Do people think consciousness poses a hard problem? Empirical evidence on the meta-problem of consciousness

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Abstract

In a recent paper in this journal, David Chalmers introduced the meta-problem of consciousness as "the problem of explaining why we think consciousness poses a hard problem" (Chalmers, 2018, p. 6). A solution to the meta-problem could shed light on the hard problem of consciousness. In particular, it would be relevant to elucidate whether people's problem intuitions (i.e. intuitions holding that conscious experience cannot be reduced to physical processes) are driven by factors related to the nature of consciousness, or rather by factors that are independent of consciousness. Whether people hold problem intuitions, and what factors drive those intuitions, are largely empirical questions. However, there is a lack of empirical research on these issues to date. The results of four studies will show that (1) problem intuitions are not widespread, and (2) when they arise, they do so because of factors that are unrelated to the nature of consciousness. This suggests that consciousness is, after all, not so problematic.

The meta-problem of consciousness

The hard problem of consciousness is the problem of explaining how and why physical processes give rise to subjective conscious experience (Chalmers, 1995). The hard problem

stands in contrast to "easy" problems such as explaining objective behavioral or cognitive functions. While behavioral and cognitive functions could be explained by appealing to computational or brain mechanisms, it seems like conscious experience cannot receive the same treatment. In a recent paper, David Chalmers has introduced the meta-problem of consciousness as "the problem of explaining why we think consciousness poses a hard problem" (Chalmers, 2018, p. 6). There are two core intuitions for the meta-problem of consciousness: Epistemic intuitions and metaphysical intuitions. Epistemic intuitions consider the existence of an explanatory gap between physical processes and conscious experiences. Metaphysical intuitions hold that conscious experiences cannot be identified with physical processes. The meta-problem of consciousness is the problem of explaining why we have these "problem intuitions".

The meta-problem of consciousness and the hard problem of consciousness are deeply connected. Thus, "we can reasonably hope that a solution to the meta-problem will shed significant light on the hard problem" (Chalmers, 2018, p. 8). Chalmers specifies two different ways in which solutions to the meta-problem could inform the hard problem. First, if problem intuitions arise due to mechanisms that could facilitate conscious experience (from now on, consciousness-related factors), this would possibly advance our understanding of consciousness. Second, and conversely, if problem intuitions are driven by factors that cannot be responsible for our conscious experiences (from now on, consciousness-independent factors), this could dissolve the hard problem.

The hard problem of consciousness is supposed to arise due to the very nature of conscious experience. In particular, because there is something special about consciousness that makes it irreducible to physical processes. If this is the case, and consciousness is "the most central and manifest aspect of our mental lives" (Chalmers, 1995, p. 207), the problematic nature of consciousness should also be manifest to us. Thus, we can reasonably expect that the mechanisms explaining people's (acquaintance with) conscious experience will also play a role in explaining their problem intuitions, and vice versa. For example, if we find that higher-order thoughts explain problem intuitions, this would suggest that higher-order thoughts play a role

in explaining conscious experience (Rosenthal, 2002). This way, a solution to the meta-problem in terms of consciousness-related factors could advance our understanding of consciousness.[1]

Conversely, if there is no hard problem of consciousness, problem intuitions cannot be driven by people's acquaintance with conscious experience, as the nature of conscious experience would not pose a problem. In this case, if problem intuitions arise, they should be driven by factors that are unrelated to the nature of consciousness. Thus, if we find that consciousness-independent factors (e.g. a lack of knowledge of the relevant science) drive problem intuitions, this would suggest that conscious experience is not intrinsically problematic. This way, a solution to the meta-problem in terms of consciousness-independent factors could dissolve the hard problem.

This approach to the meta-problem of consciousness resembles a common strategy used in experimental philosophy. In order to determine whether we should trust our intuitions regarding philosophical issues, experimental philosophers have investigated whether those intuitions are influenced by irrelevant factors. Consider, for example, intuitions regarding trolley dilemmas. Trolley dilemmas are hypothetical cases in which we have to decide whether to sacrifice the life of one individual to save the lives of several others (Foot, 1967). Some factors driving intuitions in trolley dilemmas are arguably related to morality, e.g. whether we *actively* kill one person or *allow* her death. But other factors are clearly irrelevant, e.g. whether we are in a bad mood when judging the case. If our intuitions are driven by factors that are related to the concept at hand (e.g. morality, consciousness), they can advance our understanding of that phenomenon. But if they are driven by factors unrelated to the question at hand, they are deemed unreliable (Fischer and Collins, 2015; Knobe and Nichols, 2017; Machery, 2017).

Before going any further, it is important to note that the discussion regarding whether consciousness-related or consciousness-independent factors drive problem intuitions assumes the existence of those intuitions. But do people really think that consciousness cannot be reduced to physical processes? In his treatment of the meta-problem of consciousness, Chalmers tentatively assumes that problem intuitions are widespread. However, he also acknowledges that "there is a large body of research in experimental psychology and experimental philosophy on people's intuitions about the mind, but surprisingly little of it to

[1] A further question here is whether those consciousness-related mechanisms are responsible for consciousness or the *illusion* of consciousness (Dennett, 2016; Frankish, 2016)

date has concerned core [metaphysical and epistemic] intuitions about the problem of consciousness" (Chalmers, 2018, p. 13). In the next section, I will briefly review previous research on the topic.

Previous studies on people's intuitions about consciousness

To date, the only direct test of core problem intuitions about consciousness concerns people's epistemic intuitions. Gottlieb and Lombrozo (2018) asked participants to judge whether science will someday be able to fully explain a range of different phenomena. They found that judgments about a phenomenon involving subjective experience negatively correlates with judgments about science being able to fully explain that phenomenon at some point. This suggests that people hold epistemic problem intuitions. However, as Sytsma and Ozdemir (2019) have pointed out, participants' mean agreement with whether science could fully explain conscious phenomena was above the neutral midpoint for the vast majority of items. That is, most participants agreed with the claim that science would be able to fully explain conscious experiences at some point. Thus, it is controversial whether Gotlieb and Lombrozo's results show that epistemic problem intuitions are widespread.

Other studies have tested problem intuitions regarding color inversion cases (whether others can experience color different than us) or the possibility of "zombies" - human duplicates without conscious experience - (Fischer and Sytsma, ms; Sytsma, 2010; Peressini, 2014). Furthermore, there is a wealth of research investigating people's attributions of conscious mental states (Robbins and Jack, 2006; Gray, Gray and Wegner, 2007; Knobe and Prinz, 2008; Sytsma and Machery, 2009; Arico, 2010; Phelan, Arico and Nichols, 2013; Buckwalter and Phelan, 2014; see Sytsma, 2016, for a review). Of special relevance for our purposes here are the studies testing whether laypeople attribute mental states in the same way that philosophers do.

In a seminal study on this regard, Sytsma and Machery (2010) tested attributions of conscious mental states such as seeing red and feeling pain to both human and robots. The same surveys were given to philosophers and non-philosophers. As expected, both philosophers and laypeople attributed seeing red and feeling pain to humans in the relevant situations. However, the results regarding mental state ascriptions to robots showed an interesting asymmetry

between the two groups of participants. Most philosophers denied that robots can see red or feel pain. Laypeople tended to deny that robots can feel pain, but they generally agreed that robots can see red. This suggests that philosophers and laypeople have two different concepts of conscious experience. The philosophers' concept is tied to the phenomenology or "what is like" to be in a certain state, an aspect that is present in both seeing red and feeling pain. But laypeople's concept of conscious experience seems to be tied to valence, the positive or negative tone of a mental state, an aspect that is present in feeling pain but absent in seeing red.[2]

If laypeople do not have the philosophical concept of phenomenal conscious experience, it is hard to see how they can hold problem intuitions regarding phenomenal conscious experience. Thus, Sytsma and Machery's results are directly relevant for the meta-problem of consciousness, and they would show that problem intuitions are not widespread (Sytsma and Ozdemir, 2019). However, this interpretation of their results has been challenged. Most importantly, it has been claimed that the expression "seeing red" can refer to non-phenomenal information processing, something like "detecting red" (Huebner, 2012; Fiala, Arico and Nichols, 2014; Peressini, 2014; Chalmers, 2018; see Sytsma, 2018). According to this alternative interpretation, people *do have* a concept of phenomenal consciousness, but the expression "seeing red" (or even "experiencing red", Chalmers, 2020) is less likely to trigger this concept than the expression "feeling pain". Hence the asymmetry in attributions of these states to robots.

In this paper, I will not take part in the abovementioned debate. Instead, I will assume that people can understand the concept of phenomenal conscious experience, and directly test whether they hold core problem intuitions. Based on the previous literature, the most likely candidate to trigger problem intuitions is the concept of feeling pain. Thus, I will test people's intuitions regarding the possibility of identifying (metaphysical intuitions) and explaining (epistemic intuitions) the feeling of pain in terms of physical processes. Data and materials are available at https://osf.io/kqbh7/.

[2] In subsequent work, Sytsma (2012) has revised this account and offered a new explanation according to which laypeople view colours and pains as mind-independent qualities. Note, however, that Sytsma and Machery's main claim still holds: Laypeople do not have the philosophical concept of phenomenal conscious experience.

Study 1a

In order to show that conscious experience cannot be identified with physical processes, or that it cannot be fully explained in terms of physical processes, philosophers have sometimes made a comparison between the feeling of pain and the substance water (Kripke, 1972; Levine, 1983). It has been argued that, while chemical composition H2O can fully explain / be identified with water, this is not the case for brain activity and the feeling of pain. Thus, it seems like there is something special about conscious experience that makes it irreducible to physical processes. But do the folk share these intuitions?

In order to answer this question, I conducted a survey study. Participants[3] in the study were presented with two stories: one about the association between the feeling of pain and neural activity in the Dorsal Posterior region of the Insula (DPI), another about the association between water and chemical composition H_2O (see Table 1).[4] After reading each story, participants answered whether they agree or disagree with the following two claims (between brackets the wording for the water case): "The properties of pain (water) are fully explained in terms of neural activity in the DPI (chemical composition H_2O)" (Epistemic Reduction question),[5] and "The feeling of pain (the substance water) is just neural activity in the DPI (chemical composition H_2O)" (Metaphysical Reduction question). Questions were answered on a scale from 1 ("strongly disagree") to 6 ("strongly agree"). Participants were then asked to briefly justify their responses to these questions. All participants received *both* Water and Pain cases,[6] so the differences between the two were salient.

Pain Case	***Water Case***

[3] 58 participants[3] (34 male, 23 female, 1 other, *Mean age* = 36.46, *SD* = 11.34, age range = 18 -70) were recruited through Amazon Mechanical Turk and completed the survey for a monetary payment. Post-hoc power analysis using G*Power showed that the study had 96% power to detect an effect size of .15 at the standard .05 error probability for dependent samples t-test.

[4] The wording of the vignette was inspired by Weisberg (2006) and Segerdahl *et al*. (2015), respectively.

[5] Note that, in contrast to the Metaphysical Reduction question, this question asks about "the properties of pain" instead of "the feeling of pain". Building on previous data regarding the folk concept of pain (Reuter, 2011; Reuter, Phillips and Sytsma, 2014), one might worry that participants made a non-phenomenal reading of this expression. However, given that (1) the properties mentioned in the vignette are felt properties, and (2) the results for this question were similar to those in the Metaphysical Reduction question (which asked about "the feeling of pain"), this should not be a very pressing worry.

[6] Design was one factor (Water, Pain) within-subjects.

Vignette	The feeling of pain has been carefully studied by neuroscientists for decades now. Using brain imaging techniques, researchers are now able to measure neural activity in people's brains. They have found that every pain experience involves neural activity in a specific area of the brain: the dorsal posterior region of the insula (DPI). They have also found that neural activity within the DPI varies in terms of intensity and localization. The specific localization of the neural activity within the DPI determines the qualitative character of the pain. For example, when neural activity is concentrated in the more posterior part of the DPI, pain is felt as throbbing. When neural activity is concentrated in the more anterior part of the DPI, pain is felt as stabbing.	Water has been carefully studied by chemists for decades now. Using chemical analysis techniques, researchers are now able to measure the chemical composition of substances. They have found that every sample of water involves a specific composition of atoms, in particular: two atoms of hydrogen to one atom of oxygen (H_2O). They have also found that oxygen atoms have a variable number of neutrons. There are three "types" of oxygen (isotopes) depending on the number of neutrons in the atom: O^{16}, O^{17}, O^{18}. The specific isotope of oxygen in H_2O determines different properties of the water. For example, when the isotope of oxygen in H2O is O^{16}, water freezes at 32°F. When the isotope of oxygen in H_2O is O^{17}, water freezes at 32.12°F.
Epistemic Reduction	The properties of pain are fully explained in terms of neural activity in the DPI. *1 ("Strongly disagree") to 6 ("Strongly agree")*	The properties of water are fully explained in terms of chemical composition H_2O. *1 ("Strongly disagree") to 6 ("Strongly agree")*
Metaphysical Reduction	The feeling of pain is just neural activity in the DPI. *1 ("Strongly disagree") to 6 ("Strongly agree")*	The substance water is just chemical composition H_20. *1 ("Strongly disagree") to 6 ("Strongly agree")*

Table 1. Materials in Study 1a.

Contrary to what one would expect if people hold problem intuitions about consciousness, participants agreed to the same extent with (epistemic and metaphysical) reductions of the feeling of pain to neural activity and (epistemic and metaphysical) reductions of water to its chemical composition.[7] 81% of the participants agreed (gave ratings higher than 3) that neural

[7] A repeated measures ANOVA was conducted with Case (Pain, Water) as within-subject factor, Epistemic Reduction and Metaphysical Reduction as measures. This allow us to compare participants mean agreement for Epistemic and Metaphysical Reductions between the Pain and the Water cases. There was no significant difference in participants' ratings for Epistemic Reductions in the Pain case (*Mean* = 4.38, *SD* = 1.14) and the

activity in the DPI fully explains the feeling of pain, and 79% of the participants agreed (gave ratings higher than 3) that the feeling of pain is just neural activity in the DPI. Figure 1 shows participants' responses by question and case.

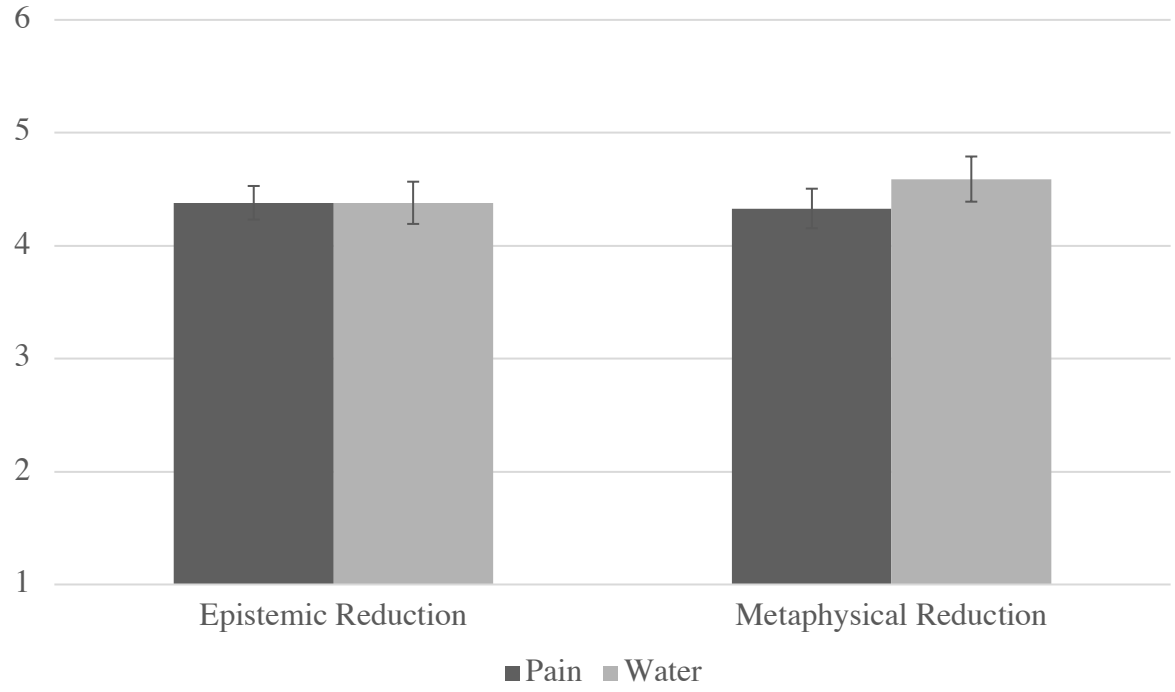

Figure 1. Participants' mean agreement with Epistemic and Metaphysical reductions by Case (Pain, Water) in Study 1a. Error bars represent standard error of the mean.

The results of Study 1a suggest that people do not hold epistemic or metaphysical problem intuitions. However, someone could argue that presenting participants with scientific findings about the relation between the feeling of pain and neural activity "pushed" them into agreeing with reductive statements. Thus, if participants were not presented with this preamble, they would be more likely to report problem intuitions. In order to test this prediction, I conducted a follow-up study.

Water case (*Mean* = 4.38, *SD* = 1.42), *F* (1, 57) = .000, *p* = 1.000. Similarly, there was no significant difference in participants' ratings for Metaphysical Reductions in the Pain case (*Mean* = 4.33, *SD* = 1.33) and the Water case (*Mean* = 4.59, *SD* = 1.52), *F* (1, 57) = 2.144, *p* = .149.

Study 1b

This study uses the same design as Study 1a, but it includes a manipulation of the amount of information that is presented to participants.[8] One group of participants read the same two-paragraph vignettes used in the previous study (Correlational + Causal Information condition), another group was presented with just the first paragraph of those vignettes (Correlational Information condition), and yet other group read no preamble to the questions (No Information condition). As in Study 1a, participants rated their agreement with Epistemic and Metaphysical Reductions of both pain and water.[9]

Results[10] show that the amount of information presented to participants didn't influence their agreement with Epistemic and Metaphysical Reductions. In general, participants agreement with reductive statements was higher in the water case in comparison to the pain case. However, as in Study 1a, the vast majority of participants agreed with Epistemic and Metaphysical Reductions of the feeling of pain to neural activity (81% and 77% of participants, respectively, gave ratings higher than 3). Figure 2 show participants' responses by question and condition.

[8] 64 participants (42 male, 22 female, *Mean age* = 33.44, *SD* = 8.96, age range = 21 -58) were recruited through Amazon Mechanical Turk and completed the survey for a monetary payment. I used a mixed design, with Case (Pain, Water) manipulated within-subjects and Information (Correlational + Causal, Correlation, No Information) manipulated between-subjects. Post-hoc power analysis using G*Power showed that the study had 94% power to detect an effect size of .25 at the standard .05 error probability for repeated measures, within-between factors interaction ANOVA involving three groups and two measurements.

[9] In the No Info condition, "DPI" was substituted by "a specific brain region", and "H_20" was substituted by "a specific chemical composition".

[10] A mixed effects ANOVAs was conducted with Case (Pain, Water) as within-subjects variable, Information (None, Correlational, Correlational + Causal) as between-subjects variable, and Epistemic Reduction and Metaphysical Reduction as measures. There was no main effect of Information, $F(1, 61) = .055$, $p = .946$, and no significant interaction effect between Case and Information, $F(1, 61) = 2.217$, $p = .118$. There was a significant effect of Case, $F(1, 61) = 7.445$, $p = .008$.

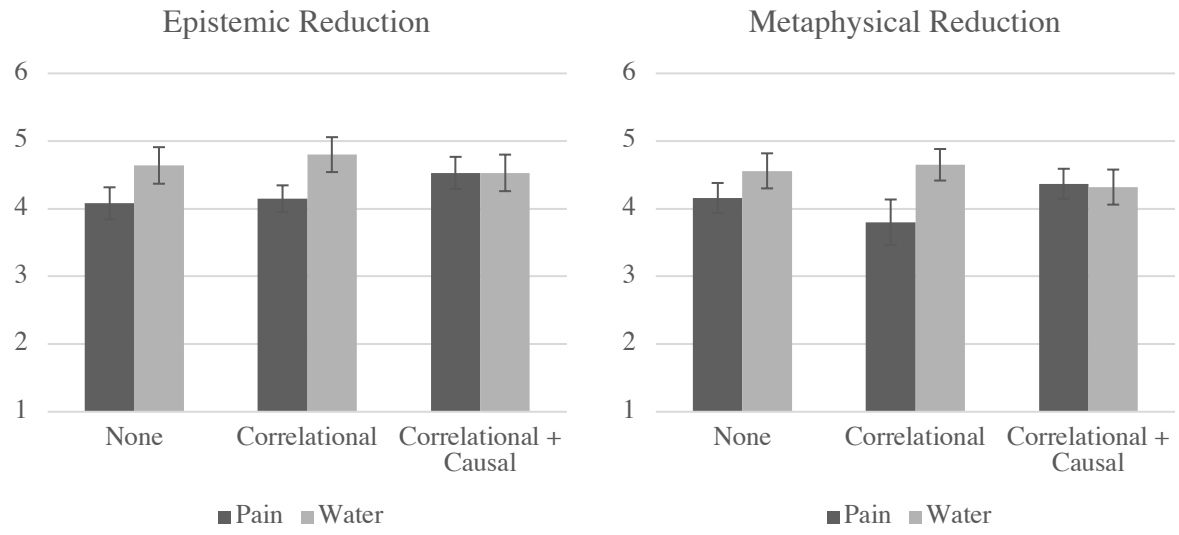

Figure 2. Participants' mean agreement with Epistemic and Metaphysical Reductions by Information condition (None, Correlational, Correlational + Causal) and Case (Pain, Water) in Study 1b. Error bars represent the standard error of the mean.

The results of Study 1b replicate those in Study 1a. However, one could argue that the results provide partial support to the objection that our design bias participants' responses. As Figure 1 shows, the difference in participants responses between pain and water cases was larger in the No Information and Correlational Information conditions in comparison to the original vignette (Correlational + Causal Information condition).[11] Thus, the next study will try to further address this worry.

Study 2a

In order to prompt problem intuitions, this study tested participants judgments about consciousness using a modified version of the Pain vignette used in Studies 1a-b.[12] The new vignette includes a description of the relevant differences between the feeling of pain and neural

[11] However, it is important to note that a series of paired samples t-tests corrected for multiple comparisons showed that participants' mean agreement with Epistemic and Metaphysical reductions of Pain vs Water were not significantly different in both the Correlational and No Information conditions (all *p*s > .008)
[12] Study 2 did not include a Water case.

activity, and explicitly mentions that the relation between the two is controversial. The vignette thus read as follows (main changes with respect to the previous version are underlined):

> The feeling of pain is a subjective mental state. Neural activity in the brain is an objective physical process. The relationship between them has been debated for centuries. Is the feeling of pain just neural activity in the brain? Using brain imaging techniques, researchers have found correlations between pain and brain activity. Whenever people experience pain, there is neural activity in a specific area of the brain: the dorsal posterior region of the insula (DPI). The intensity and character of the pain correlates with different sorts of processing in DPI. For example, when neural activity is concentrated in the more posterior part of the DPI, pain is felt as throbbing. It remains controversial whether the feeling of pain is the same thing as neural activity, or whether these are two different things correlated with one another.

After reading the vignette, participants[13] rated their agreement with Epistemic reductions ("The properties of pain are fully explained in terms of neural activity in the DPI") and Metaphysical reductions ("The feeling of pain is just neural activity in the DPI") on a scale from 1 ("strongly disagree") to 6 ("strongly agree"). Participants were then asked to briefly justify their responses to these questions.

In contrast to the results of previous studies, agreement with Epistemic and Metaphysical reductions was not significantly different from the scale's midpoint (see Figure 3).[14] Only 47% participants agreed (gave ratings higher than 3) that neural activity fully explains the feeling of pain, and only 57% participants agreed (gave ratings higher than 3) that the feeling of pain is just neural activity.[15] This stands in contrast with the 80 / 77% of participants agreeing with reductions in Study 1b.

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[13] 60 participants[13] (36 male, 24 female, *Mean age* = 33.95, *SD* = 9.93, age range = 21 -72) were recruited through Amazon Mechanical Turk and completed the survey for a monetary payment. Post-hoc power analysis using G*Power showed that the study had 98% power to detect an effect size of .5 at the standard .05 error probability for one-sample t-test / binomial test.

[14] One sample t-test showed that participants' agreement with Epistemic Reductions (*Mean* = 3.30, *SD* = 1.15) were not significantly different from the scale's midpoint (3.5), t (59) = -1.342, p = .185. Participants' agreement with Metaphysical reductions (*Mean* = 3.63, *SD* = 1.19) were also not significantly different from the scale's midpoint (3.5), t (59) = .866, p = .390.

[15] Binomial tests show that these proportions were not significantly different from a 50/50 split for Epistemic (p = .699) nor Metaphysical reductions (p = .366).

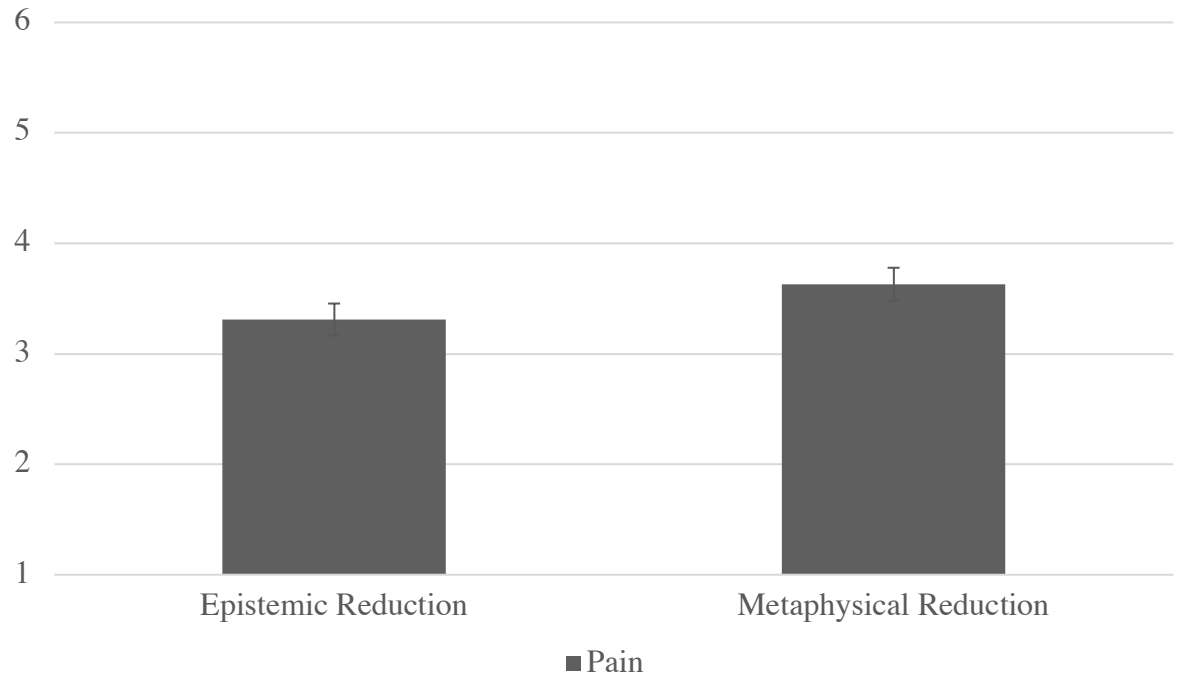

Figure 3. Participants' mean agreement with Epistemic and Metaphysical reductions in Study 2a. Error bars represent standard error of the mean.

Do these results mean that, when prompted, people report problem intuitions? In order to make sure that this was the case, we took a deeper look at the justifications that participants gave to their responses. In particular, we analyzed the justifications given by participants who disagreed with metaphysical reductions. Justifications were classified by the main author and two independent coders in two groups: Problem Intuitions (e.g. "I think that pain is more than just neural activity") or Science Problems (e.g. "Understanding how the brain works is still at a very elementary level"). Fifteen responses were classified as Problem intuitions. Fifteen were classified as Science problems.[16] The latter suggests that a non-negligible number of participants disagreed with reductions because they thought that there were problems with the

[16] First, the first author classified responses in two categories: Problem Intuitions (responses expressing that the feeling of pain cannot be reduced to neural activity) and Science Problems (responses expressing that the scientific evidence is not sound or complete enough to reduce the feeling of pain to neural activity). Afterwards, two independent coders were given the description of each category and themselves coded participants' responses. Cohen's k was run to determine if there was agreement between their coding and the author's coding (McHugh, 2012). There was weak agreement for both categories, with agreement percentages 68.75% (k = .43) and 75.00% (k = .50), respectively. Thus, we should not extract strong conclusions from these results. Responses were classified as Problem Intuitions and/or Science Problems if at least one coder classified them as such. 4 out of 26 responses were classified as both Problem Intuitions and Science Problems.

science, and not a problem with consciousness. Participants whose responses were classified as Problem Intuitions constituted only a 25% of the total number of participants, a percentage that resembles the percentage of participants disagreeing with reductions in previous studies (~20%).

The results of Study 2 suggest that, when prompted to do so, some people report problem intuitions. However, results also suggest that a sizable proportion of those intuitions are driven by consciousness-independent factors. Many participants disagreed with reductions because they thought that the relevant science is not well developed, and not because consciousness poses a hard problem. In order to directly test this hypothesis, I conducted a follow-up study.

Study 2b

In order to elucidate why people report problem intuitions, Study 2b tests the role of consciousness-related and consciousness-independent factors in people's judgments about consciousness. Participants[17] read a similar vignette to the one used in Study 2a:

> The feeling of pain is a subjective mental state; only the individual him- or herself can feel it. Neural activity is an objective physical process; outside observers can measure it. Is the feeling of pain just neural activity? Using brain imaging techniques, researchers have found correlations between the feeling of pain and brain activity. Every time people feel pain, there is neural activity in a specific area of the brain, in particular: The Dorsal Posterior region of the Insula (DPI). The intensity and localization of neural activity within the DPI determines the felt properties of the pain. For example, when neural activity concentrates in the posterior part of the DPI, pain is felt as throbbing. And when neural activity is concentrated in the anterior part of the DPI, pain is felt as stabbing. The relation between the feeling of pain and neural activity is still debated nowadays. We would like to know your opinion.

[17] 119 participants[17] (77 male, 42 female, *Mean age* = 36.46, *SD* = 10.711, age range = 21 -68) were recruited through Amazon Mechanical Turk and completed the survey for a monetary payment. Post-hoc power analysis using G*Power showed that the study had 95% power to detect an effect size of .15 at the standard .05 error probability for linear multiple regressions using three predictors.

Afterwards, participants answered a series of questions. As in previous studies, participants rated their agreement with metaphysical / epistemic reductions of the feeling of pain to brain activity (Reduction statements). In addition, and in order to prompt problem intuitions, participants rated their agreement with the existence of an epistemic / metaphysical gap between the feeling of pain and brain activity (Gap statements). The Metaphysical Gap statement was "The feeling of pain is a different thing than neural activity in the DPI". The Epistemic Gap statement was "Neural activity in the DPI cannot explain what is like to feel pain". Participants rated their agreement with each of these statements on a scale from 1 ("Strongly disagree") to 7 ("Strongly agree").[18] All measures were significantly correlated with each other (see Table 2). Principal component analyses[19] showed that all questions were consistently measuring the same underlying phenomenon. Thus, all four measures (with Reduction statements reverse-coded) were aggregated into a single Problem Intuitions measure (*Mean* = 3.78, *Standard Deviation* = 1.363, 41% of responses above the midpoint of the scale, 48% below the midpoint of the scale. 11% at the midpoint of the scale). This scale showed good internal reliability.[20]

	Mean (SD)	**Metaphysic Reduction**	**Metaphysic Gap**	**Epistemic Reduction**	**Epistemic Gap**	**Problem Intuitions**
Metaphysic Reduction	4.66 (1.65)	1	**-.477**	.658	-.404	**-.809**
Metaphysic Gap	3.70 (1.74)		1	-.356	.532	**.753**
Epistemic Reduction	4.24 (1.83)			1	**-.445**	**-.794**
Epistemic Gap	4.33 (1.78)				1	**.721**
Problem Intuitions	3.78 (1.36)					1

[18] A 7-point scale was used so participants could use the middle point in case they don't have a strong opinion.
[19] Principal component analysis was conducted on the 4 items. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .683, well above the acceptable limit of .5 (Field, 2013). Only one factor had an eigenvalue over Kaiser's criterion of 1 and explained 60.95% of the variance. All Metaphysical Reduction (.823), Metaphysical Gap (-.748), Epistemic Reduction (.795) and Epistemic Gap (-.754) loaded high on this factor.
[20] Standard Cronbach Alpha = .785.

Table 2. Descriptive statistics (Mean and Standard Deviation) and correlations among measures in Study 2b. All correlations significant at $p < .001$.

Apart from measuring participant's judgments about consciousness, Study 2b measured different factors that could be driving those judgments. Both consciousness-related and consciousness-independent factors were tested. The first factor is Inward Thinking.[21] People who tend to pay attention to the qualities of their conscious experience are probably more acquainted with it. Thus, having an inward thinking style is considered a consciousness-related factor. The second factor is participant's tendency to engage in Reflection.[22] Although not necessarily a consciousness-related factor, it could be argued that reflective people are in a better epistemic position to make judgments about consciousness than non-reflective people (Talbot, 2012; but see Sytsma and Machery, 2012). Along these lines, Chalmers has claimed that a tendency to report problem intuitions "is present in a good majority of people, at least among reflective people in contemporary Western cultures" (Chalmers, 2020, p. 2). Thus, one could expect that highly reflective people will tend to hold problem intuitions. Finally, participants rated the quality and completeness of the relevant science. Participants rated their agreement on a scale from 1 ("Strongly disagree") to 7 ("Strongly agree") with the following statements: "Science can discover much more about the feeling of pain than what is mentioned in the text" (Science Completeness - reverse coded so higher ratings indicate more completeness) and "The scientific findings presented in the text are an example of good science" (Science Quality). If participants' report problem intuitions because they think that science is not sufficiently well developed, this would mean that problem intuitions are not due

[21] Inward-thinking was measured using items from the Externally-Oriented Thinking Subscale of the Toronto Alexithymia Scale (Bagby, Parker and Taylor, 1994), a well-validated and reliable psychometric instrument. Participants rated on a scale from 1 ("Not at all") to 5 ("Very much") the following statements: "Being in touch with emotions is essential", "I can feel close to someone, even in moments of silence", and "I find examination of my feelings useful in solving personal problems". Each participants' ratings were added up for a total Inward Thinking score. Internal reliability was good (Standard Cronbach Alpha = .838).

[22] Reflection was measured using the Cognitive Reflection Test 2 (Thomson and Oppenheimer, 2016). This test consists in four problems which participants give an open-ended response to. In order to correctly solve these problems, participants have to override the first response that comes to mind. For example, one problem is "*If you are running a race and you pass the person in second place, what place are you in?*". When presented with this question, one might be tempted to quickly reply "first". However, the correct response is "second". Participants get score from 0 (no correct responses) to 4 (correct responses to all problems), which indicates their tendency to engage in cognitive reflection. Internal reliability was acceptable (Standard Cronbach Alpha = .724).

to the properties of consciousness itself (see Lau & Michel, 2019). Thus, Science Completeness and Science Quality are considered consciousness-independent factors.

Results show that both Science Quality and Completeness ratings significantly predicted participants' *lack of* problem intuitions. Participants who rated the science as good or complete tended to think that there is no problem of consciousness. On the other hard, Reflection and Inward Thinking showed no significant effect on problem intuitions.[23] Figure 4 show participants' problem intuitions in relation with these four measures.

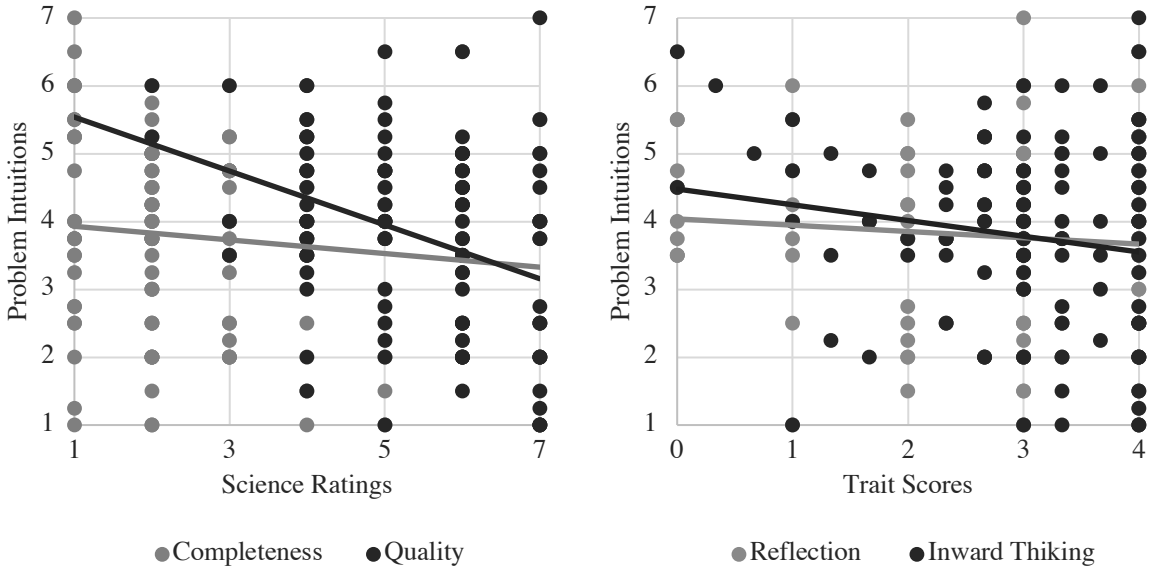

Figure 4. Relation between Problem Intuitions (Y axis) and participants Science Completeness ratings / Science Quality ratings (X axis, left), and Reflection scores / Inward Thinking scores (X axis, right). Lines represent linear regressions fit to the data.

[23] A regression analysis using Reflection scores, Inward Thinking scores, Science Quality ratings and Science Completeness ratings as predictors and Problem Intuitions as the outcome variable was conducted. Science Quality ratings significantly predicted participants' lack of problem intuitions ($\beta = -.354$, CI [-.600, -.198], $p < .001$), and so did Science Completeness ratings ($\beta = -.178$, CI [-.372, -.003], $p = .046$). Reflection ($\beta = -.124$, CI [-.311, -.064], $p = .194$) and Inward Thinking ($\beta = -.135$, CI [-.396, -.125], $p = .306$) showed non-significant negative effects on Problem Intuitions.

Overall, results suggest that participants' problem intuitions are driven by consciousness-independent factors. Participants reported problem intuitions because they think there were problems with the science and not with consciousness. Conversely, participants who thought that the science was solid tended to think that there is no hard problem of consciousness.

However, one could question whether participants' judgments of the scientific findings in the vignette are completely independent of consciousness. It might be the case that participants judged the findings in the vignette as bad science because these findings represent crude reductionism, a position that they reject. This rejection would in turn be driven by their acquaintance with conscious experience, which makes them think that conscious experience cannot be reduced to neural activity. If this is the case, participants who judged the science as bad tended to report problem intuitions *because of consciousness*. In order to test this possibility, I analyzed whether the effect of Science Quality ratings on Problem Intuitions was mediated by participants' acquaintance with conscious experience (as measured by Inward thinking scores). Contrary to objections, Inward Thinking did not significantly mediate the effect.[24] This suggests that the relation between judgments of the science and judgments of consciousness does not depend on consciousness itself. That is, that Science Quality is a consciousness-independent factor.

Discussion

As we saw at the beginning of this paper, investigating people's problem intuitions about consciousness (the meta-problem of consciousness) could inform the hard problem of consciousness itself. In particular, if consciousness poses a hard problem, problem intuitions are expected to arise due to the same mechanisms that are responsible for conscious experience. But if problem intuitions arise due to factors that are independent of consciousness, this would suggest that the hard problem is not a real problem. Despite the potential of these empirical investigations, no study to date has directly tested the prevalence and factors underlying core problem intuitions about consciousness. In four new experimental-philosophical studies, I found that (1) problem intuitions are not widespread (2) when they arise, they do because of

[24] A mediation analysis using Problem Intuitions as dependent variable, Science Quality as predictor, and Inward Thinking as mediator, was conducted. Results showed there was no significant indirect effect of Good Science on Problem Intuitions through Inward Thinking, b = -.020, CI [-.098, .059].

consciousness-independent factors. Overall, the results indicate that people do *not* think that consciousness poses a hard problem but, if anything, that it is hard to do good science. As the hard problem and the meta-problem are closely tied, this suggests that there is no hard problem of consciousness.

The results of Study 1a-b showed that, contrary to what has been assumed, problem intuitions are not widespread. Participants in these studies agreed to a similar extent with reductions of a conscious experience (the feeling of pain) to physical processes (neural activity in the brain) and reductions of a physical substance (water) to its chemical composition (H_2O). In Study 2a, problem intuitions were prompted by introducing changes in our experimental design. Around half of the participants reported that the feeling of pain cannot be reduced to neural activity. However, participants' justifications for their responses suggest that many of these judgments were driven by participants' perception of the relevant science as incomplete or poor in quality, and not by consciousness itself. The results of these text analyses, however, should be taken with caution (see footnote 16). Thus, Study 2b directly tested what factors drive people's judgments about consciousness by measuring participants' judgments of the relevant science, as well as their tendency to engage in reflection and inward thinking. Judgments of the science as complete and high in quality predicted participants' *lack of* problem intuitions. This suggests that problem intuitions do not tell as something about consciousness. Instead, they tell us that the relevant science is not sufficiently well developed.

It is important to note, however, that the studies presented here have some limitations. First, the studies only investigated the feeling of pain. They didn't test other conscious experiences such as, e.g. the experience of color, or the experience of emotions such as fear. As it has already been mentioned, the feeling of pain was selected as the best candidate for testing problem intuitions. Although the experience of color could trigger problem intuitions, it has been argued that color is more likely to suggest a non-phenomenal reading than pain (Chalmers, 1996). Previous studies show that people are more willing to attribute color experiences than pain experiences to robots (Sytsma and Machery, 2010; Sytsma and Ozdemir, 2019). Thus, I would predict that problem intuitions regarding the experience of color will be even less prevalent than problem intuitions regarding the feeling of pain. The same applies in the case of emotion, as unconscious emotions are arguably more common than unconscious pains (but see Reuter and Sytsma, 2018) and extant research suggests that people's emotion concepts encode information about non-phenomenal contextual factors (Phillips *et al*., 2017; Díaz and Reuter, 2020).

Second, one could argue that it is not clear what participants in the studies mean when they report that neural activity "fully explains" the feeling of pain. The negative correlation between participants' agreement to Epistemic Reduction and Epistemic Gap statements in Study 2b suggest that our measure is valid. However, there might be better ways of isolating the relevant kind of explanation here (reductive explanation). Third, and most importantly, only three possible factors driving problem intuitions were tested here. It could be the case that other factors do a better job at predicting problem intuitions, or that there are better ways to measure the ones that were already considered (see Study 2b). All these considerations offer interesting avenues for future research. Hopefully, the studies presented in this paper will pave the way for many future studies on people's problem intuitions, helping us achieve a better understanding of the meta-problem and shed light on the hard problem of consciousness.

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