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Phenomenal consciousness and cognitive access

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In consciousness research, it is common to distinguish between phenomenal consciousness and access consciousness. Recently, a number of scientists have attempted to show that phenomenal content can be empirically separated from cognitive access and, accordingly, that the mental content that is accessed is not (always) identical to the content that is experienced. One notable position is that of Ned Block who suggests that phenomenal content overflows cognitive access. I will review the evidence and show that existing data, in fact, do not demonstrate overflow. I will further argue that overflow is theoretically possible—yet highly difficult to empirically demonstrate—under the condition that 'cognitive access' is defined as working memory or attention. However, if 'access' is defined as information becoming 'cognitively available', in a broader sense, I will argue that a separation between subjective experience and access is impossible.

This article is part of the theme issue 'Perceptual consciousness and cognitive access'.

1. Background

One of the main controversies in current consciousness research is the relation between so-called phenomenal consciousness (subjective experience) and access consciousness. This distinction was proposed by Block [1], and many philosophical and scientific discussions revolve around it, as it essentially involves how we should conceive of the relation between consciousness and cognition. Classically, the debate is characterized by different positions: Block himself has consistently argued that the two concepts can be empirically dissociated [2–5], others argue that the two concepts, in fact, only refer to one property [6], while others again seem to argue that they are conceptually different but always empirically correlated [7].

This article focuses on the arguments for 'overflow'—that phenomenal consciousness (or P-consciousness) overflows access consciousness (A-consciousness). Obviously, in order to understand the meaning of 'overflow', one needs to have relatively precise definitions of both A- and P-consciousness. The definition of P-consciousness has been heavily debated in the consciousness literature, and most philosophers and empirical scientists seem to agree that subjective experience, P-consciousness, refers to what it is like to be in a particular mental state. Examples, such as the experience of the redness of red, the taste of coffee, the sound of music, have often been used to explain the meaning of the term. The term 'access' is less often discussed in detail. The term was introduced (alongside with the term 'P-consciousness') by Ned Block in 1995 with this definition: access consciousness is available for use in reasoning and for direct control of action and speech. For Block, reportability is both of great practical importance and at the same time a 'test' of A-consciousness: information that is in A-consciousness is, according to Block, reportable. Accordingly, 'overflow' refers to the situation where a mental state is not poised to be used for direct control—including reporting—yet is still experienced.

Elsewhere, Ned Block has proposed that information that is accessed is identical to the content of working memory, i.e. that 'access' essentially means 'working memory' ([4]; see also discussion by Carruthers [8]). Many

scientists would, most likely, be willing to assume that one can only act or speak rationally based on the information in working memory. This is, however, not sufficient to say that the two definitions are identical. First of all, working memory is a theoretical concept described in different ways (e.g. [9]). Carruthers [8] points out that the first definition above [1] is dispositional, i.e. that Block here suggests that a content is A-conscious if it is available (actually or counterfactually to control systems). Carruthers continues to argue that the second definition by Block [4] suggests that information is A-conscious only in an actual sense, i.e. if it is received as input by executive and decision-making systems.

Chalmers [7] suggested a different definition of access, namely that information is A-conscious if the content is available for a range of different behaviours—especially voluntary behaviour. This definition lacks some precision as it does not specify what exactly is meant by a 'range of different behaviours'—let alone what is meant by 'voluntary'. Nevertheless, the definition seems to say that information (or 'content') that can be used for more than one type of behaviour (contrary to, say, a reflex) is A-conscious. The definition is not very different from that of Block, yet it tones down rationality and control as well as the involvement of very specific cognitive functions (working memory).

Overall, the few existing takes on the definition of access consciousness are highly overlapping, yet the little differences may be important when evaluating whether a given empirical case represents an actual dissociation of access and subjective experience in order to demonstrate 'overflow'. It can be argued that some content is available for (a range of) behaviours without being available for 'rational control' (Block's first definition) or without being an actual item in working memory (Block's second definition), so a given content may be A-conscious in one sense yet not in another.

In most cases, one can imagine phenomenal consciousness and access are correlated rather than dissociated. My mental content related to writing this paper is experienced and accessed (in all the above meanings of 'access'). My memory of last Christmas or of planning my summer holiday is experienced and accessed. In perception research, it is a common view that there can be access (e.g. rational control of action or working memory) in the absence of phenomenal consciousness (e.g. [10,11]—see however alternative interpretations in e.g. [12–14]), although this branch of cognitive science rarely uses these terms. According to Block [4], there are, however, cases representing phenomenal consciousness without access—i.e. that a mental content may be experienced yet not accessed in one or all of the above meanings—a claimed phenomenon that in recent time is referred to as 'overflow'.

In the following, a series of empirical cases will be examined in order to investigate the evidence behind the claim that A-consciousness (in one or another sense) overflows P-consciousness. As argued above, access consciousness is currently defined in different ways and, as will be shown, the definition may determine how plausible the overflow hypothesis is in the light of the empirical cases. The article will present various arguments for overflow based on empirical evidence and show that none of them work very well for any definition of A-consciousness. It will, however, be argued that overflow is conceptually possible under some definitions of A-consciousness.

2. Becoming aware: a fictional case inspired by everyday life

Intuitively, it may be easy to come up with empirical cases that could represent an actual distinction between A- and P-consciousness. Imagine standing in a crowded room, trying to have a conversation with another person, when you suddenly become aware of what someone else at the other end of the room is saying.

One could argue that we here witness how we constantly have phenomenal consciousness of the entire scene, experiencing the contents of all the conversations at the same time, whereas only some of this content is accessed. So—in this example—when we suddenly become aware of the other conversation, this becoming aware represents a shift in the content of A-consciousness but not in the content of P-consciousness. From this perspective, A-consciousness is limited, whereas P-consciousness is potentially unlimited or, at least, has much wider limits.

Whereas this interpretation is completely consistent with all the 'data' in the example, there is another interpretation that seems at least as likely: that the unaccessed conversations were only processed to a very rudimentary level—not just in access consciousness but also in phenomenal consciousness. Several experimental papers provide evidence that subjective experience is not simply dichotomous but comes in 'degrees' and at least according to most of this evidence, this 'degree' correlates with and predicts objective performance [15–19]. Such evidence for 'degrees' of conscious experience, obviously, is not direct evidence for the alternative interpretation. The evidence simply suggests that conscious experience *can* be degraded and, accordingly, it is a logically possible interpretation that all the unattended conversations in the room were partially conscious and partially accessed—until they became attended. In this interpretation, there is no need to argue for an empirical dissociation of access and experience.

There are at least intuitive arguments in favour of the alternative interpretation as a better candidate for inference to the best explanation. One is that people will not report to have experienced—to have been P-conscious of—vivid details of the unaccessed conversations. The author of this paper certainly has never himself clearly and vividly experienced the actual content of several conversations at the very same time, and then found that this clear and vivid content was in strange contrast to the complete inability to report or act on this very same content.

How much we actually do experience of information in the periphery is a debated topic. Some scientists discuss this as a 'fringe experience' that subjectively appears more degraded and with fewer details than focal vision (e.g. [20]). However, others point out that subjective experience of the visual periphery is 'inflated' or often metacognitively 'overrated' compared to objective performance (e.g. Odegaard *et al.* [21]). Even though it is still uncertain how to characterize peripheral experiences and their relation to performance, it is not necessarily the case that the answer to this will have any influence on the overflow debate. All information we have about peripheral experience is based on report—meaning access. Accordingly, as discussed above, any description of the experienced content outside focus involves A-consciousness as well as P-consciousness of the same content.

Of course, according to the definitions of A-consciousness above, we can only report that which is A-conscious, so that

the lack of report of P-conscious states at least in others is, in principle, not direct evidence for the lack of P-consciousness *per se*. This argument could be taken as a defence of the view that one may, in fact, be experiencing all conversations in the room.

This latter 'defence', however, does not come without cost. That is, the view would bring all measures of P-consciousness into doubt as they all (be they verbal reports, button presses or other kinds of voluntary or involuntary behaviour), in fact, are measures of A-consciousness only. If there are no behaviours which could be taken as evidence for P-conscious states (and not only A-consciousness), and if P- and A-consciousness can be dissociated, the view that there may be an experience of all conversations without any report or evidence hereof seems to be a view that makes an empirical science of consciousness highly difficult. On the contrary, if one believes that P-consciousness follows A-consciousness in the example, then at least under some conditions measures of A-consciousness can be a guide to P-consciousness. If one accepts reports (or introspections) about the contents of subjective experience as evidence that what was reported was, in fact, also the content of experience, it seems natural to think that there was no (clear) subjective experience of the exact content of the conversations in the example above.

Regardless of how one may attempt to resolve this debate, it appears difficult to argue that the example above is an objective empirical argument in favour of the first interpretation mentioned. Even though it may be consistent with the first interpretation, it is just as consistent with the alternative interpretation. The core difficulty is that evidence for P-conscious states (reports or other behavioural indications) involves the A-conscious state—all that is reported is accessed, in any meaning of the term.

The question now is whether any empirical case performs better than this everyday example in separating phenomenal and access consciousness. Below, different cases that have been used as arguments for such a separation are analysed.

3. The Sperling experiment

Some of the most debated empirical examples in this debate are the experiment by Sperling [22] and the subsequent variations of his paradigm.

In Sperling's original study, subjects were presented with flashed arrays of 12 letters. Although they could report only three or four items, they had the impression of 'seeing all the letters'. When Sperling presented an auditory cue following the array, instructing subjects to report only one of the three rows, they reported nearly all items, indicating that there were indeed more contents available than the three or four items they could initially report. Sperling interpreted his finding to suggest the existence of a short-lived sensory memory store (iconic memory). Accordingly, Sperling would explain his findings saying that subjects see all the letters at the moment of presentation, but only some of them are transferred to short-term memory by way of attention—and only the content of short-term memory can be reported.

Block [5], however, introduces a different interpretation of Sperling's results. Block suggests that the impression of 'seeing all the letters' represents an empirical dissociation between access consciousness and phenomenal consciousness so that all 12 letters are experienced phenomenally, yet only a subdivision (those that are attended) is accessed. The argument for this interpretation seems to be that the experience of 'having seen the initial letters' that most participants' report must be based on the experience of each separate letter that, however, cannot be reported.

However, just as in the case of the everyday life example above, there is an intuitively plausible alternative interpretation: participants experienced, and only had access to, unclear and 'blurry' representations of letters. When participants focus on particular memory contents, this content is further processed and as a consequence made more accessible and at the same time more clearly experienced. As in the everyday life example, there is no argument why the case must represent an empirical dissociation between access and experience rather than a parallel shift from weak to stronger representations. This idea is close to the interpretation suggested by Kouider *et al.* [23] that the letters outside focal attention are partially accessed.

One can, of course, have different intuitions about both explanations. And even though the author of this paper finds the latter explanation plausible, this does not of course principally rule out that the first explanation is possible. However, the current task was to evaluate the argument that phenomenal overflow is the better candidate for inference to the best explanation—and given that both interpretations are congruent with results from the Sperling experiment, this experiment does not seem to work as evidence for overflow.

4. Colour diversity

Inspired by the Sperling experiment, Bronfman *et al.* [24] set up an experiment which, according to Ned Block, demonstrates subjective experience without access [5]. Arrays of letters were presented as in the original Sperling experiment, but of different colours. Whereas the letters always had colours, the diversity of the colours changed in different conditions. Participants were asked to estimate the colour diversity either in the cued or in the uncued row. Through six different experiments, it was shown that participants were able to report about the colour diversity outside the cued row without expense with regard to the ability to correctly report the letters in the cued row. The authors use this finding to argue that colour diversity judgements do not involve any working memory load. They further argue that the finding represents phenomenal consciousness (of the individual colours of the letters), even though they cannot be reported with any higher precision than the overall diversity.

Does this finding fare any better than the examples above in the attempt to show that empirical dissociations between experience and access exist? Intuitively yes, in the sense that the experiment attempts to control for working memory load. However, more so than in the examples above, the interpretation of the results seems dependent on the definition of 'access'.

From the standpoint that access means working memory, the results do arguably represent phenomenal consciousness without access. The interpretation is not uncomplicated, as it rests upon the belief that the experimental control for working memory load successfully 'fills up' all the capacity of working memory. Bronfman *et al.* themselves work with a 'partial representation' of working memory content, arguing

that the specific colour that is transiently experienced cannot be encoded into working memory, yet a binary 'summary' (high or low colour diversity) can. The argument is that the actual colour is experienced briefly, but only the summary is in working memory.

Whereas there seems to be good empirical evidence that only the summary is represented in working memory, the argument that the actual colour is experienced but cannot be reported is not, of course, uncomplicated—in the same way as in the previous examples. In the lack of direct evidence, the argument was inferred from the association with performance. This argument is not, however, immune to the opposite view—that only something that directly corresponded to the 'general colour diversity' was experienced—and not the exact, individual colours that were presented.

From this last point also follows that the experiment is not direct evidence for a separation of access and phenomenal consciousness following Block's original phrasing of what is meant by access: if access means information that is poised for use in rational control of action or report, the experiment is not better than the previous examples. The only way one can accept that the inference represents direct evidence for the presence of phenomenal consciousness that is not accessed is by assuming that we can have experiences we can say nothing about. In other words, the interpretation would assume the very thing that it claims to show. The very same conclusion is reached using Chalmers' availability term. To make it clear, the two interpretations may be different under the condition that it is possible to report on information that is not in working memory. If so, the experiment by Bronfman *et al.* can potentially represent P without A, whereas Block's original definition must consider a report as an expression of access.

So, it may indeed be possible that there *is* experience without access in the 'working memory sense', based on this line of evidence, while there is *not* experience without access in 'availability sense'. Given the strength of the empirical evidence for overflow, even in the 'working memory sense', it is however relatively speculative.

5. Change blindness

A completely different line of evidence for A without P, repeatedly mentioned by Block (e.g. [2]), is change blindness. 'Change blindness' refers to the findings that observers often fail to note significant changes in visual scenes, even when these changes happen right in front of their eyes. For instance, people may fail to note if their conversation partner is switched to another person, or if large background objects suddenly disappear (e.g. [25,26]).

Since the first demonstrations of change blindness, several experiments have shed more light on how it could be understood. Brady *et al.* [27] showed that the phenomenon depends on the amount of time allowed for encoding of each object. Other experiments suggest that objects in change blindness tasks in fact are perceived yet cannot be retrieved for comparison [28].

Block [2] has argued that the change blindness phenomenon is a good example of phenomenal consciousness without access. Because, regardless of whether the phenomenon demonstrates limitations of encoding or retrieving, it seems difficult to argue that the observer in the experiment did not consciously see the first or the second object in, by far, the most of these experiments. So, Block concludes that the observer must have consciously experienced the change but without accessing it.

However, and similar to the cases above, there is an alternative and highly plausible interpretation. One could argue that the observer is not just observing two events—the perception of object one and object two—but three events—namely the perception of the first and second object and the perception of the change itself. In this view, the observer can have experienced *and* accessed both persons, yet *not* experienced or accessed the change itself. In other words, the observer may experience *and* access the first event, then not experience *nor* access the change, and finally experience *and* access the second event. Block's proposed interpretation that the subject does experience the change but without access has no more and no less supporting evidence than this alternative interpretation.

Change perception is an area of research in itself (e.g. [29]), and there is some evidence for the alternative interpretation that does not involve overflow from other work on change blindness. When subjects are not consciously aware of the difference between the two stimuli, both the original shape and the changed shape show priming effects; when the difference is consciously perceived, only the changed stimulus shows those priming effects [30]. In both cases, subjects are aware of both stimuli, but being conscious of the difference between the two makes a difference in mental functioning.

So once again, although the view that change blindness represents a case of phenomenal consciousness without access is theoretically possible, it seems too strong to say that it represents direct evidence for this idea given alternative explanations. Change blindness as an argument for overflow stands in the very same situation as in the previous examples. There may be an intuitive appeal, but in the lack of direct evidence for phenomenal consciousness without access, the same evidence that is taken to support overflow also supports a correlation between phenomenal consciousness and access.

6. No-report paradigms

No-report paradigms are essentially experiments where participants simply observe a stimulus without any report being collected. Some scientists believe that neural correlates of reports confound the correlates of subjective experience, and that one therefore should use experiments without report only.

Several arguments have been raised for why no-report paradigms are important in consciousness research [31], whereas others have pointed out that such paradigms cannot work alone [32]. One main finding in no-report experiments has been that neural correlates of visual consciousness are more related to activity in occipital regions than in prefrontal regions [33,34]—a finding that is in accordance with many report-based experiments (e.g. [35,36]), although not all [37]. These experiments seem to suggest that prefrontal activations that have been suggested to be correlates of consciousness may, in fact, be correlates of functions related to reporting.

Block has suggested that such results from no-report paradigms also show that there are different neural correlates of A- and P-consciousness: for visual perception, P-consciousness

is related to occipital regions, whereas A-consciousness is related to prefrontal regions. The argument seems intuitively strong, yet it is also premature to consider the findings evidence for the dissociation between A and P. First of all, it is difficult to make conclusions about functions on the basis of neural activation alone. If one compares this evidence with evidence from brain injury, it is not the case that people with even massive prefrontal injuries are unable to report about or act on conscious experiences (Block's first definition and Chalmers' definition). Typical symptoms do involve working memory dysfunctions, yet not a working memory capacity of zero (Block's second definition). Complete occipital damage, on the other hand, does completely affect conscious visual experience—but also reports about and acts based on visual experience (Block's first definition and Chalmers' definition).

There are several other implicit assumptions underlying the view that the above-mentioned findings reveal that A-consciousness can be empirically separated from P-consciousness—e.g. that there is no interaction between them (so that the absence of a report leaves the content of subjective experience the same). Furthermore, as participants in experiments are never asked about their experience, the choice of design will always rest on previous observations where reports were used—how else would one know which kind of stimulation relates to which kind of experience. This means that no-report paradigms for reasons of principle always will be 'polluted' with report and introspection. The consequence of this argument is further elaborated elsewhere [38,39].

All things considered, it seems reasonable to argue that no-report paradigms provide evidence—that may not be conclusive—that prefrontal activations sometimes found in experiments searching for neural correlates of consciousness relate to report rather than experience itself. However, to suggest that it is direct evidence for an empirical dissociation of A-consciousness and P-consciousness seems premature.

7. Discussion

The analysis above leads to the overall conclusion that there is too little evidence to claim that phenomenal consciousness overflows access consciousness. Under the condition that we take access consciousness to mean working memory, the situation may be a little better—but still quite far from what we could call strong evidence. Although not discussed above, one may consider to partly turn attention away from the attempt to look for cases of overflow and instead to also consider why it is the case that access and experience in all or, by all accounts, by far the majority of cases appear together. The amount of observations from experiments and everyday life that there is a close correspondence between what we experience and what is either (i) available for reasoning and rational control of action and speech, (ii) in working memory, or (iii) available for a series of (voluntary) actions should be sufficient to hypothesize that this is not purely accidental. It may seem reasonable to speculate that there is more to learn about consciousness by finding out why this is the case than by chasing the few and potentially non-existing cases of one without the other.

A few existing theoretical frameworks and ideas specifically predict and attempt to explain this consistent correlation. Notably, REF-CON [13], an extension of the general neuroscientific framework REF (Reorganization of Elementary Functions) [40,41], understands consciousness and the availability to and access of information as fundamentally related. The idea is that information that is available for (some kinds of) action is conscious to some degree as the related neural activation is integrated into a neural strategy representing the current state of the individual. This is, for example, used to explain blindsight [14]. The same view is expressed in the Integrative Model proposed by Overgaard & Mogensen [42] in the analysis of the relation between the first and higher order levels of cognition. The Partial Awareness Hypothesis [23] argues that mental representations can be 'partial', and this explains what falsely can appear as a distinction between access and experience. Fazekas & Overgaard [43] suggest that consciousness (access as well as experience) can be degraded in different ways and suggest different mechanisms underlying this. These different theoretical proposals share, among other things, the idea that access and experience fundamentally go together as a principal thing. For the same reason, the proposals would share some empirical predictions that differ from what would be predicted if one believes that access and experience can be dissociated.

The consequence of how access relates to experience extends the immediate question of how to understand two concepts. The scientific attempt to isolate neural correlates of consciousness is dependent upon the knowledge of what we are looking for exactly. If the neural correlates of experience can be dissociated from those of access, we need to develop methods to subtract neural activations related to access from those related to experience—if at all possible. However, if access and experience necessarily are related, this attempt is meaningless, and we should specifically use access as a guide to better understand experience.

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