information. As a result, creative people have a faster RT.

In studying attentional priming effects on creativity, Friedman et al. (2003) distinguished between perceptual attention and conceptual attention. They revealed that defocused attention and focused attention are different processes, whereas perceptual and conceptual attention is closely related. In particular, participants who completed the broadly focusing visual search task demonstrated more originality than those who completed the narrowly focusing visual search task. It was demonstrated that situational variations in the scope of perceptual attention might analogously influence the scope of conceptual attention, thereby

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