Method or Madness: Putting Consciousness to the Test

In this essay I argue that experimenters should continue to employ subjective methods, as no-report paradigms and the neural correlate of consciousness research program will not prove efficacious for investigating consciousness empirically without integrating subjective paradigms. I contend that consciousness should always be treated as an experimental variable, as contrasts with unconscious processes are the best way to pinpoint what processes are definitively conscious and demonstrate how objective paradigms encounter greater difficulty in maintaining this contrastive analysis when no subjective measures are included in their parameters. I draw support for my claim by critically discussing the main methodologies commonly employed when testing for consciousness. I critically evaluate subjective and objective paradigms and argue that neuroscientific and other objective methods overlook crucial features of what it means to be conscious. I conclude that only a combined effort from all fields will be capable of defining, identifying, and testing consciousness, if these aims are ever to be achieved.

The study of consciousness is a hugely interdisciplinary endeavour, it is thus surprising how evasive it has proven to be in the sights of converging inquiries from both philosophic and psychological fields. This impasse is in part due to our inability to assign a proper definition to consciousness. Experimentally, consciousness is typically operationally defined as being synonymous with attention (e.g., Velmans, 1991), access and executive function (e.g., Cohen and Dennett, 2011), selection, volition, and intentional agency (e.g., Dretske, 2006), gamma wave 40Hz neural oscillations (e.g., Crick and Koch, 1990), wakefulness, or self-awareness, etc., (cf. Baars, 1993, Chs.4-6; Farthing, 1992, pp. 5-11; Zeman, 2005, pp. 3-5). Such definitions, however, fail to encapsulate what consciousness is as a totality, instead tackling but one constitutive aspect at a time. Paradigmatically, many studies of consciousness thus mistake the tree for the forest.

The most rational approach to adopt then, is to treat consciousness as an experimental variable such that a variety of conscious and unconscious processes can be compared (cf. Baars, 2005, p. 45; Phillips, 2018, p. 373), and to do so in every possible paradigm and for every operational definition, such that unconscious visual activity is separated from conscious vision, and so on for each perceptual and cognitive function. I contend that this is the only promising way to proceed as some commonality may emerge between conscious processes thus enabling an operational refinement of the definition of consciousness for future research. Some researchers wish to abandon traditional definitions of consciousness and replace them with a neural one (e.g., Lamme, 2006); to disregard consciousness as merely epiphenomenal (e.g., Velmans, 1991); or to equate consciousness to only one of its aspects, such as access (e.g., Kouider et al., 2010). These opposing views may prove to be

correct eventually, however, far more research is required before any processes are exclusively prescribed to, and separated from, consciousness (Crick and Koch, 1998, p. 98).

Problems with definition are not the only obstacle consciousness researchers face. Despite the recent refinement of self-report measures and other qualitative methods (e.g., Overgaard et al., 2004; Schwitzgebel, 2008), proponents of Mysterianism contend that the essence of how it *feels* to be something can only ever be pointed toward, and that this explanatory gap will never be bridged (e.g., McGinn, 1989; Nagel, 1974). However, to adhere to such a view would equate to an empirical forfeit. Dennett neatly summarizes this view in stating:

> *"*The question, "is it like something to be an X?" may in the end be the wrong question to ask, but it excellently captures the intuitions that constitute the challenge to a theory of consciousness." (1978, p. 202)

I share in Allen's (2012, p. 84) belief that we should persevere in the effort to explain mental processes mechanistically, otherwise there is no possibility of uncovering what it is that makes something conscious. Moreover, a science of consciousness would be incomplete if subjective experiences were excluded from the data (cf. Chalmers, 2004, p. 1111) as many processes like inner-speech and mental imagery, would be reduced to their quantitative outputs.

For example, classic studies on mental rotation investigated how participants would compare two pictured objects at different angles with the goal of determining whether the objects were identical or not. Shepard (1971) found that mental imagery is used to rotate the object in the mind's eye to deduce whether the two presented objects are the same. He concluded that greater degrees of rotation required for the task resulted in slower completion times. However, such a quantitative interpretation based on the relationship between the manipulation of the stimulus and its effect on time to completion omits subjective factors, thus presenting an incomplete explanation of the process involved. If you attempt a mental rotation task you will notice that you do not in fact *rotate* the object smoothly in the mind's eye, instead the process is phasic and occurs in stages, moreover, Dennett (1978) posits that the *rotations* are in fact merely propositional judgements and not imaged at all (pp. 219-220). This example illustrates how a purely objective paradigm can lead to incomplete conclusions. This is of little significance in the rotation study, but when consciousness is the process being studied, to continue in such a vein would present us with but a fraction of what it means for something to be conscious and many processes that are generally considered intrinsically conscious would be excluded if their mechanisms could not be subjected to standard behavioural measures. It is thus crucial to utilize third-person behavioural measures in tandem with first-person qualitative measures to build a comprehensive picture of consciousness.

Subjective methods place the emphasis on the qualitative and apperceptive contents of consciousness. The measures employed in subjective studies rely heavily on descriptive, introspective

and self-assessment reports which attempt to gain insight into the kind of observations that participants make about their own perspectives. Subjective methods have fallen out of fashion empirically, however, some fields like phenomenology contend that the observer themselves is of paramount importance when detailing conscious experience (cf. Martin, 2011, p. 206). In the following sections, I will outline several methodological shortcomings inherent to subjective approaches that illustrate why many researchers have veered away from such techniques, instead favouring objective/behavioural methods.

Until the beginning of the 21st century, introspection was the gold standard for gaining insight into consciousness as the only means philosophers had to investigate their mental contents. The first-person perspective affords the most direct route to conscious contents, but this route contains many obstacles. A key issue with introspective paradigms is distortion through observation (Farthing, p. 52), as paying attention to the ongoing processes that are subjected to experimentation can confound findings, e.g., in a perceptual task one is not just perceiving a stimulus, but also apperceiving the fact that they are perceiving the stimulus.

Furthermore, introspective evidence is generally deemed to be highly unreliable (Dennett, 1978, p. 211). This is largely due to processes which can distort one's memory of events or alter how new information is perceived, e.g., hindsight bias (Roese & Vohs, 2012, p. 411); availability heuristic (Tversky & Kahneman, 1973, p. 207); forgetting (Benton et al., 2006, p.); confirmation bias (Plous, 1993, p. 233); predecisional distortion; and the conscious disturbance of weighting schemes (Dijksterhuis & Nordgren, 2006, pp. 98-100). Introspection has been shown to provide less access to our mental contents than would at first be presumed, however, in spite of recent advancements in behavioural and nonverbal paradigms, introspective reports are still crucial to studying our immediate conscious experience (Farthing, 1992, p. 61). Singer (1993) lists several methods of determining the characteristics of conscious thoughts, all of which employ some form of introspective report (p. 104). The reliability of such report paradigms will now be discussed.

Report paradigms are intimately tied to the study of consciousness and provide the most immediate access to the contents of an individual's experiences. Naccache (2006) labels reportability as the cornerstone of conscious awareness, "the ability to report one's own mental state is the fundamental property of consciousness" (p. 1396). Despite this capacity's pivotal role in self-consciousness, experiments which probe an individual's awareness via report measures have been succeeded by objective and neuroscientific methodologies which are purported to provide more accurate and less biased results.

Cohen and Dennett (2011) express their concern over participants exaggerating their own awareness of stimuli, as they claim is the case in the Sperling paradigm (p. 360). Kouider et al., (2010) similarly suspect that such an overestimation of information may be the case in that classic

experiment. Moreover, they claim that verbal report paradigms are inferior measures to non-verbal discrimination and detection tasks, as the target information may be forgotten in the time it takes the subject to provide their report (p. 303). Subjective report experiments are incompatible with neuroimaging studies that aim to identify the neural correlate of consciousness (NCC) as the data collected would include that of cognitive processes which enable the subject to report on the experiment, and lead to an overestimation of the NCC. A further reason for the decline in the use of report paradigms is that they are not viewed as being exhaustive of consciousness (Block, 2007, p. 481), as many processes escape reportability. These are but a few of the contentious issues regarding the validity of report measures in the study of conscious processes, but they demonstrate why researchers have opted to make greater use of objective measures. I believe that this shift in approach is premature and will lead to an incomplete picture of consciousness; but first, let us critically evaluate the third-person methods which have succeeded subjective methods as the new golden standard for measuring conscious processing.

Stimulus-based psychological methods and the behaviourist turn to examine only those aspects of mentality that are publicly verifiable led the subjective qualities of consciousness to be abandoned, instead only those processes which were observable and testable were subjected to empirical scrutiny (Smith & Thomasson, 2011, p. 2). Objective methods are meant to avoid the dilemmas implicit in subjective methods, e.g., self-deception, forgetting, confounding biases, etc., as such they have been coveted by many researchers as the best means of measuring consciousness (cf. Schlicht, 2018, p.92; Zeman, 2005, p.1). Objective methods instead rely on intentional behaviours, task outcomes, and neuroimaging techniques such as EEG and fMRI. Collecting third-person data avoids many of the confounds that arise from first-person data, however, researchers can and often do prompt participants to behave in certain ways and influence the results of experiments, this is known as the observer-expectancy effect (Rosenthal, 1966, p. 464) and can significantly distort data as participants can be led by the researcher to answer in a certain way. With no explicit confirmation from participants, it can be very difficult to conduct a proper contrastive analysis and distinguish where the line lies between conscious and unconscious processes in cognitive and perceptual measures. Thus, experimenters decide what behaviours suffice as evidence for conscious experience and are at greater risk of confusing the cognitive functions underlying experience with consciousness itself by adopting this third-person approach (Lamme, 2006, p. 494).

Moreover, in quantitative methods when there are extreme outliers to the data, i.e., a subject whose performance is markedly far from the norm when compared to the rest of the sample, these outliers are often excluded from the analysis. In some cases, it is shown that the participants did not understand the task fully and hence should not be considered with the data, but this is not always the case. I take great issue with this eliminative procedure, as cognitive psychologists often force normative statistics onto their sample and thus idealize their participant's performance to lie on a

normative curve. Even when this is done to a minimal degree, data are still distilled to a mean average which is then generalized to a far larger population than the sample may warrant (depending on representation and size), and the variance between subjects is treated as subsidiary. The exclusion of outliers can lead to researchers making untenable claims, specifically when used in patient populations, such as individuals with Schizophrenia who can become disoriented during tasks. In such cases, excluding their data would present an unnatural version of events as surely their disorientation would be indicative of their state, the state which itself is being empirically tested (cf. Danion & Huron, 2007, p.487).

Objective methodologies typically employ priming and masking procedures and/or detection and selection tasks to determine unconscious from conscious processing. These methods can be less satisfactory than assumed given the paradigm, as forced choice and yes/no tasks greatly limit the scope of conscious awareness and posit it to be an all or nothing process. Dichotomous measures, such as those used in identification tasks, will deem a subject conscious of a stimulus only if they can confirm what the object is. If the subject is aware that there is something being presented but is unclear as to what exactly, they are recorded as having not been conscious of the stimulus at all, "by ignoring the graded contents of consciousness, systematically underestimate the presence of consciousness in subjects" (Irivine, 2012, p. 635).

Another issue I find with third-person methodologies is that making a participant follow strict instructions, isolated in a laboratory setting and probably using a very sparse interface, their actions may be more automatized, or conversely, utilize far more attentional resources than they would in natural everyday settings and tasks. For the simplest example, imagine a typical button-press yes/no paradigm that utilizes the Stroop effect (where a delay is evidenced in the reaction times for stimuli with incongruous features, i.e., the word "Blue" presented in the colour red). The subject would have to complete several trials in a single sitting, staring at a computer screen; pressing the left key if the word presented matched the colour it was presented in, and the right key if the word presented did not match the colour it was presented in. It is very easy to see how the subject could quickly become bored and unengaged from the tediousness of the task and sparse stimuli being utilized, or hyper-focused on the task at hand as the setting has been constructed such that their attention would only be fixed on what is being used for the study. Neither of these states would be the ideal for a participant to be in in an experiment where the researchers are attempting to distinguish conscious from unconscious processing in typical wakefulness. Subjective methods can often commit to such parameters also, but they are far more naturalistic by including the subject's account of their own experience of the experiment they can gather more data and are less likely to make false assumptions based solely on nominal outputs.

Neuroscientists studying consciousness are seeking to identify the NCC, which is defined as "the minimal set of brain processes sufficient for a particular percept." (Schlicht, 2018, p. 91). Researchers investigating the NCC hope to distinguish the difference between conscious and unconscious processing, to determine whether the rate of firing of neurons involved in consciousness differs from others, and whether a specific type of neuron is necessary for conscious processes, as "It seems probable, however, that at any one moment some active neuronal processes correlate with consciousness, while others do not." (Crick & Koch, 1990, p. 263). Put simply, the aim of the NCC research program is to identify which neural mechanisms are activated when a percept is consciously perceived, if this can be correctly identified and separated from the background unconscious processes involved, then in an idealized experiment the NCC could be independently stimulated by the experimenter, such that the percept is experienced by the participant despite the percept not being presented externally. Similarly, identifying the NCC would mean that the absence or presence of consciousness of consciousness could be demonstrated without behavioural measures (Lamme, 2006, p. 500), which is of vital importance in severe cases where individuals cannot respond to objective tests, e.g., in vegetative state patients (Shae & Bayne, 2010, p. 460). It is likely that consciousness requires particular assemblies of neurons, rather than a single centralized location (Dietrich, 2007, p. 108), which have been group by binding or synchronization, Singer (2006) thus notes that EEG will be necessary to assess the spatio-temporal activation of large collections of neurons (p.143).

Crick and Koch (1998) expressed their hope that all aspects of consciousness will share some fundamental mechanism/s, thus finding the NCC for visual consciousness would equate to finding the defining feature of the NCC which could then be investigated for across all conscious processing (p. 97). This definition of the NCC differs from the NCC of the percept explained above. For every conscious percept the minimal mechanism that makes that content conscious is the *core* NCC and is specific to that percept. The *core* NCC is presumed to be integrated into a much larger neural activation pattern which is essential for consciousness and includes other mechanisms, this is called the *total* NCC (Schlicht, 2018, p.93). This hope was short lived however, as advances in the NCC research program have been able to locate the *core* NCC for a few processes (cf. Dietrich, 2007, pp. 64-66; Lamme, 2006, Table 1, pp. 495-496), however, the *total* NCC still proves evasive. I contend that this approach will be incapable of achieving the desired result, namely identifying the *total* NCC.

No-report paradigms attempt to bypass the issues associated with reportability and many researchers espouse the benefits of experiments which do not rely on explicit reports from subjects particularly when it comes to locating the NCC as there is allegedly no possible confounding from other cognitive functions (Tsuchiya et al., 2015, p.758). Binocular rivalry has been championed as a means for investigating the NCC. This paradigm involves presenting distinct stimuli individual to each eye, a multistable perception is thus formed (Dietrich, 2007, p. 66) as both objects are not perceived as one amalgam, rather visual consciousness switches between the two competing

perceptions approximately every 1-10 seconds. One study which employed a no-report methodology exploited two automatic ocular reflexes which had been highly correlated with conscious reports of perceptual dominance in a binocular rivalry paradigm in the control (Frassle et al., 2014). In summary, the experimenters conducted the same experiment twice, first utilizing reports, then utilizing the two ocular reflexes. They found that the activation patterns were quite similar, but the intensity was somewhat diminished for the no-report trial and the predominant frontal activation of the first trial was almost completely missing from the no-report (cf. Schlicht, 2018, p.96). Yet, the correlations between the eye reflexes and conscious report is not a guarantee that the reflexes can be relied on as the sole measure of consciousness as; "correlation implies neither causation nor identity" (Ceylan et al., 2016, p. 42). Furthermore, many mechanisms have what Dennett (2011) describes as computational access, yet this does not equate to access to personal consciousness (p. 203), the ocular reflexes may represent processes of this unconscious access.

A similar study was conducted on Macaques, who were first trained to press a left key when they were presented with a face, and a right key when they were presented with a sunburst; they were then given the same task in a binocular rivalry paradigm. From the key presses the experimenter could indicate which stimulus the monkey was seeing at a given moment (Sheinberg & Logothetis, 1997). The advantage of this method is that the experimenter can investigate the conscious percept directly as opposed to the stimuli (Crick and Koch, 1990, p. 273). From rivalrous studies, that the primary visual cortex receives information, regardless of whether the perception is consciously perceived (Dietrich, 2007, p. 67).

This finding converges with evidence from blindsight patients, in which damage to V1 leaves the individual residually blind, i.e., their visual pathway is cut short with information arriving into V1 but incapable of continuing up hierarchically to the areas responsible for visual awareness. However, when prompted they are seemingly able to function highly without the awareness that they are doing so (cf. Weiskrantz, 1996, p. 215). This convergence raises several questions as to how we should define consciousness, and what its function is. Conclusions of binocular rivalry paradigms have led Crick and Koch (1995) to claim that they are not aware of any neural activity in the primary visual cortex (p. 121), if there is no neural activity there and neurons are proposed by the NCC program to be intrinsic to conscious processing in some degree, then this would lead one to conclude that blindsight patients do not need to be conscious, nor do they require neurons, to be able to guess above the level of chance that an object is what it is (Dretske, 2006, p. 159). I suspect that this is instead a shared methodological issue; that the criterion has not been set adequately. Phillips (2018) argues that:

"…tasks standardly used to establish residual sensitivity (i.e., perception) are naturally "unbiased". In effect, they relieve the subject of responsibility in deciding whether a stimulus was

present or seen. This leads to an apparent but potentially wholly artifactual dissociation between performance (i.e., perception) and consciousness." (p.484)

However, one study which investigated blindsight using signal detection theory concluded that many of the findings that are interpreted as evidence of implicit perception could be attributable to bias and not residual sensitivity (cf. Azzopardi & Cowey, 1998). Simons et al., (2007) suggest that this may be indicative of residual explicit perception in subjects with blindsight, as opposed to unconscious/implicit perception (p. 242). If blindsighted individuals do in fact possess some residual form of visual consciousness, then Crick and Koch's conclusion that V1 is not involved in conscious processing is mistaken. The fact that implicit perception often corresponds to overt perception, distinguished only by a comparatively diminished amplitude illustrates why attempts to identify conscious from unconscious processing are difficult (Simons et al., 2007, p.227) as this diminished amplitude could just be indicative of low-level conscious perception.

The main difficulty the NCC research program faces is harmonizing data from first-person and third-person approaches that conduct contrastive analysis on perception and cognition, as measures from one study which are indicative of conscious experience may be viewed as proof of unconscious processing in another:

> "Consider the localization and handling of objects. In blindsight and visual agnosia, these are taken as reflecting unconscious processing of objects that cannot be consciously detected… In neglect and extinction, however, the failure of patients to look at contralateral objects and manipulate them is taken to imply that these objects are not reaching consciousness." (Lamme, 2006, p.497)

This has grave consequences for determining where the NCC is located; for these patient groups the corresponding NCC would be in distinctly separate locations, thus one would be a confound for the other, even if one of them was correctly identified.

Commissurotomized or "split-brain" patients also raise several pressing questions that must be answered if any satisfactory delineation of conscious and unconscious processing is to be achieved. These individuals have undergone a procedure to help prevent epileptic seizures, in which the corpus callosum, the white-fibre tract which joins the two hemispheres of the brain together, is severed (Farthing, 1997, p.96). The two hemispheres can function separately as many functions are localized to one or the other, though contralaterally. This means that the right hemisphere controls movement of the left side of the body and vice versa. In commissurotomized subjects the right hemisphere often exhibits visuospatoal dominance, in that the left hand can replicate objects presented to the left eye quite accurately in drawing. The left hemisphere typically houses speech production, and as a result is seemingly more closely linked to the individual's locus of consciousness as verbal thought is associated with volitional action (Dietrich, 2007, p. 110). Are these individuals then evidence of a

dual consciousness within a single person, or should the right hemisphere be demoted to unconsciousness? The right hemisphere can respond accurately to objective tests, it can follow instructions, and seems to exhibit intentional agency for a time after the commissurotomy (cf. Gazzaniga, 1992), thus advocates of explicit objective measures (who consider reportability too unreliable as a measure of consciousness) must commit to the status of the independent right hemisphere as being conscious. yet full-fledged consciousness is thought to reside in the left hemisphere as this is where verbalization occurs (p.111.). Moreover, would there be two separate *total* NCCs for these individuals, or might one hemisphere lack the necessary firing rate or network to facilitate conscious processing at all?

I feel it is thus apparent that objective measures cannot be employed in isolation to conduct contrastive analyses on conscious and unconscious processes, there is still a need for subjective measures in determining the contents of consciousness. Research into the NCC will need to harmonize the first and third-person approaches in tandem with neuroimaging measures if there is to be any success in defining, identifying and testing consciousness.

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