Available online at www.sciencedirect.com
SCIENCE DIRECT®
Consciousness and Cognition 15 (2006) 135–146
Consciousness and Cognition
www.elsevier.com/locate/concog

Where creativity resides: The generative power of unconscious thought ☆

Ap Dijksterhuis *, Teun Meurs

Social Psychology Program, University of Amsterdam, Roetersstaat 15, 1018 WB Amsterdam, The Netherlands

Received 20 July 2004
Available online 12 July 2005

Abstract

In three experiments, the relation between different modes of thought and the generation of "creative" and original ideas was investigated. Participants were asked to generate items according to a specific instruction (e.g., generate place names starting with an "A"). They either did so immediately after receiving the instruction, or after a few minutes of conscious thought, or after a few minutes of distraction during which "unconscious thought" was hypothesized to take place. Throughout the experiments, the items participants listed under "unconscious thought" conditions were more original. It was concluded that whereas conscious thought may be focused and convergent, unconscious thought may be more associative and divergent.

Keywords: Consciousness; Unconscious; Creativity; Thinking

1. Introduction

Creativity has long been associated with the labor of the unconscious mind. Nobel laureates and famous artists, when probed to introspect on the process leading to their discoveries or

☆ This research was supported by NWO-Vernieuwingsimpuls 016.025.030.
* Corresponding author. Fax: +31206391896
E-mail address: a.j.dijksterhuis@uva.nl (A. Dijksterhuis).

1053-8100/$ - see front matter © 2005 Elsevier Inc. All rights reserved.
doi:10.1016/j.concog.2005.04.007

creations, often emphasize the crucial role of the unconscious. The importance of some conscious activity notwithstanding, it is the unconscious that at some point produces the truly "creative" or unique thought. It seems that unique insights often results from a process whereby some initial conscious thought is followed by a period during which the problem is put to rest. Subsequently, after this period without conscious thought, a solution or idea presents itself. This stage during which one refrains from conscious thought and during which the unconscious is at work, is called incubation.

The goal of the present paper is to shed light on the relation between incubation and creativity. Creativity is a broad term and it should be noted that we do not use it to refer to all the intricacies of stellar achievements of geniuses such as Mozart or Einstein. Rather, we focus on one aspect of creativity: the generation of new and original thoughts. People do associate creativity with thinking the non-obvious and the original, and we hypothesize that such non-obvious or original thoughts are more likely to be elicited by incubation than by focused, conscious thought.

Whereas the anecdotal evidence for incubation is both spectacular and abundant (Claxton, 1997; Ghiselin, 1952; Koestler, 1964; Schooler & Melcher, 1995), for a long time incubation was hard to establish in the psychological laboratory. Moreover, the few scientific demonstrations that became available over the years were often hard to replicate (see Olton, 1979; for an early review). Part of the problem may have been that researchers investigating incubation usually used so-called insight problems. Such problems have only one specific and often counterintuitive solution, causing a "Eureka experience" once found. The choice for the use of such problems is understandable, as a sizeable portion of creative ideas that occur in real life are often characterized by such sudden insights. However, solutions to insight problems are sometimes very hard to find (true needles in haystacks, see Dijksterhuis, 2004) and the difficulty to obtain sound evidence may have been caused by the fact that the period of incubation experimental participants are given in a lab experiment is often very short compared to real life creativity. After all, sometimes creativity can take months or even years.

Still, in the past 15 years some evidence for incubation has been found (e.g., Bowers, Regehr, Balthazard, & Parker, 1990; Smith & Blankenship, 1989). Smith and Blankenship (1989) for instance, gave their participants various insight problems to solve. Some were quickly solved by the participants whereas others were not. Giving participants an immediate second go at the unsolved problems did not help. However, after a delay during which they were distracted and could not attend to the problems, participants' performance improved. The reason distraction helped is that participants were given some misleading cues at the outset and distraction helped them forgot these misleading cues.

Schooler and Melcher (1995) reviewed the literature on incubation and concluded that distraction can lead to "set-shifting." People often approach a problem with the use of wrong cues, wrong heuristics, and/or wrong information. A period of distraction makes that such wrong approaches become less accessible or are forgotten altogether. The effects of distraction on a change of mental set can be both strong (such as when one tries to solve a chess problem and initially gets truly "fixed" in thinking along a wrong line) and fairly subtle (such as when distraction attenuates the biasing influence of primacy or recency effects). Such processes can be grouped under the umbrella of the "a fresh look" explanation: putting a problem aside for a while allows for a fresh, unbiased new start.

There is no denying that putting a problem aside for a while indeed allows for a fresh start and that such a fresh start often helps. The question, however, is whether this is the sole benefit of a period of distraction. Explaining effects of incubation in terms of set-shifting suggests that the role of the unconscious is merely passive. Problems are solved because of the temporary absence of conscious thought, but the unconscious mind does not contribute anything to solve the problem. The term incubation suggests more though. It suggests that the unconscious also actively thinks and contributes to solving a problem (see also Claxton, 1997; Koestler, 1964).

There is some evidence for true "unconscious thought." In experiments conducted by Bowers et al. (1990), participants were asked to guess a target word while they were given successive hints (words associated with the target words). Typically, participants are clueless for a while and then suddenly know the right answer. However, after carefully examining participants' prior, wrong guesses, it was concluded that participants are slowly getting closer to the right answer. It may "feel" as if the answer is suddenly presented to consciousness, however, before the answer become conscious, the unconscious is clearly thinking about it. It is, as it were already approaching the target.

In addition, Dijksterhuis (2004) recently compared conscious and unconscious thought in the realm of decision making. In several experiments, participants received information about various alternatives (e.g., apartments, roommates) with the goal to decide what alternative is the most attractive. Participants either chose immediately after they received the information, or after a period during which they were allowed to consciously think about the various alternatives, or after a period of distraction. In this latter condition, participants were assumed to engage in unconscious thought. These unconscious thinkers consistently made the best decisions as judged from a normative perspective. Additional evidence indicated that the mental representations of the various alternatives changed during unconscious thought. They became more clear and more organized. In sum, not only did the unconscious think, but this thinking was more fruitful than conscious thought in that it led to better decisions.

2. Conscious versus unconscious thought

The aim of the present paper is to shed more light on the process of unconscious thought. To do this, unconscious thought will be compared to conscious thought (see Baars, 1997; Dijksterhuis, 2004). Furthermore, the comparison will be made with tasks that relate to creativity. In essence, the hypothesis under consideration is that whereas conscious thought is essentially *convergent*, unconscious thought is more *divergent*, and therefore probably also more creative.

This hypothesis is not only based on the work on unconscious thought discussed in the previous paragraphs, but also on work by Wilson, Schooler and colleagues (e.g., Schooler & Melcher, 1995; Schooler, Ohlsson, & Brooks, 1993; Wilson, Dunn, Kraft, & Lisle, 1989; Wilson et al., 1993; Wilson & Schooler, 1991) on the limitations of conscious thought. In their work, participants had to evaluate objects or choose between objects under different conditions. Under baseline conditions, participants were merely asked to think a little about the objects before choosing. Under other conditions, participants were pressed to carefully analyze the reasons for their evaluations before making them and to write down these reasons. These participants, in other words, pressed their consciousness to think hard. In general, this did not help them as they did a poorer job than

participants who thought less. Importantly, additional evidence (see also Dijksterhuis, 2004) showed that their thinking was essentially convergent. Conscious thought led people to strongly focus on a limited number of attributes at the expense of taking into account other relevant attributes. Their thinking was focused, but not very encompassing.

The experiments by Wilson and colleagues point out that more focused, convergent thinking comes at the expensive of more divergent thinking. It is a trade-off. The more time one spends looking at the impressive exterior of a beautiful cathedral, the less time there is left to explore the spectacular interior. Our hypothesis is that this trade-off is different for conscious thought and unconscious thought. Conscious thought is convergent at the expense of more divergent thought. It is good at focusing on something, but it is less associative and neglects less obvious or less accessible information. Unconscious thought, on the other hand, is less convergent and more divergent. The process is not all that focused, but it is more associative and does reach the less obvious and less accessible information. In that sense, it is also more creative. Whereas conscious thought stays firmly under the searchlight, unconscious thought ventures out to the dark and dusty nooks and crannies of the mind.

3. Overview of the experiments

Three experiments were conducted and in all experiments three conditions were compared. Participants were instructed to generate a list of items, such as names of places beginning with a certain letter. In the immediate generation condition, which can be conceived of as a baseline, participants started right after receiving the instruction. In the conscious thought condition, participants were given three minutes to consciously think about the items before they are given time to list them. Finally, in the unconscious thought condition, people were first given the instruction, and were then distracted for three minutes before they are given the opportunity to list the items.

In the first experiment, participants were asked to generate new names for pasta's (see Marsh, Ward, & Landau, 1999; Sassenberg, Kessler, & Mummendey, 2005). Five examples are given of such existing names and all examples end with the letter "i." It is hypothesized that conscious thought leads to more generated pasta names that end with an "i" ("converging items"), whereas unconscious thought is expected to generate more names that do not end with an "i" ("diverging items"). That is, conscious thinkers are expected to follow the cue more rigidly than unconscious thinkers. In the second experiment (divided into Experiments 2a and 2b), participants are requested to list Dutch places that start with an "A" (2a) or an "H" (2b). Whereas conscious thought is expected to lead to the generation of more cities, unconscious thinkers are expected to list more—relatively inaccessible—small villages. Finally, in the third experiment participants are asked to list things one can do with a brick (see Friedman & Förster, 2001). Unconscious thinkers are expected to list more creative and unusual ideas than conscious thinkers.

A few words should be said about the distracter tasks used in the experiment. As said before, these tasks were designed to rule out task relevant conscious thought. In the first experiments we did on unconscious thought (Dijksterhuis, 2004), we used a so-called n-back task (e.g., Jonides et al., 1997). This task is highly demanding and indeed rules out conscious thought. The disadvantage of this task, however, is that participants strongly dislike it making it impossible to have them do it for more than just a few minutes. Hence, in later experiments, we used distracter tasks that

were more enjoyable but at the same time less demanding. Although we do not have any reason to assume that the results obtained with such easier tasks are any different from those obtained with the n-back task, it is true that the easier tasks do not fully rule out conscious thought. In the current series of Experiments, we use the n-back task in Experiment 2b, and a less demanding task in the remaining experiments. We use the term "unconscious thought" to refer to the distraction conditions, but one may argue that the term "less conscious" is more appropriate than "unconscious" for Experiments 1, 2a, and 3. To avoid confusion and inconsistent terminology between experiments however, we always refer to the distraction conditions as unconscious thought conditions.

4. Experiment 1

4.1. Method

4.1.1. Participants and design

Eighty-seven undergraduate students from the University of Amsterdam participated in the experiment. They were randomly assigned to one of three conditions: an immediate generation condition, a conscious thought condition, and an unconscious thought condition. They either received course credits or money (7€) for their participation.

4.1.2. Procedure and materials

The experiment was the last experiment in a longer session with multiple, unrelated experiments. During the experiment, participants worked in separate cubicles and all instruction were given by the computer program. The experiment was introduced as being an experiment on language production and participants were asked to generate new names for pastas. In the instruction, five examples of non-existing names were listed, all ending with the letter "i."

After participants read the instructions, they were randomly allocated to one of three conditions by the computer program. In the immediate generation condition, they were immediately asked to list new pasta names. They were given one minute to complete this task. In the conscious thought condition, participants were given three minutes to think about new pasta names before they were given one minute to list the names they came up with. In the unconscious thought condition, participants were told that they would be asked to generate pasta names sometime later, but that they would first do another task. These participants were distracted for three minutes before they were given the one minute to list the pasta names.

The goal of the distracter task used in the unconscious thought condition was to occupy conscious attention of the participants. The task was introduced as a validated and important measure of "anticipatory hand-eye coordination." Participants saw a circle appear on the computer screen at a random location. The circle would move and participants were asked to track the circle with the use of the mouse. After a random interval, the circle would change color. Participants were instructed to press the space bar as fast as possible after a color change. Upon clicking the circle would disappear and after s short pause, the next circle would appear. Participants performed this task for exactly 3 min, including a 20-s instruction screen.

4.2. Results

For all participants, the number of new pasta names listed was counted. A few participants listed one or two existing pasta names, these were not included in the count. The pasta names were assigned to one of two categories: those ending with an "i" (called "converging items," as they are in line with the cue given), versus those not ending with an "i" ("diverging items"). The cell means and standard deviations are listed in Table 1.

The items were analyzed with a (3: Condition: Immediate generation vs. conscious thought vs. unconscious thought) × 2 (Items: Converging vs. diverging) mixed-model analysis of variance. The main effect of item was significant, $F(1,84) = 15.65$, $p < .001$, indicating that participants listed more converging than diverging items. The main effect for condition was marginally significant, $F(2,84) = 2.90$, $p < .06$. More importantly, both effects were qualified by the predicted two-way interaction, $F(2,84) = 3.27$, $p < .05$.

To compare conditions, three separate 2 (two of the three conditions) × 2 (Items: Converging vs. diverging) were done. The comparison between the immediate generation condition and the conscious thought condition showed that conscious thinkers listed more pasta names than participants in the immediate condition, $F(1,63) = 4.38$, $p < .04$. The comparison between the immediate generation condition and the unconscious thought condition revealed that unconscious thinkers listed more pasta names than participants in the immediate condition, $F(1,53) = 5.45$, $p < .03$. In addition, the two-way interaction was reliable, $F(1,53) = 5.31$, $p < .03$, showing that unconscious thinkers listed more diverging items, whereas participants in the immediate generation condition listed more converging items. Finally, the comparison between the conscious and unconscious thinkers also yielded the crucial two-way interaction $F(1,52) = 4.33$, $p < .05$.

The results confirm the hypothesis. Conscious thinkers converge more than unconscious thinkers, whereas unconscious thinkers diverged more than participants in the other two conditions. In concrete terms, conscious thinkers listed more items in line with the cue given to them (examples ending with an "i"), whereas unconscious thinkers did much less so. It should be noted though, that these data can be explained by a "fresh look" or "set-shifting" explanation and do not necessarily demonstrate true unconscious thought. Perhaps the subtle cue given to participants were less salient or less accessible for the unconscious thinkers at the time of listing the items than for other participants. However, in both Experiments 2 and 3 tasks are used that do not allow such an alternative explanation.

To confirm our earlier conclusions regarding the interchangeability of different distracter tasks (Dijksterhuis, 2004) we ran two separate Experiments (2a and 2b) with two different distracter tasks. The task in Experiment 2a is the same as the one in Experiment 1, whereas the task used in Experiment 2b is the much more demanding n-back task.

Table 1
Mean number of convergent and divergent items listed per condition (standard deviations are given between parentheses), Experiment 1

	Immediate	Conscious thought	Unconscious thought
Converging	2.91 (1.47)	3.63 (2.76)	2.55 (2.15)
Diverging	1.00 (1.20)	1.44 (1.59)	2.50 (2.18)

5. Experiments 2a and 2b

5.1. Method

5.1.1. Participants and design

Forty-seven (2a) and seventy-two (2b) undergraduate students from the University of Amsterdam participated in the experiment. They were randomly assigned to one of three conditions: an immediate generation condition, a conscious thought condition, and an unconscious thought condition. They either received course credits or money (7€) for their participation.

5.1.2. Procedure and materials

Experiment 2a was exactly the same as Experiment 1 with two exceptions. First, participants were asked to list Dutch place names starting with an "A." Two examples were given to all participants (Amsterdam and Arnemuiden). Second, participants were given two minutes rather than one minute to list the items.

Experiment 2b was the same as Experiment 2a with two exceptions. Participants were asked to list Dutch place names starting with a "H." The examples given were Haarlem and Huizen. Second, participants were given a different distracter task, the n-back task. In this task, participants are presented with a series of digits and for each digit they have to decide whether it matches the digit that preceded it by *n* places. Here participants completed a 2-back task. This demanding task affects executive functioning quite severely and can therefore be expected to successfully eliminate conscious thought (e.g., Jonides et al., 1997). Participants performed the 2-back task for 3 min (including a 20 s instruction screen). A number between 1 and 9 appeared on the screen every second and participants had to indicate a "match" by pressing the space bar. In general, participants did well on the n-back task, except for three participants who erred on over 10% of the trials. These participants were not taken into account in further analyses.

5.2. Results

For all participants, the number of correct place names listed was counted. The place names were assigned to one of two categories: those places with more than 10,000 inhabitants (called "cities and towns") and places with less than 10,000 inhabitants (called "villages). The cell means and standard deviations are listed in Table 2.[1]

[1] The limit of 10,000 inhabitants is to some extent arbitrary, but the use of other limits (5000 or 20,000) yielded comparable results. Readers who find the limit low should take into consideration the fact that Holland is a small country. In Holland there are 23 cities with more than 100,000 inhabitants (5 of them beginning with an "A," 3 of them beginning with a "H.") and 55 cities with more than 50,000 inhabitants (10 of them beginning with an "A," another 10 beginning with a "H"). In a big country, such as the US, it would likely make more sense to use a higher limit (e.g., 50,000) as the number of big cities is much higher and it would therefore be doubtful whether participants would list any small villages of less than 10,000 people at all.

Table 2
Mean number of accessible items (cities and towns) and inaccessible items (villages) listed per condition (standard deviations are given between parentheses), Experiment 2a (top) and 2b (bottom)

	Immediate	Conscious thought	Unconscious thought
Accessible	6.93 (1.91)	6.94 (1.48)	5.87 (1.73)
Inaccessible	1.67 (1.45)	2.29 (.99)	2.80 (1.74)
Accessible	5.12 (1.76)	5.87 (1.39)	5.76 (1.37)
Inaccessible	0.98 (.88)	1.17 (.92)	1.69 (1.39)

5.2.1. Experiment 2a

The items were analyzed with a (3: Condition: Immediate generation vs. conscious thought vs. unconscious thought) × 2 (Items: Cities and towns vs. villages) mixed-model analysis of variance. The main effect of item was significant, $F(1,44) = 197.09$, $p < .001$, indicating that participants listed more cities and towns than villages. Importantly, this main effect was qualified by the predicted two-way interaction, $F(2,44) = 4.36$, $p < .02$.

To compare conditions, three separate 2 (two of the three conditions) × 2 (Items: Cities and towns versus villages) were done. The comparison between the immediate generation condition and the conscious thought condition revealed no effects involving condition. The comparison between the immediate generation condition and the unconscious thought condition yielded the predicted two-way interaction, $F(1,28) = 6.44$, $p < .02$, showing that unconscious thinkers listed more villages, whereas participants in the immediate generation condition listed more cities and towns. In addition, the comparison between the conscious and unconscious thinkers also revealed the crucial two-way interaction $F(1,30) = 4.50$, $p < .05$.

5.2.2. Experiment 2b

The items were analyzed with a (3: Condition: Immediate generation vs. conscious thought vs. unconscious thought) × 2 (Items: Cities and towns vs. villages) mixed-model analysis of variance. Again, the main effect of item was significant, $F(1,66) = 80.41$, $p < .001$, indicating that participants listed more cities and towns than villages. Importantly, this main effect was qualified by the predicted two-way interaction, $F(2,66) = 3.96$, $p < .05$.

To compare conditions, three separate 2 (two of the three conditions) × 2 (Items: Cities and towns versus villages) were done. The comparison between the immediate generation condition and the conscious thought condition revealed no effects involving condition. The comparison between the immediate generation condition and the unconscious thought condition yielded the predicted two-way interaction, $F(1,46) = 5.41$, $p < .03$, showing that unconscious thinkers listed more villages, whereas participants in the immediate generation condition listed more cities and towns. In addition, the comparison between the conscious and unconscious thinkers also revealed the crucial two-way interaction, although it just failed to reach significance $F(1,44) = 3.76$, $p < .06$.

Again, the results confirm the hypothesis. Conscious thinkers list more (relatively accessible) cities and towns, whereas unconscious thinkers list more (relatively inaccessible) villages.

Table 3
Mean number of items listed and average creativity of the items listed per condition (standard deviations are given between parentheses), Experiment 3

	Immediate	Conscious thought	Unconscious thought
Number	4.26 (1.94)	4.66 (1.63)	5.19 (2.08)
Creativity	2.45 (.76)	2.58 (.71)	2.91 (.78)

6. Experiment 3

6.1. Method

6.1.1. Participants and design

One hundred and thirteen undergraduate students from the University of Amsterdam participated in the experiment. They were randomly assigned to one of three conditions: an immediate generation condition, a conscious thought condition, and an unconscious thought condition. They either received course credits or money (7€) for their participation.

6.1.2. Procedure and materials

The experiment was exactly the same as Experiment 1 with one exception. Participants were asked to list things one can do with a brick. No examples were given and participants were given one minute to list their thoughts.

6.2. Results

For all participants, the number of things one can do with a brick listed were counted. All listed items were scored on creativity by two independent judges who were blind to the purpose of the experiment. They used 7-point scale ranging from 1 (not at all creative) to 7 (very creative). Their judgments showed a high correlation (.78) and their scores were averaged. The relevant data are listed in Table 3.

First, the numbers of items listed were compared, but the effect of condition failed to reach significance, $F(2,110) = 2.31$, $p < .11$. Second, the average creativity of the listed items was compared this time revealing an effect of condition, $F(2,110) = 3.75$, $p < .03$. On average, unconscious thinkers listed thoughts that were judged to be more creative than participants in the immediate generation condition, $F(1,73) = 6.79$, $p < .02$, and than conscious thinkers, $F(1,72) = 3.66$, $p < .06$, although this latter effect failed to reach significance.

7. General discussion

The results of the present experiments show that conscious thought and unconscious thought are different modes of thought leading to different results. In the experiments, participants were requested to list items of a certain category and in all experiments, the output of conscious and unconscious thought differed. Conscious thought led to more items in line with a cue, whereas unconscious thought led to more items diverging from this cue (Experiment 1). Conscious thought

led to more accessible items, whereas unconscious thought led to more inaccessible items (Experiments 2a and 2b). Finally, unconscious thought led to more creative and unusual items than conscious thought (Experiment 3). In all experiments, unconscious thinkers also differed significantly from participants who were not given time to think at all.

It should also be stressed that the results are the consequence of an *active* unconscious process. Earlier effects of incubation were usually explained differently. Schooler and Melcher (1995), for instance, reviewed findings showing that distraction can lead to "set-shifting" or to the change of a "mental set." In such cases, the role of the unconscious is *passive*. There are many examples of set-shifting. People often approach a problem with wrong cues, wrong heuristics and/or wrong information. After a period of distraction, wrong approaches become less accessible or are forgotten altogether. The effects of distraction on a change of mental set can be strong (such as when one tries to solve a chess problem and initially gets truly "fixed" in thinking along a wrong path) or more subtle (such as when distraction merely attenuates the biasing influence of primacy or recency effects). The bottom line of these findings is that putting a problem aside for a while allows for a fresh, unbiased new start and this is often helpful.

However, as said, we propose a more active role of the unconscious and it is therefore crucial to show that the current results are not the consequence of set-shifting. In our view, only the data of Experiment 1 can be explained by set-shifting. Here, participants in the unconscious thought condition may have forgotten the examples ending with an "i." The data of Experiments 2 and 3 are not open to an alternative explanation in terms of set-shifting. In Experiment 2 participants were asked to list "plaatsnamen," which literally means "place names" and this word is not associated with places of a particular size. Furthermore, of the two examples given one was a city and the other a village. In Experiment 3, no hints are cues were given at all during the instructions, basically meaning that was no specific "mental set" that could change in the first place.

It is possible that participants in different conditions responded differently to different manipulations. Perhaps conscious thought makes people more motivated or more anxious. Perhaps the distracter task in the unconscious thought condition changes participants' mood (one reason for not always using the n-back task is that people do not like to do it). Such effects can be not be ruled out altogether, but one should keep in mind that participants in the conscious and unconscious thought conditions never differed in terms of the quality of their performance. Participants did not list more items in one condition than in the other, something one may expect on the basis of different levels of motivation or anxiousness. Rather, participants in the conscious and unconscious thought conditions only differed in terms of nature of the items listed, but participants were unaware of the fact that the experimenters were interested in the nature, rather than the sheer number, of items listed.

8. On the nature of conscious and unconscious thought

The current as well as other findings (Dijksterhuis, 2004; Dijksterhuis & Bos, 2005; Dijksterhuis & van Olden, 2005) have led to the formation of the Unconscious and Conscious thought Theory (UCT; Dijksterhuis & Nordgren, in press). UCT is aimed at explaining psychological processes we associate with thought, such as decision making, choosing, impression formation, and creativity.

It holds that there are two different modes to approach such psychological hurdles: conscious thought and unconscious thought. Unconscious thought is reminiscent of lay people's idea of "sleeping on it." Finally, UCT maintains that conscious and unconscious thought have different characteristics, making them differentially applicable in different situations.

Now what can we say about the nature of conscious and unconscious memory search, as investigated in the current experiments? Unconscious thought is hypothesized to work "bottom-up" and is relatively insensitive to highly accessible cues, such as examples of pasta names ending with an "i." Conversely, conscious thought work "top-down" and uses cues and heuristics. Memory search is guided by such cues and these highly accessible and sometimes even conscious cues cause convergence, or better still, the absence of too much divergence. In concrete terms, during memory search conscious thinkers were consciously aware of examples given by the experimenter (the pasta names ending with an "i") or of highly accessible self-generated examples (e.g., Amsterdam, the biggest Dutch city). Conscious awareness of such examples probably leads closely associated information to become accessible, and incongruent information to be very inaccessible.

9. Conclusion

The findings reported here speak to the relevance of unconscious thought in general and to the relation between unconscious thought and creativity or divergent thinking. One could say that unconscious thought is more "liberal" than conscious thought and leads to the generation of items or ideas that are less obvious, less accessible and more creative. Upon being confronted with a task that requires a certain degree of creativity, it pays off to delegate the labor of thinking to the unconscious mind.

References

Baars, B. J. (1997). *In the theater of consciousness*. New York: Oxford University Press.

Bowers, K. S., Regehr, G., Balthazard, C., & Parker, K. (1990). Intuition in the context of discovery. *Cognitive Psychology, 22*, 72–110.

Claxton, G. (1997). *Hare brain, tortoise mind: How intelligence increases when you think less*. New York: HarperCollins.

Dijksterhuis, A. (2004). Think different: The merits of unconscious thought in preference development and decision making. *Journal of Personality and Social Psychology, 87*, 586–598.

Dijksterhuis, A., & Bos, M. W. (2005). "I think about you when I should not" The dangers of conscious thought during impression formation. *Submitted for publication*.

Dijksterhuis, A., & Nordgren, L. F. (in press). Struggling with thinking: The unconscious and conscious thought theory. *Perspectives on Psychological Science*.

Dijksterhuis, A., & van Olden, Z., 2005. To think or not to think, or to think unconsciously perhaps? Unconscious thought increases post-choice satisfaction. *Submitted for publication*.

Friedman, R. S., & Förster, J. (2001). The effects of promotion and prevention cues on creativity. *Journal of Personality and Social Psychology, 81*, 1001–1013.

Ghiselin, B. (1952). *The creative process*. New York: The New American Library.

Jonides, J., Schumacher, E. H., Smith, E. E., Lauber, E. J., Awh, E., Minoshima, S., & Koeppe, R. A. (1997). Verbal working memory load affects regional brain activation as measured by PET. *Journal of Cognitive Neuroscience, 9*, 462–475.

Koestler, A. (1964). *The act of creation*. London: Penguin.

Marsh, R. L., Ward, T. B., & Landau, J. D. (1999). The inadvertent use of prior knowledge in a generative cognitive task. *Memory & Cognition, 27*, 94–105.

Olton, R. (1979). Experimental studies of incubation: Searching for the elusive. *Journal of Creative Behavior, 13*, 9–22.

Sassenberg, K., Kessler, T., & Mummendey, A. (2005). When creative means different: *Activating creativity as a strategy to initiate the generation of original ideas*. Manuscript under review.

Schooler, J. W., & Melcher, J. (1995). The ineffability of insight. In S. M. Smith, T. B. Ward, & R. A. Finke (Eds.), *The creative cognition approach* (pp. 97–134). Cambridge, MA: MIT Press.

Schooler, J. W., Ohlsson, S., & Brooks, K. (1993). Thoughts beyond words: When language overshadows insight. *Journal of Experimental Psychology: General, 122*, 166–183.

Smith, S. M., & Blankenship, S. E. (1989). Incubation effects. *Bulletin of the Psychonomic Society, 27*, 311–314.

Wilson, T. D., Dunn, D. S., Kraft, D., & Lisle, D. J. (1989). Introspection, attitude change, and attitude-behavior consistency: The disruptive effects of explaining why we feel the way we do. In L. Berkowitz (Ed.). *Advances in Experimental Social Psychology* (Vol. 1, pp. 123–205). Orlando, FL: Academic Pres.

Wilson, T. D., Lisle, D., Schooler, J. W., Hodges, S. D., Klaaren, K. J., & LaFleur, S. J. (1993). Introspecting about reasons can reduce post-choice satisfaction. *Personality and Social Psychology Bulletin, 19*, 331–339.

Wilson, T. D., & Schooler, J. W. (1991). Thinking too much: Introspection can reduce the quality of preferences and decisions. *Journal of Personality and Social Psychology, 60*, 181–192.

Further reading

Spencer Brown, G. (1969). *Laws of form*. London: Allen and Unwin.