The Merits of Unconscious Thought in Creativity

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Abstract

Despite anecdotes recounting the discovery of creative solutions through unconscious thought, research has yielded weak empirical support. To understand this gap, the authors examined the effect of unconscious thought on two outcomes of a Remote Association Test (RAT): implicit accessibility versus conscious reporting of answers. In Experiment 1, using very difficult RATs, a short period of unconscious thought (i.e., participants were distracted while holding the goal of solving RATs), increased the accessibility of RAT answers but did not increase the number of correct answers compared to an equal duration of conscious thought or mere distraction. In Experiment 2, using moderately difficult RATs, unconscious thought led to similar level of accessibility but fewer correct answers compared to conscious thought. These findings confirm and extend the unconscious thought theory (Dijksterhuis & Nordgren, 2006) by demonstrating that processes that increase the mental activation of correct solutions do not necessarily lead them into consciousness.

The ability to associate remotely connected elements underlies many discoveries and creations in fields such as physics, mathematics, and art. Poincare, for instance, noted, "to create consists of making new combinations of associative elements which are useful...the most fertile will often be those formed of elements drawn from domains which are far apart" (cf., Mednick, 1962). Others have drawn a more explicit connection between associative processes and creativity and considered the former the basis for creative output. For example, learning multiple languages or living abroad increases the number of associations between ideas (Leung, Maddux, Galinsky, & Chiu, in press; Nemeth & Kwan, 1987; Simonton, 1999). Despite its significance, however, the nature of these associative processes has not been sufficiently understood.

One remarkable aspect of associative processes is that they do not seem to excel under conscious direction. In fact, conscious thought can subvert the search for creative solutions – novel connections or ideas often insinuate themselves into the conscious mind when attention is directed elsewhere (Ghiselin, 1952; Mednick, 1962; Olton, 1979). Poincare described this very phenomenon, "I turned my attention to the study of some arithmetical questions apparently without much success and without a suspicion of any connection with my preceding researches. Disgusted with my failure, I went to spend a few days at the seaside, and thought of something else. One morning, walking on the bluff, the idea came to me … that the arithmetic transformations of indeterminate ternary quadratic forms were identical to those of non-Euclidean geometry" (cf., Hadamard, 1945).

Systematic examination of the effects of temporary inattention or incubation on associative search for creative solutions, however, has yielded weak and inconsistent findings (Olton, 1979). In the *forgetting-fixation* or *mental set-shifting* research traditions, incubation has been given a secondary role in associative process: correct solutions are made inaccessible during initial problem solving because incorrect solutions are mistakenly retrieved. Thus, temporary distraction reduces associations with incorrect solutions, allowing correct ones to surface (Schooler & Melcher, 1995; Smith & Blankenship, 1989). Indeed, creativity is often hampered by existing knowledge structures, salient exemplars, and recently activated constructs (Kray, Galinsky, & Wong, 2006; Ward, 1994). In this view, there is no inherent relationship between incubation and creativity; any factors that reduce associations with incorrect associations should improve creative output.

Recently, however, Dijksterhuis and Meurs (2006) found that unconscious thought (i.e., being distracted while still holding a task-relevant goal) increased the generation of novel ideas more than an equal duration of continuous attention, suggesting that temporarily distracting attention away from the task of generating ideas allowed participants to conduct broader searches that were less constrained by conventional associations. Unlike previous researchers, Dijksterhuis and colleagues attributed the change in associative search pattern and increased creativity to something intrinsic to the absence of attention during unconscious thought. Compared to conscious thought, which is adept at analytic and derivative processing that primarily isolates and discriminates, unconscious thought excels at integrating and associating information and is capable of carrying out associative searches across a broad basis of background knowledge (Dijksterhuis & Nordgren, 2006). When Dijksterhuis and Meurs (2006) asked participants to generate new product names, those participants who were distracted for a number of minutes generated more names that diverged from the examples that were given than those who consciously thought about the task for an equal duration, even though the total number of names generated did not differ. Unconscious thought appears to change the very nature of the search process.

If this is true, however, why is there a paucity of empirical support for the incubation effect? To understand this gap, we introduce a distinction between thought process and outcome, with incubation in the context of creativity and problem solving conceptualized as a two-step process. First, unconscious thought associates and creates the novel idea or solution to a problem, and second, this solution is transferred to consciousness. A failure of either step would lead to the absence of empirical support for incubation. It is important to realize that the two steps can, and should, be separated. The idea that activation of solutions to creative problems could occur at different levels of consciousness is not new. Wegner and Smart (1997) drew a similar distinction in their discussion of deep cognitive activation. In their model, full activation of a thought or answer refers to one that is both conscious and accessible, but deep activation refers to a thought that is accessible but not currently conscious. In one study, for example, after unsuccessful attempts to solve insight problems, individuals displayed shorter latency to solution-related words than solution-unrelated words when these words were presented to the right visual field (Bowden & Beeman, 1998).

We propose that unconscious thought may indeed be better at associative search than conscious thought (Dijksterhuis & Meurs, 2006; Dijksterhuis & Nordgren, 2006), but the products of unconscious thought may not always be immediately entered into consciousness. Instead, they may remain unconscious, only later emerging into consciousness as insight (Maier, 1931) or eventually dissipating. Alternatively they may surface as tacit cognitive or affective recognition of patterns, coherences, or themes. For example, when presented with coherent stimuli such as an incomplete drawing of a camel, participants were able to recognize better than by chance the existence of some coherence in the incomplete drawings but could not always articulate what it was (Bowers, Regehr, Balthazard, & Parker, 1990). We suggest that this feeling of “something is there” may be a partial manifestation of unconscious generation.

Thus, the absence of the incubation effect on creative problem solving does not necessarily imply an absence of creative activity. Researchers may have been looking for the incubation effect in the wrong place. In the current research, we differentiate conscious and unconscious manifestations by examining two separate outcomes of the Remote Associates Task (RAT, Mednick, 1962): implicit accessibility of correct RAT answers versus expression of those correct answers (Wegner & Smart, 1997). The RAT was originally developed as a test of creativity and has been widely used to study insight and creative thinking (e.g., Bowden & Beeman, 1998; Bowers et al, 1990; Schoolar & Melcher, 1995). Each RAT problem consists of three words (e.g., cheese / sky / ocean) and participants generate a fourth word that, when combined with each of the three stimulus words, results in a word pair used in everyday language (e.g., blue cheese, blue sky, blue ocean). This creativity problem is ideal to investigate our two-stage model because previous research has shown that accessibility to RAT answers do not always correlate with conscious answers (Beeman & Bowden, 2000; Bowden & Beeman, 1998). Thus, we predicted that unconscious thought will increase mental accessibility of RAT answers compared to conscious thought, but that this increased deep activation may not translate into the expression of correct answers.

Because Bos, Dijksterhuis and van Baaren (2007) found that unconscious thought improved decision quality only when participants expected problem solving following the distraction, we included a third condition (a mere distraction condition) in which people were distracted just as in the unconscious thought condition, but without having a problem solving goal. We expected that without the goal, the unconscious would remain less active and thus lead to lower accessibility to correct RAT answers.

Experiment 1

Method

Participants and Design

The participants were 94 undergraduate students (43 male, median age 21). The experiment used a 3 (processing style: conscious thought vs. unconscious thought vs. mere distraction) × 2 (target words: RAT answers vs. control words) mixed factorial design with the former being the between-participant factor.

Procedure

All instructions and materials were delivered via a computer. Participants were randomly assigned to one of the three conditions. In the conscious thought and unconscious thought conditions, participants were told, “the goal in this experiment is to *find* a word that is somehow linked to all three of the words (a triad) presented on each screen.” In the mere distraction condition, they were told, “the goal is to *think about* a word that is somehow linked to all three of the words (a triad) presented on each screen.” Thus, participants in the distraction condition were not given any explicit goal of problem solving. Participants then read two examples of the RAT test before they started the task (e.g., the words *round*, *manners*, and *tennis* were linked by the word *table* (round table, table manners, table tennis).

Participants saw nine triads of words presented on the center of the screen; each triad lasted for 5 seconds with 3-second breaks in between. After they had seen the 9th triad, a screen containing all triads was shown for 10 seconds. Afterwards, participants in the conscious condition were told that they had 5 minutes to think about these triads, during which they were shown the screen containing all triads but were not allowed to write down notes or answers. Participants in the unconscious condition were told that they would engage in an unrelated task before returning to the word task. Those in the distraction condition were told that they had finished the task and would move on to unrelated tasks. Participants in the unconscious and distraction conditions next completed a 2-back task, which consumes considerable working memory (Jonides et al., 1997), for five minutes to prevent conscious thought (Dijksterhuis, 2004). Participants saw a sequence of numbers on the center of the screen and decided whether each number matched the number that has been presented two numbers previous in the sequence.

After 5 minutes of conscious thought or distraction, all participants engaged in a Lexical Decision Task (LDT) with RAT answers as target words and four unrelated words and five non words as control words presented in a random order (Bargh, Raymond, Pryor, & Strack, 1995). Participants saw string of letters on the center of the screen and decided whether each string of letters constituted a word in English by pressing one of two buttons[1]. Participants were given a short practice session consisting of six trials to acquaint them with the task. After the LDT, participants in all three conditions were again shown the RAT items and were asked to input their answers into a textbox.

Measures

RAT items and answers. We included 9 RAT triads selected from Bowden and Jung-Beeman (2003) (Appendix A) that are extremely difficult. Pretesting involving 39 participants found that all but one of the 9 triads had lower than 20% solving rate (Bowden & Jung-Beeman, 2003).

Results and Discussion

[1] We counterbalanced the keyboard buttons for words or non words.

RAT answers

As expected, participants had considerable difficulty resolving the RAT items; across the conditions participants correctly solved on average less than 17% of the triads. Moreover, there were no differences between conditions, $F(2, 91) = .72$, $p = .49$, $p_{rep} = .51$. The number of correct solutions in the unconscious condition ($M = 1.18$, $SD = 1.31$) did not differ from that in the conscious ($M = 1.61$, $SD = 1.60$) and distraction ($M = 1.45$, $SD = 1.68$) conditions.

Response latencies

We excluded response latencies more than 1000 milliseconds and less than 300 milliseconds (Bargh et al., 1995). We submitted the data to a 3 (processing style: conscious thought vs. unconscious thought vs. mere distraction) × 2 (target words: RAT answers vs. control words) mixed analysis of variance. There was a significant two-way interaction, $F(2, 91) = 3.42$, $p = .037$, $p_{rep} = .90$ (Figure 1). As expected, participants in the unconscious condition had lower response latencies and hence greater accessibility to RAT answers than those in the conscious and distraction condition, $t(91) = -1.99$, $p = .049$, $p_{rep} = .88$. However, their response latencies to control words were not different from those in the other two conditions, $t(91) = -.029$, $p = .98$, $p_{rep} = .07$. This pattern persisted even after excluding response latencies to RAT answer keys that participants later solved correctly: unconscious thought still had the lowest response latencies to RAT answer keys compared to the other two conditions, $t(91) = -1.72$, $p = .089$, $p_{rep} = .83$.

Across the three conditions, the correlation between response latencies for the answers and correct answers was not significant ($r = -.041$, $p = .70$, $p_{rep} = .36$). This suggests that implicit accessibility of RAT answers does not automatically emerge into the conscious mind as correct answers. However, restriction of range given the low numbers of correct answers may have prevented meaningful correlations from emerging.

Focusing only on the conscious report of RAT answers, our results replicated the lack of a meaningful incubation effect: a period of incubation did not increase the reporting of correct answers compared to the same duration of concentration. The results on accessibility, however, revealed a striking difference: unconscious thought increased mental accessibility to RAT answers compared to conscious thought and mere distraction. Because conscious and unconscious condition did not differ in reported correct answer, the increased accessibility to RAT answers following unconscious thought can best be attributed to differences between thought processes. Consistent with the unconscious thought theory, this suggests that unconscious processing is better adept at associating and integrating information than conscious processing (Dijksterhuis & Nordgren, 2006). Moreover, it is worth noting that merely distracting participants did not result in the same level of RAT answer activation as the unconscious thought. This provides further evidence that the increased accessibility is not due to the release of incorrect associations, as suggested by the forgetting-fixation hypothesis, but possibly a consequence of a "power boost" from the goal-directed unconscious thought.

This accessibility finding also extends previous research examining the role of explicit verbal reflection and neural activity in insight problems (Beeman & Bowden, 2000; Bowden & Beeman, 1998; Schooler, Ohlsson, & Brooks, 1993). Schooler, Ohlsson, and Brooks (1993) found that explicit verbal reflection interfered with the access to insight problem solutions. They suggested that explicit verbal reflection disrupted non-reportable, unconscious processes that typically lead to a solution. Likewise, using similar RAT problems, a number of studies have linked increased solution-related activation for unsolved problems to activities in the right hemisphere, which is generally thought to govern holistic reasoning and coarse semantic associations (Beeman & Bowden, 2000; Bowden & Beeman, 1998). These previous studies provided only suggestive evidence to the involvement of unconscious process in creativity problems because unconscious processes were not explicitly controlled or measured. Our experiment, however, provides direct evidence to the causal relationship between unconscious thought and increased solution-related activation. By differentiating implicit accessibility of solutions and conscious reporting of correct answers, we were able to reconcile the gap between the anecdotal evidence for the role of unconscious process in creative discoveries and the lack of empirical support for the effect of incubation. Unconscious activation may serve as inspirational sparks underlying the "Aha!" moment that eventually leads to important discoveries.

Experiment 2

A key distinction between conscious and unconscious thought is that the former excels at linear search and analytic processing and the latter is better at associative processing (Dijksterhuis & Nordgren, 2006). As a result, conscious and unconscious thought have been shown to have differential effects on decision making depending on the level of difficulty. In a recent experiment (Dijksterhuis, Bos, Nordgren, & van Baaren, 2006), participants had to choose among four hypothetical Japanese cars (one of the cars had more positive features than the others). In the easy condition, each car included 4 features, whereas in the difficult condition there were 12 features per car. Under simple conditions, conscious thought outperformed unconscious thought, but under more demanding circumstances unconscious thought outperformed conscious thought. Similarly, Dijksterhuis and Meurs (2006) asked conscious and unconscious thinkers to list as many names of places (cities, towns, etc.) beginning with certain letters. The memory search of unconscious thinkers led them to list more small towns and villages than the conscious thinkers, whereas this advantage of unconscious thinkers was absent (in one study) or even reversed (in another study) for names of big cities that merely require a more local memory search. Thus, the advantages of unconscious thought in RAT problems should be most prominent when resolving problems that involve remote or weak associations. With strong and obvious associations, the benefits of unconscious thought should disappear, and the linear and analytic search process under conscious thought can be just as effective or even superior in discovering the common link in the RAT (Bowden & Jung-Beeman, 2003).

Method

Participants and Design

The participants were 36 undergraduate students (9 male, median age 20) who volunteered for the study. The experiment used a 2 (processing style: conscious thought vs. unconscious thought) × 2 (target words: RAT answers vs. control words) mixed factorial design with the former being the between-participant factor.

Procedure

The procedure of Experiment 2 was exactly the same as that of Experiment 1. Because we differentiated unconscious thought from mere distraction in Experiment 1, participants were randomly assigned to only one of two conditions: unconscious or conscious thought. The main difference from Experiment 1 was that we used a different set of RAT problems. We selected 12 moderately difficult RAT triads from Bowden and Jung-Beeman (2003) (Appendix B), which produced correct answer rates between 41% to 59% when tested on 39 separate participants (Bowden & Jung-Beeman, 2003).

Results and Discussion

RAT Answers

As expected, participants had moderate difficulty resolving the RAT items; across the conditions participants correctly solved on average 47% of the triads. Unlike Experiment 1, participants in the conscious thought condition correctly solved significantly more RAT (*M* = 6.83, *SD* = 3.24) than those in the unconscious thought condition (*M* = 4.44, *SD* = 3.20), *F*(1, 34) = 4.95, *p* = .03, p_{rep} = .91.

Response Latencies

After excluding response latencies more than 1000 milliseconds and less than 300 milliseconds, we submitted the data to a 2 (processing style: conscious thought vs. unconscious thought) × 2 (target words: RAT answers vs. control words) mixed analysis of variance. The significant interaction between processing style and target words found in Experiment 1 was no longer present, *F*(1, 34) = 1.35, *p* = .25, p_{rep} = .68. Participants in the conscious condition (*M* = 596.34, *SD* = 70.29) and unconscious condition (*M* = 582.98, *SD* = 89.85) had similar response latencies to RAT answers; there was also no difference in response latencies to control words in the conscious (*M* = 646.83, *SD* = 76.09) and unconscious condition (*M* = 662.39, *SD* = 89.74). Similar to Experiment 1, across the two conditions, the correlation between response latencies for the answers and correct answers was not significantly different from zero (*r* = -.23, *p* = .18, p_{rep} = .74).

Experiment 2 supported our predictions. We did not find any difference in accessibility to RAT answers between conscious and unconscious thought when RAT items were easier, conceptually replicating Dijksterhuis and Meurs (2006). In addition, we found that conscious thought produced more correct answers than unconscious thought when resolving these moderately difficult RAT problems. Together, Experiment 1 and 2 show that unconscious thought can facilitate discovering remote but not local associations. However, these associations discovered in unconscious thought may not necessarily enter into consciousness.

General Discussion

When a printer is not printing calculations of a program properly, it is not always because the program is not working. Instead, the printer may be broken or the connection between the program and the printer may be severed. Oversimplified as it is, we suggest that this metaphor may account for the lack of empirical support for the incubation effect. We conceptualized incubation as involving two relatively independent steps. In the first step, unconscious thought “boosts” the associative search for creative solutions. In the second step, solutions are transferred to consciousness. A failure of either step will lead to the absence of empirical support for incubation. Thus, previous research may have underestimated both the importance and complexity of incubation in creative processes and therefore was looking for the incubation effect in the wrong place.

To the contrary, Experiment 1 found that compared to equal duration of conscious contemplation or mere distraction, unconscious thought enabled participants to better narrow in on the solutions to creative problems as reflected in the increased accessibility to correct RAT answers in a standard lexical decision task. However, this increased activation did not result in more correct RAT answers. In this experiment, we purposefully selected RAT problems that are extremely difficult so that the increased accessibility could not be attributed to anything but differences between thought processes. Experiment 2 used RAT problems that were only moderately difficult and found that participants in conscious and unconscious thought condition had similar accessibility to RAT answers but those who had engaged in conscious thought reported more correct answers than unconscious thought participants. These findings conceptually replicate previous research on unconscious thought theory, which showed that whereas conscious thought is better at making linear, analytic decisions, unconscious thought is especially effective at solving complex problems (Dijksterhuis & Meurs, 2006; Dijksterhuis & Nordgren, 2006).

Although we have drawn a distinction between conscious and unconscious output, we are not proposing that there is any inherent, fundamental difference between conscious and unconscious representations. Rather, cognitive representations are best considered as activation at different “levels of consciousness”. This is consistent with previous conceptualizations where accessibility is often viewed as a readiness to think of something consciously (Bruner, 1957; Higgins, 1996). In these conceptualizations, however, there is a linear relationship between activation and consciousness: unconscious activation increases until it breaks a certain threshold and becomes consciously present and the greater the unconscious activation, the more likely that it will enter consciousness.

Our findings call into question this direct correspondence between activation and consciousness (see also Wegner & Smart, 1997). In two experiments, we found that higher unconscious activation did not increase conscious reporting of correct answers (Experiment 1) and that similar levels of activation corresponded to different levels of conscious performance (Experiment 2). Furthermore, in both experiments there was no correlation between accessibility and reporting of correct answers. While it is possible that the lack of correlation in Experiment 1 was due to restriction of range in number of correct answers, this concern was alleviated in Experiment 2 where participants on average resolved half of the RAT problems. Thus, the level of unconscious activation does not appear to be the only factor that determines the likelihood the unconscious representation will enter into consciousness.

So what are the implications of the current research for creative discoveries? If inattention is indeed better than concentration in resolving complex problems, should artists or scientists simply engage in daydreaming to produce ground-breaking discoveries or trail-blazing artistic creations? We suspect that although unconscious thought processes are more powerful than conscious thought processes in connecting remotely associated elements, for associative search to function there will have to be a plethora of raw materials available to be connected. In this sense, unconscious thought cannot “create” knowledge; conscious learning and thought process are needed to establish a knowledge base. More importantly, Experiment 1 found that only when directed by a meaningful goal (i.e., compared to mere distraction) did inattention increase solution-related activation. Without conscious learning and thought, mathematicians and scientists would not be able to know what problems to tackle and artists may get lost in the vast array of options available; without goals, inattention is simply walking in darkness.

These points raise the question of what combination of conscious and unconscious thought is most fruitful for allowing insights and discoveries to be articulated and implemented. Should a period of conscious thought be followed by a period of unconscious thought and then another round of conscious thought? The finding that conscious thought led to similar levels of accessibility but more correct answers compared to unconscious thought in Experiment 2 may suggest that unconscious thought should be applied to find solutions, whereas a subsequent period of conscious thought would increase the probability that this solution enters into consciousness. Hopefully after a period of unconscious reflection, future researchers will tackle the arduous task of discovering when increased accessibility produced by unconscious thought springs forth into consciousness.

References

Bargh, J. A., Raymond, P., Pryor, J. B., & Strack, F. (1995). Attractiveness of the underling: An automatic power → sex association and its consequences for sexual harassment and aggression. *Journal of Personality and Social Psychology, 68,* 768-781.

Beeman, M. J. & Bowden, E. M. (2000). The right hemisphere maintains solution-reltaed activation for yet-to-be solved insight problems. *Memory & Cognition*, 28: 1231-1241.

Bos, M. W., Dijksterhuis, A., and van Baaren, R. B. (2008). On the goal-dependency of unconscious thought. *Journal of Experimental Social Psychology*.

Bowden, E. M., & Beeman, M. J. (1998). Getting the right idea: Semantic activation in the right hemisphere may help solve insight problems. *Psychological Science*, 9: 435-440.

Bowden E. M. & Jung-Beeman, M. (2003). Normative data for 144 compound remote associate problems. *Behavior Research Methods, Instruments, & Computers, 35*, 634-639.

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

Bruner, J. S. (1957). On perceptual readiness. *Psychological Review*, 64: 123-152.

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., Nordgren, L.F., & van Baaren, R.B. (2006). On making the right choice: The deliberation-without-attention effect. *Science*, 311, 1005-1007.

Dijksterhuis, A., & Meurs, T. (2006). Where creativity resides: The generative power of unconscious thought. *Consciousness and Cognition, 15*, 135–146.

Dijksterhuis, A. & Nordgren, L. F. (2006). A theory of unconscious thought. *Perspectives on Psychological Science, 1*: 95-109.

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

Hadamard, J. (1945). *The mathematician's mind: The psychology of invention in the mathematical field.* Princeton University Press: New Jersey.

Higgins, E. T. (1996). Knowledge activation: accessibility, applicability, and salience. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: A handbook of basic principles,* 133-168. New York: Guilford Press.

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.

Kray, L. J., Galinsky, A. D., & Wong, E. M. (2006). Thinking within the box: The relational processing style elicited by counterfactual mind-sets. *Journal of Personality and Social Psychology, 91*, 33-48.

Leung, K., Y, Maddux, W. M., Galinsky, A. D., & Chiu, C. Y. (in press). Multicultural experience enhances creativity: The when and how. *American Psychologist.*

Maier, N. R. F. (1931). Reasoning in humans. 11. The solution of a problem and its appearance in consciousness. *Journal of Comparative Psychology, 12*, 181-194.

Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review, 69*, 220-232.

Nemeth, C. J., & Kwan, J. (1987). Minority influence, divergent thinking and detection of correct solutions. *Journal of Applied Social Psychology, 17*, 788-799.

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

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.

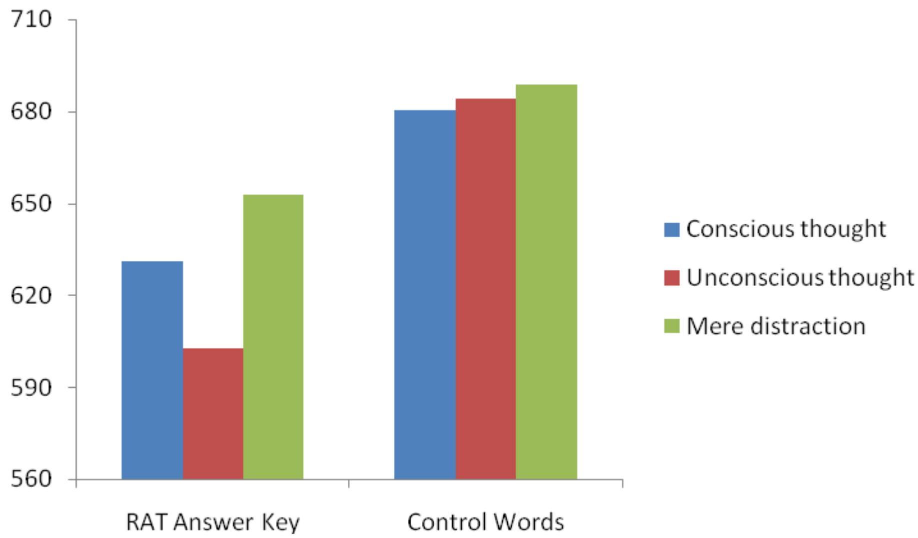
Simonton, D. K. (1999). *Origins of Genius: Darwinian Perspectives on Creativity.* New York: Oxford University Press.

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

Ward, T. B. (1994). Structured imagination: The role of category structure in exemplar generation. *Cognitive Psychology*, *27,* 1-40.

Wegner, D. M. & Smart, L. (1997). Deep cognitive activation: A new approach to the unconscious. *Journal of Consulting and Clinical Psychology*, 65: 984-995.

Figure 1. Response latency to RAT answers and control words (in milliseconds)



Appendix A

Experiment 1. Very Difficult RAT and Answers

RAT Triads			Answers
stick	maker	point	match
trip	house	goal	field
fork	dark	man	pitch
line	fruit	drunk	punch
mate	shoes	total	running
land	hand	house	farm
hungry	order	belt	money
forward	flush	razor	straight
cast	side	jump	broad

Appendix B

Experiment 2. Moderately Difficult RAT and Answers

RAT Triads			Answers
light	birthday	stick	candle
wheel	hand	shopping	cart
cross	rain	tie	bow
boot	summer	ground	camp
catcher	food	hot	dog
wagon	break	radio	station
health	taker	less	care
down	question	check	mark
carpet	alert	ink	red
blank	list	mate	check
test	runner	map	road
man	glue	star	super