



Universiteit
Leiden
The Netherlands

Deprivation and discovery motives determine how it feels to be curious

Noordewier, M.K.; Dijk, E. van

Citation

Noordewier, M. K., & Dijk, E. van. (2020). Deprivation and discovery motives determine how it feels to be curious. *Current Opinion In Behavioral Sciences*, 35, 71-76.
doi:10.1016/j.cobeha.2020.07.017

Version: Publisher's Version

License: [Creative Commons CC BY 4.0 license](#)

Downloaded from: <https://hdl.handle.net/1887/3133357>

Note: To cite this publication please use the final published version (if applicable).



Deprivation and discovery motives determine how it feels to be curious

Marret K Noordewier and Eric van Dijk

Curiosity is evoked when people experience an information-gap between what they know and what they do not (yet) know. Curious people are motivated to find the information they are missing. This motivation has different components: People want to reduce the uncertainty of not knowing something (deprivation motive) and they want to discover new information to expand their knowledge (discovery motive). We discuss recent research that shows that the affective experience of curiosity is the result of the relative strength of the deprivation and discovery motives. This, in turn, is contingent on individual differences, anticipated features of the actual target, and features of the information-gap.

Address

Leiden University, The Netherlands

Corresponding author:

Noordewier, Marret K (m.k.noordewier@fsw.leidenuniv.nl)

Current Opinion in Behavioral Sciences 2020, 35:71–76

This review comes from a themed issue on **Curiosity (Explore versus Exploit)**

Edited by **Daphna Shohamy** and **Ran Hassin**

<https://doi.org/10.1016/j.cobeha.2020.07.017>

2352-1546/© 2020 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Introduction

Curiosity is triggered when people are confronted with an information-gap—a gap between what one currently knows and what one wants to know [1–3,4[•],5,6]. This can occur in many situations, ranging from specific gaps following teasers, gambles, or questions [2,6–9], to more wide-ranging or diversive gaps following intellectual challenges or when exploring the surface materials on Mars [4[•],5,10]. Cognitive incongruity can also be considered an information-gap, as on a more meta-level it is a gap between incongruity and the desired state of congruency [5]. This means that unfamiliar or unusual stimuli can result in curiosity toward (unknown) information that explains how this fits with one's current knowledge [11,12]¹.

Curiosity is characterized by a powerful motivation to find currently missing information. This motivation has different components: On the one hand, people may be motivated to reduce the uncertainty of not completely knowing something (i.e. end knowledge deprivation). On the other hand, people can be motivated to discover new information to expand their knowledge (i.e. anticipate new knowledge [4[•],5,9,13[•],14[•],15[•],16]). The former motive may be seen as related to closing an information-gap; the latter motivate is more focused at opening up one's information repertoire. Differentiating between these motives is important, as their relative strength affects how it feels to be curious. This distinction may first of all contribute to the debate of whether (and when) curiosity is a pleasant state or not; and whether affect should be included in the definition of curiosity [4[•],5]. Moreover, it helps to explain individual and situational differences in pleasure and voluntary exposure to curiosity.

In the following, we discuss recent research that supports the notion that how it feels to be curious depends on whether people have a *deprivation* or *discovery* motive. More specifically, this review shows that the subjective experience of curiosity depends on a) individual differences, b) anticipated features of the actual target, and c) features of the information-gap—which all can influence the relative importance of one motivation over the other.

The individual: who is curious?

Curiosity is the result of an information-gap, but this information-gap may be perceived very differently depending on individual differences: For some, not knowing something is an exciting trigger to discover new things; for others this same information-gap can be a more uncomfortable sign of deprivation, as one realizes that the world is not completely known or understood [1,18,19].

Openness and need for structure

Recent research for instance shows that the enjoyment of unusual or unknown stimuli depends on individual differences in openness to experience and need for structure. Higher openness and lower need for structure predicted preferences for schema-violating images—like an Inuit in the desert or a hipster on the moon [12,20].

¹ Note that this could also involve interest. For a relevant reflection on whether and how it is possible to differentiate between curiosity and curiosity see Refs. [4[•],5].

Similarly, when asked to explore complex stimuli like art, philosophical quotations, or complex problem-solving tasks, high openness participants reported interest while also being confused. In contrast, low openness participants were less likely to associate confusion with interest [11]. Thus, complex, unusual, or unknown stimuli are more appreciated by those who are open to the experience of not knowing something, relative to those who prefer clarity and structure [12].

Deprivation versus interest in trait curiosity

These findings mimic trait curiosity scales that differentiate between curiosity as *feeling interested* versus curiosity as *feeling deprived* [1,19,21,22,26]. Particularly relevant is the recent five-dimensional curiosity scale (5DC), which incorporates the factors joyous exploration, thrill seeking, deprivation sensitivity, stress tolerance, and social curiosity [24*,25]. Corroborating the idea that people differ in how they perceive lack of information, studies [24*] showed that people who scored high on joyous exploration and stress tolerance also reported relatively high motivation for new knowledge (e.g. stretching, openness, flexibility). Thrill seeking was better described by a motivation for the pleasure and adventure of the unknown (e.g. it correlated with sensation seeking and embracing novelty). These findings fit with the notion that information-gaps can motivate (some) people to explore.

Results [24*] also revealed that people high in deprivation sensitivity scored quite differently. They seemed more motivated to reduce the tension of not knowing something (e.g. it correlated with need for closure and anxiety). These results fit with the notion that information-gaps can motivate (some) people to reduce the uncertainty. Importantly, these differential perceptions may determine the affective experience of curiosity. It seems more pleasant to be a joyous exploration type that has high stress tolerance than to be an individual that is sensitive to deprivation [24*].

Trait curiosity and well-being

These dispositional tendencies and experiential correlates can also translate into more general well-being effects. The positive relation between trait curiosity and happiness/well-being is well-established [23,27,28]. It is explained by a higher probability of pleasurable and meaningful moments in life [23] and higher openness to things that are unknown or difficult to understand—for instance, when viewing art [29], acquiring reading and math competence [30], engaging with contradictory political information [31], or dealing with rejection [32]. While these studies do not typically focus on the affective experience of curiosity per se, they show that a curious disposition is a positive predictor of positive feelings. Interestingly, this curiosity-happiness link seems more likely among those who can enjoy lack of information without feeling stressed and deprived [24*, but see

Ref. 33]. A tentative conclusion might be that differential affective experiences also connect to the underlying motivations we distinguished, such that (individual differences in) discovery motivation might be more connected to positive feelings than (individual differences in) deprivation motivation.

In sum, depending on individual differences, an information-gap can either be associated with the joy and/or thrill of discovery, while it can also be an uncomfortable deprived feeling that one's knowledge of the world is incomplete.

The target: curious about what?

In addition to the impact of individual differences on how it feels to be curious, it also seems to matter what people are curious about (the target). While curious people lack definite information about the exact information that is missing, they often have some clues and ideas about what it might be. This can range from very concrete information about possible outcomes (e.g. the prize they might win in a lottery) to more general ideas about the valence or value of information (e.g. whether it will be nice or useful). In addition to the expected reward of closing the information-gap [2,4*,5,7,9], these valence and value anticipations are likely to influence affect.

Anticipated valence and value

People can for instance be curious about positive things like the answer to fun questions [7], the meaning of art [11], or a possible positive turn of events [34]. They can also be curious about stimuli that they know will be negative, like checking a 'sealed box' for awful noises or electric shocks [35], choosing to see morbid images showing death or harm [36,37], or deciding to know something that people are better off without [38].

In general, people are more curious about outcomes with high value [7,13*], which can also be connected to valence. Anticipating the discovery of positive outcomes is likely to make curiosity feel good. For instance, when participants were curious about a prize that they won in a lucky draw (versus knowing the exact prize immediately) they experienced more pleasure, particularly when they could look forward to and fantasize about positive prospects (i.e. high imagery [34]; for positive uncertainty effects in advertising, see Ref. [39]). To savor this positive feeling, people may even postpone its resolution. Such savoring-delays of resolution have been described as 'deliberate ignorance', which for positive outcomes may be preferred to maintain surprise and suspense [40].

In contrast, anticipating the discovery of negative outcomes may be associated with worry about the possible negative impact of the resolution. For instance, when people are curious to uncover morbid materials [36], they are likely to also feel uncomfortable because of the impact

this material may have. We do not know of studies directly testing this, but stimuli used in morbid curiosity research are very similar to those used to trigger negative affect or emotions like fear [36,41]. Anticipating the discovery of such materials may then resemble negative feelings as found in the context of awaiting bad news [42] or anticipating a negative consumer experience [43].

While curiosity about positive outcomes will generally feel more positive, this does not mean that curiosity about negative things will always feel bad. When people perceive value in the discovery of this information, curiosity may become associated with positive feelings. For instance, when people are looking for a possible thrill or a disruption from boredom, anticipating negative materials may be exciting [24*,44]. Moreover, disturbing art can be enjoyed when people can distance themselves from it and embrace it [45]. Finally, people are not only motivated to feel good; they can also be motivated to form accurate beliefs [14*,17,46]. The discovery of new (negative) information may give people a better representation of their environment and for these reasons, people might appreciate it (for predictive coding connections, see Refs. [47–49]; for a more elaborate discussion on motives underlying curiosity for negativity, see Ref. [50]). This perceived value of negative information can also explain when and why curiosity can outweigh avoidance motivation [13*,40,51,52].

In sum, affective underpinnings of curiosity are not only determined by the expected reward of ending deprivation but also by the anticipated valence and value of the actual content. Expectancies about how the resolution will impact people and what this means to them can make curiosity less or more pleasant.

The information-gap: what is missing and how long will it last?

Even if individual differences and outcome anticipations would be held constant, features of the information-gap can also affect the relative strength of deprivation versus discovery motives. Relevant in this context are the specificity and size of the information-gap [1,4*,54] and the time it takes to close it [15*].

Specificity of information-gap

First, the distinction between deprivation and discovery can be connected to specific and diversive curiosity ([53]; see also information sampling versus search [54]). Specific curiosity means that people have a clear information-gap, (e.g. not knowing the contents of a box [55]) and finding the missing information would resolve this curiosity. Diversive curiosity refers to exploring for the sake of exploration (e.g. wandering an unknown city) and involves a more generic motivation, where people discover information without a specific end-point in mind. In these contexts, people may be more likely to focus on rather undefined discovery and as a result, appreciate

each new piece of information they encounter. With specific curiosity, however, it is more likely that people focus on the missing information. In accordance with this, we would predict that people enjoy diversive information-gaps more than specific information-gaps. This also fits with scholars who connect diversive curiosity to fascination with learning new information and specific curiosity to more deprivation-focused curiosity [56].

Size of information-gap

Similarly, the amount of information that people have versus the amount they miss seems to impact the relative focus on deprivation or discovery. Studies show that smaller information-gaps (i.e. having more information) result in more curiosity [1–3]. Information-gap theory argues that a small (versus big) information-gap makes people feel close to closing the gap, which intensifies the focus on what is missing (like a focus on missing pieces in a jigsaw puzzle, when the puzzle is near to completion; [2]). A small (versus big) information-gap is therefore predicted to increase the relative impact of deprivation (versus discovery) feelings.

In line with this, a study presented participants with questions after which they could rate whether the answer was ‘at the tip of their tongue’ (TOT) or whether they did not know (representing a small versus big information-gap; [57]). Results showed correlations between curiosity as deprivation and ratings of TOT-states and between curiosity as interest and ‘I don’t know’ states [57]. Note, however, that this TOT-effect has recently also been connected to positive feelings [58], which is explained by the fact that TOT-states are associated by ‘feeling warm’ or close to the discovery of the new information. Future research should establish the exact relations between information-gap size and affective consequences, but these findings indirectly support that a focus on deprivation is less pleasant than a focus on discovery.

When to close the information-gap

Finally, often people need to wait until they can resolve their curiosity—like waiting for the outcome of a lottery [52] or when a new product is ‘coming soon’ [8]. Studies show that the longer it takes to close the information-gap, the more people focus on deprivation [15*]. Specifically, participants who were made curious about the contents of a video but did not expect to close their information-gap soon, reported less positive affect, more discomfort, and more annoyance with lacking information. When they thought they could close their information-gap quickly, they had a stronger anticipation of the resolution and felt better. This suggests that the temporal proximity of the resolution strengthens the focus on discovery, making curiosity feel better. Interestingly, these findings may also connect to those obtained in studies that manipulated a time-gap between taking a test and possibly learning the outcome: No affective measures were included, but

participants were more curious immediately after the test than after a more extended period [59], which was explained in terms of greater salience of information.

In sum, the size and specificity of the information-gap and the time it takes to resolve it impacts the strength of deprivation versus discovery motives. The smaller and more specific the information-gap and then longer it lasts, the more likely it is that people feel deprived, and the more unpleasant curiosity gets.

Conclusion

Curiosity feels very different depending on whether people focus on the uncertainty of not knowing something (deprivation motive) or the possibility of attaining new knowledge (discovery motive). A focus on deprivation is less pleasant than a focus on discovery and the relative importance of these components depends on individual differences and features of the target and the information-gap. Specifically, an information-gap is an enjoyable trigger to discover for some, but a more uncomfortable sign of deprivation for others. In addition, anticipating positive and valuable information makes curiosity feel good, but the more people focus on the information-gap (because it is small, specific, and it takes a while to resolve), the more unpleasant curiosity gets. Thus, the experience of an information-gap is the core of curiosity and the relative strength of deprivation and discovery motives underlie the affective experience of curiosity. This implies that both motives are likely to be part of the experience of curiosity, but which one dominates is determined by features of the individual, the target, and the information-gap.

Taken together, this review highlights the relevance of incorporating affect as a dimension of curiosity [4*,5], as it showed that affective components systematically vary depending on deprivation versus discovery motives. Future research could more systematically incorporate these motivational components, to uncover predictors of (continuous) enjoyment of curiosity. Moreover, it would be interesting to study combinations of features of the individual, the target, or the information-gap: For example, anticipating negative outcomes may feel particularly uneasy to those who see curiosity as deprivation; and a more diversive information-gap could be extra enjoyed when it takes a while to resolve.

Conflict of interest statement

Nothing declared.

References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

- of special interest

1. Litman JA: **Curiosity and the pleasures of learning: wanting and liking new information.** *Cognit Emot* 2005, **19**:793-814 <http://dx.doi.org/10.1080/02699930541000101>.

2. Loewenstein G: **The psychology of curiosity: a review and reinterpretation.** *Psychol Bull* 1994, **116**:75-98 <http://dx.doi.org/10.1037/0033-2909.116.1.75>.
3. Kidd C, Hayden BY: **The psychology and neuroscience of curiosity.** *Neuron* 2015, **88**:449-460 <http://dx.doi.org/10.1016/j.neuron.2015.09.010>.
4. Murayama K, FitzGibbon L, Sakaki M: **Process account of curiosity and interest: a reward-learning perspective.** *Educ Psychol Rev* 2019, **31**:875-895 <http://dx.doi.org/10.1007/s10648-019-09499-9>.
The authors present a process account on curiosity and interest. They argue that it is important to focus on the reward associated with knowledge acquisition. This reward reinforces the value of further information, which strengthens further information-seeking behavior. The authors connect this model to educational psychology.
5. Pekrun R: **The murky distinction between curiosity and interest: state of the art and future prospects.** *Educ Psychol Rev* 2019, **31**:905-914 <http://dx.doi.org/10.1007/s10648-019-09512-1>.
6. Silvia PJ, Kashdan TB: **Interesting things and curious people: exploration and engagement as transient states and enduring strengths.** *Soc Personal Psychol Comp* 2009, **3**:785-797.
7. Marvin CB, Shohamy D: **Curiosity and reward: valence predicts choice and information prediction errors enhance learning.** *J Exp Psychol Gen* 2016, **145**:266-272 <http://dx.doi.org/10.1037/xge0000140>.
8. Ruan B, Hsee CK, Lu ZY: **The teasing effect: an underappreciated benefit of creating and resolving an uncertainty.** *J Mark Res* 2018, **55**:556-570 <http://dx.doi.org/10.1509/jmr.15.0346>.
9. Van Lieshout LL, Vandenbroucke AR, Müller NC, Cools R, de Lange FP: **Induction and relief of curiosity elicit parietal and frontal activity.** *J Neurosci* 2018, **38**:2579-2588 <http://dx.doi.org/10.1523/JNEUROSCI.2816-17.2018>.
10. Grotzinger JP: **Analysis of surface materials by the curiosity Mars rover.** *Science* 2013, **341** <http://dx.doi.org/10.1126/science.1244258> 1475-1475.
11. Fayn K, Silvia PJ, Dejonckheere E, Verdonck S, Kuppens P: **Confused or curious? Openness/intellect predicts more positive interest-confusion relations.** *J Personal Soc Psychol* 2019, **117**:1016-1033 <http://dx.doi.org/10.1037/pspp0000257>.
12. Gocłowska M, Baas M, Elliot AJ, De Dreu CKW: **Why schema-violations are sometimes preferable to schema-consistencies: the role of interest and openness to experience.** *J Res Personal* 2017, **66**:54-69 <http://dx.doi.org/10.1016/j.jrp.2016.12.005>.
13. Golman R, Loewenstein G: **Information gaps: a theory of preferences regarding the presence and absence of information.** *Decision* 2018, **5**:143-164 <http://dx.doi.org/10.1037/dec0000068>.
The authors use expected utility theory to identify predictors of acquiring or avoiding information. They differentiate between the information-gap and information, and identify curiosity as the motivation to close an information-gap to lower uncertainty. The anticipated valence information drives acquisition versus avoidance choices, where people have a general preference for pleasurable over painful.
14. Kobayashi, Ravaioli S, Baranes A, Woodford M, Gottlieb J: **Diverse motives for human curiosity.** *Nat Hum Behav* 2019, **3**:1-11 <http://dx.doi.org/10.1038/s41562-019-0589-3>.
The authors focus on different motives that underlie curiosity and show variation in curiosity about probabilistic events, depending on the uncertainty of the outcome versus the value of the outcome. Following this, they argue that in addition to the expected reward of resolving curiosity, the anticipated utility of the outcome is an important determinant of curiosity.
15. Noordewier MK, van Dijk E: **Curiosity and time: from not knowing to almost knowing.** *Cognit Emot* 2017:1-11 <http://dx.doi.org/10.1080/02699931.2015.1122577>.
The authors show that curiosity feels different, depending on the temporal proximity of the resolution: When people cannot close their information-gap soon, they feel more uncomfortable because of a stronger focus on lacking information, whereas when they can close their information-gap

soon, they focus more on acquiring information and they feel more positive.

16. Oudeyer P-Y, Gottlieb J, Lopes M: **Intrinsic motivation, curiosity, and learning: theory and applications in educational technologies.** *Prog Brain Res* 2016, **229**:257-284 <http://dx.doi.org/10.1016/bs.pbr.2016.05.005>.
 17. van Lieshout LLF, de Lange FP, Cools R: **Motives underlying human curiosity.** *Nat Hum Behav* 2019, **3**:550-551 <http://dx.doi.org/10.1038/s41562-019-0565-y>.
 18. Kashdan TB, Silvia PJ: **Curiosity and interest: the benefits of thriving on novelty and challenge.** In *Handbook of Positive Psychology*, edn 2. Edited by Snyder CR, Lopez SJ. New York, NY: Oxford University Press; 2009:367-374.
 19. Litman JA: **Interest and deprivation dimensions of epistemic curiosity.** *Personal Individ Differ* 2008, **44**:1585-1595 http://dx.doi.org/10.1007/978-1-4419-1428-6_1645.
 20. Gocłowska MA, Baas M, Crisp RJ, De Dreu CKW: **Whether social schema violations help or hurt creativity depends on need for structure.** *Personal Soc Psychol Bull* 2014, **40**:959-971 <http://dx.doi.org/10.1177/0146167214533132>.
 21. Kashdan TB, Gallagher MW, Silvia PJ, Winterstein BP, Breen WE, Terhar D, Steger MF: **The curiosity and exploration inventory-II: development, factor structure, and psychometrics.** *J Res Personal* 2009, **43**:987-998 <http://dx.doi.org/10.1016/j.jrp.2009.04.011>.
 22. Mahmoodzadeh M, Khajavy GH: **Towards conceptualizing language learning curiosity in SLA: an empirical study.** *J Psycholinguist Res* 2018, **48**:333-351 <http://dx.doi.org/10.1007/s10936-018-9606-3>.
 23. Kashdan TB, Sherman RA, Yarbro J, Funder DC: **How are curious people viewed and how do they behave in social situations? From the perspectives of self, friends, parents, and unacquainted observers.** *J Personal* 2013, **81**:142-154 <http://dx.doi.org/10.1037/a0021786>.
 24. Kashdan TB, Stikma MC, Disabato DJ, McKnight PE, Bekier J, Kaji J, Lazarus R: **The five-dimensional curiosity scale: capturing the bandwidth of curiosity and identifying four unique subgroups of curious people.** *J Res Personal* 2018, **73**:130-149 <http://dx.doi.org/10.1016/j.jrp.2017.11.011>.
- The authors developed a new curiosity scale that differentiates between five distinct factors: Joyous exploration, deprivation sensitivity, stress tolerance, social curiosity, and thrill seeking. These factors systematically relate to personality, emotion, and well-being measures and the scale can be used to describe different types of curious people—for instance those who are fascinated by new knowledge versus those who rather avoid it.
25. Birenbaum M, Alhija FN-A, Shilton H, Kimron H, Rosanski R, Shahor N: **A further look at the five-dimensional curiosity construct.** *Personal Individ Differ* 2019, **149**:57-65 <http://dx.doi.org/10.1016/j.paid.2019.05.038>.
 26. Powell C, Nettelbeck T, Burns NR: **Deconstructing intellectual curiosity.** *Personal Individ Differ* 2016, **95**:147-151 <http://dx.doi.org/10.1016/j.paid.2016.02.037>.
 27. Sheldon KM, Jose PE, Kashdan TB, Jarden A: **Personality, effective goal-striving, and enhanced well-being.** *Personal Soc Psychol Bull* 2015, **41**:575-585 <http://dx.doi.org/10.1111/j.1467-6494.2007.00484.x>.
 28. Lydon Staley DM, Zurn P, Bassett DS: **Within-person variability in curiosity during daily life and associations with well-being.** *J Personal* 2019, **77**:1-17 <http://dx.doi.org/10.1017/pen.2018.3>.
 29. Fayn K, Silvia PJ, Erbas Y, Tiliopoulos N, Kuppens P: **Nuanced aesthetic emotions: emotion differentiation is related to knowledge of the arts and curiosity.** *Cognit Emot* 2017, **32**:593-599 <http://dx.doi.org/10.1016/j.copsyc.2015.02.007>.
 30. Lechner CM, Miyamoto A, Knopf T: **Should students be smart, curious, or both? Fluid intelligence, openness, and interest co-shape the acquisition of reading and math competence.** *Intelligence* 2019, **76**:101378 <http://dx.doi.org/10.1016/j.intell.2019.101378>.
 31. Kahan DM, Landrum A, Carpenter K, Helft L, Hall Jamieson K: **Science curiosity and political information processing.** *Political Psychol* 2017, **38**:179-199 <http://dx.doi.org/10.1037/a0023253>.
 32. Kawamoto T, Ura M, Hiraki K: **Curious people are less affected by social rejection.** *Personal Individ Differ* 2017, **105**:264-267 <http://dx.doi.org/10.1016/j.paid.2016.10.006>.
 33. Garrosa E, Blanco-Donoso LM, Carmona-Cobo I, Moreno-Jiménez B: **How do curiosity, meaning in life, and search for meaning predict college students' daily emotional exhaustion and engagement?** *J Happiness Stud* 2016, **18**:17-40 <http://dx.doi.org/10.1007/s10902-016-9715-3>.
 34. Lee YH, Qiu C: **When uncertainty brings pleasure: the role of prospect imageability and mental imagery.** *J Consum Res* 2009, **36**:624-633 <http://dx.doi.org/10.1086/599766>.
 35. Hsee CK, Ruan B, Scholte HS: **The pandora effect: the power and peril of curiosity.** *Psychol Sci* 2016, **27**:659-666 [http://dx.doi.org/10.1016/0191-8869\(86\)90107-8](http://dx.doi.org/10.1016/0191-8869(86)90107-8).
 36. Oosterwijk S: **Choosing the negative: a behavioral demonstration of morbid curiosity.** *PLoS One* 2017, **12**:e0178399 <http://dx.doi.org/10.1371/journal.pone.0178399>.
 37. Oosterwijk S, Snoek L, Te Koppele J, Engelbert L, Scholte HS: **Choosing to View Morbid Information Involves Reward Circuitry.** Advance online publication; 2019 <http://dx.doi.org/10.1101/795120>.
 38. Kruger J, Evans M: **The paradox of Aplysia and the pursuit of unwanted information.** *J Exp Soc Psychol* 2009, **45**:1173-1179 <http://dx.doi.org/10.1016/j.jesp.2009.06.009>.
 39. Ketelaar PE, Van't Riet J, Thorbjørnsen H, Buijzen M: **Positive uncertainty: the benefit of the doubt in advertising.** *Int J Advert* 2018, **37**:256-269 <http://dx.doi.org/10.1080/02650487.2016.1231163>.
 40. Gigerenzer G, Garcia-Retamero R: **Cassandra's regret: the psychology of not wanting to know.** *Psychol Rev* 2017, **124**:179-196 <http://dx.doi.org/10.1037/rev0000055>.
 41. Hagenaaers MA, Stins JF, Roelofs K: **Aversive life events enhance human freezing responses.** *J Exp Psychol Gen* 2012, **141**:98-105 <http://dx.doi.org/10.1037/a0024211>.
 42. Sweeny K, Falkenstein A: **Is waiting the hardest part? Comparing the emotional experiences of awaiting and receiving bad news.** *Personal Soc Psychol Bull* 2015, **41**:1551-1559 <http://dx.doi.org/10.1111/1467-9280.03455>.
 43. Yang Y, Gu Y, Galak J: **When it could have been worse, it gets better: how favorable uncertainty resolution slows hedonic adaptation.** *J Consum Res* 2016, **6**:747-768 <http://dx.doi.org/10.1509/jmr.12.0430>.
 44. Bench SW, Lench HC: **Boredom as a seeking state: boredom prompts the pursuit of novel (even negative) experiences.** *Emotion* 2018, **19**:242-254 <http://dx.doi.org/10.1037/emo0000433>.
 45. Menninghaus W, Wagner V, Hanich J, Wassiliwizky E, Jacobsen T, Koelsch S: **The distancing-embracing model of the enjoyment of negative emotions in art reception.** *Behav Brain Sci* 2017, **40**:1-63 <http://dx.doi.org/10.1017/S0140525X17000309>.
 46. Wright SA, Clarkson JJ, Kardes FR: **Circumventing resistance to novel information: piquing curiosity through strategic information revelation.** *J Exp Soc Psychol* 2018, **76**:81-87 <http://dx.doi.org/10.1016/j.jesp.2017.12.010>.
 47. Kiverstein J, Miller M, Rietveld E: **The feeling of grip: novelty, error dynamics, and the predictive brain.** *Synthese* 2017, **96**:2847-2869 <http://dx.doi.org/10.1007/s11229-017-1583-9>.
 48. Friston KJ, Lin M, Frith CD, Pezzulo G, Hobson JA, Ondobaka S: **Active inference, curiosity and insight.** *Neural Computation* 2017, **29**:2633-2683 <http://dx.doi.org/10.3389/nnins.2012.00001>.
 49. Ligneul R, Mermillod M, Morisseau T: **From relief to surprise: dual control of epistemic curiosity in the human brain.** *Neuroimage* 2018, **181**:490-500 <http://dx.doi.org/10.1016/j.neuroimage.2018.07.038>.

50. Niehoff E, Oosterwijk S: **To know, to feel, to share? Exploring the motives that drive curiosity for negativity.** *Curr Opin Behav Sci* 2020, **35**:56-61 <http://dx.doi.org/10.1016/j.cobeha.2020.07.012>.
51. Hertwig R, Engels C: **Homo ignorans: deliberately choosing not to know.** *Psychol Sci* 2016, **11**:359-372 <http://dx.doi.org/10.1177/1745691616635594>.
52. Charpentier CJ, Bromberg-Martin ES, Sharot T: **Valuation of knowledge and ignorance in mesolimbic reward circuitry.** *Proc Natl Acad Sci U S A* 2018, **115**:E7255-E7264 <http://dx.doi.org/10.1073/pnas.1800547115>.
53. Day HI: **The measurement of specific curiosity.** In *Intrinsic Motivation: A New Direction in Education*. Edited by Day HI, Berlyne DE, Hunt DE. New York: Holt, Rinehart & Winston; 1971.
54. Gottlieb J, Oudeyer P-Y, Lopes M, Baranes A: **Information-seeking, curiosity, and attention: computational and neural mechanisms.** *Trends Cognit Sci* 2013, **17**:1-9 <http://dx.doi.org/10.1016/j.tics.2013.09.001>.
55. Van Dijk E, Zeelenberg M: **When curiosity killed regret: avoiding or seeking the unknown in decision-making under uncertainty.** *J Exp Social Psychol* 2007, **43**:656-662 <http://dx.doi.org/10.1016/j.jesp.2006.06.004>.
56. Hardy JH III, Ness AM, Mecca J: **Outside the box: epistemic curiosity as a predictor of creative problem solving and creative performance.** *Personal Individ Differ* 2017, **104**:230-237 <http://dx.doi.org/10.1016/j.paid.2016.08.004>.
57. Litman JA, Hutchins TL, Russon RK: **Epistemic curiosity, feeling-of-knowing, and exploratory behaviour.** *Cognit Emot* 2005, **19**:559-582 <http://dx.doi.org/10.1080/02699930441000427>.
58. Cleary AM: **The biasing nature of the tip-of-the-tongue experience: when decisions bask in the glow of the tip-of-the-tongue state.** *J Exp Psychol Gen* 2019, **148**:1178-1191 <http://dx.doi.org/10.1037/xge0000520>.
59. Golman R, Loewenstein G, Molnar A, Saccardo S: *The Demand for, and Avoidance of, Information.* . Available at SSRN 2019 <http://dx.doi.org/10.2139/ssrn.2149362>.