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What does 'truth' feel like?

Background

Many of our decisions are driven by hunches or intuitions, rather than deliberate, analytic, and conscious thought. Here we consider the possibility that the Aha! moment is akin to an intuition about the 'truthiness' of an idea or solution. When a solution to a problem or an idea pops into our minds unexpectedly, we often do not know 'why we know' that the idea is correct, and much of complex problem-solving may be hidden from awareness. This is exemplified in cases where a solution appears in mind while engaged in an unrelated task. It's possible that the Aha! phenomenology occurs as a kind of cue to signal that an idea is likely to be true given what a person currently knows and believes. Extending on the work of Metcalfe & Wiebe (1986), Salvi et al., (2016), Webb et al., (2016), and Danek et al., (2017), across a range of tasks we evaluate when and under what conditions the sudden insight experience helps individuals make accurate decisions without any conscious verification, and propose a mechanism for why the phenomenology of insight predicts objective performance We also aim to validate a novel objective measure of the insight experience using a hand held dynamometer, and demonstrate that real-time Aha! experiences, as well as their intensity, predict confidence and accuracy without any conscious deliberation.

The Eureka Heuristic: A model of how Aha! moments may guide judgments of truth by signalling consistency with implicit knowledge structures.

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	1	Problem solving begins with an accumulation of information, experiences, and beliefs, which form implicit knowledge structures.	
	2	Information integration occurs below awareness, and new patterns and associations are formed that contribute to problem solving.	
3			
		Implicit processes lead to a solution that is cognised suddenly and unexpectedly accompanied by an Aha! moment.	
		Intensity of Aha! phenomenology is partly determined by the extent to which implicit knowledge structures cohere with the solution.	
	4	The intensity of the Aha! phenomenology is interpreted such that greater intensity results in greater judged truth of the solution.	

The phenomenology of truth:

The Aha! experience predicts accurate decisions in contexts of uncertainty or where problem solving or retrieval processes are hidden from awareness.





In this preregistered experiment we present 60 participants with 3 classic problem solving tasks: 10 Insight problems, 10 analytic problems, and 10 compound remote associates task. After solution, we ask each participant whether they experienced an Aha! moment (yes / no) and if yes, we also ask them how intense it was on a continuous scale. They also provide a rating of confidence and familiarity (counterbalanced). Throughout problemsolving participants indicate their perceived progress on the problem using a Vernier Hand Dynamometer which is a highly sensitive measure of grip strength. If an Aha! moment occurs, they are instructed to make a full strength squeeze which indicates the sudden onset of an insight solution.













Example non-insight moment



Results:

- Both self-reports and the dynamometer measure converge showing that insight solutions are more accurate than non-insight solutions overall, d =1.32^{**} and $d = .98^{**}$, respectively. And the more intense the Aha moment the more likely it was accurate ($r = .151^{**}$).
- An interaction by problem type, such that analytic problems—which involve a conscious deliberate approach to problems—show no benefit for the insight experience.



Note. * p < .05, ** p < .01, *** p < .001



In experiment 2 we test the possibility that the Aha! experience, as a feeling of 'truth', extends beyond problem-solving to the domain of sensory identification. In this preregistered experiment we present 80 participants with 10 aromas, 10 snippets of popular songs, and 10 famous faces. If the participants find a solution (the identity of the stimulus), they then indicate whether they experienced an Aha! moment, the intensity of the Aha! moment, and their confidence in the solution (counterbalanced).

Heuristics are most useful in times of uncertainty (Gigerenzer & Gaissmaier, 2011). Therefore, we reasoned that uncertainty could be estimated by the reaction time of participants. Through pilot testing we found that uncertainty is likely to be experienced for responses after 2 seconds for faces, 7 seconds for songs, and 6 seconds for smells. We expected the same pattern of results as in experiment 1 for uncertain trials, but expected that—like analytic problems in experiment 1—the problems solved without 'uncertainty' would not show an accuracy benefit for Aha! versus no Aha! solutions.

Results:



Experiment 2



Beyond problem solving: Insight experiences when identifying familiar aromas, songs, and faces also predict accuracy and confidence

• For uncertain trials Aha! solutions predict accurate decisions and higher confidence than non-Aha! solutions.

• For trials without uncertainty there is no difference in accuracy for Aha! and non-Aha! solutions, but may be partly explained by a ceiling effect.

•The predictive power of the Aha! experience is strongest in the smell condition, which was also the most difficult and invoked the least confidence in responses

More Dynamometer Results...

- the participant's mean.
- moments.



problem solving domains and three different sensory identification tasks we consistently find that—where implicit processing is involved—the 'Aha!' experience is highly predictive of accurate decisions. We propose that humans use the Aha! phenomenology as a heuristic shortcut for truth in moments of uncertainty or wherever problem solving and retrieval processes are hidden from awareness. The feeling of insight may be a highly adaptive intuition about the veracity of an idea or solution to aid quick decisions under pressure. To measure the ineffable moment of insight, the hand held dynamometer is a promising alternative to self-report measures and feelings-of-warmth. The precise mechanism behind the insight-accuracy relationship remains an open question, but we consider the possibility that the Aha! experience signals consistency or coherence with ones existing knowledge and experience.

References:

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• The dynamometer finds a pattern of results consistent with self-reports and in the direction expected in the literature for different problem categories.

• In line with Metcalfe & Wiebe (1987), creative problems are solved more suddenly (smaller slope) and analytic problems are solved with more gradual patterns of progress (larger slope).

• Participants were instructed to provide an immediate full strength squeeze if an Aha! moment occurs. Objective spikes (dynamometer Aha! moments) were defined as a max grip strength equal to or greater than 6SD above

• **Conclusion:** The Dynamometer is currently the most sensitive objective measure of insight and problem-solving, which can also capture the sudden onset of an Aha! moment in real time. It shows promise as a visceral, laboratory measure of problem-solving progress and Aha!

Summary of findings: In two experiments using three different

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