Is Understanding Pleasurable?
The Existing Evidence, the Conditional Pleasure Hypothesis and Its Implications for Ignorance Studies

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Abstract

Is understanding pleasurable? This article reviews the research without a systematic search. It first splits the question into four separate concepts (knowing, learning, understanding and aha), because the evidence differs for each. The strongest evidence concerns aha and curiosity. In humans, it comes almost entirely from self-report, from the blood-oxygen-level-dependent (BOLD) signal in brain imaging, and from electroencephalography (EEG). For conceptual understanding we found no direct neural or pharmacological evidence. The closest pharmacological evidence concerns word learning. The pleasure of aha has also been reported for wrong solutions, so it does not suffice as an indicator of truth. On this basis the article proposes the 'conditional pleasure' hypothesis: the pleasure of understanding, or at least the motivation to approach it, depends on the transition from unawareness to awareness. This transition is pleasant only under four conditions: a perceived and closable gap, a low effort cost, an individual tendency towards cognitive engagement, and an outcome that does not conflict with the person's identity or interests. The hypothesis is untested. We weigh it against three rival accounts: success reward, prediction-error reduction (learning progress) and explanation drive. We propose three refutable predictions and a two-by-two experimental design that separates the first two rivals from the hypothesis. We examine seven implications for ignorance studies, including the separation of the sense of understanding from truth, conspiracy theories and artificial intelligence. We conclude that persistent ignorance can be seen as the net balance between the cost and the value of the transition to awareness (hypothesis). The contribution of the article is synthesis, framing and refutable predictions, not empirical discovery. We label each claim as a finding, theory, interpretation, hypothesis or no valid study found.

Keywords: pleasure of understanding, conditional pleasure, aha, sense of understanding, curiosity, ignorance, information avoidance

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Introduction: the question of this article

In this article, we address two observations that seem to contradict each other. The tension between them may be one of the central questions of ignorance studies. On the one hand, there is evidence that the 'aha' moment is pleasurable for us, and that curiosity and information seeking occur even

in animals (Danek & Wiley, 2017; Kidd & Hayden, 2015). This is the closest evidence we have for the pleasure of understanding (Section 2). On the other hand, we know that ignorance (in its general sense) sometimes persists even when information and the opportunity to know are available. People may avoid information within their reach, and a false belief can survive correction (Golman et al., 2017; Lewandowsky et al., 2012).

How should we explain and understand these two observations together?

This puzzle matters for ignorance studies, because its answer decides whether we should attribute the persistence of ignorance to a lack of attraction, to the presence of an obstacle, or to something else.

Two answers are possible.

Answer A: Understanding is inherently pleasurable, so the persistence of ignorance must come from an obstacle to this pleasure.

Answer B: Understanding is not inherently pleasurable, so nothing attracts us to remove ignorance. Persistence is then the natural human condition and needs no further explanation.

Both answers share an unspoken assumption: that the 'pleasure of understanding' is a fixed quantity, independent of circumstances. As far as we know, ignorance studies have rarely tested this assumption against evidence. The existing evidence is scattered across research on the 'aha moment', 'curiosity', the 'reward circuit' and 'information avoidance'.

Because of this scatter, the first question of the article is this: if understanding comes with pleasure, is the amount fixed, or does it depend on circumstances? If it depends on circumstances, on which ones? What does the existing evidence say? And what follows for understanding persistent ignorance? Our answer to these questions will be a hypothesis, not a finding.

A reader may ask which classical or conventional view of ignorance this article builds on, and what exactly we mean when we speak of ignorance.

Common definitions give ignorance two main forms: the absence of knowledge, and a false belief that its holder takes to be true. The Islamic tradition also names these two forms 'simple ignorance' (jahl basit) and 'compound ignorance' (jahl morakkab), for example in al-Ta'rifat by al-Jurjani. Simple ignorance is the mere absence of knowledge and can coexist with awareness of one's ignorance. This state of 'conscious not-knowing' is roughly the kind of ignorance that the Socratic view treats as valuable (Plato, 2002, 21d).

This distinction is decisive for the article. According to the 'information-gap theory of curiosity', curiosity arises from seeing a gap between 'what one knows and what one wants to know' (Loewenstein, 1994).

We take 'understanding' to mean 'grasping explanatory relations' (Section 1). In our interpretation, understanding usually begins from seeing a gap. The claim that the pleasure of understanding depends on seeing such a gap is not part of the definition. It is an empirical hypothesis, which appears in Section 4 and is tested in Section 7.3. At first we limit the question to 'conscious ignorance', because the available evidence (aha and curiosity) concerns perceived gaps. The second kind of ignorance, 'compound ignorance', is a separate question, because its holder sees no gap in themselves. We return to it in the section on implications.

Another point to settle in this introduction: as far as possible, we have tried to attach one of the following labels to each claim in the text.

‘Finding’: what a study or review directly reports. Everyday examples fall outside these categories. We use them as ‘illustration’, not as findings or evidence.

‘Theory’: a claim that a published source makes in theoretical or argumentative form, without reporting data of its own.

‘Interpretation’: an inference from findings.

‘Hypothesis’: an untested proposal.

‘No valid study found’: the result of our unsystematic search, which found no ‘valid’ study (an empirical study or a review published in a peer-reviewed journal) on the question concerned. This label does not claim that no study exists. It only reports our search.

This separation matters, because a claim sometimes looks like a ‘finding’ when it is really an ‘interpretation’ or a ‘hypothesis’, and so gains more credibility than it deserves.

To answer these questions, we follow this path.

Section 1 clarifies four concepts and separates them: knowing, learning, understanding and aha (the sudden ‘I’ve got it!’ moment).

Section 2 presents the evidence for each concept.

Section 3 examines the mechanism: the difference between ‘wanting’ (the motivation to approach) and ‘liking’ (pleasantness on arrival), and what has been measured directly in humans.

Section 4 sets out the ‘conditional pleasure’ hypothesis with its four conditions and three refutable predictions, and weighs it against three rival theories.

Section 5 examines seven implications for ignorance studies. They include mapping the hypothesis onto the meanings of ignorance, the separation of pleasure and the sense of understanding from truth, identity reward, conspiracy theories, artificial intelligence, and a comparison with ‘rational ignorance’.

Section 6 states the limitations.

Section 7 lists open questions for future research. They include an experimental design that separates the first two rivals from the hypothesis, the pleasure of poetry, the origin of individual differences, and artificial intelligence as a model.

Finally, we present the conclusion.

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1. Four concepts and the boundaries between them

In the introduction, we said that the question of this article concerns the pleasure of understanding. In everyday speech, however, people often use knowing, learning, understanding and the aha moment interchangeably, although the evidence for pleasure differs for each. Before we review the evidence, we therefore need to clarify the boundaries of these four concepts.

We take ‘knowing’ to mean having information or a justified belief. In philosophy, knowing, unlike understanding, can be simple and piecemeal (Grimm, 2021). In the view of this article, knowing is an ‘epistemic state’, not an event. Someone who knows the capital of France does nothing at the moment of knowing, and the knowing lasts for some time (illustration). So if knowing carries any pleasure, it is the pleasure of ‘having’, not of ‘arriving’ (interpretation).

We take ‘learning’ to mean a lasting change in knowledge or ability as a result of experience. Learning is gradual and differs from momentary signs of progress. Momentary performance is an unreliable index of learning, and what lasts is often accompanied by difficulty (Bjork, 2013). Learning is not equivalent to knowing or understanding. A person can memorise a list without understanding anything, and can understand something without committing it to memory (illustration).

We take ‘understanding’ to mean grasping the explanatory relations among pieces of information, that is, the ‘why’ and the ‘how’. Understanding is harder than knowing, and it is more like an epistemic achievement than something obtained easily. Its object is also more structured and interwoven, not piecemeal (Grimm, 2021). This definition does not depend on seeing a gap. In our interpretation, understanding usually begins from a perceived gap (on gaps and curiosity, see Loewenstein, 1994) (interpretation). But the claim that pleasure depends on that gap is a hypothesis, and it appears in Section 4.

We must also separate understanding from the ‘sense of understanding’. This sense is neither necessary nor sufficient for real understanding, and it is not the same as the epistemic state itself (Grimm, 2021). A clear example of this separation is the ‘illusion of explanatory depth’. People think they know how everyday phenomena work, but when they try to explain them, they find that they do not (Rozenblit & Keil, 2002) (finding). So pleasure that accompanies the ‘sense of understanding’ is not necessarily the ‘pleasure of understanding’ (interpretation).

‘Aha’ (insight) is a sudden, brief event: the restructuring of a problem and the arrival at a solution in a single moment. As far as our unsystematic search shows, empirical research on pleasure has dealt most with this concept. But aha is not the same as understanding. Aha can come with a wrong solution, and the link between its pleasure and the correctness of the solution is imperfect (Danek & Wiley, 2017) (finding). Conversely, understanding can occur gradually, with no sudden moment (interpretation).

So these four concepts overlap but do not substitute for each other. Aha can occur without understanding, understanding without aha, and learning without either (interpretation).

The concept our question addresses is understanding. We present the evidence on the other three concepts only as evidence about those concepts, not in place of evidence about understanding. We mark the status of each piece of evidence with the labels finding, theory, interpretation, hypothesis or no valid study found.

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2. Evidence by concept

In Section 1, we clarified the boundaries of four concepts: knowing, learning, understanding and aha. Here we present the evidence of pleasure for each concept separately, in the same order. We shall see that the evidence is thinnest for ‘knowing’ and richest for ‘aha’. ‘Curiosity’ is not a fifth concept of this article. But curiosity is the motivation that precedes understanding, and a large part of the existing neural evidence relates to it. We therefore present its evidence separately at the end.

Knowing

We found no evidence that ‘having knowledge’, as a state and not a transition, gives pleasure (no valid study found).

Learning

A study from 2024 involved 345 children and adolescents aged 10 to 18. Each participant had 40 trials in which they had to extract the meaning of an invented word from two sentences, and they received no feedback during learning. The ‘pleasantness’ that participants rated themselves was higher after a correct response than after a wrong one (on a 9-point scale, mean 6.31 against 5.89). In trials with no meaning to extract, this difference was not significant. The pleasantness of remembered words did not differ from that of forgotten words either, contrary to the hypothesis of the authors (Bains et al., 2024) (finding: self-report, small effect).

Earlier, in 2018, researchers had tested a similar paradigm (experimental procedure) in young adults with a pharmacological intervention (Ripollés et al., 2018) (finding: double-blind pharmacological experiment). As far as we found, this is the only pharmacological evidence in this field (no other valid study found). We give its details in Section 3.

One caveat applies here. As we said in Section 1, momentary performance is an unreliable index of lasting learning, and lasting learning is often accompanied by difficulty (Bjork, 2013). So this evidence concerns the pleasantness of the ‘moment of extracting meaning’, not the pleasure of learning in the sense of a lasting change (interpretation).

Understanding

For understanding, in the sense defined in Section 1, we found no direct neural or pharmacological evidence (no valid study found). What exists is two pieces of marginal evidence.

First, the ‘illusion of explanatory depth’ shows that the ‘sense of understanding’ can exist without ‘real understanding’ (Rozenblit & Keil, 2002) (finding). So we cannot take any report of satisfaction or pleasure in ‘understanding’ as evidence of real understanding without qualification (interpretation).

Second, the theoretical account given in the aha subsection (Topolinski & Reber, 2010) raises the possibility that part of what we call the ‘pleasure of understanding’ is in fact the pleasure of ‘processing fluency’ (interpretation).

Aha

Most of the evidence concerns this concept. It includes the following.

Self-report. In a study from 2017, 70 students searched for solutions to 37 magic tricks (two tricks were never solved). The authors regard three dimensions, ‘pleasure’, ‘suddenness’ and ‘confidence’, as core components of the aha experience (Danek & Wiley, 2017). In this study, the correlation of pleasure with aha intensity was 0.62 for correct solutions and 0.65 for wrong solutions. Aha and its pleasure were also reported for wrong solutions, although the pleasure was lower for them (finding: self-report).

Brain imaging. A study from 2018 used functional magnetic resonance imaging (fMRI) at 7 tesla. It examined 29 people solving the German version of the Remote Associates Test (RAT). In this test, a person must find a word that forms a compound word with each of three given words. In the ‘high insight’ condition (solved trials in which the person had reported more insight than their own average), activity was higher in the anterior superior temporal sulcus (aSTS), the nucleus accumbens (NAcc) and the caudate nucleus. The last two belong to the reward circuit. The ventral tegmental area (VTA) in the midbrain and the hippocampus were active in both conditions, but the VTA was more active under ‘high insight’ (Tik et al., 2018). The authors did not measure dopamine release and did not show a causal relationship (finding: correlation).

Electroencephalography (EEG). A study from 2020, in which participants solved anagrams, reported a second gamma burst after the main burst of gamma waves at the moment of insight. This second burst appears in the prefrontal region, and the orbitofrontal cortex (OFC) contributes to it. The size of the burst correlated with the person's sensitivity to reward, and the authors interpreted it as an 'insight-related reward signal' (Oh et al., 2020) (finding: EEG; the label 'reward' is the authors' interpretation, and it is exposed to the risk of 'reverse inference', Section 3).

Memory (not pleasure). A study from 2011 used 'camouflaged images', that is, perceptual insight. Left amygdala activity when the person saw the solution predicted how well the solution stayed in memory. The more active the left amygdala was when the person saw the solution, the better the person recalled that solution in a later memory test (Ludmer et al., 2011) (finding: the samples are small, and the third experiment had 9 people).

A 'theoretical model' likewise treats insight as the updating of a predictive model through prediction error, and it assigns dopamine and noradrenaline a role in the memory advantage of insight (Becker & Cabeza, 2025) (hypothesis). Note that these two sources concern the link between aha and memory. They do not measure pleasure.

In addition, an independent theoretical account (separate from these findings on the aha experience) proposes the following. In the aha experience, the sudden appearance of the solution comes with a surprising jump in 'processing fluency'. This jump triggers three things: 'positive affect', the 'feeling that the solution is right' (perceived truth) and 'confidence in one's own judgement' (Topolinski & Reber, 2010) (hypothesis). If so, the 'pleasure of aha' and the 'feeling of correctness' come from one source, and this could explain why aha also occurs for a wrong solution (Danek & Wiley, 2017) (interpretation).

Curiosity, as the motivation that precedes understanding

Here too, several studies use different methods.

In an fMRI study of 19 students who read 'trivia questions' (general-knowledge questions with a definite answer), higher curiosity went with greater activity in the left caudate nucleus. Earlier work had linked this region with 'reward anticipation', and the authors interpret the activity as 'anticipation of rewarding information' (Kang et al., 2009) (finding).

The same study showed, in a separate behavioural experiment, that higher curiosity in the first session went with better recall of surprising answers 11 to 16 days later (Kang et al., 2009) (finding).

In another fMRI study, activity in the midbrain and the nucleus accumbens was higher in the 'high curiosity' state. Memory was also better, both for the information the person was curious about and for incidental material learned in that state (Gruber et al., 2014) (finding).

In another study, 19 volunteers saw ambiguous images. During 'ambiguity', the anterior insula and the anterior cingulate cortex were more active, and during the resolution of ambiguity the striatum was more active (Jepma et al., 2012) (finding: BOLD). This evidence concerns 'perceptual curiosity', not 'conceptual understanding'. Its sample is small, and it is exposed to the risk of 'reverse inference'.

The authors present this result as 'neurobiological support' for 'Berlyne's classical theory'. According to that theory, curiosity is an unpleasant state with raised arousal, ending it is rewarding, and it facilitates memory (Berlyne, 1954).

In addition, Loewenstein also called curiosity a ‘deprivation caused by a knowledge gap’, a state whose satisfaction is sometimes disappointing (Loewenstein, 1994).

So, taken together, part of what we call ‘pleasure’ may be relief from unpleasantness (interpretation).

In summary, the evidence is richest for aha and thinnest for knowing and understanding, and none of it is direct evidence for the ‘pleasure of understanding’. Most of the evidence comes from self-report and indirect brain markers. On its own, it does not tell us whether what was observed is ‘wanting’ or ‘liking’, a distinction that is the subject of Section 3 (interpretation).

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3. Mechanism: wanting versus liking, and what has been measured directly in humans

In Section 2, we saw that human evidence on ‘aha’ and ‘curiosity’ comes mostly from self-report and indirect brain markers. On its own, it does not tell us whether what was observed is ‘wanting’ or ‘liking’. This section clarifies that distinction and asks what has been measured directly in humans. First comes the theoretical distinction, then the chemical evidence available in humans, and finally the mechanistic hypotheses that no one has yet tested for understanding.

Before any chemical claim, we must separate two things. ‘Wanting’ is ‘incentive salience’, which pulls a person towards something. ‘Liking’ is received pleasure. The main review in this field shows that dopamine is linked above all with wanting, and that liking does not need it on its own.

Researchers attribute liking to ‘hedonic hotspots’ in structures such as the ventral pallidum, parts of the nucleus accumbens and the orbitofrontal cortex. Opioid and endocannabinoid systems play a part in them (Berridge & Robinson, 2016) (finding in animals; generalisation to humans: interpretation). In this article, ‘reward’ (in ‘reward circuit’ and ‘reward signal’) is only a label for the activity of a circuit. It says nothing about wanting or pleasure. Wherever we mean wanting or pleasure, we use that word.

The implication of this distinction for our question is clear. Suppose we see ‘activation of the reward circuit’ or ‘release of dopamine’ during curiosity or problem solving. This finding alone does not show that understanding is pleasurable, because it may only show that the person wants to continue. A study from 2009 on two monkeys showed that dopamine neurons respond to information that predicts reward, and that monkeys choose to receive such information (Bromberg-Martin & Hikosaka, 2009) (finding in monkeys; generalisation to human understanding: hypothesis). Note that this evidence concerns ‘information’ in an animal, not ‘understanding’ in a human.

By contrast, human evidence on aha and curiosity comes almost entirely from three tools: the blood-oxygen-level-dependent signal (BOLD in fMRI), electroencephalography (EEG) and self-report. None of them directly measures dopamine, opioids or any other molecule.

In our searches for direct chemical studies of aha and curiosity, that is, positron emission tomography (PET) or microdialysis, we found none. Our search was not systematic (no valid study found).

Even so, another field offers more direct chemical evidence in humans. In 2011, PET showed that dopamine is released in different parts of the striatum during the anticipation of a musical peak of pleasure and during the peak itself (Salimpoor et al., 2011; the PET analysis included 8 people). In another study, a pharmacological manipulation (with levodopa and risperidone) also changed

the reward experience of music (Ferreri et al., 2019) (finding in music). So the tools exist, but we found no similar study of understanding (no valid study found).

The only pharmacological evidence close to understanding concerns word learning, not understanding. It is an experiment from 2018. Raising dopamine (levodopa), compared with blocking its receptor, increased self-reported pleasantness and the amount of word-meaning learning. The effect on 24-hour memory was marginal (Ripollés et al., 2018) (finding for word learning).

In this experiment, the researchers did not measure the level of dopamine in the brain, the pleasantness is only self-reported, and the sample is small. Its paradigm resembles that of Bains and colleagues (2024), and the two studies share an author. They are therefore not two fully independent pieces of evidence.

So the precise statement is this. For word learning, there is (limited) causal pharmacological evidence. For aha, curiosity or conceptual understanding, we found no pharmacological evidence (no valid study found).

Here we must avoid reverse inference. From the fact that a region is active, for example the striatum or the orbitofrontal cortex, we cannot conclude that the state of 'pleasure' has occurred. The same regions are also active in anticipation, surprise, uncertainty and valuation. For this reason, no sentence of the type 'aha means dopamine release' appears in this article.

We can name two mechanistic proposals. Neither has been tested for understanding in humans.

The opioid hypothesis: the perceptual pleasure of novel, interpretable stimuli is mediated by mu-opioid receptors in the visual pathway, and this explains the phenomenon of 'information hunger' (infovore) (Biederman & Vessel, 2006). The researchers call it a 'hypothesis' and 'preliminary', and they measured parahippocampal activity for 'images'. We found no opioid blockade and no test concerning understanding (hypothesis; no valid study found).

The link between aha and memory: Section 2 presented its evidence (Ludmer et al., 2011; Becker & Cabeza, 2025). This link describes 'co-occurrence' with memory and does not measure pleasure, so it is not evidence for a pleasure mechanism (finding for the memory effect; on pleasure: no valid study found).

In sum, in humans, the link between understanding and pleasure rests on self-report and indirect brain markers. No one has measured the chemical basis of the pleasure of understanding in humans, except in word learning. What people say about it comes from animals and from reasoning (interpretation).

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4. Conditional pleasure and its rivals

In Sections 2 and 3, we saw that the evidence supports neither 'understanding is always pleasurable' nor 'understanding is not pleasurable'. Studies have reported the pleasure of aha for a wrong solution too, and reward-circuit activity has accompanied anticipation in several studies (curiosity: Kang et al., 2009; information in monkeys: Bromberg-Martin & Hikosaka, 2009; music: Salimpoor et al., 2011) (finding). No one has yet measured the chemical basis of the pleasure of understanding in humans. So the right question is this: in which situations is understanding pleasant or motivating, and in which is it not?

From an unsystematic review of separate studies, we select four factors with which pleasantness and the desire to know have varied.

A perceived and closable gap

The desire to know arises when a person sees a gap in what they know and knows that it can be closed (Loewenstein, 1994) (theory; generalisation to understanding: hypothesis).

Effort cost

People avoid mental effort (Kool et al., 2010) (finding in six experiments; generalisation to understanding: hypothesis).

Individual difference

Some people enjoy cognitive effort more (Cacioppo & Petty, 1982), and the reward-like response to insight is not the same in everyone (Oh et al., 2020) (finding).

Consequence of the truth for the person

If knowing conflicts with a person's identity or interests, they avoid it (Golman et al., 2017) (review). This avoidance depends on the value of the news. Participants chose to know a favourable outcome more often than an unfavourable one. They chose ignorance about an unfavourable outcome more often than about a favourable one. The mesolimbic reward circuit responded only to the chance of learning good news, whereas the orbitofrontal cortex (OFC) responded to the chance of learning, whether the news was good or bad (Charpentier et al., 2018) (finding about information, not understanding). On political belief, see Section 5.4.

Everyday examples show these factors. The pleasure of a crossword comes at the moment the last word fits, not in rereading the answer. Many people sign a long contract without reading it. A patient who does not open the envelope with the test result finds knowing unpleasant (illustration, not evidence).

So we may assume that each of the four factors determines whether the transition from unawareness to awareness is pleasant or motivating. The 'conditional pleasure' hypothesis follows from this. The pleasure of understanding, and at least the motivation to approach it, depends on this 'transition'. The transition is pleasant or motivating only under certain conditions (the same four factors, which we call 'conditions' from here on). We found no study that tests these conditions together. So this hypothesis is a combination of several separate findings, and it is not yet a tested theory (hypothesis; no valid study found).

This hypothesis is not the only possible explanation. Three rival explanations also account for the same evidence. We turn to them after our own three refutable predictions.

Three predictions that can be refuted (all three are hypotheses; we found no tested ones)

Timing. Pleasantness should peak and fade at the moment the gap closes. It should not stay high after understanding.

Perceivable gap. Pleasure is greater for a gap that the person sees and considers closable.

Effort cost. Hold the gap and the reduction of uncertainty constant. Then making the closing of the gap more costly should reduce pleasure. Close evidence comes from the field of choice (Kool et al., 2010), not from the measurement of pleasure.

These predictions are refutable only if researchers measure or manipulate the conditions independently of the outcome (for example, the participant's belief that the problem is solvable). Otherwise, anyone can explain any finding after the event.

Here we must also point to the three rival explanations of the hypothesis.

Success reward

The studies of Bains and colleagues (2024) and Ripollés and colleagues (2018) compare a correct response with a wrong or meaningless one. This comparison fits both ‘the transition’ and ‘any success is rewarding’. We found no experiment that separates the two (no valid study found).

Prediction-error reduction and learning progress

Researchers have equated pleasure with a reduction in the mismatch between expectation and receipt (Joffily & Coricelli, 2013). They have equated the reward of art with the move from uncertainty to predictability (Van de Cruys & Wagemans, 2011), and ‘joy’ with learning progress (Schmidhuber, 2010; Oudeyer et al., 2007).

In a human test, models with learning progress fitted the choice of activities best (Ten et al., 2021).

These studies concern curiosity and choice, not the pleasure of understanding (theoretical interpretation).

Explanation drive

According to Gopnik, the feeling of explanation satisfies a drive for theory building. This reward is tied to the process of explanation-making itself, and it does not guarantee that the explanation is correct (Gopnik, 1998).

This account comes close to the separation of pleasure from truth (Section 5.3) and the separation of wanting from liking (Section 3) (theoretical interpretation).

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5. Implications of the hypothesis for ignorance studies

If the conditional pleasure hypothesis is true, ‘persistent ignorance’ is neither a mere deficit nor a natural state without obstacles. It is the net balance between the cost and the value (pleasure or approach motivation) that the ‘transition to awareness’ has for the person.

Below we set out seven implications of this view and state the level of confidence of each. This section concerns ‘individuals’. ‘Institutions’ do not feel pleasure, and for them one must speak of ‘organisational costs and benefits’, which this article does not address.

5.1 Mapping onto three meanings of ignorance

Proctor (2008) distinguishes three meanings of ignorance: the native state (the starting point of knowing), the lost realm (ignorance resulting from research and social choices) and the strategic ploy (the active construction of ignorance) (Proctor, 2008) (theoretical division, not an empirical finding).

Conditional pleasure could link these three at the level of the individual (interpretation; untested mapping).

When the person does not see the gap, or closing it is costly, ignorance stays in the ‘native state’.

When reaching awareness is unpleasant or costly, ignorance remains as a ‘lost realm’, that is, something the person does not pursue.

And when someone can keep the ignorance of others by manipulating the cost or value of this transition for them, the third meaning arises. This article does not examine it, because the article is about the individual.

5.2 Why do many people not pursue understanding?

If understanding is pleasurable, why does not everyone pursue it? On the basis of our hypothesis (Section 4), the desire to know does not arise, or weakens, in four cases:

when the person sees no gap,

when effort has a cost,

when the person has little inclination to enjoy cognitive effort,

and when the truth conflicts with their identity or interests (hypothesis).

For a review of the psychological reasons for not wanting to know, see Gigerenzer and Garcia-Retamero (2017) (review).

5.3 Separating pleasure and the sense of understanding from truth

This is the most important link with ignorance studies. In one experiment, participants rated statements as truer when they came with an aha experience. The effect was medium in the within-participant comparison, became smaller when only solved items were kept, and was not significant in the between-participant comparison. The researchers did not measure pleasure, so the loop 'pleasure → sense of truth' remains untested (Laukkonen et al., 2020) (finding).

A follow-up by the same group found a smaller effect. It is not independent, because the authors overlap (Laukkonen et al., 2022) (finding; needs independent replication).

Studies have reported the pleasure of aha for a wrong solution too (Danek & Wiley, 2017) (finding), and we overestimate our understanding (the 'illusion of explanatory depth') (Rozenblit & Keil, 2002) (finding). The proposed mechanism is that a sudden jump in processing fluency creates both a positive feeling and a sense of truth (Topolinski & Reber, 2010) (hypothesis). In the opposite direction, in insight problems, solutions that come with insight are more often correct (Salvi et al., 2016) (finding). So aha has an imperfect link with truth. Sometimes the two go together, and sometimes they separate.

Implication: aha and the sense of understanding can occur without correct knowledge. So if a false but coherent narrative creates a 'sense of understanding', that sense can attach confidence to a false belief. This produces an ignorance whose holder is unaware of it and thinks they are informed, the 'compound ignorance' of the introduction (hypothesis).

We extend this implication from a few small puzzle and statement experiments to social and identity narratives. No one has tested this extension.

5.4 Identity consequence and social reward

For 'identity narratives', the fourth condition (the consequence of the truth for the person) works in two directions.

A narrative that fits one's identity has social value in addition to understanding.

A truth that conflicts with identity has a cost. The close evidence for this is as follows.

Social and monetary rewards both activate the striatum (Izuma et al., 2008) (finding).

In 30 partisans, biased conclusion-drawing went with regions related to emotion regulation, not with regions of cold reasoning (Westen et al., 2006) (finding).

In 40 liberals, challenging political beliefs activated the 'default mode network' more than challenging non-political beliefs. Resistance to changing belief correlated with activity in the dmPFC, insula and amygdala. The authors note that belief change is confounded with belief content (Kaplan et al., 2016) (finding).

This pattern is not universal, though. Higher science curiosity has accompanied less partisan bias in the processing of political information (Kahan et al., 2017) (finding). So individual differences in curiosity may moderate the effect of identity (interpretation).

None of these studies measured the pleasure of understanding or the reward of an identity narrative.

From all of this, we may assume the following. When a narrative both gives understanding and confers identity, the two sources of value point the same way, and the transition to that narrative becomes more attractive. A truth that conflicts with identity, by contrast, carries a cost at the same time (hypothesis).

This inference relies on a 'common value currency', the idea that different values add up in a single 'common account'. This concept is contested. For example, a meta-analysis of 81 fMRI studies found evidence for 'common subjective value' in the vmPFC and ventral striatum. But these signals correlate with reward prediction error, and the method cannot separate the two (Clithero & Rangel, 2014). The concept itself has also been questioned (Hayden & Niv, 2021) (live controversy). So the 'adding up of two sources of value' is only a working hypothesis.

5.5 Conspiracy theories: a heap of small transitions

Seeing patterns in patternless data predicts belief in conspiracies and the supernatural (van Prooijen et al., 2018) (finding). Belief in conspiracy arises from psychological, political and social factors, and it does most harm in politics and science (Douglas et al., 2019) (review). The conditional pleasure hypothesis offers a complementary explanation. Conspiracy believers sometimes spend a great deal of time and effort on 'research' ('do your own research') (illustration; we found no study that measures this effort; no valid study found). If so, the issue is not that the whole narrative is cheap. The hypothesis is that each step costs little but the steps are many. Each new link (a document, a coincidence, a sign) closes a small gap and gives a sense of coherence ('it fits') (hypothesis).

Further, a conspiracy narrative blames a specific group, and accepting it joins the person to an informed 'us' against a deceiving 'them'. So, besides the pleasure of understanding, it gives identity reward (hypothesis) (Section 5.4). Because the sense of understanding can separate from truth (Section 5.3), none of these steps needs to be true (hypothesis; we found no study that measured pleasure or the sense of understanding in conspiracy belief; no valid study found).

Researchers must define a 'step' before testing: one separate claim with one separate piece of evidence. Without such a definition, we can explain both great effort (conspiracy believers) and little effort (an instant language-model answer) by choosing the unit of cost, and the hypothesis stops being refutable.

The hypothesis is refutable in two cases.

(a) A narrative that presents the same content in small, successive steps (each step one separate claim with one separate piece of evidence) should give a greater sense of understanding than the same content presented in one piece.

(b) When each step requires checking the evidence, the advantage of the conspiracy narrative in the sense of understanding should shrink.

If neither holds, we refute the role of many small steps, and other explanations (identity, simplicity of the narrative) remain.

5.6 Artificial intelligence and the cheap sense of understanding

In several online experiments, searching the internet raised people's estimates of their own internal knowledge, even when the search had not reached an answer (Fisher et al., 2015) (finding). In an unreviewed preprint with 102 students, the illusion of explanatory depth was larger in the chatbot group than in a group that read the same texts directly, and larger than in the control group (Aslanov et al., 2025) (finding; preprint). This is a small study, and it is still unreviewed. Later studies must replicate it. In Nature, too, researchers have argued that artificial intelligence in scientific research can create an 'illusion of understanding' (Messeri & Crockett, 2024) (theoretical argument).

Language models give fluent, coherent, instant answers. According to one account of aha, a sudden jump in processing fluency creates both a positive feeling and a sense of truth (Topolinski & Reber, 2010). If this mechanism also generalises to the continuous fluency of a language-model answer, we can expect the same effect (hypothesis; Section 5.3). In these conditions, the cost of reaching the answer falls greatly, but the cost of verifying it does not. So a person can obtain the sense of understanding without effort and before verification (hypothesis).

On the basis of the cost component of the conditional pleasure hypothesis, we expect that the cheaper it is to reach the answer, the greater the pleasure and the motivation to continue. Suppose pleasure and the sense of understanding both arise from processing fluency, as the previous paragraph said. Then the sense of understanding also rises as answers get cheaper. Since the sense of understanding can separate from truth (Section 5.3), the danger lies in the separation of the sense of understanding from verification (hypothesis; we found no study on pleasure when using language models; no valid study found).

To test the role of cost, researchers could present the same content once instantly and once with forced verification. They should measure processing fluency in both conditions, or hold it equal, because forced verification also reduces processing fluency and can confound the result. If pleasure and the motivation to continue do not differ between the two conditions, we refute the role of the 'cost component' in this area.

5.7 Comparison with 'rational ignorance' and 'rational irrationality'

According to Downs, a voter stays rationally ignorant when the cost of becoming informed about politics exceeds the benefit of the influence of their single vote ('rational ignorance') (Downs, 1957). According to Caplan, people 'consume' a false belief when holding it costs little and gives psychological satisfaction ('rational irrationality') (Caplan, 2007). Both are economic theories, not empirical findings. Conditional pleasure is close to both, but it differs in two respects.

First, the location of value. Downs sees information as 'instrumental' and weighs its cost against its benefit. Caplan locates value in holding a 'pleasant belief'. Conditional pleasure locates value

in the ‘transition from unawareness to awareness’ itself, and this transition can separate from truth (Section 5.3).

Second, scope. ‘Rational ignorance’ explains simple unawareness, and rational irrationality explains false belief. The cost-and-value model in this article can bring both into one framework (interpretation; untested).

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6. Limitations

This article proposes a hypothesis that no one has yet tested, so the reader needs to know how far they can rely on it. In this section we show where the evidence is ‘scarce’ or ‘indirect’ and how far the hypothesis has ‘credibility’.

On the basis of what we saw in the earlier sections, we must stress the following.

Direct evidence is scarce, especially in these areas.

Empirical evidence is mostly about aha and curiosity.

On gradual learning, we found only the self-report of children and adolescents (Bains et al., 2024) and of young adults in word learning (Ripollés et al., 2018).

On gradual conceptual understanding in adults, and on the pleasure of the ‘state of knowing’, we found no direct evidence.

A large part of the evidence (curiosity, information avoidance, word learning) concerns aha, information or words. Its generalisation to conceptual understanding is a hypothesis.

So the working hypothesis of the article, ‘the dependence of pleasure on the transition’, is untested and not refuted.

On direct neurochemical evidence: we found no PET or microdialysis study of insight or curiosity in humans. Pharmacological evidence in the area close to understanding exists only for word learning (Ripollés et al., 2018), and it is weak. Our search was not systematic, so we must read ‘absence’ as ‘we did not find’.

On experimental samples and culture: the samples are mostly students, European and American, and we found no cross-cultural study on the pleasure of understanding. The article does not claim ‘all cultures’.

On measuring pleasure: part of the evidence is self-report. Self-report is an appropriate tool for subjective pleasure. But it cannot separate pleasure from relief of unpleasantness (Loewenstein, 1994) or from the feeling of processing fluency.

On the choice of conditions: we chose the four conditions from an unsystematic review, and the list is not complete. Other factors may have been left out.

On the separation from truth: in one experiment, the effect of aha on the sense of truth was medium ‘within participants’ and not significant ‘between participants’. It has no independent replication, and it does not measure pleasure (Laukkonen et al., 2020). In the other direction, insight accompanies the correctness of the solution (Salvi et al., 2016).

On the controversy over common value: the ‘two sources of value’ argument in Section 5.4 relies on a concept that is itself contested (Clithero & Rangel, 2014; Hayden & Niv, 2021).

On the third rival: we offered no separating prediction for explanation drive. This rival agrees with our hypothesis on the separation of pleasure from truth, and separating the two needs a separate design.

On the contribution and limits of the article, then, ‘conditional pleasure’ is probably not a new theory standing against the rivals in Section 4. It is their combination, applied to understanding as a domain-specific case. If this combination is correct, it gives a prediction that no rival gives alone: the simultaneous effect of prior gap and cost. The contribution of the article is synthesis, framing and the offer of refutable predictions, not empirical discovery.

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7. Open questions for future research

In this section, we list questions whose answers would make the hypothesis stronger or refute it, so that later studies know where to start.

7.1 The timing of pleasure

Does pleasure arise at the moment the gap closes, or in the persistence of understanding? (Design: continuous measurement of pleasure during gradual learning, compared with aha.)

7.2 The sense of understanding in identity narratives

Does a coherent narrative, like aha, create both a sense of understanding and a sense of truth through a jump in processing fluency? Does making the narrative identity-conferring strengthen this effect? (Design: present the same content once as identity-conferring and once as unrelated to group identity, and measure the sense of understanding, the sense of truth and pleasure. This links Sections 5.3 and 5.4.)

7.3 Transition or success

Does the ‘transition from unawareness to awareness’ itself bring pleasure? Or does pleasure come from something else: from success in reaching the answer, or from the reduction of prediction error?

To separate these, researchers could build an experiment with two factors.

The first factor is whether the person felt a gap before seeing the answer (heard a question and made a guess) or saw the answer with no prior question.

The second factor is whether reaching the answer is low-cost (instant) or high-cost (waiting or effort).

In all four conditions the amount of information is the same, and the person reaches the answer at the end. The experiment measures pleasure and the willingness to pay the cost separately. The stimuli are explanations (answers to ‘why’ or ‘how’), not isolated facts, so that the event under study is understanding, not knowing. After each trial, a short question records the participant’s understanding.

These three accounts, success reward, prediction-error reduction and conditional pleasure, predict different patterns.

According to success reward, only cost matters, and its effect is the same in both gap conditions: a costlier success is worth more and gives more pleasure. Bains and colleagues (2024) mention the possibility that a low-challenge task reduces pleasure, but they did not test it.

According to prediction-error reduction, only the prior gap matters and cost has no effect, because without a prior expectation there is no error to reduce.

According to conditional pleasure, both matter. Without a prior gap, pleasure is lower. With a prior gap, higher cost reduces pleasure or the motivation to continue. This is the opposite direction to what success reward predicts (hypothesis; no valid study found).

7.4 Intervention

If conditional pleasure is true, which interventions (reducing cost, reducing identity threat) reduce ignorance?

7.5 The pleasure of poetry: a puzzle of meaning? (hypothesis; untested)

Poetry often acts like a verbal puzzle. The structure of sentences is deliberately scrambled or made polysemous, and this may be a form of 'defamiliarisation', meaning 'deliberately making perception difficult and slow' (Shklovsky, 1917/1965). From this view, in the Persian tradition, iham (using a word with two possible meanings) and taqdim o ta'khir (rearranging the elements of a sentence) may serve a similar function (interpretation). The hypothesis is that part of the pleasure of reading poetry is the same pleasure of moving from a gap to meaning, as in solving a crossword.

The closest research evidence was a study with 30 participants and 'difficult-to-see two-tone images', some of which hid a face. Insight, identified by a jump in the clarity score of the image, raised liking for the image in later rounds. The study measured liking for the image, not the pleasure of the insight itself (Muth & Carbon, 2013) (finding; generalisation to poetry: hypothesis).

Two cautions apply here.

First, poetry often keeps the gap open. If pleasure depended only on closure, unresolved ambiguity should not give pleasure. If it does, then pleasure lies, at least in part, in approaching, not arriving. We must then rewrite the hypothesis for poetry as 'transition or approach'. This agrees with the distinction between approaching and arriving in music. Different parts of the striatum are involved in the anticipation of the peak and in the peak itself (Salimpoor et al., 2011; dopamine measured with PET in eight people) (finding in music; generalisation to poetry: hypothesis).

Second, poetry usually has no external correct answer. The meaning that the reader builds is an 'aha' without external confirmation. This is the same mechanism that appeared as a danger in Sections 5.3 and 5.5. In poetry this pleasure is often low-risk, because there is usually no verifiable claim about the world at stake (hypothesis).

Refutable predictions:

(a) Poems of medium difficulty, provided the reader believes them understandable, should be more pleasurable than very simple or wholly ambiguous poems.

(b) Saying 'this poem has no single answer' should not reduce the pleasure of a poem, but saying 'this crossword is unsolvable' should reduce the pleasure of a crossword.

If (b) holds, two readings are possible. Either 'closable' in the first condition means, in poetry, 'capable of being given meaning' and not 'having a single answer'. Or the pleasure of poetry does not follow the first condition, and poetry limits the scope of the hypothesis. The first reading is acceptable only if we define 'capable of being given meaning' before the experiment.

7.6 The origin of individual differences: childhood, temperament, encouragement or a feedback loop?

This question is for future research and is not part of the main hypothesis of the article. It is a secondary, untested hypothesis. The possibility is that from childhood, people differ in how sensitive their reward and learning circuits are to understanding transitions. Responsive parental encouragement during curiosity could bring a child into a loop in which success, pleasure and practice reinforce each other. This view does not claim that all individual differences come from encouragement. Part of the difference comes down to real learning ability. Four caveats are needed here.

• Dopamine is not the substance of pleasure (Berridge & Robinson, 2016) (review), so we should speak of the 'sensitivity of reward and learning circuits'. The reward-like response to insight correlates with sensitivity to reward, but this finding concerns adults and is correlational (Oh et al., 2020) (finding).

• External encouragement does not always reinforce. In a meta-analysis of 128 experiments, tangible, expected reward reduced intrinsic motivation, but positive verbal feedback raised it overall. The effect of this feedback was much smaller in children than in students (Deci et al., 1999) (review). Praising intelligence, as opposed to praising effort, reduced the persistence and enjoyment of pupils after failure (Mueller & Dweck, 1998) (finding). So we must distinguish 'informational feedback' from 'controlling reward'.

• Simple observation cannot separate nature from nurture. The heritability of intelligence is substantial and rises with age, and encouraging parents are often genetically similar to their child. Separating the two needs twin, adoption or longitudinal designs (Plomin & Deary, 2015) (review; it concerns intelligence, and for the pleasure of understanding we assume the same logic).

• Cause and effect may be reversed. A child who succeeds more gets more reward, practises more and succeeds more. This is the 'Matthew effect', described for reading (Stanovich, 1986) (interpretation; generalisation to conceptual learning, such as mathematics: hypothesis). Anyone who wants to test this view can use these refutable predictions:

(a) A young child's reaction to solving a puzzle (smiling, persistence) should predict later interest in mathematics, after controlling for prior attainment and parental education.

(b) Informational feedback should beat controlling reward in maintaining interest after failure.

(c) In genetically informed designs, the contribution of nurture should remain after controlling for genetics.

If none holds, we refute this view (we found no study that measured the pleasure of transition in childhood and predicted later schooling; no valid study found).

7.7 Artificial intelligence: model, environment or subject?

Section 5.6 treated artificial intelligence as an environment. As a computational model, reinforcement learning already contains both of our rivals.

The first rival, success reward, is the standard external reward: the agent receives reward only on reaching the goal (interpretation).

The second rival, prediction-error reduction, comes in two versions. In the naive version, the reward of the agent is the prediction error itself, and the agent falls into the 'noisy-TV problem'. It sticks to an endless source of noise, and its learning slows sharply (Burda et al., 2019). In the

advanced version, the reward comes from ‘learning progress’, that is, the reduction of error over time (Schmidhuber, 2010; Oudeyer et al., 2007). Endless noise produces no progress, and this version already contains the condition of a ‘closable’ gap (interpretation). So what conditional pleasure adds to the second rival is cost, together with individual difference and the consequence of truth.

Researchers can build three artificial agents: one with success reward, one with learning-progress reward, and one with learning-progress reward modulated by cost (conditional pleasure). They can then write down the predictions of the three agents in the two-by-two design of Section 7.3 and test them against human behaviour (Ten et al., 2021, is an example of such a comparison) (hypothesis; untested). Suppose human behaviour in high-cost and low-cost conditions is closer to the simple learning-progress agent than to the conditional pleasure agent. Then cost adds nothing to the second rival, and we refute this part of the hypothesis.

This method has two limits.

First, because we built the agent from the hypothesis, reproducing a pattern is not by itself proof. The agent makes predictions precise and distinct, and only human data can test whether they are correct for humans.

Second, our hypothesis concerns human pleasure, and we make no claim about whether an artificial agent feels pleasure.

Finally, taking all the discussion of this article together, we may say this: the question is no longer whether understanding is pleasurable, but under which conditions. Until we know when understanding is pleasant, we do not know why people sometimes do not want to know.

This article neither denies the ‘pleasure of understanding’ nor accepts it unconditionally. Its claim is that this pleasure ‘has conditions’, and that we can measure the conditions. If empirical tests confirm them, we will know when understanding is pleasant and when it is not. If tests refute them, at least we will have set aside a hypothesis that was clear enough to be refuted. Until then, the question of when understanding is pleasant is itself an unknown that the field of ignorance studies must address.

Conclusion

The question of this article was whether understanding is pleasurable and, if it is, whether this pleasure is fixed.

The available evidence supports neither ‘always pleasurable’ nor ‘not pleasurable’. The strongest evidence concerns aha and curiosity, and it is mostly self-report or indirect brain markers. For conceptual understanding we found no direct evidence, and the pleasure of aha and the sense of understanding also occur for a wrong solution (finding).

On this basis we proposed the ‘conditional pleasure’ hypothesis. The transition from unawareness to awareness is pleasant or motivating only when the gap is perceived and closable, the effort cost is not high, the person tends towards cognitive engagement, and the truth does not conflict with their identity or interests (hypothesis). Three rivals explain the same evidence differently: success reward, prediction-error reduction and explanation drive. The two-by-two experiment, prior gap against cost, can separate the first two rivals from conditional pleasure. Success reward counts only cost, prediction-error reduction counts only prior gap, and conditional pleasure counts both. This experiment does not separate explanation drive.

For ignorance studies, if the hypothesis is true, persistent ignorance is neither a mere deficit nor a natural state without obstacles. It is the net balance between the cost and the value of the transition to awareness for the person. The sense of understanding can occur without correct knowledge and produce an ignorance that its holder does not know about. Identity narratives and conspiracy theories may become attractive through a heap of small transitions and identity reward. Artificial intelligence, by making answers cheap, may also separate the sense of understanding from verification (hypothesis).

The limits of this article are clear. The hypothesis is untested, the evidence is scarce and indirect, and our search was not systematic, so we must not read ‘not found’ as ‘does not exist’. The contribution of the article is synthesis, framing and refutable predictions, not empirical discovery.

There is also a practical implication. If the hypothesis is true, no single remedy reduces all persistent ignorance. A person who sees no gap needs a question put to them. A person who finds effort expensive needs a cheaper route. A person who sees the truth as a threat first needs the threat reduced. An intervention must target the condition that has broken.

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