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The Appeal of Insight: Why Riddles and Whodunits Captivate Us

Marius Mercier[1], Alexis Garsmeur[2], and Hugo Mercier[1]
[1] Institut Jean Nicod, Département d'études cognitives, Ecole Normale Supérieure, EHESS, CNRS, Université Paris Sciences et Lettres
[2] LaPsyDÉ, CNRS, Université de Paris Cité

Insight, or the "Aha" experience, is pivotal in the appreciation and engagement with various cultural products. This article explores how the feeling of insight contributes to the success of riddles and whodunits, two popular products with a strong cross-cultural appeal. We report a series of five experiments manipulating the probability of experiencing an insight when solving, or being provided with the solution of a riddle or a short whodunit story. Participants are more likely to declare wanting to consume and to share material that generates more insight. We also observe that many participants choose to consume a new riddle or a new whodunit instead of immediately finishing the experiment, but that only High Insight riddles, and not whodunits, were significantly preferred. These results suggest that feelings of insight play an important role in shaping some popular cultural products.

Keywords: insight, problem-solving, riddles, whodunit, cultural evolution

Supplemental materials: https://doi.org/10.1037/aca0000773.supp

Insight—also called the "Aha!" moment—is a sudden understanding that reorganizes one's mental representations to reveal a nonobvious interpretation (Kounios & Beeman, 2014). This feeling has attracted attention in part due to his supposed role in motivating scientists (e.g., Karikó, 2024). Yet, the same cognitive and emotional processes occur in less exalted, but more common, everyday life contexts (Ovington et al., 2018). This article explores how the phenomenology of insight influences the appreciation and consumption of two culturally widespread products: riddles and whodunits. We document the cross-cultural appeal of riddles in preindustrial small-scale societies and the widespread popularity of whodunits in literate cultures. We hypothesize that the feeling of insight is central to the success of riddles and whodunits, even when individuals do not personally solve them, which is often the case for insight-generating cultural materials. We present five experiments testing whether participants are more likely to declare wanting to share, wanting to consume, and to actually consume materials triggering stronger feelings of insight.

Popular Insight-Generating Materials: Riddles and Whodunits

Riddles and whodunits, two insight-generating cultural products, have proven to be extremely culturally successful. Høyrup (2001) suggests that mathematical riddles invented by Babylonian scribes in the third millennium BCE were transmitted to India, Greece, and even to medieval Italy. Some riddles have been passed down by children for hundreds of years. Many of the riddles collected by the Opies in the 20th century (Opie & Opie, 1959) can be traced back to the Middle Ages. For any cultural element to persist in children's culture, it must be highly appealing, considering the fast-paced generational turnover (Morin, 2016).

Riddles are not only enduring but also widespread, having been observed in cultures across the world (Taylor, 1951 cited by Dienhart, 1999). We conducted a review of the Human Relations Area Files anthropological database (eHRAF: World Cultures database, https://ehrafworldcultures.yale.edu/) and found that ethnographies report riddles as being present in at least one culture in each continent with a total of 43 cultures mainly in Africa and Asia (see Table 1 in the online supplemental materials for more information including references, cultures' name, and example of riddles). Riddles were found in 18 of the 60 cultures of the Probability Sample Files, a sample of largely unrelated preindustrial small-scale societies. This shows that riddles can be transmitted through purely oral traditions and that they emerged independently across various societies, highlighting their strong cross-cultural appeal.

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Marius Mercier https://orcid.org/0000-0002-1431-4284
Hugo Mercier https://orcid.org/0000-0002-0575-7913
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Correspondence concerning this article should be addressed to Hugo Mercier, Institut Jean Nicod, Département d'études cognitives, Ecole Normale Supérieure, EHESS, CNRS, Université Paris Sciences et Lettres, 29 rue d'Ulm, 75005 Paris, France. Email: hugo.mercier@gmail.com

Whodunits are a type of mystery fiction in which the main focus is solving a crime, often a murder. The success of this genre is attested by the wide-ranging popularity of its most famous practitioner, Agatha Christie, who is, with more than two billion books sold in over 40 languages, the best-selling novelist of all times. As of 2022, books in the crime/mystery genre secured the second position in terms of profitability on Amazon's U.S. marketplace (Talbot, 2021). Far from being an exclusively Western phenomenon, other cultures share a similar attraction for detective fiction. The stories of Judge Bao, a magistrate investigating and solving crimes, have been part of Chinese culture since the Yuan Dynasty (13th century) in the form of stage play (Idema, 2010). Later adapted as short novels in the 16th century, Judge Bao is still a central character of Gong'an (crime-case) fiction today. In recent years, Japan has produced some of the foremost authors in the whodunit genre, such as Natsuo Kirino and Keigo Higashino.

How Cultural Products Might Elicit Insight?

We hypothesize that the cultural success of riddles and whodunits can be explained by their ability to elicit "Aha!" moments that motivate people to consume more of them and share them with others. What makes certain cultural products more likely to elicit insight than others? To understand this, we can turn to cognitive theories of insight. An influential theory is the representational change theory (Knoblich et al., 2001), according to which insight emerges from (a) the sudden resolution of a problem (Metcalfe & Wiebe, 1987; Stuyck et al., 2021) through a (b) restructuring of the mental representation (Danek, 2018; Gilhooly & Murphy, 2005; Weisberg, 2015) that (c) initially blocked the solution (Knoblich et al., 1999; Ohlsson, 1992). While the question of how the restructuring happens is debated (Seifert, 2024; Webb, 2023), converging lines of evidence suggest that restructuring is a necessary condition of insight (Danek et al., 2016, 2020; Öllinger et al., 2014; Vitello & Salvi, 2023; but see Becker et al., 2021).

Riddles and whodunits have in common specific features setting the stage for the feeling of insight. Riddles often exploit psychological mechanisms to create misleading mental representations, leading the audience in an impasse (see in particular the type of riddles called stumpers, Bar-Hillel et al., 2018). Restructuring the mental model can then be done very easily, once someone finds or is exposed to the solution, thus increasing the probability of a feeling of insight. By contrast, non-riddle problems that can be solved step by step typically do not lead to feelings of impasse, nor to restructuring of mental representations, and thus rarely to feelings of insight.

Whodunits obey a set of rules which makes it a fairly homogeneous cultural product with an identifiable form (Knobloch-Westerwick & Keplinger, 2006). The audience typically follows the investigation along with the protagonist and no clue is hidden from them. A well-crafted whodunit should be theoretically solvable by the reader, yet intricate enough that few people find the solution before it is revealed. Whodunits belong to broader genres—crime, mystery, thriller—that share many attention-grabbing features, from danger (Clasen et al., 2020; Scrivner, 2021) to very competent characters (Reilly, 1999). However, what differentiates whodunits is the final reveal of the criminal and the accompanying explanation. In this, whodunits are similar to stumpers: the audience creates a misleading mental model of the situation that obscures the solution, creating an impasse. When the solution is revealed, this mental model is restructured, which increases the probability of eliciting a feeling of insight.

Why Eliciting Insight Would Make a Cultural Product Successful?

Features of riddles and whodunits suggest they are specifically designed to elicit insight experiences, but this raises the question of why eliciting insight would make them culturally successful. Compared to step-by-step problem-solving, insight is associated with unique neural (Bowden & Jung-Beeman, 2007; Chesebrough, Salvi, et al., 2024; Kounios & Beeman, 2014; Salvi, 2023; Salvi & Bowden, 2024), physiological (Salvi et al., 2020; Shen et al., 2018) and behavioral patterns (Laukkonen et al., 2021). Insight also has a distinct phenomenology (Stuyck et al., 2021): researchers have identified several dimensions of the feelings of insight such as pleasure, confidence, obviousness, suddenness, and drive (Danek & Wiley, 2017; Danek et al., 2014; Stuyck et al., 2021; Webb et al., 2018). Among these dimensions, the pleasurable and rewarding aspect of insight is often the most important. Beyond self-reported subjective experiences, results from the neuroscience literature (for a review, see, Chesebrough, Salvi, et al., 2024) have revealed an involvement of the dopaminergic system when solving insight problems, suggesting a neural reward signal caused by insight (Chesebrough, Oh, & Kounios, 2024; Oh et al., 2020; Salvi, 2023; Tik et al., 2018). For example, Oh et al. (2020) discovered that individual differences in the intensity of feelings of insight were related to broader differences in reward sensitivity linked to a specific neural reward response. Moreover, participants who enjoy one type of insight-generating stimuli (e.g., puzzles) tend to enjoy other types as well (e.g., popular science; Mercier et al., 2025), which suggests personality differences in enjoyment of insight (Chesebrough, Oh, & Kounios, 2024). The pleasure associated with insight, as well as its neural underpinnings, makes sense of the performance-related emotions, such as pride and increased motivation to engage with the task at hand, often reported by participants (Danek & Wiley, 2017; Danek et al., 2014; Skaar & Reber, 2021).

Why are insights characterized by this specific phenomenology? According to the processing fluency theory (Topolinski & Reber, 2010), the Aha! experience is the outcome of a sudden shift in the processing of representation. Alternatively, the metacognitive prediction error theory (Dubey et al., 2021) suggests that this feeling arises when one solves a problem faster than they expected. Another recent metacognitive approach, the Eureka Heuristic theory (Laukkonen, 2024; Laukkonen et al., 2023), proposes that the phenomenology of insight corresponds to a reward for the reduction of uncertainty after solving a problem (Friston et al., 2017). It has also been suggested that this phenomenology has an adaptive function, motivating us to make sense of the world around us (Gopnik, 1998), or helping us select valuable new ideas (Laukkonen, 2024).

How can insight influence cultural success? For a cultural product to become culturally successful—to spread widely and persevere through time—enough people must be sufficiently motivated both to consume it and to share it with others (Mesoudi, 2016; Stubbersfield, 2022). Recent models of cultural evolution show that individual preferences, even weak, are sufficient to stabilize culture (Acerbi & de Courson, 2025). When a large audience is eager to consume a given cultural product, it creates various incentives for others to produce similar content, allowing them to gain reputational

and, in some contexts, financial benefits (André et al., 2023; Sperber, 1996). The motivation to share a cultural product also plays an important role in its diffusion. This is true in oral cultures, where active sharing is the only means of diffusion, but also in literate cultures, in which word-of-mouth remains a crucial factor in product diffusion (see Berger, 2014; on cultural transmission more generally, see Eriksson & Coultas, 2014; Mesoudi, 2016; Richerson & Boyd, 2008). Other factors play a role in cultural transmission, such as ease of remembering for orally transmitted riddles, but in a modern environment in which information is easily reproduced, memory arguably plays a smaller role than the demand for and willingness to share content.

The central hypothesis of this article is that feelings of insight motivate people to consume and share insight-generating materials. In terms of consumption, several dimensions of the peculiar phenomenology of insight discussed above might contribute. Insight is pleasurable and rewarding, and it is associated with feelings of drive and motivation (Danek et al., 2014; Skaar & Reber, 2021). This should lead people to consume more insight-generating materials. In terms of sharing, people could be motivated to share insight-generating materials either because of the pleasure they produce in others or because insight is generally associated with valuable ideas (Laukkonen et al., 2023). Sharing materials that please the audience, and sharing valuable ideas, tends to be rewarded with gratitude (Karabegovic et al., 2024) and increased reputation (Altay et al., 2020), further motivating such sharing.

The hypothesis that insight drives the cultural success of some products such as riddles and whodunits is not trivially true. Other features of these cultural products could explain their success: for riddles, the pleasure of solving a problem, with or without insight; for whodunits, the thrill of a crime story and its resolution, again with or without insight. Second, enjoyment is not a necessary condition for cultural success: some materials spread even though they are not pleasurable (rumors, negative news, etc.; see, e.g., Boyer & Parren, 2015). These two points combined suggest that, in the case of insight-generating products, their informational content, instead of the feelings of insight they evoke, could drive their success. Third, if feelings of insight evolved to motivate us to learn more about the world (Gopnik, 1998, see also Laukkonen, 2024), it is not clear why they should promote the consumption of materials that have, as a rule, no relevance to the real world, which tends to be the case for riddles and whodunits.

The Present Experiments

The goal of the present experiments is to empirically test the hypothesis that the feeling of insight drives the cultural success of riddles and of whodunits: not only that people want to consume riddles and whodunits because of the insight they generate, but that they also want to share these materials. To do so, we present participants with riddles (Experiments 1–3) or whodunits (Experiments 4 and 5) and ask them whether they would hypothetically like to consume more similar materials (willingness to consume) and whether they would share more similar materials (willingness to share), but also measure if they actually choose to consume more similar materials (actual consumption).

For both riddles and whodunits, in order to specifically study the role of insight, we compare material supposed to elicit insight (High Insight Condition) with material matched on relevant properties (e.g., convincingness for whodunits), but supposed to elicit less insight (Low Insight Condition). Note that we can only manipulate the probability of solving a problem through insight in a nondeterministic way as most problems can be, arguably, solved through insight or noninsight solutions (Webb et al., 2016). We chose to use riddles and whodunits as these are very popular forms of insight-generating stimuli, despite the availability of potentially better controlled stimuli like Compound Remote Associates (Bowden & Jung-Beeman, 2003, 2007). Unlike Compound Remote Associates, which are limited to laboratory settings and tend to evoke weaker feelings of insight (Webb et al., 2016, p. 4), riddles and whodunits offer more ecological validity.

In our experiments, for each of the three dependent variables (actual consumption, willingness to consume, and willingness to share), we tested two preregistered hypotheses. The first hypothesis compared the outcomes between the two conditions (High Insight vs. Low Insight Condition), and the second tested whether self-reported insight predicted the outcomes. In this, we use a standard and validated method in insight research (see, e.g., Bowden & Jung-Beeman, 2003; Chesebrough, Salvi, et al., 2024).

Hypothesis 1 (H1): Willingness to share.

Hypothesis 1.1 (H1.1): Participants in the High Insight Condition, compared to the Low Insight Condition, have a higher willingness to share problems.
Hypothesis 1.2 (H1.2): Participants' mean insight positively predicts their mean willingness to share.

Hypothesis 2 (H2): Actual consumption.

Hypothesis 2.1 (H2.1): Participants in the High Insight Condition, compared to the Low Insight Condition, are more likely to consume another problem.
Hypothesis 2.2 (H2.2): Participants' mean insight positively predicts their odds of consuming another problem.

Hypothesis 3 (H3): Willingness to consume.

Hypothesis 3.1 (H3.1): Participants in the High Insight Condition, compared to the Low Insight Condition, are more willing to consume other problems.
Hypothesis 3.2 (H3.2): Participants' mean insight positively predicts their mean willingness to consume other problems.

Note that H3.1 and H3.2 were only tested in Studies 3 and 5 when we added the measure of willingness to consume. Study 4 was conducted before Study 3 and did not include the measure. All studies (hypotheses, materials, analyses) were preregistered and approved by the Institutional Review Board of the research ethis committee Paris Descartes (2019-03-MERCIER). Sample sizes were determined by a priori power analyses which are included in the preregistrations. Data, preregistrations, materials, and analysis scripts can be found at https://osf.io/7qwt2/.

For the riddles studies, we had preregistered another hypothesis regarding the direct effect of insight for each problem instead of analyzing the effect of mean insight across the three riddles presented. First, for Studies 1–3 we preregistered that participants would be more willing to share a problem for which they had a higher insight. Second, for Study 3, we preregistered that, within each condition, participants would be more willing to consume a problem for which they had a higher insight. All hypotheses were validated, but we have

decided to report the results in Tables 2–5 and Section 3 in the online supplemental materials for concision.

Riddles Studies

Study 1

In Study 1, we test whether participants are more likely to want to share, and to actually consume, riddles by contrast with problems that can be solved in a stepwise manner.

Method

Participants. Two hundred and one participants were recruited. For all studies, participants were recruited through Prolific, they were located in the United States and informed consent was obtained. As preregistered, we excluded participants who did not understand the feeling of insight. Four participants were excluded, so 197 participants took part in the experiment (99 women, $M_{age} = 38.63$, $SD = 12.16$).

Design. The study had a between-participants design, with participants randomly distributed to a "High Insight Condition," in which they had to solve three riddles, or a "Low Insight Condition" in which they had to solve three noninsight problems (Table 1).

Procedure. First, we explained the concept of insight or "Aha experience" to the participants adapting the wording from Danek et al. (2013):

> We will present you with a series of brain teasers. For each, we would like to know whether you experienced a feeling of insight when you solve each task: A feeling of insight is a kind of "Aha!" characterized by suddenness and obviousness (and often relief!)—like a revelation. By contrast, you experienced no Aha! if the solution occurs to you slowly and stepwise. As an example, imagine a lightbulb that is switched on all at once in contrast to slowly dimming it up. We ask for your subjective rating whether it felt like an Aha! experience or not, there is no right or wrong answer. Just follow your intuition.

After reading the instructions, participants had to indicate if they understood that feeling. Participants were then invited to solve three problems, presented in a random order. For each problem, participants were first presented with the problem, and given an open text box to provide an answer, with no time constraints. Once they had answered (including by saying they could not find an answer), participants were provided with the correct answer and asked if they understood the solution. Then, for each problem, they were asked two questions to be answered on a scale from 1 to 7: to what extent they had experienced a feeling of insight, and how likely they were to share the problem with another person. Finally, after the three problems, participants were thanked for their participation in the study and offered the choice to either end the survey or see a new problem. We specified that they would not be compensated for seeing the additional problem (see the online supplemental materials for the exact wording of the questions).

Table 1
Examples of Materials, Study 1

Condition and example material
High Insight Condition
A man married 20 women in the town. He and the women are still alive, and he has had no divorces. He is not a bigamist and is not a Mormon and yet he broke no law. How is that possible? Answer: The man is a priest.
Low Insight Condition
Given a source of unlimited water and four containers of different capacities (99, 14, 25, and 11 L) obtain exactly 86 L of water. (L is the symbol for the Liter, a metric unit of volume equal to 0.26 gallons.) Answer: There are several answers. The easiest way is to pour the 25L containers into the 99L containers three times (75L), then add 11L with the corresponding containers.

Note. All materials for Study 1–3 can be found in the online supplemental materials.

Materials. Problems in the High Insight Condition were drawn from Bar-Hillel (2021). Based on the data from Ross (2021), we selected problems that were of medium difficulty (approximately 50% of correct answers) and that generated the highest insight. Problems in the Low Insight Condition were selected from Webb et al. (2017) and Karimi et al. (2007), in which they were used as a control for insight problems (Table 1).

Results and Discussion

All statistical analyses were conducted in R (V.4.1.1), using R Studio (V.1.4.1717). Average marginal effects for generalized linear models were obtained with the margins function from the "margins" package (Leeper, 2021). All the beta reported in this article have been standardized and reported standard errors are heteroskedasticity-robust. Table 2 presents the descriptive statistics of all riddles studies (1–3).

Manipulation Check. The Low Insight Condition ($M = 2.9$, $SD = 1.37$) yields a significantly lower mean rating of insightfulness than the High Insight Condition ($M = 4.2$, $SD = 1.46$), Welch's $t(193.7) = -6.4$, $p < .0001$, 95% confidence interval (CI) $[-1.7, -0.9]$, $d = -0.92$.

Confirmatory Analyses. All models included three controls that were identified as possible confounders: the mean time spent solving the problems (in log), the number of problems successfully solved, and the number of times participants did not understand the solutions they were given. The last control was not preregistered but after seeing that some participants did not understand the solution, we added it as a control since these participants' feelings of insight did not track their understanding of the solution. The results were not significantly altered by this addition (see Tables 6–34 in the online supplemental materials for detailed regression tables for all studies).

In line with H1.1, being in the High Insight Condition (compared to the Low Insight Condition) leads to a significant increase in the mean ratings of willingness to share, $\beta = .56$, $t(188) = 3.7$, $p < .0001$. In line with H1.2, the mean insight rating (by participant, across the three problems) is significantly and positively related to the mean willingness to share the problems, $\beta = .61$, $t(188) = 10.5$, $p < .0001$.

Next, we conducted two probit regressions. In line with H2.1, being in the High Insight Condition significantly increased the probability of seeing one more problem by 25% ($\beta = .75$, $p < .001$). However, we found no statistically significant effect of the mean insight rating (by participant) on the probability of consuming one

Table 2
Descriptive Statistics of Riddles Studies (Studies 1, 2, and 3)

Study	Condition	Mean insight	Mean sharing	Correct answers (%)	Consumption extra riddle (%)	Mean declared consumption
1	High insight	4.21	4.06	43	45	NA
	Low insight	2.90	3.08	28	24	NA
2	High insight	4.02	3.67	44	43	NA
	Low insight	2.89	2.51	55	27	NA
3	High insight	4.34	4.37	45	54	5.14
	Low insight	3.41	3.08	35	50.4	4.47

Note. NA = not applicable.

more problem, although the direction of the effect is consistent with H2.2 ($\beta = .11$, $p = .28$).

Discussion. In Study 1, participants were more likely to say they would share, and to actually consume additional riddles (High Insight) rather than step-by-step problems (Low Insight) although the insight ratings did not predict the likelihood of consuming more problems. However, it is possible that other aspects of the riddles, such as their social content (see, Mesoudi, 2016) or higher solution rates (43% vs. 28%), might have influenced these results.

Study 2

Study 2 addresses potential confounds of Study 1 (different contents and solution rate) by creating novel control stimuli for the Low Insight condition. Based on the representational change theory (Knoblich et al., 2001), we modified riddles from the High Insight Condition and removed the need of restructuring one's representation to find the solution. Thus, stimuli of the Low Insight condition had similar content and difficulty but should have a lower probability of generating insight.

Method

Participants. Two hundred and one participants were recruited, four were excluded, for a final sample of 197 (97 women, $M_{age} = 36.91$, $SD = 13.07$).

Design and Procedure. Identical to Study 1.

Materials. The stimuli of the High Insight Condition were those of Study 1, while those of the Low Insight Condition were versions aimed at reducing insightful problem-solving. For instance: "A man in town married 20 women in the town. He and the women are still alive, and he has had no divorces. How is that possible? Answer: The man is a polygamist or a priest" (see the online supplemental materials for the other problems).

Results and Discussion

Manipulation Check. The Low Insight Condition ($M = 2.9$, $SD = 1.37$) yields a significantly lower mean rating of insightfulness than the High Insight Condition ($M = 4$, $SD = 1.46$), Welch's $t(189) = -5.2$, $p < .0001$, 95% CI [−1.55, −0.7], $d = -0.75$.

Confirmatory Analyses. All models include the same three controls as Study 1.

Confirming H1.1 and H1.2, being in the High Insight Condition, $\beta = .59$, $t(190) = 4.2$, $p < .0001$, and an increase in insight ratings, $\beta = .66$, $t(190) = 11.7$, $p < .0001$, significantly increased the average willingness to share riddles.

In line with H2.1, being in the High Insight Condition significantly increased the probability to see one more problem by 14% ($\beta = .41$, $p < .05$). However, regarding H2.2, we still found no effect of the reported insight on consumption ($\beta = .14$, $p = .15$).

Discussion. The manipulation check confirmed that the problems of the Low Insight Condition generated less insight. The results replicate those of the first study. In both studies, participants were consistently more likely to want to share High Insight problems. By contrast, the effects of insight on the consumption of an extra problem were smaller, and more ambiguous, since rated insight did not significantly predict consumption (although the effects were in the predicted direction). Differences between the type of materials people like to consume, and the materials people like to share, have been shown in some studies (e.g., Bright, 2016). However, in our studies, the difference between sharing and consuming could be influenced by the measurement methods—self-reported willingness versus actual behavior.

Study 3

Study 3 aims to address the question of whether the difference between participant's willingness to share and their actual consumption is due to measurement methods (self-reported vs. behavioral), or to a genuine difference in people's willingness to consume versus share insight-generating materials. To do so, Study 3 replicates Study 2, with the addition of a self-reported measure of willingness to consume.

Method

Participants. One hundred ninety-four participants were recruited, and none were excluded (95 women, $M_{age} = 41.55$, $SD = 14$).

Design, Procedure, and Materials. The design and procedure were identical to those of Study 2. The only difference was the addition of this question after participants had seen the solution to each problem: "To what extent are you interested in seeing one more brain teaser similar to the one you just saw?" (Answer on 7-point scale).

Results and Discussion

Manipulation Check. The Low Insight Condition ($M = 3.41$, $SD = 1.84$) yields a significantly lower mean rating of insightfulness

than the High Insight Condition ($M = 4.34$, $SD = 1.78$), Welch's $t(191) = -3.57$, $p < .001$, 95% CI [−1.44, −0.42], $d = -0.51$.

Confirmatory Analyses. All models include the same three controls as Study 1.

Replicating previous results, we found that being in the High Insight Condition, H1.1, $\beta = .62$, $t(185) = 4.51$, $p < .0001$, and an increase in insight ratings, H1.2, $\beta = .74$, $t(185) = 15$, $p < .0001$, significantly increased the average willingness to share the riddles.

Contrary to previous studies, H2.1 was not verified as we found no significant effect of being in the High Insight Condition in the probability to consume one more riddle ($\beta = .19$, $p = .32$), although the direction of the effect is consistent with those of Studies 1 and 2. By contrast, we found a significant effect of the reported insight on the probability to consume one more problem (H2.2, $\beta = .34$, $z = 3.41$, $p < .001$).

To test the hypotheses relative to declared willingness to consume, we ran two linear models including the same controls as before. In line with H3.1, we found that being in the High Insight Condition significantly predicted higher willingness to see a similar problem, $\beta = .31$, $t(185) = 2.21$, $p < .05$. In line with H3.2, an increase in the reported insight led to a significant increase in the willingness to consume a similar problem, $\beta = .56$, $t(189) = 9.75$, $p < .0001$.

Discussion. Study 3 replicates the pattern from Studies 1 and 2: participants are more likely to declare wanting to share High than Low Insight problems, and participants' self-reported insight significantly predicts how much they want to share a problem. Study 3 extends these results to a measure of willingness to consume, suggesting that the difference between sharing and consumption observed in Studies 1 and 2, with more robust effects of insight for the former, was due to a measurement difference between the two measures (one declarative, and one behavioral).

Whodunits Studies

The first three studies focused on riddles and supported the hypothesis that insight drives their cultural success. We now turn to another widely popular insight-generating cultural product: whodunits.

Study 4

This study tests whether participants are more likely to declare being willing to share a crime story with a High Insight resolution (whodunit) and whether they are more likely to want to read a new story similar to the one they've already read. To do so, we reproduce the design and procedures of the previous riddles studies and create controlled Low Insight versions of whodunits.

Method

Participants. Two hundred and eighty-one participants were recruited, one participant was excluded, for a final sample of 280 (139 women, $M_{age} = 38.52$, $SD = 14.03$).

Design. The study had a between-participants design, with participants randomly distributed to a "High Insight Condition" or a "Low Insight Condition." In both conditions, participants were asked to read one of the three detective stories. The beginning of the stories was common between the High and Low Insight Conditions but the resolution varied between a High Insight explanation and a Low Insight one.

Procedure. As in Study 1, we explained the concept of insight to the participants using a slightly modified version (see Section 1 in the online supplemental materials). Participants were then invited to read one story randomly assigned. Before seeing the conclusion they were instructed to "take some time to think about how the murder could have happened." Then, after reading the conclusion, we asked participants to report to what extent they experienced a feeling of insight, how convincing they found the resolution, and how likely they were to share the story and its resolution with other people. Participants were offered the choice to read one more story at the end, similar to the one they had already read.

Materials. We created three different short detective stories. These stories were inspired by fictional detective stories written by popular whodunit authors. The story called Cocktail was an adaptation of a popular detective mystery online, the story called Chocolate was inspired by *The Avenging Chance* written by Anthony Berkeley (1929). Finally, Nightmare was created from a short story by Agatha Christie entitled *The Dream* (1937).

For each story, two resolutions were written: one designed to elicit a high level of insight and the other a low level. The High Insight resolution focused on the modus operandi of the killer and mimicked a typical conclusion of a whodunit. The Low Insight resolution presented the revelation of the guilty party's identity based on new evidence introduced in the resolution, violating the rules of whodunits. In both resolutions, the identity of the murderer was the same, the length was similar, and they were pretested so that the Low Insight resolution would be as convincing as the High Insight resolution (see Table 3 and Section 1 in the online supplemental materials).

Results and Discussion

Linear mixed models and generalized linear mixed models were computed with the "lmerTest" package to obtain p values via Satterthwaite's degrees of freedom method (Kuznetsova et al., 2017). Table 4 presents the descriptive statistics of the two whodunits studies. Note that Study 4 was conducted before Study 3, and did not include the declarative measure of consumption.

Manipulation Check. The Low Insight Condition ($M = 3.26$, $SD = 1.72$) had a significantly lower mean rating of insightfulness than the High Insight Condition ($M = 4.32$, $SD = 1.72$), Welch's $t(277.95) = -5.2$, $p < .0001$, 95% CI [−1.47, −0.66], $d = -0.62$. We also conducted a nonpreregistered t test to ensure that the difference between the two conditions in convincingness was not significant ($p = .5$).

Confirmatory Analysis. Since participants only saw one study, we introduced a random intercept effect for the story when the reported insight was the main predictor (H1.2 and H2.2). Because the random effects of stories assume a normal distribution and the distribution was binomial by design (three stories were created to elicit high ratings of insight, the three others to elicit low ratings of insight), we estimated the effect of insight within each condition.

Table 3
Example of Short Whodunit Story: "The Cocktail"

Condition and example material
It's the beginning of a very hot summer, and Claire has just broken up with her boyfriend. They had been together for a very long time, and he took it really hard, becoming nearly abusive. To find a distraction, Claire invited Juliana, her best friend, to go out for drinks together. Juliana insisted on going to the blue lagoon, because they serve delicious, ice-cold cocktails here.
At the blue lagoon, they ordered one large drink to be shared between the two of them. The waiter brought up a small pitcher, put two straws in, and served it to the women. Juliana, as usual, finished her half of the drink very quickly. Claire, by contrast, nearly always sips her drink slowly, and this time was no exception, it was a good half hour later that she had finished the rest of the pitcher.
Shortly after she'd finished the drink, Claire started complaining of stomach pain. Julianna called an ambulance. Claire died one hour after arriving at the hospital, where the doctors said that she had been poisoned. Juliana also felt slightly sick, but nothing serious happened to her.
After the waiter had brought the drink to their table, no one had gone anywhere near them. On that evening, the bartender was the only one who had access to the drink preparation area, while the waiter was the only one to have access to the drinks after they had been prepared. Both the bartender and the waiter are natural suspects since they were both friends with Claire's ex-boyfriend, who was known to be very jealous and vindictive.
For the first couple of days, the police can't figure out what happened. A few days later, new information has come to light, and you read in a newspaper a journalist writing:
High insight resolution:
"Both the bartender and the waiter might have conspired with the ex-boyfriend to poison Claire. The poison is unlikely to have been in one of the straws, since they could not have known which straw Claire would use. However, Claire's ex-boyfriend knew that she typically slowly sips her drink, while her friend Juliana drinks very quickly. As a result, a way of poisoning Claire and not Juliana was to put poison in the ice, which would be slowly released in the water. This way, only Claire would be poisoned, and not Juliana. Since the bartender is the one who put the ice in the pitcher, it must be him who poisoned Claire."
Low insight resolution:
"The police found deleted text messages between the bartender and Claire's ex-boyfriend, in which they plotted her poisoning. Questioning relatives of the bartender and of Claire's ex-boyfriend confirmed that they were planning something against Claire. On several occasions, they talked about "taking care" by "any means" of Claire. The police profilers also established that Claire's ex-boyfriend was a manipulative person. The bartender is known by police services for previous cases of violence and harassment. Confronted with this evidence, the bartender confessed. It must be him who poisoned Claire."

Note. All materials for Study 4–5 can be found in the online supplemental materials.

Similarly to the previous study, for H1.1 and H2.1, we respectively use a linear model and a probit regression. As preregistered, all models included the mean time spent reading (in log) and how much participants were convinced by the story as controls (one preregistered control, about the frequency of detective fiction consumption, was accidentally omitted from the questionnaire).

In line with H1.1, being in the High Insight Condition (compared to the Low Insight Condition) leads to a significant increase in the willingness to share, $\beta = .29$, $t(276) = 2.95$, $p < .01$. In line with H1.2, the effect of insight on the willingness to share was significant within both the High Insight Condition, $\beta = .35$, $t(121) = 4.311$, $p < .0001$, and the Low Insight Condition, $\beta = .39$, $t(137) = 4.99$, $p < .0001$.

Testing for H2.1, we found no significant effect of being in the High Insight Condition on the probability to read another story ($\beta = -.04$, $p = .8$). The insightfulness of the story had no effect on the probability to see one more story either in the High Insight Condition ($\beta = -.1$, $p = .47$) or in the Low Insight Condition ($\beta = -.03$, $p = .81$).

Discussion. Study 4 shows that participants are more likely to declare wanting to share stories in the High Insight Condition, and stories they rate as having generated more insight. By contrast, neither the condition nor the differences in insight had a significant effect on the actual consumption of a new story. See the Meta-Analyses section for a discussion regarding the null effects of self-reported insight and the condition on the behavioral measure of consumption.

Study 5

Similar to Study 3 above, we test in Study 5 whether the difference between the willingness to share and the actual consumption is due to the hypothesis tested (sharing vs. consuming), or to the method (declarative vs. behavioral).

Method

Participants. Two hundred and eighty-one participants were recruited, and none were excluded (140 women, $M_{age} = 42.32$, $SD = 13.22$).

Design Procedure, and Materials. They are identical to Study 4, except that we added a question about declared willingness to consume, identical to Study 3. We also queried participant's familiarity with detective fiction at the outset: "How often do you read or watch detective fiction (like Hercule Poirot, Sherlock Holmes, etc.)?"

Results and Discussion

Manipulation Check. The Low Insight Condition ($M = 3.47$, $SD = 1.81$) yields significantly lower mean rating of insightfulness than the High Insight Condition ($M = 4.49$, $SD = 1.65$), Welch's $t(276.92) = -4.871$, $p < .001$, 95% CI $[-1.42, -0.60]$, $d = -0.58$.

Confirmatory Analyses. As preregistered, three controls were included in all models: time spent reading (in log), the convincingness of the resolution, and how much participants usually read detective stories. We added this last control because fans of detective stories might both prefer another High Insight story and rate it lower for insightfulness, due to their familiarity with the genre.

In line with H1.1, we found that being in the High Insight Condition significantly increased the willingness to share a similar problem, $\beta = .27$, $t(276) = 2.82$, $p < .01$. In line with H1.2, an increase in the rating of insightfulness of the story led to a significant increase in the willingness to share a story both in the High Insight Condition, $\beta = .36$, $t(135) = 4.71$, $p < .0001$, and in the Low Insight Condition, $\beta = .45$, $t(136) = 6.76$, $p < .0001$.

Testing for H2.1, we found no significant effect of the condition on the probability to consume a new story ($\beta = .07$, $p = .6$). We conducted two mixed-effects generalized linear model to test for H2.2 and found that the reported insight of the story was not predictive of the probability to see a new story neither in the High Insight Condition ($\beta = -.14$, $p = .3$), nor in the Low Insight Condition ($\beta = .16$, $p = .2$).

In line with H3.1, we found that being in the High Insight Condition significantly increased the reported willingness to see a

Table 4
Descriptive Statistics of Whodunits Studies (4 and 5)

Study	Condition	Mean insight	Mean sharing	Mean convincingness	Consumption extra whodunit (%)	Mean declared consumption
4	High insight	4.32	4.04	4.78	45	NA
	Low insight	3.26	3.46	4.67	46	NA
5	High insight	4.34	4.31	5.01	38	4.93
	Low insight	3.48	3.73	4.9	35	4.46

Note. NA = not applicable.

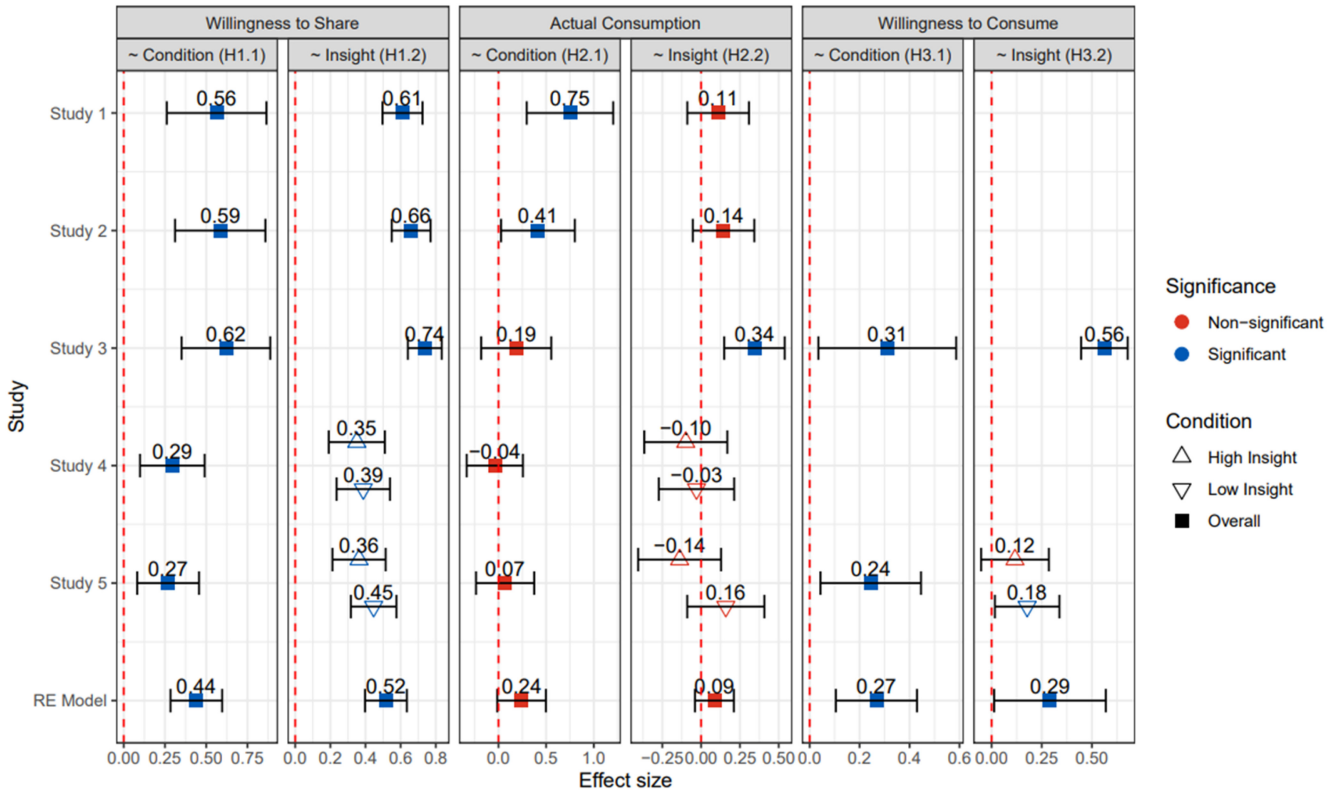
similar story, $\beta = .24$, $t(276) = 2.38$, $p < .05$. Regarding H3.2, the effect of insight on the reported willingness to see a story was not significant in the High Insight Condition, $\beta = .12$, $t(135) = 1.35$, $p = .2$, but it was significant in the Low Insight Condition, $\beta = .18$, $t(135) = 2.16$, $p < .05$.

Discussion. Study 5 replicates Studies 1–4 regarding the effect of both the condition and the reported insight on the willingness to share a particular story. It also replicates Study 3 regarding the lack of significant effect on the actual behavior of participants (see section Meta-Analyses for a discussion). However, we see a significant effect of the condition on the declared measure of consumption, as in Study 3. As for the precise role of insight, the effects are less clear as we see no significant effect within the High Insight Condition, but with an effect in the predicted direction, and a significant effect within the Low Insight Condition.

Meta-Analyses

Given that the hypotheses regarding actual consumption (H2.1 and H2.2) yielded mixed results, we aimed to synthesize the findings of the five studies. To achieve this, we used random-effects meta-analyses models with the "metafor" package (Viechtbauer, 2010). The random-effects model was chosen to account for potential variability in effect sizes across studies as we used different stimuli. This model combines the effect sizes from each study, weighting them by their precision (standard errors), to estimate an overall effect size for interpretation (see Figure 1, "random effect model").

Figure 1
Forest Plot of All Standardized Effects With Heteroskedasticity-Robust Standard Error



Note. "RE model" is the meta-analytical effect for each hypothesis. The error bars represent the 95% confidence interval around each effect. H = hypothesis; RE = random effect. See the online article for the color version of this figure.

The meta-analysis revealed that the willingness to share a problem was significantly predicted by the condition (H1.1, $\beta = .44 \pm .08$, $z = 5.44$, $p < .0001$, CI [0.28, 0.6]), and the reported insight (H1.2, $\beta = .48 \pm .057$, $z = 8.4$, $p < .0001$, CI [0.36, 0.59]). However, there was no significant effect of the condition (H2.1, $\beta = .24 \pm .13$, $z = 1.8$, $p = .07$, CI [−0.02, 0.50]), or the reported insight (H2.2, $\beta = .09 \pm .06$, $z = 1.41$, $p = .16$, CI [−0.03, 0.21]) on the probability of consuming a supplementary riddle or whodunit. By contrast, the meta-analysis revealed a significant effect of the condition (H3.1, $\beta = .27 \pm .08$, $z = 3.32$, $p < .001$, CI [0.11, 0.43]), and of the reported insight (H3.2, $\beta = .29 \pm .15$, $z = 2.01$, $p < .05$, CI [0.01, 0.58]) on the declared willingness to consume a supplementary riddle or whodunit.

The hypotheses evaluated using declarative measures were thus verified, whereas the hypotheses tested through the behavioral measure were not. We can also ask whether different patterns of results emerge when analyzing the riddles and whodunits studies independently. By splitting the analysis by problem type, we find a significant effect of insight on actual consumption for the riddles (H2.1, $\beta = .42 \pm .17$, $z = 2.5$, $p < .05$, CI [0.09, 0.76]; H2.2, $\beta = .20 \pm .07$, $z = 2.94$, $p < .01$, CI [0.065, 0.33]), but no effect for the whodunits (H2.1, $\beta = .01 \pm .11$, $z = 0.1$, $p = .92$, CI [−0.2, 0.22]; H2.2, $\beta = -.02 \pm .07$, $z = -0.3$, $p = .75$, CI [−0.15, 0.10]). The lack of a significant difference in the behavioral measure for whodunit stories, as well as the weaker effect for riddles, might be attributed to the inherent noisiness of behavioral consumption metrics which are influenced not only by features of the problem but also by contextual factors (e.g., the participant may be in a hurry). As a result, the effect of insight on the behavioral measure is bound to be reduced, compared to its effect on the declarative measures. Regarding the null effect for the whodunit stories, it might be that in the process of creating controlled stimuli (Low Insight resolution), we created stories that participants also found appealing. Participants appear to enjoy reading about crime and about criminals getting caught, even if they are not caught in a particularly insightful manner. For instance, participants seeking sensation (Clasen et al., 2020) or curious about morbid outcomes (Scrivner, 2021) are attracted to crime and horror fictions. This is supported by the relatively high percentage of participants who choose to read an additional, unpaid, crime story in the Low Insight Condition ($M = 40.5\%$; see Table 4). It is thus possible that we faced a ceiling effect, with most of the participants who had extra time available being willing to read another story, whether it was high or low insight.

Very few people find the solution on their own when faced with a whodunit and the answers to riddles also often remain elusive. If insight drives the success of these cultural products, it is important that it should also be felt when the solution is provided, and not found. In line with this, in the present studies, participants are asked to report their feelings of insight after they have been provided with the correct solution, contrary to most previous studies which ask to do so participants before providing them with the solution (e.g., Danek & Kizilirmak, 2021). As an exploratory research question, we estimated the relation between the resolution of a problem and its reported insight, controlling for the ability of participants (the number of riddles they solved apart from the one being examined), and the time spent on the problem (using linear mixed models, on Studies 1–3). We included a random intercept and random slope for the participant and a random intercept for the specific riddle (see Tables 35–41 in the online supplemental materials). Meta-analyses show that, for insight problems, solving the problem oneself ($M_{insight} = 3.64$, $SD = 1.93$), by contrast with being provided with the solution without having solved it ($M_{insight} = 4.63$, $SD = 1.95$), was associated with significantly lower insight ($\beta = -.42 \pm .07$, $z = -5.92$, $p < .0001$, CI [−0.55, −0.28]). This relation was absent in non-insight problems ($\beta = .06 \pm .10$, $z = 0.61$, $p = .54$, CI [−0.13, 0.25]).

Conclusion

Riddles are found in many unrelated cultures, and they persist for centuries in oral cultures. Whodunit is a popular genre, having fueled the success of the best-selling author in the world. We suggest that the popularity of both of these cultural products is due to the feelings of insight that they generate, feelings which would motivate people both to want to share the materials (by retelling the riddles, or suggesting whodunits to other potential readers), and to consume more of them.

To test the impact of feelings of insight on the cultural success of riddles and whodunits, we conducted five studies in which participants were given riddles (Studies 1–3) or short whodunits stories (Studies 4 and 5). In each case, stimuli designed to generate a feeling of insight (stumpers, stories with typical whodunit-like resolutions) were contrasted with other stimuli with a lower probability to generate feelings of insight (e.g., problems that can be solved in a stepwise manner or stories whose resolutions require new information). As shown by a meta-analysis of the five studies, participants consistently declared wanting to share, and to consume more of, the materials that had generated more insight. Participants were also given the option to consume one extra problem without being compensated. Participants were more likely to want to consume more of the insight-generating riddles, compared to other problems, but not more of the whodunits, compared to a crime story with a noninsightful resolution.

These studies contribute to a growing literature in which the cultural success of fictional stories is explained by their ability to tap into specific cognitive mechanisms (for a review, Dubourg et al., 2024). For instance, studies have been done on particular features of fiction such as horror (Clasen et al., 2020), drama (Nettle, 2005), imaginary worlds (Dubourg & Baumard, 2022), or sympathetic plot (Singh, 2021). The present experiments are the first, to the best of our knowledge, to investigate the role of a metacognitive feeling in cultural transmission. Our study draws attention to the fact that people seem to not only enjoy consuming insightful materials but are also keen on sharing them with others. This sharing step cannot be taken for granted: for some stimuli (such as news), there can be no relationship between the type of stimuli people like to consume, and those they share with others (Bright, 2016). This point is crucial from a cultural transmission point of view, as absent this motivation, some insight-generating products such as riddles could never have spread (we also note that the different phases of transmission have to be studied in their own right, and have different effects on cultural transmission, see Stubbersfield, 2022). This raises the question of why people seem so keen on sharing insight-generating stimuli, a question which cognitive science has not, to the best of our knowledge, addressed. As mentioned in the introduction, this motivation might be related to impression management, as participants seek to show that they understood and appreciated the cleverness of the whodunit resolution (see, Altay et al., 2020). This interpretation is bolstered by the fact that the strongest effects were observed on the declared willingness to share.

The current experiments bring some methodological innovations to the study of insight. First, as noted above, we developed new stimuli—whodunit stories—and controls for the experimental study of insight (for previous studies using stumpers without such a control condition, see, Ross, 2021). These stimuli are arguably more ecologically valid (given their cultural prevalence) than the standard Compound Remote Associate Tasks (Bowden & Jung-Beeman, 2003) or anagrams (Ammalainen & Moroshkina, 2021; Metcalfe, 1986; Webb et al., 2018) that are commonly used in the study of insight problem-solving. Second, we introduce a behavioral measure that allows studying the impact of insight on motivation in an ecologically valid, but potentially noisier manner.

Finally, our results should be of interest for theories of insight. In the current studies, we pay attention to the insight felt by people after being provided with the solution, instead of only the insight felt by those who found the solution on their own (see, Webb et al., 2019). Arguably the former is a more common experience in everyday life, as others provide us with solutions to puzzles, we read whodunits, learn about scientific discoveries, and so forth. Our results indicate a pattern similar to that observed by Webb et al. (2019): when presented with the solution, participants who generated incorrect guesses report higher ratings of insight than those who had found the correct solution on their own (see the Meta-Analyses section). If that were not the case, it would be impossible to explain the cultural success of insight-generating materials, since many people (or most in the case of whodunits for instance) do not solve a problem themselves. We believe that this result is also important to metacognitive theories of insight. Dubey et al. (2021) propose that insight is generated by a metacognitive prediction error: people are positively rewarded when they solve a task faster than they expected. However, it is not clear how this metacognitive prediction error is computed when the solution is provided to the participant. This theory thus has to integrate the fact that people appear to feel at least as much insight when they do not solve the problems themselves. By contrast, the Eureka Heuristic theory (Laukkonen, 2024; Laukkonen et al., 2020, 2021, 2022, 2023) proposes that insight serves as a metacognitive heuristic that helps humans quickly determine which ideas are valuable given past learning. Our results are compatible with this theory. One possible interpretation is that when participants are not able to solve a problem, they may have a stronger insight as the solution resolves a more important uncertainty (Friston et al., 2017).

Our studies present several limitations. First, they were only conducted in a specific culture, which hampers our ability to generalize—although, as noted in the introduction, the actual success of riddles and whodunits appears to be very broadly cross-cultural. Second, we did not investigate a crucial step of transmission in the case of riddles (at least in purely oral cultures, but not only): memorization. Prior research shows that participants better remember solutions for problems they solved through insight (Danek & Wiley, 2020, 2024; Danek et al., 2013; Kizilirmak et al., 2016). Future studies could attempt to replicate our results in other cultures or with younger participants, given the observation that riddles can persist in children's cultures for centuries (Opie & Opie, 1959), and by testing people's ability to remember riddles that generate more or less insight. Third, although we controlled for the most relevant potential confounds (the same content was presented in riddles and whodunits, the convincingness of the resolution was matched for the whodunits), we cannot completely exclude that factors besides the differences in insight might account for the differences in outcome (although, given that measured insight was also a predictor of these outcomes, the confound would have to correlate with insight). Fourth, by explaining to participants what the feeling of insight is, we might have primed them to expect to feel insight, which might then have led them to be disappointed in the control conditions which might explain the less positive outcomes. We note, however, that participants did not feel overly negatively toward Low Insight stimuli either, since nearly half of them consumed an extra Low Insight crime story.

As noted in the introduction, past research has stressed the importance of insight in scientific discovery (conversely, the success of conspiracy theories might also be explained in part by the feelings of insight they generate, see, Van de Cruys et al., 2024). What our findings suggest is that learning about others' discoveries could also generate a strong feeling of insight. Besides changes of mind about specific issues, whole scientific vocations might also be attributed to a feeling of insight triggered not by one's own discoveries, but by reading insightful materials. For instance, several important intellectuals, from Hobbes to Einstein, reported that their first encounter with Euclid's elements, and the insight that his mathematical proofs presumably generated, played a significant role in triggering their interest in scientific demonstrations (Isaacson, 2008; Shapin & Schaffer, 1985). Our understanding of learning could also be advanced by taking into account the feelings of insight that some pedagogical materials generate (Barot et al., 2024; Jirout et al., 2018), or on the contrary, fail to generate. More broadly, understanding the mechanisms of insight is relevant for comprehending how writers create compelling and engaging stories.

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