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Mental strength: A theory of experience intensity

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Abstract

Our pains can be more or less intense, our mental imagery can be more or less vivid, our perceptual experiences can be more or less striking. These degrees of intensity of conscious experiences are all manifestations of a phenomenal property I call *mental strength*. In this article, I argue that mental strength is a domain-general phenomenal magnitude; in other words, it is a phenomenal quantity shared by all conscious experiences that explains their degree of felt intensity. Mental strength has been largely overlooked in favor of mental states' type, representational contents, domain-specific phenomenology, or processes such as attention. Considering mental strength in our reflections about the mind illuminates debates about the relation of representational contents and phenomenal character, and it also helps address questions about the structure and functions of consciousness. Mental strength provides a unifying construct to model what is shared in the phenomenology of different types of conscious experiences.

Hume's starting point in *A Treatise of Human Nature* is that mental states have degrees of strength: "All the perceptions of the human mind resolve themselves into two distinct kinds, which I shall call IMPRESSIONS and IDEAS. The difference betwixt these consists in *the degrees of force and liveliness*, with which they strike upon the mind, and make their way into our thought or consciousness."[1] (Hume 1739, 1.1.1.1; my italics) Under IMPRESSIONS he includes sensations, perceptions, passions, and emotions, while IDEAS are "faint images of these" (*ibid*) that include memories, imaginations, reasonings, and thoughts. Hume thinks that the degree of strength of mental states can be used as a criterion for individuating mental states by type: "[Impressions and ideas] are in general so very different, that no-one can make a scruple to rank them under distinct heads, and assign to each a peculiar name to mark the difference."[2] (*ibid*) This Humean criterion for determining a mental state's type has found several critics, but also champions.[3] Beyond the ontology of mental states, recent work in psychology and neuroscience shows that people use the intensity of experiences to classify their own states as perceptual or imaginative (Dijkstra and Fleming 2023; Dijkstra et al. 2021; Fleming 2020; see Perky 1910). However, Hume's more general insight that conscious states have degrees of strength, and that this phenomenal strength is a fundamental property shared across different types of conscious experiences, has been in general wrongly underestimated.[4]

Pains can be more or less strong, perceptions more or less striking, mental images more or less vivid, emotions more or less intense. Are these intensity variations different in kind depending on the type of state? Phenomenally speaking, is the degree of intensity of a headache unrelated to the degree of intensity of an experience of joy, or is there something that these disparate experiences share with respect to their intensity? In this article, I argue that these variations in experienced intensity in otherwise radically different states are explained by variations along a single phenomenal dimension shared across conscious experiences. I call this dimension *mental strength*.

According to the view I develop here, mental strength is a distinct phenomenal magnitude of all conscious experiences (in particular, experiences with a sensory component such as pain, mental imagery, or perception). As such, the degree of strength of a mental state can be understood as its degree of phenomenal intensity. Mental strength increases from zero, as it were, when the conscious experience has not yet arisen, and grows in certain time to a given measure. Different degrees of mental strength result in different degrees with which mental events "make their way to our consciousness," to use Hume's phrase. In other words, it is the degree of mental strength of a conscious state that marks the intensity of an experience, or "how much it takes up" of someone's stream of consciousness at a given time.[5] We can enjoy several experiences simultaneously without them "obscuring" each other (e.g., one can have two pains, or one can both see and hear something without interference). However, high-intensity experiences may "take over" the stream of consciousness by reducing or even inhibiting the mental strength of other experiences.[6] For instance, a pain or a vivid mental image may become "blinding".

Importantly, this inhibition of experience can take place across different types of experience: loud noises can blind us, vivid imaging can prevent us from hearing, and so on. This suggests that mental strength, being present in all conscious experiences in such a way as to interfere across modalities, is a domain-general phenomenal property. This is not true of all phenomenal properties, some of which are domain-specific: only visual experiences have color or brightness phenomenology, only auditory experiences have loudness or pitch phenomenology, only haptic experiences have texture phenomenology, and so on. Experiencing one color or another, in and of itself, does not seem to affect our ability to experience a particular pitch. In contrast, an overall, amodal intensity of experience is present across different types of experience and interactions

do take place. Thus, we can think of mental strength as domain-general or amodal phenomenal intensity.

One of my goals here is to develop a framework for understanding mental strength. In doing so, I will characterize mental strength across various types of conscious experience, distinguishing it from related, but ultimately different, phenomena such as attention, saliency, or representational contents of intensity. I will also highlight some philosophical consequences that follow from recognizing mental strength as a domain-general phenomenal property shared by all conscious mental states regardless of their type, content, or type-specific phenomenology. This should enhance our understanding of mental strength in particular and consciousness in general.

In section 1, I analyze the representative case of pain strength. Compared to other states, pain can more straightforwardly help us understand the role and nature of mental strength. In section 2, I expand the view to mental imagery and perception. In section 3, I discuss the domain-general nature of mental strength. In section 4, I focus on distinguishing mental strength from attention, salience, and representational contents. Finally, in section 5, I discuss some of the philosophical consequences of including mental strength in our explanations of the mental. In particular, I discuss its repercussions in debates about the structure of the stream of consciousness, the functions of consciousness, and cognitive phenomenology.

1 | PAIN STRENGTH

Imagine you wake up late for work. When rushing to the shower, you stub your big toe. A sudden painful sensation invades your conscious awareness: your toe hurts. First, the pain is sharp, strong, and unpleasant. You hold your toe and, while doing so, you are unable to focus on anything else except the painful sensation. After a few seconds, your experience starts changing: it slowly becomes weaker while still being a sharp, unpleasant pain in your toe. As the pain intensity decreases, your mind gets back to thinking about being late for work and you resume your plan to take a shower. An obvious phenomenal change takes place as the intensity of your pain first increases and then decreases. This phenomenal change is, I argue, a change in the mental strength of your painful experience.

Pains, however, are complex. This means their mental strength emerges in a complex way too. In what follows, I will characterize multiple modulators of mental strength in pain. Even though pain mental strength is an amalgamation of different etiologies, these ultimately result in a single intensity magnitude.[7]

Pains have distinct sensory-discriminative, affective-motivational, and cognitive-evaluative components (Grahek 2007; Hardcastle 1999; Langland-Hassan 2017). All these components admit degrees and, together, they shape the overall phenomenology of pain. In the stubbed toe example, the affective-emotional and the cognitive-evaluative components—as well as some of the sensory-discriminative components such as felt location and sensory character (pain type)—remain constant throughout the described phenomenal changes. In contrast, its sensory intensity, which is part of the sensory-discriminative component, raises quickly and then slowly starts decreasing. In this case, changes in mental strength are driven by variations along the sensory dimension.

The everyday example of stubbing your toe reveals important phenomenal aspects of pains within the sensory dimension that go beyond sheer intensity. Pains have felt locations, as they are always felt *somewhere* in the body. Even phantom limb pain patients attribute the source of their pain to a bodily location on their no-longer existent limb. Pains can be felt as affecting a volumetric

area or just a surface, inside or outside the body, with a precise or an undefined shape. Pains also have pain-specific phenomenal characters that determine their type; a pain can be sharp, pricking, stabbing, gnawing, burning, dull, throbbing, etc. (Melzack 1975).

Although mental strength can naturally be understood in reference to sensory intensity, mental strength is not exhausted by it. Changes in other aspects of the sensory-discriminatory dimension such as felt location and sensory character, as well as variations along the affective and cognitive dimensions, can also modulate the mental strength of pains. These changes occur independently from changes in sensory intensity. For example, a sharp and pounding pain may raise the overall mental strength of the experience—"how much it takes up" of the stream of consciousness—more than a dull and flickering pain with an identical sensory intensity. Similarly, other things being equal, a pain in the face may be more "blinding" than a pain in the leg; it may occupy more of the conscious stream of the subject, making it more distracting or attention-grabbing.

The affective-motivational dimension of pains may also affect how intensely they are felt. The overall mental strength of an unpleasant pain may be higher than that of an equally intense (sensorily speaking) but less unpleasant pain. For example, you may find a paper cut more unpleasant than a prick, even if you rate them as being equally intense. In such a case, the paper cut may grab more your attention, affect more your capacity to focus on other things, or, in extreme cases, even "blind" you from other experiences if just for a second. Thus, increases in mental strength can be modulated by variations in unpleasantness too.

Disentangling the sensory intensity and the unpleasantness dimensions is hard. Stronger pains tend to be nastier and nasty pains tend to be stronger. But sensory intensity and unpleasantness can be dissociated (Rainville 2002), which indicates they are independent from one another. For example, patients with pain asymbolia report feeling the sensory intensity of being pricked in very similar ways to the normal population, but they do not report feeling the pain's unpleasantness (Grahek 2007). This does not mean they find pain pleasant, rather they are just indifferent to it and they do not feel compelled to avoid it. Something similar happens after morphine intake, thalamus lesions, prefrontal lobotomies, and, in a more modest way, hypnosis (Rainville et al. 1997) and mindful meditation (Gard et al. 2012). Importantly, the dissociation works in the other direction as well. Dental patients whose nerves are electrically stimulated while under the potent analgesic fentanyl report pain to be as unpleasant as without the drug but less intense (Gracely, Dubner, and McGrath 1979). In all these cases, the overall mental strength of these pains is arguably reduced.

The mechanism for increasing (or reducing) mental strength via a non-sensory pathway could operate in different ways. It could be that the sensory-discriminative intensity dimension of pain—and, therefore, mental strength—is affected by changes involved in variations of unpleasantness. Alternatively, it could be that there are in fact non-sensory changes that affect mental strength. If the latter, mental strength is a phenomenal magnitude over and above the intensity in the sensory-discriminatory dimension; if the former, unpleasantness is a means by which sensory pain intensity—and with it, mental strength—is modulated. Although I am inclined to believe the first alternative is correct, for our current purposes we do not need to solve this issue, and it suffices to point out these possibilities.

With respect to changes in cognitive appraisal, catastrophizers are an illustrative case. Catastrophizing, an exaggerated negative mental set brought to bear during painful experiences (Sullivan et al. 2001), affects mental strength by changing the cognitive-evaluative dimension of pain. Catastrophizing comprises three dimensions: magnification ("I worry that something serious may happen"), rumination ("I can't stop thinking about how much it hurts"), and helplessness ("It's awful and I feel that it overwhelms me"). Catastrophizers rate pains—usually chronic pains—as having higher intensity than non-catastrophizers with similar ailments. In contrast, when pain

is reappraised and subjects stop conceiving it as a signal of a potential life-threatening pathology, intensity ratings decrease (Leeuw et al. 2007). As with unpleasantness, this opens two possibilities. One, that catastrophizing is a mechanism that modulates sensory intensity; the other, that catastrophizing affects mental strength independently of the pure sensory-discriminative intensity dimension. Again, there is no need to decide here between these two possibilities.

Pain strength has multiple sources: sensory, affective, and cognitive components. This entails that some mild but nasty pains may have a high degree of mental strength; a pain that is not very strong or unpleasant, but of which we ruminate and obsess about, may have a high degree of mental strength. Duration, as chronic pain sufferers well know, is another important dimension that can contribute to pain mental strength. It is not the same to experience an intense pain that lasts a second than to experience a similar one that lasts for an hour. The interaction between all these components can be complex. Consequently, the mental strength of a given state need not be a simple aggregate of the contribution of each component (cf. Fazekas 2023a). This suggests mental strength is not simply reducible to the specific sensory, affective, and cognitive appraisal components that modulate it. This point is crucial for generalizing mental strength to conscious experiences other than pain, as other mental states lack these dimensions and possess others absent in pain.

2 | BEYOND PAINS

So far, I have focused on pains as an initial case study. Mental strength, however, is a property of other sensory conscious states as well. For brevity, here I only discuss mental imagery and perceptions, but similar arguments can be made about other types such as moods, feelings, or emotions. The presence of mental strength in non-sensory states like desires and thoughts hinge on whether they posses phenomenal character. Because this is a controversial issue (Montague 2015; Chudnoff 2015), I do not discuss these mental states here, but I briefly come back to them at the end of section 5.

I argued above that pain strength has various sources: sensory intensity, unpleasantness, and a cognitive-emotional dimension. Variation in one or all of them affects the overall mental strength of a painful state, in its turn affecting how much a given painful experience "takes up" of someone's stream of consciousness at any given moment. This general explanation can be extended to other states. The sources of mental strength of non-painful experiences are diverse too, and they interact with each other to modulate mental strength.

2.1 | Mental imagery

The term 'vividness' is often used in the imagery domain to capture what I mean by mental strength (Cornoldi, Beni, and Mammarella 2008; Galton 1880; Hume 1739; James 1890; Kosslyn 1996; Marks 1973; Pearson et al. 2015; Fazekas 2023b). Independently of their visualizing capacity or the precision of their descriptions, people seem to consistently use a small set of terms to describe the strength of their mental images.[8] William James (1890, XVIII, vol. II), for instance, offers a compilation of reports by other scientists and by his own students who, besides using descriptors like 'strength' or 'vigor', appealed to the degree of vagueness, blurriness, sharpness, dimness, clarity, or number of details to capture imagery vividness. Furthermore, subjects have no trouble providing consistent vividness ratings across time (Cui, Jeter, Yang,

Montague, & Eagleman 2007). This convergence strongly suggests that, even though a precise definition of vividness offers some challenges (Kind 2017; Thomas 2009), people have an intuitive understanding of the notion of imagery strength.

The strength of mental imagery is affected by, and varies along, at least six dimensions that lay along intensity, specificity and reality axes.[9] Intensity: (1) sensory properties (e.g., brightness, loudness, etc.); specificity: (2) clarity, (3) number and (4) salience of details; and reality: (5) the feeling of presence of the imagined objects or events, and (6) the overall stability of the image (Cornoldi et al. 2008; Thomas 2009). When you imagine your childhood's house, the brightness and saturation of the colors in the mental image you invoke are likely to play a role in the overall strength of your experience. The stability of the imagined house is important too. For instance, the shape of the windows may shift as you struggle to maintain the image in your mind. These shifts are clearly related to the representational contents of the image; some are more static and others more dynamic, but still representational. But there are non-representational components that affect the intensity of the imagined house too. The intensity of the feeling of presence or reality that you are in front of your childhood's house may emerge over and above the representational details of the image.[10]

Naturally, all these dimensions admit variations in degree. *Ceteris paribus*, a more stable mental image will be stronger, as would be a brighter and more saturated image or a more detailed one. Some dimensions covary with others. Increasing the number of details can make it easier to experience the imagined objects as being present, but it can also hinder the stability of the image. Importantly, the overall strength of the imagining experience will be a function of the degrees of intensity along each of these dimensions. Mental images with faint colors and few details may still be strong. Their strength may stem from a very salient feature or from being able to picture a target in a very stable way. This may explain why subjects who report scant details about their mental images can still judge them to be vivid (Bigelow, McCoy, and Ullman 2023). Even within a single dimension, different objects can contribute to different degrees of strength. For example, the image of your childhood's house could be faint, but the grass and sky could be quite bright and saturated, making the experience strong overall. Alternatively, even if an image is really clear or has lots of stability, having few imagined details or no salient features could yield a weaker experience.

Mental imagery strength cannot be reduced to a single dimension or to a single aspect within one dimension. If sensory properties were picked as the only dimension that mattered for imagery strength, one should not be able to vividly imagine a dim candlelight. However, at least some people can do that, so imagined brightness cannot be simply identified with mental imagery strength. If clarity were selected as the single most important dimension, one should fail to strongly imagine a blurry image of one's childhood's house. But at least some people seem to be able to strongly imagine their houses even if these have an ill-defined contour or if the image lacks some details. The same applies for other dimensions.

2.2 | Perception

Perceptual and imagery strength work in a very similar fashion. Hume described imagination as perception that is "faint and languid, and cannot without difficulty be preserv'd by the mind steady and uniform for any considerable time." (1739, 1.1.3) In fact, neuropsychological and physiological research shows visual mental imagery shares many of the behavioral and neural profiles of visual perception (Laeng and Sulutvedt 2014; Pearson and Tong 2008; Pearson, Rademaker,

and Tong 2011; Pearson et al. 2015). It is not surprising, then, that this overlap has pushed philosophers and psychologists, very much in Hume's spirit, to characterize mental imagery as perception that is "weak" (Pearson et al. 2015), "degraded" (Byrne 2010), "essentially poor" (Sartre 1940), or "decayed" (Hobbes 1651).

An important difference with imagery is that perception is committal about a particular (the representation is caused by a singular object with the attributed properties), while imaginings are noncommittal about particulars.[11] To have a perceptual experience of an object, the perceiver must have a commitment regarding its presence in their immediate environment. Note that this is true too even in cases of inaccurate representations, illusions, and hallucinations. Imagining does not carry such commitment. Even when the imagined-to-be-present dimension is heightened, in normal cases we are still not committed to the presence of the object in our immediate surroundings. However, it is worth nothing, as Hume did, that in extreme cases such as fever, madness, or situations involving low threshold stimuli, cross-overs between perception and imagination are not impossible (1739, 1.1.1.1; Dijkstra and Fleming 2023). Notwithstanding this obvious difference, the other five dimensions of imagery strength function similarly in perception.

The causal origin of perceptual experiences is not per se relevant for our current purposes, but unlike imagery and very much like pain, perceptual strength is modulated by external stimulation. Retinal size, speed, lightness, and saturation are important bottom-up modulators of perceptual strength. *Ceteris paribus*, strong stimuli give rise to strong experiences. But things are rarely *ceteris paribus*. Not just because we can misrepresent how things are, but because perceptual strength can be modulated by attention too.[12] An attended weak perceptual stimulus, then, could yield a stronger experience than when it remains unattended. As has been shown in multiple experiments, attention in fact alters appearance and, in consequence, it can alter mental strength too (Carrasco, Ling, and Read 2004; Tse 2005).

Much more could be said about the relation of representational contents, salience, attention, and mental strength in perception. However, because of its similarity to mental imagery, for the present purposes this must suffice. In section 4, I will discuss these issues at greater length.

3 | MENTAL STRENGTH IS DOMAIN-GENERAL

The lessons learned from pain, mental imagery and visual perception can be extended to other sensory modalities and types of experiences such as auditory and olfactory experiences, moods, or emotions. Mental strength is a phenomenal magnitude present in all kinds of sensory experiences. This makes it a domain-general phenomenal magnitude. This fact is evidenced when increasing mental strength in one experience reduces the mental strength in others. When you stub your toe and the pain becomes more prominent, your worries about being late for work and your thoughts of taking a shower disappear. It is almost as if the total mental strength one can have at any given moment has to be shared among simultaneous states in one's stream of consciousness, effectively reducing the strength of some states when others become stronger. This could explain why mental states with high strength become "blinding". When they dominate the stream of consciousness, they sometimes do it to the detriment of other states. For instance, an effective remedy against pain involves increasing the strength of other experiences. This could be achieved by focusing attention on something else, imagining one is in a different situation, or in the most extreme cases, inducing a new source of pain. A similar phenomenon occurs when vividly daydreaming. A faint image that flickers in and out of consciousness is not very distracting. But when someone gets completely lost

while daydreaming, mental imagery can be so strong that one becomes perceptually "decoupled" or unaware of one's surroundings (Hove et al. 2016; Schooler et al. 2011).

Research in psychophysics shows something like blinding takes place within the perceptual domain too. Load Theory holds that perception is automatic and has a limited capacity. It predicts that perceptual load in a task modulates whether other stimuli enter conscious awareness or not independently of attention and the properties of non-target stimuli (Lavie, Beck, and Konstantinou 2014; Forster and Lavie 2016). In Load Theory, perceptual load is understood as the number of target items that need to be perceived in a task. For example, in a search task, when perceptual load is high, conscious awareness includes only the main task's stimuli and it does not "spillover" to others. When perceptual load is low, other stimuli enter awareness too, distractors affect task performance, attentional capture is increased, etc. When the target is very different from the non-targets or when there are few non-targets, subjects become aware of task-irrelevant stimuli. These effects are found across identical attentional conditions and independently of whether stimuli are in the periphery or at fixation, whether they are objects of socio-biological significance or not, or whether subjects are expecting the task-irrelevant stimuli or not. In contrast, when perceptual load is high, task-irrelevant stimuli go unnoticed, as if the main task blinded subjects from seeing them.

While Load Theory is cashed out in terms of perceptual processing and informational load, its results could be recast in terms of mental strength. As I argued above, mental strength is increased by quantitative stimulus properties, number of features, and so on. In my terms, then, these experimental results confirm that when perceptual experiences are strong (like when there are many target stimuli), other experiences (or other objects in the visual experience) become weaker.

Importantly, the theory of mental strength makes explicit novel predictions with respect to the strength of an experience and its ability to suppress or "blind" other experiences. For example, people with aphantasia—the inability to experience mental images—should experience less pain reduction while attempting to form a mental image than vivid imagers who can bring a mental image to their mind's eye, despite exerting similar cognitive effort (Bantick et al. 2002; Legrain et al. 2009; Miron, Duncan, and Bushnell 1989). The domain-generality of mental strength also allows us to make predictions about other downstream effects, for example, in how attention is allocated or how accurately one can introspect intense versus weak experiences (Morales 2021).

The examples and predictions above indicate that "blinding" is possible because the degrees of strength of simultaneous states interact with each other, which in turn is possible because of the domain-general nature of mental strength. In other words, if the mental strength of pains were of a different nature from the mental strength of visual experiences, we would have more trouble explaining why an increase in pain strength affects visual strength and vice versa. But these interactions happen all the time, suggesting that mental strength is a shared property across different kinds of mental state.

4 | WHAT MENTAL STRENGTH IS NOT

One may question, upon reflecting on the examples in the previous sections, whether mental strength is truly a distinct trait of mental states. After all, the cases I discussed seem to involve either bottom-up stimulus-driven intensity changes or top-down attention effects. Mental strength then could just be garden-variety sensory intensity driven by the representational

contents of the state (e.g., potential tissue damage, a bright light, etc.) or by attention. If this were correct, mental strength would not be a distinct, domain-general phenomenal magnitude of conscious experiences. It would be, at best, a domain-specific phenomenal magnitude. At worst, mental strength would be reducible to something else. Here, I discuss attention, salience, and representational contents as the most likely candidates for reduction. I argue that mental strength is not reducible to either of them.

4.1 | Mental strength is not attention

Is mental strength just attention? Mental strength and attention tend to covary with each other.[13] Moreover, it is well known that attention affects phenomenology (Carrasco, Ling, and Read 2004), and that it can be captured by sudden stimuli (so-called exogenous attention) (Wright and Ward 2008). So, someone could argue that mental strength is just the orientation of attention and its information-processing consequences.

Despite the initial plausibility of this suggestion, attention and mental strength are distinct. First, they do not belong to the same metaphysical category: mental strength is a phenomenal property of conscious experiences themselves, whereas attending is the exercise of a cognitive capacity. Second, while mental strength can be *modulated* by attention, they are not identical. Presumably, your toe pain comes into existence *before* you attend to it. Or at least, counterfactually, we can say that attention would not have been directed to your toe had you not experienced pain. It would be odd to claim that the cause of your pain or the cause of the intensity of your pain is *that* you attended it. This order of explanation is backwards.[14]

This observation does not annul the important role attention performs in modulating strength. In the case of pains, for example, subjects whose attention is distracted away from a noxious stimulus (e.g., by engaging cognitive resources in a demanding task), generally report less intense pains (Bantick et al. 2002; Legrain et al. 2009; Miron, Duncan, and Bushnell 1989). The opposite effect takes place too. When noxious stimulation becomes the main focus of attention, subjects rate pains as being stronger (Miron et al., 1989), and physiological markers along with neural activity of areas known to encode pain strength become more active (Hauck, Lorenz, and Engel 2007). Remarkably, even in cases where external stimulation is lacking altogether (e.g., in phantom limb patients), attention also modulates experienced pain strength (Nikolajsen and Jensen 2001). However, and to the point of its distinctness, attention typically modulates pain strength only within a limited range. Normally, even if you give your full attention to a weak pain, it does not become excruciating. Alternatively, you can try to distract your attention away from an excruciating pain and, unfortunately, it probably will not completely disappear.

The case for distinguishing mental imagery from attention is similar. Attention can increase the strength of mental images. By focusing on the generated image and attending to its features, more clear, stable, salient, and bright details may be experienced, in turn making the image stronger. But this kind of attentive focusing need not translate into a stronger experience. First, as already mentioned in section 2, increases in one isolated dimension do not necessarily imply increases in the strength of the image overall. Second, sometimes we just fail, in spite of our attentive efforts, to picture a strong image. Thinking otherwise would amount to saying it is always in our hands to generate strong images given that it is always in our hands to attend to their features. Rather, like in the case of pains, attending can enhance the strength of an already existing image only within a limited range. A similar line of reasoning can be applied to perception.

4.2 | Mental strength is not salience

Another candidate for reducing mental strength to something else is salience. In vision science it is well established that salient stimuli grab attention (for a review, see Itti and Koch 2001), alter appearance by increasing apparent contrast and apparent saturation (Kerzel et al. 2011), and boost reaction time and performance (as measured by accuracy) in a wide variety of tasks (Donk and Zoest 2008). In general, salient stimuli effortlessly stand out from their neighbors in a visual scene. A salient stimulus, for example, a red letter in a page full of black letters, immediately attracts attention and facilitates detection. Could salience be a better explanation than mental strength for why we have a strong experience of the red letter? Pain strength could also be attributable to pain salience. After all, the sensation of pain in your toe stands out from the non-painful sensations in the neighboring parts of your body, and the effects of pain salience and pain habituation are very similar to those in visual perception (Legrain et al. 2011).

Salience, like attention, is a modulator—not a substitute—of mental strength (Beck and Schneider 2017). For example, Kerzel and colleagues (2011) showed that salient stimuli (e.g., a tilted bar in a set of upright bars) increase their apparent contrast and color saturation. It is reasonable to suppose that the mental strength of the experience of the tilted bar was heightened along these other changes in appearance. However, mental strength cannot be identified with salience. The most obvious reason is that salience, as it is understood in psychology, is typically a property of stimuli, not of the mental states that represent them. Moreover, mental strength and salience have different time courses and they provide different benefits, which suggest they are not identical. For instance, accuracy in a visual task is increased when salient stimuli are used, but this benefit is only short lived (Donk and Zoest 2008). Salient stimuli may improve performance, but only when responses are produced very fast (in less than 200ms after the stimulus appears on a screen). Responses with longer latencies—which constitute the majority of responses we produce outside the laboratory—do not seem to benefit as much from salience. The effects of a mentally-strong state, however, last much longer than a few milliseconds. When a strong experience dominates the stream of consciousness, it can attract attention and rearrange the subject's mental structure for several seconds and, in some cases, even longer. So, even though a salient stimulus can increase the strength of an experience, salience and mental strength are not the same.

Perhaps the strongest argument in favor of distinguishing salience and mental strength does not come from the lab, but from everyday experience. It should be obvious that an experience has a degree of strength even when there is nothing salient in its representational contents. When you see a polka dot dress, your experience of the individual dots will definitely have certain mental strength (after all, you are conscious of them). However, none of the dots has to be, or has to be represented as, salient. This simple example shows that there is mental strength even when there is nothing salient in the environment or in the experience itself.

There is an intricate relation between mental strength on one hand, and attention and salience on the other. This relation, however, is not that of identity.[15]

4.3 | Mental strength is not representational contents

Two questions remain. First, is the intensity of experiences modulated by their representational contents? Second, is the intensity of experiences reducible to their representational contents? An affirmative answer to the first question would indicate that the representational status of

experiences and their mental strength are related, but mental strength might still be a distinct phenomenal magnitude. An affirmative answer to the second question would put pressure on the claim that mental strength is distinct. Here, I will argue that mental strength may be modulated by experiences' representational contents, but that strength is ultimately distinct from them. Before proceeding, it is worth noting that this is also Hume's view. He thinks that we should distinguish between the mental strength of a conscious mental state and its contents. Impressions and ideas in general, and ideas of memory and ideas of imagination in particular, differ "in having a greater degree of vivacity, or force and liveliness—conceived not as an additional perception or mental content but rather as a 'manner' in which these ideas occur" (Garrett 2002, 26). Hume refers to this 'manner' also as a 'feeling' that varies in its degree of intensity (1739, 1.3.7.7).

Representationalist philosophers about the phenomenal character of conscious experiences hold that "if two experiences are alike representationally, then they are alike phenomenally (and vice versa)."[16] Hence, contrary to my proposal, the representationalist would say that changes in mental strength are really just changes in represented strength, not on the experience's strength itself (Byrne 2001; Harman 1990; Tye 2000; Bourget 2017; Fazekas 2023b)[17] The representationalist's argument could unfold as follows. Let us consider pain strength. Suppose that a painful state's content is something like "«there is a disturbance of type *d* in location *l*»" (Cutter and Tye 2011, 92). Assume too that "the physiological type *d* includes information about the shape, volume, and *intensity* of the disturbance" (*ibid*.; my emphasis). Thus, under disturbance type, spatial extent (i.e., shape and volume) and the intensity of pain are included. The changes in felt strength, the representationalist continues, are effected by changes in how spatial extent and intensity are represented. As with any other representation, the representational accuracy of the actual spatial extent and intensity of the tissue damage can vary. Phantom limb pain, for instance, would be an extreme case of inaccurate representation. But even then, pain intensity could be explained as the (inaccurate) representation of (potential) tissue damage.

Here I focus on how the representationalist's argument deals with attention and representational accuracy. First, let us review some basic known facts about attention. In the perceptual domain, attention systematically makes subjects faster and more accurate when discriminating stimuli (Carrasco 2011; Posner 1980; Posner, Snyder, and Davidson 1980; Wright and Ward 2008). In the classic Posner cueing attention paradigm, subjects discriminate (detect or identify) a stimulus briefly presented at one of two possible locations of a screen while directing their gaze to a central fixation point throughout each trial. A cue indicating with a certain probability the location of the target is briefly presented before the stimulus appears on the screen. Subjects are instructed to use this cue to direct their attention internally toward the expected target location. Their responses are systematically faster and more accurate in valid/attended trials (i.e., when the target appeared at the location predicted by the cue) than in invalid/unattended trials. There is a consensus that these behavioral improvements are achieved via perceptual signal processing enhancement and noise reduction which lead to increased representational accuracy (Carrasco 2011).

If mental strength is just represented tissue damage, it is not surprising, the representationalist would argue, that attention affects the precision of the relevant pain representations. As noted above, attending increases pain and distracting attention decreases it. The representationalist would say this is not surprising because this modulation of representational precision is well established for the perceptual domain and pain is not different in this respect (cf. Aydede 2009). Consider this example. Let us stipulate that the actual extent and intensity of the bodily disturbance that produces your stubbed toe pain is 5 units on an arbitrary scale. Then, you try to ignore the pain by occupying your attention with something else. The effect, we can anticipate, will be the reduction of pain. The alleged explanation is that because of the lack of attention your pain

experience represents inaccurately the extent and intensity of bodily disturbance and, thus, you now experience, say, 3 units of pain.

This explanation is consistent with the experiments described in the previous subsections. Despite its *prima facie* plausibility, however, this explanation cannot fully account for the data. As presented above, we know that inattention systematically *decreases* pain strength. But there is nothing about inaccurate representation due to inattention that requires *unidirectional* inaccuracy. It is hard to see what a representationalist explanation would be. Appealing to inaccurate representation does not explain why, when distracted, subjects do not feel stronger pains sometimes. Inaccuracy implies variability in any direction. Why are inattentive subjects not inaccurate by representing the pain as 7 units instead of 3 units?

The representationalist could try to insist that subjects are systematically biased to underestimate the extent and intensity of bodily damage when they are not attending. While not impossible, a systematic bias for being wrong in one particular direction would be bizarre. It would be bizarre in the perceptual domain too. It would be surprising to discover that when not paying attention, humans always see things, say, 10° of visual angle to the left of where they really are. Note that I mean misrepresenting the location of objects, not just having a computational bias. Certainly, unidirectional computational biases in the perceptual domain are not unheard of. For example, our visual system solves convex-concave ambiguity by assuming light comes from above (and slightly to the left) (Sun and Perona 1998). However, this is not a bias that makes us systematically *wrong*. Rather, it is a computational bias that makes us, in fact, accurate on the vast majority of circumstances *despite* informational ambiguity. Furthermore, a systematic underestimation of the extent and intensity of bodily disturbances is not a prediction of representationalism. Assuming such a bias without independent reasons would seem ad hoc. In stark contrast, the evidence can be simply explained by appealing to a direct modulation of pain strength by attention.[18]

In summary, felt pain strength can vary independently from the representation of external stimulation. The evidence for this comes largely from experiments that manipulate pain strength via attention while keeping stimulation constant. I argued that these results cannot be easily explained by a representationalist account of pain strength. This does not mean that representationalism should be completely discarded.[19] For example, I have not shown that pains do not have contents (they probably have some), that they do not have representational contents of the extent and intensity of external stimulation (they probably have some), or that other phenomenal properties of experiences are not reducible to representational contents (probably some are). However, as other non-representationalists have pointed out (Block 1996; Doulatova 2019), there are phenomenal properties that are not reducible to contents such as the pleasure of a pleasurable experience, the effort of a cognitively demanding task, the difference between perceived and imagined scenes or, as I have tried to argue, the overall intensity of an experience. Moreover, I do not deny that the representational contents of an experience have a role in modulating the mental strength of an experience (as should be clear from the explanation of mental strength in imagery and perception that I offered in section 2). However, the objections laid out here against the representationalist position make plausible that mental strength is a distinct phenomenal property of experiences that cannot be simply reduced to their representational contents.

5 | Philosophical Consequences

Characterizing mental strength is a valuable project in its own right, independently of its philosophical consequences. Nevertheless, making explicit some of these is important. I will finish

by pointing out how mental strength sheds light onto some relevant philosophical issues related to the structure of the stream of consciousness, the functions of consciousness, and cognitive phenomenology.

5.1 | The structure of the stream of consciousness

Philosophers and psychologists often describe the structuring relations between mental states using the familiar terminology of 'center' and 'periphery'. Naturally, this structuring relation does not have to be binary, it could be graded. On my view, mental strength is the structuring property of the stream of consciousness. Importantly, when mental strength is considered in our explanations of the mental, structuring comes for free.

This is not true of all proposals that highlight the importance of central/peripheral relations. For example, Watzl's priority structures theory requires both bottom-up and top-down attention (Watzl 2017). On my view, in contrast, the explanation is straightforward and uncostly. Conscious mental states have an intrinsic property, mental strength, by means of which they fall into a natural ordering. Our conscious life *is* structured, rather than having to be constantly structured. The difference is subtle but important. In Watzl's view mental states are, so to speak, inert. It is the powerful action of the constant deployment of attention that keeps them ordered. This criticism should not reduce the importance of attention as a source of mental strength and, hence, as a powerful structuring tool. In the case of voluntary attention, it is a subject-guided structuring tool, which entails that the shape of our conscious life is to a large extent under our control. This, however, does not mean that attention is the ultimate explanation of the conscious mind's structure. Rather, the structure of the conscious mind depends on mental strength. Thinking otherwise risks attributing to attention powers it does not have. As William James sharply points out, there is "no need of [attention] to *drag* ideas before consciousness or fix them, when we see how perfectly they drag and fix each other there" (1890, 452, XI, vol. I; my emphasis). Ultimately, the conscious mind is self-structuring.

5.2 | The functions of consciousness

Intuitively, consciousness performs important functions. When we see, hear, feel, move, imagine, or think, we typically do so consciously. In philosophy and psychology, consciousness has been credited with allowing, among other things, rational thought, motivation for action, flexible control of behavior and cognitive control (e.g., action inhibition and preparation, task switching, control of attention, working memory) (Block 1995; Cleeremans and Tallon-Baudry, 2022; Tye 1996). Some have gone as far as to argue that consciousness is the mark of the mental (most famously, John Locke; see Coventry and Kriegel 2008).

Philosophers, however, have also forcefully argued that consciousness does not have a function, or at least that it was not evolutionarily selected for performing any function (Rosenthal 2008; Robinson, Maley, and Piccinini 2015). There also has been abundant excitement in the last few decades about unconscious perception and all that can be achieved through it (putting into question the utility of consciousness). Subjects who fail to report awareness of stimuli can perform above chance in a wide array of visual and cognitive tasks, such as stimulus discrimination, word meaning extraction, simple arithmetic operations, and cognitive control in general (for a review, see Dehaene et al. 2014). Performance can be matched between more conscious and

less conscious conditions in visual tasks (Lau and Passingham 2006). Blindsight patients who have sustained damage to visual cortex can detect and discriminate stimuli they are unaware of (Weiskrantz 1986). In the most striking cases, blindsight patients can even avoid obstacles while walking down a hallway (Gelder et al. 2008). Even when nuanced methods are used, researchers have often failed to demonstrate a clear advantage provided by conscious awareness in various laboratory tasks (Koizumi, Maniscalco, and Lau 2015; Peters and Lau 2015; Samaha et al. 2016).

Despite this recent enthusiasm about unconscious perception[20], mental strength, and thereby conscious experience, serves at least three important functions. First, and as argued above, mental strength structures the conscious mind. While it is unclear whether the unconscious mind is necessarily structured or not, the conscious mind is necessarily structured. The proposal is that it is the mental strength of conscious states that does the structuring. Second, mental strength helps justify self-guided action and reasoning (Cleeremans and Tallon-Baudry 2022). Conscious states do not have the same effects in our decision-making and in our mental lives independently from their strength. Certainly, there would be no first-personal reason to take an aspirin if one were undergoing an unconscious pain. Similarly, there is less motivation for taking an aspirin when experiencing a mild headache than when experiencing a strong headache; a more vivid mental image is more useful for simulating a future scenario than a weak mental image; there is less justification to take weak visual experiences at face value, and therefore act upon them, than when these are strong. Finally, a third function of mental strength is modulating introspective accuracy (Morales 2021). According to introspective signal detection theory (iSDT), how well we know our own minds is largely dependent on how strong our conscious experiences are. Consider the difficulty of introspecting a faint mental image or a weak pain compared to the ease of introspecting a vivid mental image or a strong pain.[21]

Philosophers and psychologists have been reasonably fascinated by the existence of unconscious perception. But consciousness, and mental strength in particular, plays an important role in the initiation of action, the justification of perceptual beliefs, the structuring of the stream of consciousness, and introspection.

5.3 | Cognitive phenomenology

Mental strength, as argued above, is a domain-general phenomenal magnitude. Phenomenal character, however, is often described only in terms of domain-specific sensory qualities: the redness of a tomato (vision), the complex flavor of wine (taste), or the odor of a rose (smell). Mental strength, in contrast, is present in all experiences in spite of originating from diverse phenomenal and representational components unique to each domain. A common, shared phenomenal magnitude emerges. Perhaps this extends to non-sensory states? The domain-generality of mental strength in the sensory domain invites us to think that other conscious, non-sensory states such as thoughts and desires may also have mental strength. This does not address whether cognitive states have *distinct* phenomenology from sensory states, which is a question that drives most debates about cognitive phenomenology. However, in virtue of having mental strength, cognitive states may have a phenomenal character of intensity if nothing else. This much can be accepted even if it turns out that cognitive states lack any other distinct, cognitive-specific phenomenal character. And if so, this could explain why conscious intense thinking or an obsessive desire can be "blinding" in a similar way to the way intense pains "blind" us.

6 | CONCLUSIONS

In this article, I argued that mental strength is a distinct domain-general phenomenal magnitude of conscious mental states. As the mental strength of a state changes, it changes the degree to which it makes its way to our stream of consciousness. This important role of mental strength has been often underplayed by philosophers and psychologists in their theorizing and experimental designs. Here I offered an account of mental strength understood as a domain-general property of conscious experiences themselves, rather than as some aspect of their representational contents or attentional status. Instead of explaining the degrees of consciousness in each domain by appealing to domain-specific representational and phenomenal characteristics, the theory of mental strength offers a parsimonious account of the intensity of experiences by postulating the existence of a single, domain-general intensity phenomenal property. Mental strength also explains the self-structuring nature of the stream of consciousness. Finally, mental strength can also explain some functions of consciousness in action, cognition, and self-knowledge. This invites us to reconsider Hume's intuition and bring back mental strength into our theorizing about the mind.

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ENDNOTES

[1] Throughout the *Treatise,* Hume refers to this distinctive property with many different terms in addition to force and liveliness. Among others, he uses strength, intensity, vivacity, influence, firmness, violence, vigor, and steadiness (Hume 1739, see Annotations and Glossary).

[2] The criterion was meant to have a wide scope. However, it is clear that Hume thought there could be exceptions in the case of sleep, fever, madness or "any very violent emotions of soul" (Hume 1739, 1.1.1.1).

[3] For example, (Bennett 1971, 255; Stroud 1977, 28–29); but see (Dauer 1999; Everson 1988) who try to make the criterion respectable.

[4] For recent discussion of conscious experiences having degrees, see (Lee 2023; Cohen, Keefe and Brady 2023).

[5] We can only speculate about the precise nature of mental strength as a magnitude. However, insofar as mental strength is a property of subjective experiences, it is clear that it should be thought of as an intensive magnitude (like temperature), rather than an extensive magnitude (like length). Intuitively, an intensive magnitude allows for rankings of magnitudes of the same type (e.g., greater than, lesser than, equal to). For example, we can say that one object is hotter or cooler than another one. And we can certainly rank conscious experiences by their strength: this toothache is stronger than this headache. However, intensive magnitudes are not suitable for ratio scales: they do not allow assignments of a ratio to two unequal magnitudes. It is not meaningful to say that a cup of tea is twice as hot as a glass of cold water. In contrast, it is meaningful to talk about ratios of extensive magnitudes, for which an intuitive notion of addition of the magnitudes is acceptable (Suppes and Zinnes 1963; Peacocke 2015). An object can have twice or half the length of another object. But can we say that this toothache is twice as strong as this headache? Probably not meaningfully.

[6] Interestingly, Kant seemed to have held a similar view regarding conscious intensive magnitudes in the *Critique of Pure Reason* ('The anticipation of perception') and in his *Lectures on Metaphysics*: "For example, when a representation has inhibited many others, we say that this has made a great impression" (cited in Longuenesse 1998, 320). Longuenesse's commentary of this passage is illuminating: "Even states of consciousness can thus be

[…] compared as to their magnitude. *A representation is 'more or less intense' according to the multiplicity of representations it inhibits*; a very great pain makes one deaf and blind toward any other representation." (Longuenesse 1998, 320)

[7] For related discussions (with ultimately different conclusions) about the nature of complex phenomenal experiences and their intensity (see Fazekas and Overgaard 2016; Fazekas and Overgaard 2017; Fazekas 2023a, 2023b).

[8] At least since Galton (1880) it has been observed that the individual differences in visual imagery capacity are notable. In extreme cases of aphantasia, people do not seem to experience mental images at all (Zeman et al. 2010; Zeman, Dewar, and Sala 2015).

[9] For a helpful article dissecting the intensity and specificity components of mental imagery, see (Fazekas 2023b).

[10] Whether the feeling of reality and the intensity of experiences are linked is a current source of controversy. Some theories hold that intensity of experience explains the feeling of reality (e.g., whether something is a perception or a mental image) (e.g., Hume 1739; Perky 1910; Fleming 2020; Dijkstra et al. 2021; Dijkstra, Kok, and Fleming 2022; Dijkstra and Fleming 2023) while others think that intensity and reality are orthogonal (Lau 2019).

[11] There are, of course, other differences too. Mental images, for instance, represent objects that need not be clearly located in space. Besides, the imagined objects exhibit an "essential poverty" to use Sartre's phrase (1940, 9). They are deprived of relations, which abound in perceived objects; imagined objects are, in this sense, isolated.

[12] An unsettled issue, however, is whether attentional influence on appearances in fact implies inaccurate perception or not (Block 2010; Stazicker 2011).

[13] Attention and mental strength certainly interact, even if they are not identical. It is not a coincidence that notions similar to, but ultimately different from, mental strength involve attention. Some of such notions include Beck and Schneider's mental primer (2017) and Wu's phenomenal saliency (2011). For a recent alternative view of the relationship between attention and consciousness, see Lopez's (2022) informational enhancement account.

[14] My view is compatible with unconscious attention, or subpersonal mechanisms necessary for attention, being engaged before a pain becomes conscious. Unconscious attention to tissue damage may even help bring a pain to awareness. However, at the personal level, conscious attention is attracted to the pain only as a result of being antecedently conscious.

[15] Here I did not discuss the relation between salience and attention. While some have argued for a necessary connection between conscious attention and phenomenal salience (Wu 2011), there is some empirical evidence suggesting attention and salience are independent (Kerzel et al. 2011).

[16] This slogan marks the commitment of what has been called 'weak representationalism'. 'Strong representationalism', in contrast, holds that the qualitative character of our experience *consists in* the representational content of such states (Tye 2000). The discussion in this subsection is concerned only with weak representationalism.

[17] Representationalism is part of a wider view sometimes called intentionalism, according to which, phenomenal characters can be reduced to contents, even if not representational ones. For pains, intentionalism can take the shape of imperativism, according to which, the contents of painful experiences are commands (Martínez and Klein 2015; Martínez 2010). Imperativists have addressed the issue of pain strength (Klein and Martínez 2018), but here I only address representationalist concerns.

[18] An interesting case is precisely that of attention altering appearance. It has been repeatedly shown that attention alters appearances along several dimensions. Typically, these changes take place in one direction (i.e., stimuli become brighter, larger, etc.) (Anton-Erxleben, Henrich, and Treue 2007; Carrasco, Ling, and Read 2004; Fuller and Carrasco 2006; Fuller, Park, and Carrasco 2009; Liu, Fuller, and Carrasco 2006; Gobell and Carrasco 2005; Montagna and Carrasco 2006). I think that this is *precisely* because what is being altered in those cases is mental strength, rather than the perceptual representations. This would be consistent with views that hold that changes in appearance through attention do not necessarily involve inaccurate representations (for discussion, see Block 2010; Stazicker 2011).

[19] For arguments against pain representationalism, see (Aydede 2009, 2017).

[20] Recent concerns have been raised about whether there can be true unconscious perception at all (e.g., Phillips 2021; see also Peters and Lau 2015). While an important (and often technical) question, and despite the importance of the functions of consciousness that I describe in the main text, the extant evidence still favors the possibility of unconscious perception (Michel and Lau 2021; Michel 2022).

[21] See Dołęga (2023) for a recent evaluation of iSDT according to a conceptual tool for evaluating models of introspection proposed by Kammerer and Frankish (2023).

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