

Creativity: The role of unconscious processes in idea generation and idea selection

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ABSTRACT

Today's world of continuous change thrives on creative individuals. Anecdotal reports suggest that creative performance benefits from unconscious processes. Empirical research on the role of the unconscious in creativity, though, is inconsistent and thus far has focused mainly on one aspect of the creative process – idea generation. This is the first study to assess the role of the unconscious mind for both idea generation and idea selection. Participants generated creative ideas immediately, after conscious thought, or after a period of distraction during which unconscious thought was hypothesized to take place. After having listed their ideas, participants selected their most creative idea. Performance in idea generation was similar between conscious and unconscious thought; however, individuals who had unconsciously thought about ideas were better in selecting their most creative idea. These findings shed more light on the role of unconscious processes in creativity, and provide a means to enhance creative performance.

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1. Introduction

In everyday life, creative vision is highly appreciated. For example, a recent survey among 1500 chief executives around the world ranked creativity as the most crucial leadership quality (IBM Corporation, 2010), and creativity was rated as an important determinant of making a psychology article influential (Sternberg & Gordeeva, 1996). In the scientific literature, 'creativity' is defined as the process of bringing into being something that is both new and useful (e.g., Amabile, 1996; Sawyer, 2006; Sternberg & O'Hara, 1999). Given that effort, hard work, and training play an important role in the creative process (Amabile, 1996; Csikszentmihalyi, 1996; Sawyer, 2006), one may expect that creativity is achieved through extensive conscious thought; however, several studies have pointed out that the unconscious mind is also indispensable in creative performance (e.g., Simon, 1996; Smith, 1995). Moreover, the importance of the unconscious in creativity is emphasized by many anecdotes about individuals hailed as geniuses (Ghiselin, 1952; Wallas, 1926; Woodworth & Schlosberg, 1954). For example, the mathematician Poincaré was convinced that his creative ideas emerged from the unconscious, and Einstein reported that he first 'saw' the solution to a problem without being able to express it (Ghiselin, 1952). In arts, experiences of creativity seem to be similar. According to Schopenhauer (1970, p. 41), "everything primary, and consequently everything genuine, works as the forces of nature do, unconsciously."

These and many similar anecdotal reports strongly suggest that creativity cannot be explained by conscious processes alone. According to dual process theories, we have a conscious, rule-based, controlled system, and an unconscious, associative, automatic system (Evans et al., 2009). In creativity, the period during which the unconscious is at work is often called 'incubation'. One of the earliest well-developed concepts of incubation was postulated by Wallas (1926), who assumed that

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during incubation one does not consciously think about the task but rather the mind continues to work on it below the level of consciousness. There is some controversy, though, as to why incubation is helpful. One of the explanations for the positive effects of incubation on creative problem solving is the reduction of mental fatigue (Posner, 1973). According to the mental set-shifting or forgetting-fixation hypothesis, putting a problem aside for a while helps to find creative solutions, as it allows for a fresh, unbiased and new look at a problem and reduces associations with incorrect answers, allowing correct ones to surface (Schooler & Melcher, 1995; Smith & Blankship, 1989). These explanations ascribe to the unconscious a merely passive role, whereas the term 'incubation' itself suggests that the unconscious also actively contributes to solving a problem (e.g., Claxton, 1997; Koestler, 1964). Therefore, these explanations may not be the only benefit of an incubation period, and the question rises as to whether the unconscious also actively contributes to creative problem solving.

The idea of an active unconscious was supported by a pioneering experiment from Bowers, Regehr, Balthazard, & Parker (1990). Participants had to guess a target word while they were given successive hints. Whereas individuals felt clueless for quite some time and then suddenly came up with the correct answer, participants' prior guesses show that they were slowly getting closer to the right solution before the solution reached their consciousness. Further evidence for an active unconscious was provided by Zhong, Dijksterhuis, & Galinsky (2008), who examined the effect of 'unconscious thought' (i.e., task-related thought processes that occur while conscious attention is directed elsewhere; Dijksterhuis & Nordgren, 2006) on two outcomes of a remote association test (RAT): implicit accessibility and conscious reporting of answers. The accessibility of RAT answers, but not the number of correct answers, was higher after unconscious thought than after an equal duration of conscious thought. Interestingly, the level of activation of RAT answers was also higher than in the mere-distraction condition, which suggests that the increased accessibility after unconscious thought was not due to relaxation or the release of incorrect associations, as suggested by the forgetting-fixation or mental set-shifting hypothesis. Unconscious thought seems to think actively and, thereby, facilitates the discovery of remote associations. Besides the scientific evidence for an active unconscious, though, and the tremendous anecdotal evidence for the importance of the unconscious in creativity, research has yielded no sound empirical support for the beneficial effect of unconscious processes on creative performance (Sio & Ormerod, 2009). How can this discrepancy be explained? Is it possible that the beneficial effect of unconscious processes on creative performance is especially visible during the idea selection phase?

Various creativity theories have suggested a role for the evaluation and selection of ideas, as being creative includes both generating many novel options and subsequently identifying the single best option. In cognitive theories, creating ideas is distinguished from evaluating ideas (Cropley, 2006). Moreover, sociocultural theories suggest that having an idea is easy, whereas it is difficult to develop an idea so that the domain's audience accepts it (Sawyer, 2006; Sternberg, 2006). Also, in Darwinian theories, a distinction is made between processes that generate ideas and processes that selectively preserve the most creative idea (Simonton, 1999). Several good efforts have been made to gain more insight into how individuals (Rietzschel, Nijstad, & Stroebe, 2010; Runco & Smith, 1992), groups (Faure, 2004), and eminent creators (Kozbelt, 2007) select ideas; however, research on idea generation has overshadowed the question of idea evaluation. To the best of our knowledge, no previous research has investigated whether unconscious processes may help people to be more discerning. Is it possible that a period of unconscious thought enables individuals to converge more toward the selection made by trained raters?

From previous research we know that after a period of unconscious thought people are better at selecting the most attractive alternative among several options (e.g., Dijksterhuis, 2004; Dijksterhuis et al., 2006; Ham, Van den Bos, & Van Doorn, 2009; Lerouge, 2009). In a typical unconscious thought experiment, participants have to choose the most attractive alternative among several options. They either do so immediately after having received the information, or after a period during which they were allowed to consciously think about the options, or after a period of distraction, during which 'unconscious thought' was assumed to take place. The best decision, as judged from a normative perspective, is usually made by the unconscious thinkers. It is assumed that unconscious thought helps to make complex decisions, as it is good at evaluating, weighting, and integrating attribute information concerning various alternatives (Dijksterhuis & Nordgren, 2006). Given that selecting one's most creative idea can be considered a decision making process, these findings suggest that thinking about one's ideas unconsciously may also have a beneficial effect on the idea selection part of the creative process. If it is, indeed, the case that the role of the unconscious is especially visible during idea selection, this would explain why anecdotes of creative people, which rely on real life creativity and, therefore, on idea generation as well as on idea selection, support the role of the unconscious in creativity, whereas scientific studies, which mainly focus on idea generation, provide only weak evidence.

In the current studies, we do not use the term 'creativity' to refer to achievements of geniuses such as Einstein, Poincaré and Schopenhauer. Rather, we focus on two aspects of creativity: the generation of creative thoughts and the ability to select one's most creative idea. The aim of the current experiments is to investigate the role of the unconscious mind in the idea generation and the idea selection part of the creative process. Based on previous findings, we hypothesize that thinking about ideas unconsciously especially facilitates the idea selection phase of the creative process. The findings of the current studies may shed more light on the role of unconscious processes in creativity, and may provide a means to enhance individuals' creative performance.

2. Experiment 1

Participants were asked to think of as many ideas as possible to solve a problem. After having listed their ideas, they were asked to select their most creative idea. This task allowed us to untangle the role of unconscious processes in the idea generation, as well as the idea selection part of the creative process.

2.1. Method

2.1.1. Participants and design

One hundred and twelve students from Radboud University Nijmegen received course credits or money (4 Euros) for participation. Their average age was 20.8 years (ranging from 16 to 29, $SD = 2.23$), and 21 were male. Participants were randomly assigned to one of three conditions – an immediate condition ($n = 37$), a conscious thought condition ($n = 37$), or an unconscious thought condition ($n = 38$).

2.1.2. Procedure

Participants were randomly allocated to one of these three conditions. In the immediate condition, participants were instantly asked to generate and list ideas on how to solve the creativity task. In the conscious thought condition, participants were asked to first carefully think about possible solutions for 2 min before listing their ideas. In the unconscious thought condition, participants were informed that they would first have to perform an unrelated task for 2 min and, thereafter, would have time to list their ideas. To minimize task-relevant conscious thought during the distraction period, they had to click as quickly as possible on circles of different sizes that appeared rapidly at random locations on the computer screen.

After the manipulation, participants had 2 min to list their ideas in an empty box presented on the screen. Finally, participants were asked to choose their most creative idea from all the ideas they had generated.

2.1.3. Creativity task

Participants had to generate and list ideas on how to make the waiting time at the cash desk more bearable. Unlike letter fluency tasks and semantic fluency tasks, the current task intends to capture the creative quality of the responses, not merely the number of responses. Furthermore, this task enabled us to ask participants to select their most creative idea from all the ideas they generated.

2.1.4. Creativity measures

For the idea generation phase, the measures of interest were the number of ideas that a participant listed and the participant's average creativity score. Concerning the idea selection phase, we were interested in whether a participant's selection of the most creative idea was in accordance with judgment of trained raters. Creative ideas, as all creative products, do not have a distinct, inherent level of creativeness; the creative worth of an idea is usually determined by complex sociocultural and historical processes (Sawyer, 2006; Simonton, 1998), which makes it difficult in an experimental setting to determine an individual's creative performance. There is a long tradition in creativity research, however, of scoring creative performance by having trained raters evaluate participants' responses. Good agreement has been found in the judgments of independent raters (Baer, Kaufman, & Gentile, 2004; Kaufman et al., 2005). Hence, in the current experiment, three trained raters were asked to examine the creativity of each idea, and to identify the most creative idea of each participant.

2.1.4.1. Training of objective raters. Training consisted of an elaborate explanation of the concept of creativity (i.e., that a creative idea has to be both useful and novel; Hennessey & Amabile, 2010; Sawyer, 2006; Sternberg & O'Hara, 1999), and the raters were provided information about the scoring system. Hereafter, the raters were given a 10-min exercise in which they had to examine the creativity of various ideas.

2.1.4.2. Scoring procedure. To receive a reliable average creativity score, all raters had to score each idea in terms of creativity on a five-point scale (1 = 'not at all creative', to 5 = 'extremely creative'). For each idea, a mean of the three scores was calculated (inter-rater reliability $\alpha = .77$), and per participant these mean scores were added. This sum score was divided by the number of ideas a participant listed to make sure that a participant's creativity score was independent from fluency, i.e., the number of ideas generated.¹

For the implementation of creative ideas, it is crucial that one succeeds in recognizing and selecting one's most creative idea. Previous research usually instructed participants to rate their responses (Grohman, Wodniecka, & Kłusak, 2006; Runco & Smith, 1992); however, real-life creative performance typically requires making a selection instead of judgments or rankings. Therefore, participants as well as three trained raters were instructed to select one idea only – the one they considered most creative. To receive an objective external judgment, it was required that at least two of the three raters agreed about a participant's most creative idea. This requirement was fulfilled in almost all cases (94%); however, two participants had to be excluded from the analysis as they did not comply with the task instruction of selecting only one idea, and two participants could not select their most creative idea as they had only listed one idea.

¹ The correlation between fluency and creativity sumscore was $r(108) = .80, p < .01$.

Table 1

Number of ideas and the average creativity by thought condition. Results are expressed as means, standard deviations (SD), and 95% confidence intervals (CI).

Experiment	Thought condition	Mean	SD	95% CI	
				Lower Bound	Upper Bound
Number of ideas					
1	Immediate	3.89	1.73	3.31	4.47
	Conscious	5.24	2.06	4.67	5.82
	Unconscious	4.68	1.49	4.11	5.25
2	Immediate	6.39	2.36	5.36	7.42
	Conscious	7.91	3.00	6.90	8.92
	Unconscious	7.59	1.75	6.58	8.60
Average creativity					
1	Immediate	2.11	.61	1.91	2.32
	Conscious	2.20	.64	1.99	2.41
	Unconscious	2.10	.64	1.90	2.30
2	Immediate	1.90	.40	1.70	2.09
	Conscious	2.29	.54	2.10	2.48
	Unconscious	2.05	.43	1.86	2.25

2.2. Results

2.2.1. Idea generation

In order to investigate whether the thought manipulation influenced the number of ideas generated and the mean creativity of these ideas, two ANOVAs were conducted. An ANOVA on the number of ideas revealed a main effect of thought condition, $F(2,109) = 5.43$, $p < .01$, $\eta^2 = .09$. As shown in Table 1, participants in the immediate condition generated fewer ideas than participants in the conscious thought and unconscious thought conditions, $t(72) = 3.06$, $p < .01$, $t(73) = 2.13$, $p < .05$, respectively. However, conscious and unconscious thinkers did not differ in the number of ideas they generated, $t(73) = 1.35$, ns. An ANOVA on the average creativity revealed that the effect of thought condition was not significant, $F < 1$.

2.2.2. Idea selection

In order to investigate whether a participant's selection of the most creative idea was in accordance with the judgment of trained raters, a Chi-Square test was conducted and revealed a main effect of condition, $\chi^2(2) = 11.15$, $p < .01$. As presented in Fig. 1, unconscious thinkers outperformed conscious thinkers, $\chi^2(1) = 5.67$, $p < .05$, and those who immediately listed their ideas, $\chi^2(1) = 10.46$, $p < .01$, in selecting their most creative idea. Conscious thinkers did not differ from participants who immediately listed their ideas, $\chi^2(1) = .74$, ns.

To summarize, conscious and unconscious thinkers did neither differ in the number of ideas listed nor in the average creativity of their ideas; however, participants in the unconscious thought condition had an important advantage: they performed better than participants in the conscious thought condition and the immediate condition in selecting the most creative idea from all self-generated ideas. These findings support the idea that the role of the unconscious is especially vital during idea selection. Since the ability to select one's most creative idea is important for the implementation of creative

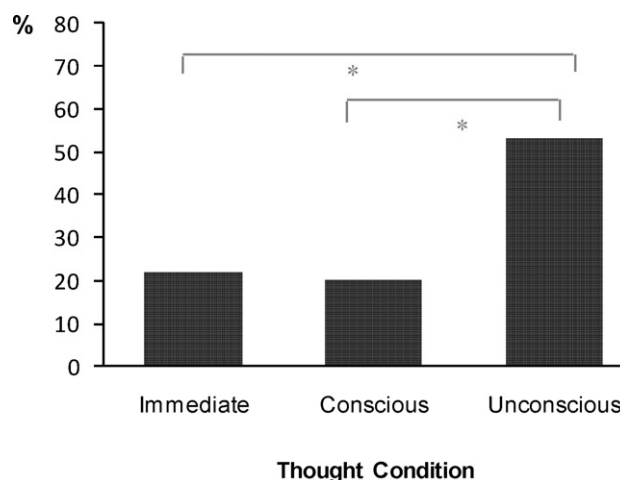


Fig. 1. Percentage participants who succeeded in selecting their most creative idea from several self-generated ideas. * $p < 0.05$.

ideas, the current experiment provides insight into the role of unconscious processes in creativity, and offers a means to facilitate creative performance.

3. Experiment 2

Experiment 1 has shown that thinking about ideas unconsciously does not lead to more creative ideas but enhances individuals' ability to select their most creative idea. The aim of the current experiment was to replicate the findings of Experiment 1 and, furthermore, to gain more insight into the beneficial effects of unconscious thought on idea selection. Does thinking about ideas unconsciously specifically help in the selection of the most creative idea? Or does it enhance participants' general selection capacity; and does it enable participants, therefore, to also better select their least creative idea? To investigate these questions, we asked participants to select their most creative, as well as their least creative idea.

3.1. Method

3.1.1. Participants and design

Sixty-eight students from Radboud University Nijmegen received course credits or money (4 Euros) for participation. Their average age was 22 years (ranging from 17 to 65, $SD = 5.78$), and 18 were male. Participants were randomly assigned to one of three conditions – an immediate condition ($n = 22$), a conscious thought condition ($n = 23$), or an unconscious thought condition ($n = 23$).

3.1.2. Procedure and materials

The procedure was similar to that in Experiment 1; however, in the current experiment, creative solutions for a different self-relevant problem had to be found. Participants had to come up with as many ideas as possible on how students can earn some extra money. Furthermore, after having listed their ideas, participants not only had to choose their most creative idea but also their least creative one.

3.1.2.1. Measures of interest. The experiment employed the same dependent variables as in Experiment 1: number of ideas listed, average creativity, and most creative idea. In addition, we added a fourth variable – least creative idea. In the current experiment, no training was provided as the ideas were scored by the same raters as in Experiment 1 (inter-rater reliability $\alpha = .88$).

3.2. Results

3.2.1. Idea generation²

An ANOVA revealed that the number of ideas participants generated did marginally differ between the three conditions, $F(2,65) = 2.46$, $p = .09$, $\eta^2 = .07$. As shown in Table 1, participants in the immediate condition listed marginally less ideas than participants who had first thought consciously or unconsciously, $t(43) = 1.89$, $p = .07$; $t(43) = 1.95$, $p = .06$, respectively. However, conscious and unconscious thinkers did not differ in the number of ideas they listed, $t < 1$. An ANOVA on the average creativity revealed a significant main effect of condition, $F(2,65) = 4.10$, $p < .05$, $\eta^2 = .11$. As shown in Table 1, unconscious thinkers did not differ from conscious thinkers, $t(44) = 1.64$, p ns. However, compared to participants who immediately listed their ideas, conscious thinkers were more creative, $t(43) = 2.75$, $p < .05$.

3.2.2. Idea selection³

Two Chi-Square tests were conducted to investigate whether the thought manipulation had an effect on individuals' ability to select their most creative and their least creative idea. The effect of condition was significant for the selection of the most creative idea, $\chi^2(2) = 8.00$, $p < .05$, as well as for the least creative idea, $\chi^2(2) = 7.20$, $p < .05$. As presented in Fig. 2, unconscious thinkers significantly outperformed conscious thinkers and participants who immediately listed their ideas in choosing their most creative idea, $\chi^2(1) = 4.83$, $p < .05$, $\chi^2(1) = 6.42$, $p < .05$, and their least creative idea, $\chi^2(1) = 5.11$, $p < .05$, $\chi^2(1) = 5.87$, $p < .05$, respectively. Conscious thinkers did not differ from participants who immediately listed their ideas, all $\chi^2 < 1$.

In line with Experiment 1, unconscious thinkers and conscious thinkers neither differed in the number of ideas listed nor in the average creativity of their ideas. However, as in Experiment 1, unconscious thinkers outperformed conscious thinkers in selecting their most creative idea. In addition, unconscious thinkers were better than conscious thinkers in selecting their

² The correlation between fluency and creativity sumscore was $r(68) = .90$, $p < .01$.

³ The agreement between the three raters about the most creative idea, $F(3,86) = 1.19$, $p > .10$, and the least creative idea, $F(3,86) = 1.11$, $p > .10$, was equally distributed across the three conditions. This suggests that for trained raters' selection performance it does not matter whether they have to select the most or least creative idea from an idea pool that was generated by participants who immediately listed their ideas, or by participants who first thought consciously or unconsciously about their ideas.

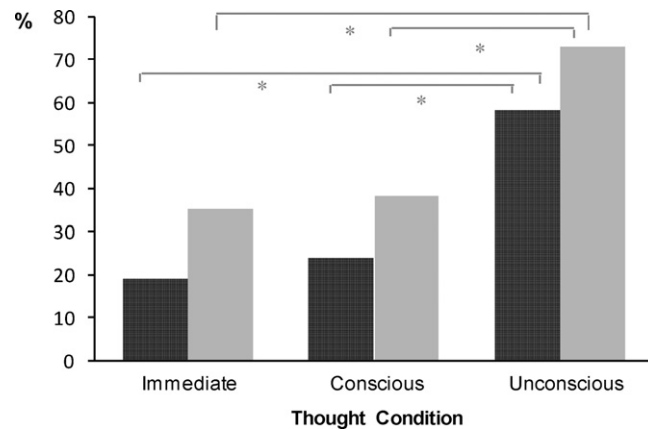


Fig. 2. Percentage participants who succeeded in selecting their most and least creative idea from several self-generated ideas. * $p < 0.05$.

least creative idea from all self-generated ideas. These findings provide further support for the idea that the role of the unconscious is vital for the idea selection part of the creative process.

4. Discussion

Despite various anecdotes about the importance of the unconscious in creativity, research has provided no sound empirical support. The aim of the current studies was to investigate the role of unconscious processes in the idea generation and idea selection part of the creative process. Based on the extant evidence concerning selection advantages achieved after unconscious thought, we hypothesized that thinking about ideas unconsciously facilitates the selection part of the creative process.

Our results show that individuals did not generate more creative ideas after unconscious thought than after conscious thought; however, individuals who thought about their ideas unconsciously had an important advantage – they performed better than conscious thinkers in recognizing their most and least creative idea. This may, at least partially, explain why anecdotes of creative people, which rely on real-life creativity and, therefore, on idea generation as well as idea selection, support the role of the unconscious in creativity, whereas scientific studies, which mainly focus on idea generation, provide weak evidence. Given that the ability to recognize one's most creative idea is crucial for the implementation of creative ideas, we can conclude that the unconscious mind plays a vital role in creative performance.

Why are individuals who unconsciously thought about their ideas better able to select their most creative idea? It is possible that during unconscious thought ideas are associated with their appropriate evaluative connotation, for example with positive or negative affect. This spontaneous tagging process may, in turn, unconsciously influence individuals' selection of the most and least creative idea later on. However, we concede this explanation is speculative and warrants further study.

In addition to their scientific contribution, the current findings also have a practical implication. For many years, creativity research has focused mainly on idea generation, and it has been assumed that people would be highly capable of identifying their most creative idea. People indeed seem to possess the ability to discriminate between their ideas, especially when they score high on openness to experience (Silvia et al., 2008); however, research has also shown that people do not perform optimally at idea selection (Faure, 2004; Putman & Paulus, 2009; Rietzschel et al., 2010). In line with these findings, individuals in the immediate and conscious thought conditions performed poorly in selecting their most creative idea. Participants who had unconsciously thought about their ideas, however, were able to select their most creative and least creative idea from several self-generated ideas. Therefore, the current findings provide a means to increase individuals' performance in the idea selection part of the creative process. This is vitally important for everyday creativity, as even after the successful generation of ideas, suboptimal results can be gained when the wrong idea is chosen for further elaboration. For future research it may be interesting to examine whether a longer unconscious processes not only facilitates the idea selection but also the idea generation part of the creative process. Moreover, the current research focused on individual creativity. For the development of innovations in organizations, it is also important to stimulate group creativity (Paulus & Nijstad, 2003). Therefore, future research may investigate whether a period of unconscious thought also increases the idea selection performance of groups, e.g., in brainstorm sessions.

In the current experiment, we combined creativity research with research on unconscious cognitive processes. The present findings increase our scientific understanding of the role of unconscious processes in creativity and, furthermore, provide a means to enhance individuals' creative performance. This is important, as today's world of continuous change thrives on creative individuals and inventive organizations.

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