Unconscious Insights

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Abstract

From early in the history of psychology, theorists have argued about whether insights are initially unconscious or whether they are conscious from the start. Empirically identifying unconscious insights has proven difficult, however: How can we tell if people have had an insight if they do not tell us they have had one? Fortunately, although obtaining evidence of unconscious insights is difficult, it is not impossible. The present article describes an experiment in which evidence of unconscious insights was obtained. Almost 90% of second graders generated an arithmetic insight at an unconscious level before they were able to report it. Within five trials of the unconscious discovery, 80% of the children made the discovery consciously, as indicated by their verbal reports. Thus, the initial failure to report the insight could not be attributed to the children lacking the verbal facility to describe it. The results indicate that at least in some cases, insights arise first at an unconscious level, and only later become conscious. Rising activation of the new strategy may be the mechanism that leads children to become conscious of using it.

Keywords

insight; discovery; conscious; unconscious; arithmetic

Do unconscious ideas drive our conscious perceptions, thoughts, and behavior? Over the past decade, advances in cognitive neuropsychology have helped spark a rebirth of interest in this enduring question. To cite one example, there have been documented cases of blindsight, in which patients who have suffered brain damage are unaware of seeing objects but can accurately "guess" the objects' locations (Weiskranz, 1997). The influence of unconscious knowledge on behavior is not limited to brain-damaged patients. College students who are asked to learn artificial grammars, four-way statistical interactions, and other complex rule systems often are unaware of having learned the rules, yet they can use the rule systems to classify novel instances (Lewicki, Hill, & Czyzewska, 1992). Recent findings indicate that even insightful discoveries sometimes arise unconsciously before they reach a conscious (i.e., reportable) level. This article describes some of the research leading to this conclusion.

PERSPECTIVES ON INSIGHT AND CONSCIOUSNESS

Long before there was a scientific field of psychology, philosophers, mathematicians, and scientists described the role of consciousness in their own insights. Archimedes' experience of stepping into the bath, seeing the water rise, and exclaiming "Eureka" is probably the prototypical insight: a sudden change from not knowing a problem's solution to knowing it consciously.

In the Archimedes anecdote, an external event stimulated the insight. Other thinkers have emphasized the contribution of unconscious processes and dreams to their discoveries. Perhaps the prototypical account of this type is Kekule's dream of intertwined snakes, which led him to "see" the structure of the benzene ring.

Although these two cases differ in what led up to the insight, the insight itself emerged suddenly in both cases. Other accounts differ, though. Wittgenstein (1969), for example, compared generation of new ideas to a sunrise: Although our experience is that the new day suddenly "dawns," the amount of light actually grows continuously over a fairly protracted period of time.

These examples suggest two major questions regarding the relation between consciousness and insight: Do insights arise at an unconscious (i.e., nonreportable) level before they arise consciously, and do insights arise suddenly or gradually? These are basic questions about human nature, and they have motivated considerable theorizing over the past century (see Sternberg & Davidson, 1995, and the special section of *American Psychologist* edited by Loftus, 1992, for incisive discussions of classical and current perspectives on these issues). However, the questions have proven resistant to empirical resolution. The main reason is the difficulty of obtaining evidence regarding unconscious insights. Simply put, how can we know that people have an insight if they do not tell us that they had it? Recently, however, Elsbeth Stern and I found a way to obtain independent measures of conscious and unconscious insights and thus to examine the relation between them (Siegler & Stern, 1998).

THE INVERSION TASK

On problems of the form A + B – B (e.g., 18 + 24 – 24), the answer always is A. Such inversion problems are useful for studying insight because they can be solved in either insightful or noninsightful ways. The noninsightful way is to use the standard procedure of adding the first two numbers and subtracting the third. The insightful way involves simply saying the first number.

In addition to allowing both insightful and noninsightful solutions, the inversion task has the unusual property of allowing independent measurement of conscious and unconscious versions of the insight. Immediately retrospective verbal reports provided the measure of conscious use of the insight in the research Stern and I conducted. Young school-age children typically report their arithmetic strategies quite accurately, as indicated by converging evidence from reaction time and error patterns (cf. Siegler, 1987). What made the inversion problems special, however, was that an implicit measure of strategy use, one that did not require any verbal report, also could be obtained: the child's solution time. Ordinarily, solution times are insufficient to infer the strategy that was used on an individual trial. However, they are considerably more useful for inferring strategy use on inversion problems. The reason is that solving the problems via computation generates much slower solution times than solving them by using the arithmetic insight. Consistent with this view, solution times on inversion problems in our study were bimodally distributed: 92% of times were either fast (4 s or less) or slow (8 s or more). Converging evidence from overt behavior supported the view that the fast times reflected use of the insight and that the slow times reflected use of computation. Overt computational activity was observed on 80% of trials classified as computation, versus 0% of trials on which children were classified as using the shortcut. (Methods used to classify strategy use are discussed in the next section.)

CONSCIOUS AND UNCONSCIOUS DISCOVERIES

Having both a verbal report and a solution time on each trial made it possible to define three main strategies: *computation*, *shortcut*, and *unconscious shortcut*. Children were classified as using the computation strategy on each trial on which they took more than 4 s to come up with a solution and said they computed the answer; they were classified as using the shortcut on each trial on which the solution time was 4 s or less and they said they used the shortcut; and they were classified as using the unconscious shortcut on each trial on which their solution time was 4 s or less but they claimed to have computed the answer.

We expected that on the large majority of trials, the verbal-report and solution-time measures of strategy use would converge: Children would either solve the problem quickly and say they used the shortcut or take longer to solve it and say they computed the answer. However, we also expected that sometimes the measures would diverge: The child would solve the problem in 4 s or less but claim to have solved the problem through addition and subtraction. Such trials, if they occurred most often at predicted places in the learning sequence, would indicate unconscious use of the shortcut.

THE UNCONSCIOUS-ACTIVATION HYPOTHESIS

Based on previous research showing unconscious influences on other types of thinking, we formulated the *unconscious-activation hypothesis*: Increasing activation of a strategy leads to people first using it unconsciously; then, as the activation increases further, people become conscious of using it. The straightforward implication of this hypothesis was that the unconscious shortcut would emerge before the conscious version of the strategy.

To further test the unconscious-activation hypothesis, we created two experimental conditions. One was the *blocked-problems condition*. Children in it were presented A + B – B problems, that is, problems that could be solved by the inversion principle, on 100% of the trials. The other experimental condition was the *mixed-problems condition*. In it, children were presented A + B – B problems on 50% of trials, and on the other 50% were presented A + B – C problems (i.e., problems, such as 18 + 24 – 15, in which the three numbers differed and therefore that could not be solved via the shortcut strategy). The unconscious-activation hypothesis predicted that presenting children inversion problems on 100% of the trials would lead to a more rapid increase in activation of the shortcut, which in turn would lead to (a) more rapid discovery of the unconscious-shortcut and shortcut strategies (discovery after fewer inversion problems), (b) a shorter gap between discovery of the unconscious shortcut and discovery of the shortcut, (c) more consistent use of the shortcut on inversion problems once it was discovered, and (d) greater generalization of the strategy to novel problems of similar appearance, such as A – B + B and A + B + B.

AN EXPERIMENT ON CONSCIOUS AND UNCONSCIOUS INSIGHTS

To test these predictions, we presented 31 German second graders with either the blocked problems or the mixed problems. The experiment was conducted over an 8-week period, one session per week.

Each of the predictions of the unconscious-activation hypothesis was borne out. Almost 90% of the children discovered the unconscious version of the shortcut before the conscious version. Relative to children in the mixed-problems condition, children in the blocked-problems condition discovered both the unconscious-shortcut and the shortcut strategies after seeing fewer inversion problems, exhibited a shorter gap between their discovery of the two strategies, used the strategies more often once they discovered them, and generalized the strategies more widely to novel types of problems.

Examination of strategy use just before and after discovery of the unconscious-shortcut and shortcut strategies provided particularly direct support for the unconscious-activation hypothesis. Figure 1 illustrates the circumstances surrounding the first use of the unconscious shortcut among children in the blocked-problems condition. Trial 0 for a given child is the trial on which the child first used the unconscious shortcut; thus, by definition, 100% of children used the unconscious shortcut on Trial 0. Trial –1 for a given child is whichever trial immediately preceded that child's Trial 0; Trial 1 is whichever trial immediately followed the child's Trial 0; and so on.

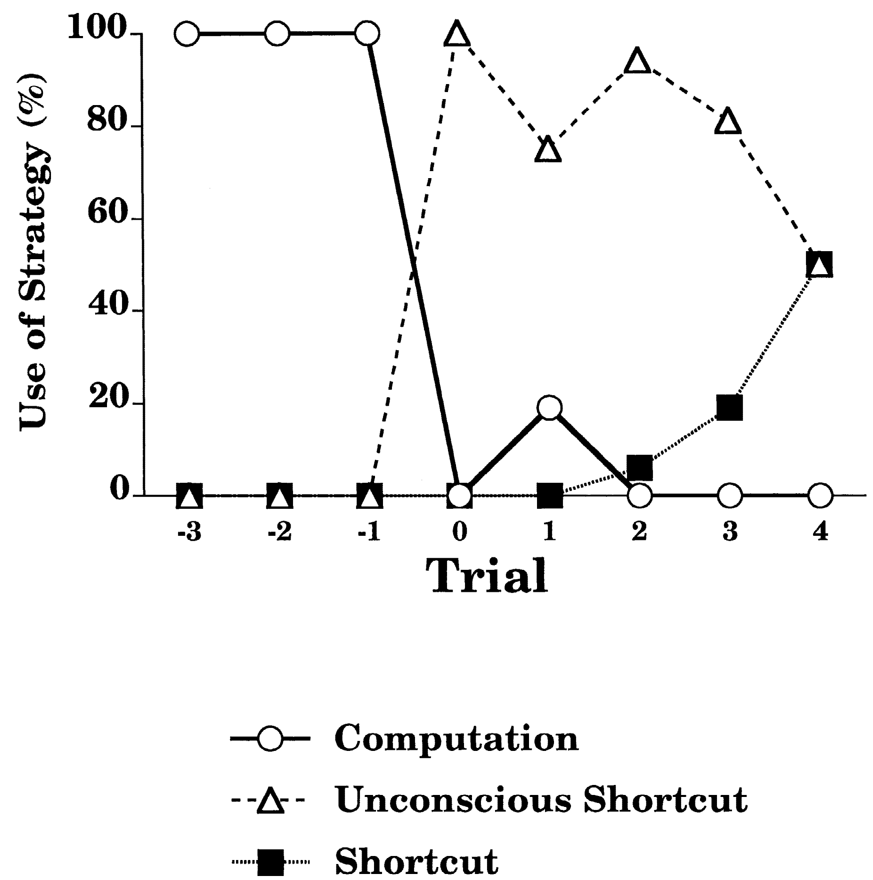

Fig. 1. Percentage use of computation, unconscious-shortcut, and shortcut strategies in the blocked-problems condition on trials immediately preceding and following children's first use of the unconscious shortcut. Each child's first use of the unconscious shortcut is designated Trial 0; the trial just before it is designated Trial –1, the trial just after it is designated Trial 1, and so on.

Data from the blocked-problems condition were particularly striking. Figure 1 reveals that just before their first use of the unconscious shortcut, all of these children used the computation strategy. After their initial use of the unconscious shortcut, most of them continued to use the unconscious shortcut over the next three trials. By the fourth trial after the initial use of the unconscious shortcut, half of the children reported using the shortcut. By the fifth trial, 80% of the children reported using it.

Figure 2 shows a parallel analysis centered on first use of the shortcut by the same children. On the three trials immediately preceding its first use, roughly 80% of these children used the unconscious shortcut (as opposed to less than 10% use of this strategy for the study as a whole). Once the children began to report using the shortcut, they continued to use it quite consistently within that session. However, when they returned a week later for the next session, fewer than 35% used the shortcut on any trial before Trial 5. Thereafter, more children rediscovered the shortcut, and by the end of the session, more than 90% of them were again using it.

Changes in solution times from the trials just before the first use of the unconscious shortcut to the trial of discovery suggested that the unconscious shortcut represented a sudden, qualitative shift in thinking. On the three trials immediately before its first use, solu-

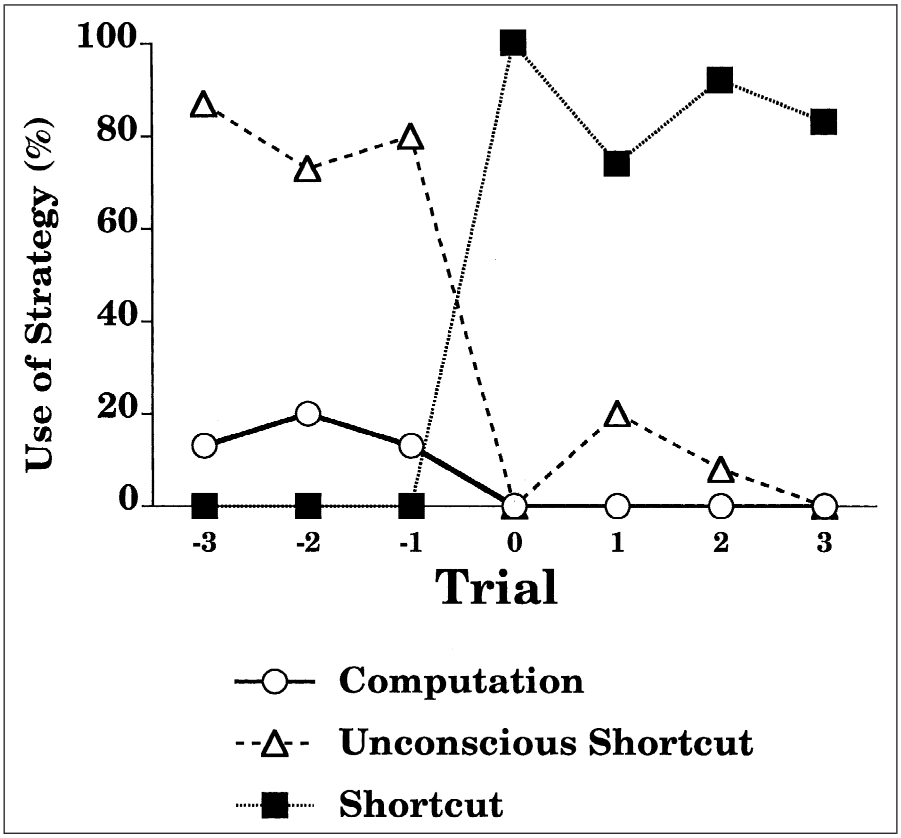

Fig. 2. Percentage use of computation, unconscious-shortcut, and shortcut strategies in the blocked-problems condition on trials immediately preceding and following children's first use of the shortcut. Each child's first use of the shortcut is designated Trial 0; the trial just before it is designated Trial −1, the trial just after it is designated Trial 1, and so on.

tion times averaged 12 s; on its first use, the mean solution time was 2.7 s. Solution times on subsequent unconscious-shortcut trials (and on shortcut trials as well) continued to average between 2 s and 3 s in all sessions. Thus, although children who used the unconscious shortcut did not report doing anything different, they had already had the insight at a behavioral level.

The lack of reporting of the insight on unconscious-shortcut trials could not be attributed to the children being generally inarticulate, to the insight being difficult to put into words, or to children's perceptions of social desirability preventing them from reporting an approach that they knew they were using. If those were the reasons for children initially not reporting the shortcut, why would the same children have almost invariably reported using it a few trials later in the same session? Further supporting the view that use of the shortcut was at first unconscious, when children rediscovered the shortcut in the session following the one in which they initially used it, most again used the unconscious version just before beginning to report its use.

CONCLUSIONS

These results shed light on both of the questions raised at the outset regarding insights and consciousness. With regard to the first question, the findings demonstrate that insights are not always conscious from the start. At least sometimes, they arise first in unconscious form.

The results also provide an answer to the second question: Insights are abrupt in some senses, but gradual in others. On the one hand, the dramatic reduction in solution times that accompanied the first use of the unconscious shortcut indicates a sense in which insight was abrupt. The fact that solution times on shortcut trials did not decline further indicates that in terms of efficiency of execution, the shortcut emerged full-blown. On the other hand, the insight was gradual in two other senses. First, children initially discovered the shortcut in a nonreportable form and only later became able to report using it. Second, use of the shortcut increased slowly, never extending to more than 60% of trials in a given session.

The results also raise several intriguing questions. Do adults also begin to use new strategies unconsciously before they become conscious of using them, or is unconscious use of strategies unique to children? Are unconscious insights limited to single-step strategies, as in the present case, or do people also discover multistep strategies at an unconscious level before they discover them consciously? Perhaps most important, through what cognitive processes are unconscious insights generated?

Underlying these and other relatively specific questions is the main point of our study, a point consistent with a wide range of previous research: Having a thought, or even an insight, is not the same as being aware of having that thought or insight. Learning how consciousness is related to insight remains one of the basic challenges in understanding human psychology, just as it was in the days of Archimedes.

Recommended Reading

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Note

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