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NONCONSCIOUS IDEA GENERATION[1]

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Summary.—The recognition of the correct solution to a problem after a period when one is not actively searching for an answer is well documented. However, previous research has focused on problems an individual has not yet resolved. We presented a scenario in which 125 participants believed that they had completed a task and so had no reason to seek further solutions. To their surprise, after a period of distraction, we resumed the testing session. This novel method was combined with accurate recording of both response content and timing. The results from the second session displayed a remarkable similarity to those from the first, including an initial burst of ideas, allowing the inference that, even in the absence of a reason to seek solutions, a process of nonconscious idea generation might be operating.

The sudden awareness of the correct solution for an unresolved problem has been suggested, at least since the time of the Gestalt psychologists, as a psychological phenomenon demanding explanation (Koffka, 1935/1962), a fact noted in a number of texts (see, e.g., Best, 1999). Perhaps the most famous account of this so-called 'aha' experience was cited by French mathematician Poincare when arriving at the solution to a problem that had troubled him for some time: "the idea came to me without anything in my former thoughts seeming to have paved the way for it" (1913, p. 388), and many readers will undoubtedly have personal examples. Indeed, Wallas (1926) was inspired by Poincare's anecdote when formulating his theory of the stages of creative processes involved in problem solving. Wallas (1926) postulated four stages to the creative process: (1) Preparation, (2) Incubation, (3) Illumination, and (4) Verification. This account of problem solving, called by the Gestalt psychologists 'division of thinking', included the proposition that reaching a solution might, on occasion, be aided by nonconscious thought processes occurring during the Incubation stage, the phase that is least well understood (Best, 1999). Typically, studies investigating the effect of the Incubation stage in problem solving have employed a break between two testing sessions, which is the method used in the current study (see, e.g., Fulgosi & Guilford, 1968; Guilford, 1979).

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There have been vigorous objections to descriptions of problem solving by nonconscious processing, such as Wickelgren's disparaging statement that "there isn't a shred of evidence to support it" (1979, p. 381). Such objections have led to a number of alternative explanations being offered. According to Posner (1973), these can be categorized into two main themes: (1) relief from fatigue and (2) relief from a 'mind set'. The former position argues that a period spent not actively thinking relieves the solver from mental effort and thus (somehow) revives capacity to attempt a solution. The latter approaches an explanation in terms of either restructuring (e.g. Maier, 1931), relieving functional fixedness (e.g. Keane, 1989), or an alteration of the problem set (e.g., Luchins & Luchins, 1959). To minimize the rationale underlying the first explanation, participants in our experiment were required to remain mentally active during the break between testing sessions. To address the second objection our participants were presented a problem that, whilst not devoid of the 'mind set' effect, would be one that at least minimized such concerns. To this end, we employed a divergent idea generation task that allowed multiple correct solutions, as opposed to the typically used convergent tasks, which usually have a single correct solution. Presumably, such a task should encourage participants to engage in actively seeking a number of differing responses and thus minimize concerns that people become 'stuck' in a single response pattern.

A common theme in studies attempting to elucidate the 'aha' phenomenon has been the recognition by the subject that a problem remains unresolved. Thus, there remains an implicit, yet unasked, question of whether this seemingly nonconscious process of searching for answers still occurs when the problem is apparently resolved. To approach this question in a logically coherent fashion, the current study, as previously noted, employed a divergent rather than a convergent task (see Carroll, 1993, for a comprehensive re-analysis of investigations employing these methods). The rationale underlying the adoption of this procedure was that participants could be informed that the testing session had finished, even though additional responses could potentially still be supplied. Obviously, the intention was to lead our volunteers to believe that they had no reason to continue cogitating on or generating further answers to the task. Whilst we do not deny the contentious nature of explanations of this occurrence in terms of a nonconscious process of 'idea generation', this paper presents empirical evidence that such an event might be plausible.

METHOD

Participants

One hundred and twenty-five participants (aged 11 to 71 years) were presented a measure based on Guilford and Christensen's (1956; see also Carroll, 1993) construct of Ideational Fluency (see, French, Ekstrom, & Price, 1963, for a full description of the task structure).

Task description and procedure.

To ensure that the task was relatively independent of learning, an item that could be assumed to be familiar to all was selected, in this case a piece of paper. The reason for selecting such a common item was that it has been reported elsewhere that the problem representations adopted by those with special knowledge differ

from those of less experienced people (see, e.g., Chi & Glaser, 1985; Larkin, 1989).

The task requirement followed the procedure of French, et al. (1963). Participants were requested to list as many uses for the piece of paper as possible within a five-minute period. This period was based on a pilot study in which, after five minutes, most people appeared to have run out of new ideas. At the end of five minutes participants were told that the test had finished and that the final phase of the session would commence. Participants then engaged for five minutes in a cognitively demanding and distracting task, involving either the presentation and discussion of a brief video on championship or an interview to gather biographical data, neither of which have any obvious connection with "uses for a piece of paper". Immediately after the distracting task, participants were asked to generate new ideas on the use of paper. At the end of the second test session volunteers were debriefed on the nature of the experiment and thanked for participating.

Responses were recorded in real time on a computer to provide an accurate depiction of response profiles. An audio recording was made of responses to investigate whether ideas were replicated. The accurate recording of both timing and content of ideas generated, alongside the imposition of a distracting break followed by a second testing session, comprise the innovative methodology introduced in the current study and, within the limitations of research, is intended to minimize concerns mentioned previously.

RESULTS

Responses were transcribed from the sound files and tallied in the pre- and postbreak sessions for each participant. A typical example is presented below as Table 1.

TABLE 1
TYPICAL RESPONSE PATTERN FOR TASK: SUBJECT NO. 55

First 5 Min.		After 5-min. Break
Wrapping	1	Swatting
Writing	2	Cleaning
Drawing	3	Padding
Blotter	4	Bedding
Cleaning window	5	Stuffing
Tissue	6	Fire light
Toilet paper	7	Smoking
Place mat	8	
Message	9	
Name tag	10	

As might be expected, there were individual differences in the number of ideas produced, with the total number of responses varying between 8 and 44 (M = 23.2, Mdn = 22). In the Prebreak session the number of responses ranged between 5 and 33 (M = 15.4) and for the postbreak session the range was between 3 and 15

(M = 7.8). However, and unexpectedly, individuals produced a similar pattern of responses across the two testing sessions, with participants who were more productive in the first session continuing to be so in the second, and with less fluent participants remaining relatively unproductive in both sessions. This outcome is reflected in the moderately high Pearson product-moment correlation (r = .58) between the two sessions.

The responses were then matched to the times at which they were supplied. The response profiles were remarkably similar across participants. The response profiles for the two sessions, averaged across all participants, are presented as Fig. 1.

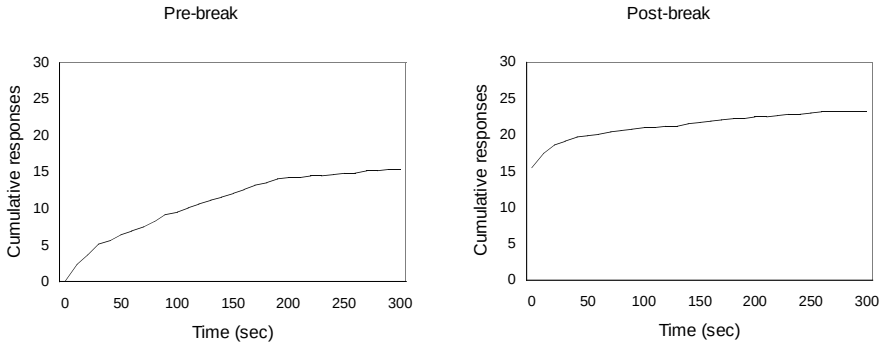

FIG. 1. Cumulative response curves for the two testing sessions, Prebreak and Postbreak. The solid line represents the average response pattern across all participants.

Although the majority of participants had seemingly exhausted their capacity to produce new ideas by the end of the first session, in the second session they generated, on average, approximately 60% as many new ideas as they had on the first occasion. Importantly, replicating the pattern exhibited in the first session, there was a burst of new ideas in the first few seconds immediately following the break, as though these ideas had been accumulating whilst participants were engaged on the distracting task. Furthermore, scrutiny of the responses indicated that repetition of ideas was very rare, indicating that the ideas produced in the second session were indeed novel.

DISCUSSION

Participants had generally run out of ideas by the end of the first session, yet they produced a burst of new ideas in the second session, even though conscious effort on the task was not required during the break (they were told the task was over) and, in fact, was precluded by performance of a cognitively demanding and distracting task. Both the number and the pattern of responses, especially the burst of new ideas produced after the break, indicate that solutions for an original problem may continue to be generated. As the experimental design did not afford participants a break from cognitive effort and presented a divergent task that arguably

should lessen the presence of a 'mind-set', both relief from fatigue and cognitive fixation were minimized. Thus the construct of nonconscious idea generation cannot be disregarded as an explanation of the results of this investigation. We do not argue that this outcome offers an absolute demonstration of the existence of nonconscious idea generation, rather that this construct offers a plausible account of the current findings.

Ongoing research in our laboratory is investigating possible relationships between nonconscious idea generation, personality and established cognitive abilities within the framework of the theory of fluid and crystallized intelligence (Cattell & Horn, 1978). Our research is aimed towards examining both convergent and divergent validity of this novel measure of idea generation. We also seek to ascertain the effects of manipulating the break between sessions on the possible nonconscious idea generation effect. Research will also examine the extent to which the measure offers incremental validity in predicting performance in the corporate environment, in addition to that afforded by established tests of cognitive ability and personality.

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