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Commentary: Moment of (Perceived) Truth: Exploring Accuracy of Aha! Experiences

ABSTRACT

Danek and Salvi (*The Journal of Creative Behavior*, 1–3, 2018) provide a sound overview of research on the relationship between feelings of aha and the accuracy of problem-solving solutions. However, there are reasons to be cautious in concluding that a characteristic of insightful solutions is their superior accuracy. A relationship between correct solutions and aha experiences clearly exists in the literature. However, the strength and frequency of aha experiences seem to be variable across individuals and can be manipulated. We provide a brief overview of some literature that challenges the claim that aha experience indicates accurate solutions, particularly, manipulations of aha experiences, metacognitive misattributions and erroneous insights, and dispositions toward insight.

Keywords: insight, aha experience, problem solving.

There are moments during creative pursuits and problem-solving in which an individual sees with sudden clarity what is to be done – whether this be a new way to test a theory or how to make a striking piece of artwork. These are often referred to as moments of insight, or aha moments, and occur across domains as far reaching as mathematics and firefighting (Klein & Jarosz, 2011). These moments have a subjectively distinct feeling and are highly rewarding and highly motivating. While traditionally the study of insight moments has focused on problem-solving accuracy of literature-specific problems (insight problems), contemporary research on insight is increasingly recording both the accuracy of solutions to problems and the phenomenology of insight (typically through subjective reports of the aha experience). Throughout the literature, there is robust evidence for a strong positive relationship between the aha experience and solution accuracy (Salvi, Bricolo, Bowden, Kounios, & Beeman, 2016; Webb, Little, & Cropper, 2016). Danek and Salvi (2018) interpret the direction of this relationship as “aha experiences are correct”; that is, an aha experience is indicative that the solution under consideration is a correct solution for a given problem. Such claims are clearly data-driven; however, the causal direction of the relationship between accuracy and insight or, indeed, whether there is any causal link, remains unclear. Historically, the predominant focus in this area of research has been on developing problems designed to elicit insight when solved correctly (insight problems) and on comparing the characteristics of the successful solution of insight problems to that of “non-insight” (analytic) problems, in order to ultimately disentangle the complex processes underlying the insight experience. Within this context, a robust positive relationship between an aha experience alongside successful solution of a problem is not only expected, it is necessary in order to claim that an insight problem is able to elicit an experience of insight. Moving beyond the insight literature, the claim that an aha experience implies an accurate solution to a problem is highly valuable, particularly if the likelihood of having insight experience can be optimized. Nevertheless, it is not always the case that aha experiences imply that the solution will be correct: The feeling of insight can be manipulated independently of accuracy, there is consistent evidence of erroneous insights and associated biases such as strong-but-wrong errors and overconfidence, and there are dispositional and individual biases toward experiencing aha moments.

MANIPULATING INSIGHT EXPERIENCES

An important aspect of the aha experience is the sensation of certainty in solution accuracy and in the veracity of a given statement. However, it is possible to manipulate this feeling: Topolinski and Reber

(2010b) manipulated the experience of truth in a statement by presenting participants with a problem (i.e., an anagram or a math problem) and increasing or decreasing the time before solutions were presented. Solutions that were presented in closer temporal proximity with the questions were perceived as more “truthful.” This finding has been discussed in terms of processing fluency, also applied to the study of insight (Topolinski & Reber, 2010a). Other elements of processing fluency through which it might be possible to manipulate an aha experience include the readability of font (Topolinski, 2014), familiarity (Begg, Anas, & Farinacci, 1992; though see Metcalfe, 1986 trivia problems for further data), repetition (Hasher, Goldstein, & Toppino, 1977) and color (Unkelbach, 2007). So while the feeling of insight is such that the individual *does* feel more confident in the outcome of their deliberations, it is not necessarily due to a causal link between insight and accuracy, but also impacted by other irrelevant factors (Reber, Wurtz, & Zimmermann, 2004).

ERRONEOUS INSIGHTS AND METACOGNITIVE ERRORS

Beyond manipulating aha experiences, the accuracy of an aha experience might be hijacked through misattribution and overgeneralization beyond the target solution. Laukkonen et al. (2020) presented participants with general knowledge statements such as “Kangaroos keep growing until they die.” Participants rated whether the claim was true or false but before they made the rating they were required to unscramble a key word in the claim. In this case, they needed to unscramble the word *kgraaaosn* (kangaroos). The results indicate that when participants solved the anagram successfully, they were more likely to believe the claim was true and this effect was particularly pronounced when they also reported an aha experience (see also Laukkonen et al., 2018). The most probable explanation for this finding is that the aha experience triggered by the anagram was misattributed to the initial claim such that the statement now seemed, to the participant, to be more true. This effect is consistent with feelings-as-information theory (Schwarz, 2011) and other examples where feelings induced by one stimulus can confound judgments of a temporally coincident but unrelated stimulus (Reber & Schwarz, 1999). The result indicates that an aha experience is not simply a marker of an accurate solution, rather that there is a more complex process of metacognitive interpretation of the feeling that takes place, and during this interpretative process, mistakes can be made. As a practical example, the contents of a speech by a charismatic presenter could appear more true if it is interleaved with moments that trigger feelings of insight in the audience.

Other cognitive errors which result in insight and insight problem-solving inaccuracies may arise from following the problem-solving pathway implied in the instructions (rule-based error), leading to the incorrect solution (e.g., the Water lily problem or the Dinner problem), associated with a “strong-but-wrong” error (Reason, 1990). Such errors may also be a product of basing the solution on incomplete knowledge (knowledge-based error), resulting in overconfidence. A strong-but-wrong error occurs when individuals use a familiar strategy even when it is applied in the wrong circumstances: The participant believes they have the correct solution, but this is not based on a full analysis of the problem (Wagenaar, Hudson, & Reason, 1990). Overconfidence is similarly a judgment on the veracity of an answer based on incomplete information (Gigerenzer, 1991; Gigerenzer & Gaissmaier, 2011). A number of varying research domains investigate overconfidence and accuracy (i.e., high confidence and low accuracy in economic decisions, eyewitness testimony, beliefs about own knowledge), each with cautionary data regarding distinctions between confidence and accuracy.

DISPOSITIONS TOWARD INSIGHT

Another factor to be accounted for when asserting an experience of insight reflects a correct solution to a problem is the disposition toward insight experiences. There are little data on this beyond qualitative investigations (Ovington, Saliba, Moran, Goldring, & MacDonald, 2015), with much of the investigation within the literature constrained by problem-solving requirements in order to access insight experiences (Webb, Little, & Cropper, under review). However, a disposition toward experiencing insight may be indicated by erroneous insights and by psychopathology, such as the aha experience often reported during first episode psychoses (Fineberg & Corlett, 2016; Kapur, 2003; Mishara, 2010). That an aha is associated with the restructuring of perception (often into a delusion or hallucination) questions whether this experience is dependent on the accuracy of the solution. Such false percepts are also seen in a healthy population where some individuals are prone to perceiving meaningful patterns in noise more than others (Brugger et al., 1993; Partos, Cropper, & Rawlings, 2016): Do these individuals also experience insight alongside their false percept? A disposition toward insight could predispose an individual to erroneous insights. Erroneous

insights can be disastrous and range across a number of contexts: from becoming so enamored with a business idea that you are blind to its shortcomings (often called the entrepreneurial seizure, see Gerber, 1995), religious revelations that your brother's wife must die (e.g., Ron Lafferty of the Mormon religion, Krakauer, 2003), or subsequently finding problems in the proof that you thought you had solved (an example of this would be Cantor refusing to acknowledge flaws and paradoxes in his mathematical axioms and theorem, see Dauben, 1979, p. 248). Danek and Salvi (2018) note erroneous insights in their paper, in reference to Ohlsson's (1984 p. 124) term and discussion of erroneous insights. This issue was also raised recently by Laukkonen et al. (2018), who used the term *insight fallacy*. However, there are as yet little data within the insight literature regarding erroneous insights (Danek & Wiley, 2017; Webb, Cropper, & Little, 2018).

AHA EXPERIENCES BEYOND PROBLEM-SOLVING?

There is research regarding traits and insight problem-solving (e.g., Karimi, Windmann, Güntürkün, & Abraham, 2007; Ostafin & Kassman, 2012; Salvi & Bowden, 2019; Webb, Little, Cropper, & Roze, 2017); however, investigations of traits that predispose toward insight as investigated through insight problem-solving are constrained by the high problem-solving component required. Moving beyond insight problem-solving processes enables investigation of other stimulus sets that are able to elicit an insight experience. For example, Webb, Little and Cropper (2019) used a creativity task to elicit aha moments and demonstrated a positive relationship between schizotypy and aha moments across two studies. Mooney images (black and white binarized images) are also able to elicit reports of an aha experience (Kizilirmak, Galvao Gomes da Silva, Imamoglu, & Richardson-Klavehn, 2015). The ability to identify out-of-focus pictures/embedded figures has already been associated with insight problem-solving abilities (Laukkonen & Tangen, 2017; Schooler & Melcher, 1995). However, this opens the stimulus set to noisy stimuli, in which there is not an experimenter-defined measure of accuracy available (e.g., identifying a face in noise, such as in Partos et al., 2016). If an individual has an aha experience in the recognition of an image that only they see, is this image "correct" or "incorrect"? The perceived truth and the perceived accuracy of this interpretation is what matters in this context. Interestingly, this raises the question of what insight might be, if not a component of problem-solving. There are a number of discussions regarding the aha experience, and whether this is an epiphenomenon of insight, or integral to insight (Sandkühler & Bhattacharya, 2011).

ARE INSIGHT SOLUTIONS MORE ACCURATE?

Danek and Salvi (2018) provide an overview of research on the relationship between feelings of aha and the accuracy of problem-solving solutions. However, there are reasons to be cautious in concluding that a characteristic of insight solutions is their superior accuracy. In pointing to future research, Danek and Salvi (2018) highlight the interesting prospect of revealing instances where the relationship between aha and accuracy breaks down. We suggest that this is not only an avenue for future research but also a necessary test bed for the proposition that aha experiences are more accurate. As our brief review suggests, factors such as manipulation, misattribution, and possible trait dispositions question the aha and accuracy relationship. There are also issues of generalizability because existing research is limited to laboratory problems or other stimuli that often lack clear ecological validity. There is, at least hypothetically, manifold variables that could increase the incidence of false insights in the world and in educational contexts. For example, what is the influence of misleading information or fake news on the incidence of an accurate aha moment? Do individuals adopting a position counter to apparently overwhelming evidence to the contrary (e.g., Flat-Earthers, Climate change deniers) come to that conclusion, at least in part, due to a contrived and inaccurate moment of insight? Whether the aha and accuracy relationship generalizes from laboratory problems to the complex socio-cultural, political, philosophical, and religious insight experiences that occur in the world is a question that would be prudent to answer in the future, when there are both more data and more generalizable experimental materials to account for individual differences, states of mind, and environment. Ultimately, aha moments may correlate with accuracy in the most general sense, or in laboratory problems, but in the same way we would not say that safety is a characteristic of cars without knowing the context, perhaps it is too early to conclude that higher accuracy is a characteristic of insight.

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