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Do creative people use shorter associative pathways?

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ABSTRACT

In this study we investigate the relationship between individual differences in associative information processing and different facets of creativity. Associative information processing was measured by means of a slightly modified variant of Gianotti et al.'s (2001) word pair list, in which participants are shown indirectly related (e.g. *cat – cheese*) and unrelated word pairs (e.g. *subject – marriage*) and asked to generate a third word that could possibly serve as a connective associative link between the presented stimuli words. In contrast to Gianotti et al., we instructed our participants to judge the associative distance between the given problem words on a rating scale. This modified word pair list was administered along with a variety of psychometric creativity tasks in two different groups of university students who considerably differed with respect to their creativity-related demands in their fields of studies. We observed a weak but significant negative correlation between originality and the rated associative distance between the unrelated word pairs. In addition to this, the higher creative group estimated the distance between unrelated word pairs as being smaller than lower creative people. The results support Mednick's (1962) theory of individual differences in associative hierarchies.

1. Introduction

Creativity pervades almost all areas of our everyday life and it is crucial or even essential in many different domains. The ability to think creatively is, for instance, necessary in science, pedagogy or education just as in the economic or industrial domain (see e.g. Runco, 2004). In scientific literature, creativity is commonly defined as the ability to produce work that is both novel and useful in a particular social setting (Flaherty, 2005; Sternberg & Lubart, 1996). More specifically, in his influential presidential address at the American Psychological Association, Guilford (1950) defined creativity as the ability to produce a large number of ideas (i.e. ideational fluency), to produce different types of ideas (i.e. flexibility) and to produce novel, original ideas (in terms of statistical infrequency). In this particular context Guilford also mentions that realistic or accepted creative outcomes must be realized under "some degree of evaluative restraint, but too much restraint, of course, is fatal to the birth of new ideas" (p. 453).

In the meanwhile, interest in the scientific study of creativity is rapidly growing and more and more theoretical and empirical studies contribute to our understanding of this complex but nonetheless fascinating mental ability domain. Dietrich (2004), for instance, provides a comprehensive review of contemporary research in the field of cognitive science and neuroscience related to creativity. He argues that creativity requires a variety of classic cognitive abilities such as working memory, sustained attention, cognitive flexibility, or the ability to break conventional rules of thinking (for recent theoretical approaches in this field see also Ward, Smith, & Finke, 1999; Weisberg, 1999). In characterizing creative people, early concepts in this field refer to individual differences in primary vs. secondary process cognition (Kris, 1952), defocused attention (Mendelsohn, 1976) or to individual differences in the hierarchy of associations (Mednick, 1962). Kris' theory of primary vs. secondary process cognition suggests that creative individuals are more able to shift between primary and secondary modes of thinking. Primary process cognition involves processes like dreaming and reverie or abnormal or even pathological states such as hallucinations or psychosis. By contrast, secondary process cognition can be characterized by more rational, logical and analytical modes of thinking. Kris assumes that in creating novel, original ideas an individual needs to regress to primary thought processes, because in this state the associative network is released, which could be seen as an important prerequisite in the generation of new connections or associations and thus in the production of original or creative ideas. In a very similar vein, Mendelsohn (1976) presumes that creative individuals are more capable of defocusing attention. Defocused attention implies that individuals are more able to pay attention to different stimuli, tasks or events, in contrast to just focusing on a single event (i.e. focused attention). The more stimuli a person can pay attention to, the more different combinations can be made.

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According to Mednick's (1962) theory of individual differences in associative hierarchies, creative individuals are characterized by "flat" (more and broader associations to a given stimulus) instead of steep associational hierarchies (just a few, common associations to a given stimulus). In other words, this theory also suggests that creative individuals appear to have a more flexible associative network than less creative individuals. Possibly, creative individuals have more associative links in their network and can connect or disconnect associative relations faster than less creative individuals, thereby facilitating more efficient creative problem solving. Based on his theory, Mednick (1962) developed the so-called Remote Associate Test (RAT) to measure creativity. In this test, individuals are presented three problem words, for instance "*tower*", "*bracelet*" and "*hour hand*" and they have to identify a fourth word ("*watch*") which could serve as an associative link between the given problem words. Mednick reports evidence that pupils who were characterized as being creative by their teachers exhibited shorter reaction times and found more often the interconnected word.

Eysenck (1995) referred to a similar concept which also originates from the idea of more flexible associative networks in creative individuals, namely the concept of "overinclusiveness" or "allusive" thinking as being characteristic for creative people. Accordingly, creative individuals are supposed to include much more stimuli or categories in their mental processes than less creative people do. Hence they are capable of creating more relations or connective associations between single stimuli, but such a "overinclusiveness" of information could also cause some kind of breakdown of filter mechanisms (which are responsible for inhibiting irrelevant stimuli in order to facilitate efficient information processing), which is believed as being characteristic for psychotic-prone people as well (cf. Eysenck, 1995).

The literature briefly summarized so far suggests that individual differences in the flexibility of the associative network could be seen as an important correlate of creativity and empirical research in this field is continuously thriving. For instance, Mohr, Graves, Gianotti, Pizzagalli, and Brugger (2001) aimed at investigating the flexibility of the associative network in relation to magical ideations. Magical ideation involves paranormal belief, but also experiences with hallucinations and delusions. To assess the flexibility of the associative network, Mohr and colleagues developed a test containing indirectly related ("*bee – bread – honey*") and unrelated ("*ladder – bottle – frog*") word triples. The participants had to rate the associative distance between the three words on a six-point rating scale (e.g. to the word pair *BEE* and *BREAD* the word *HONEY* is semantically very closely – very distantly related). Mohr et al. observed a negative correlation between magical ideation and the rated associative distance. Persons who scored higher on the magical ideation scale estimated the distance between the unrelated word pairs as being smaller than persons with lower magical ideations scores did. Similarly, Gianotti et al. (2001) investigated individual differences in associative processing in relation to paranormal belief. Gianotti and colleagues used indirectly related and unrelated word pairs and their participants were requested to generate a third word that could serve as an associative connective link between the two given stimuli words (e.g. *cat – cheese*; third word: *mouse*). The authors report evidence that paranormal believers produced more rare associations than persons who do not believe in paranormal phenomena.

The study of Mohr et al. (2001) and the study of Gianotti et al. (2001) make an important contribution to relevant research literature inasmuch as they provide valuable measures of the flexibility of the associative network. However, the authors did not analyze the relationship between associative information processing and creative cognition. In order to fill this gap, the present study was designed to investigate the relationship between the flexibility of the associative network and psychometrically determined creativity. To this end, we used a battery of different psychometric creativity tasks along with a slightly modified variant of Gianotti et al.'s (2001) word association test. Participants were shown indirectly related (e.g. *cat – cheese*) and unrelated (e.g. *subject – marriage*) word pairs (taken from the Gianotti et al. study) and, contrary to Gianotti et al., participants' task was to rate the associative distance between the presented stimulus words on a rating scale (cf. Mohr et al., 2001). We expect creative individuals (as opposed to less creative individuals) to rate the associative distance between the unrelated word pairs as being smaller. Given that indirectly related words might be similarly presented in the associative network of most individuals (e.g. most people would name "*mouse*" in response to the stimuli "*cat*" and "*cheese*") we expect no creativity-related differences in the estimated associative distance between indirectly related word pairs.

2. Methods

2.1. Participants

Participants were 106 undergraduate university and college students. Due to difficulties with German language, six individuals had to be excluded from further analyses. These persons would have been heavily disadvantaged in the performance of the experimental tasks (i.e. creativity tasks and associative information processing tasks) which strongly draw on verbal demands. The remaining sample included 50 students with lower creativity-related demands in their studies (recruited from the University of Graz, most of them ($n = 41$) were psychology students in the first semesters and $n = 9$ studied geosciences) and 50 students from a design and multimedia-art school (considerably higher creativity-related demands). Students must successfully complete various acceptance tests to get admitted to the design and multimedia-art schools. These tests include among others creativity tasks (e.g. creating a short movie) and only the most creative candidates are admitted to the schools. Fifty-four participants were female and 46 male. The age of the students ranged from 18 to 33 years ($M = 23.03$; $SD = 3.21$). The two groups of participants (higher vs. lower creativity-related demands) did not differ significantly with respect to age and verbal ability.

2.2. Psychometric tests

2.2.1. Creativity tasks

In order to obtain a comprehensive and reliable measure of participants' creativity level we administered several psychometric creativity tasks. The first was the subtest picture completion of the Torrance tests of creative thinking (TTCT, Torrance, 1974). In this task, participants were shown abstract lines and figures which had to be completed or extended in an original way. We also administered a German-speaking version of the classic alternative uses (AU) test in which participants were required to name as many and as original uses of conventional everyday objects (such as a tin, brick, pencil or sock; cf. "Verbaler Kreativitätstest", VKT; Schoppe, 1975). The third creative task was the unusual situation test (UUS). In this task two pictures of a particular situation or object (e.g. chair) are shown. The first picture symbolizes the initial state (e.g. chair with four chair legs) and the second the end status of the stimulus situation (e.g. chair with only three chair legs). Participants are required to produce as many and as original explanations for the illustrated alteration. And finally, we administered a subtest of the imagination scales of the "Berliner Intelligenz Struktur Test" (BIS, Jäger, Süß, & Beauducel, 1997), the so-called insight task. In this task participants had to respond creatively to the ques-