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Consciousness as a graded and an all-or-none phenomenon: A conceptual analysis

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ABSTRACT

The issue whether consciousness is a graded or an all-or-none phenomenon has been and continues to be a debate. Both contradictory accounts are supported by solid evidence. Starting from a level of processing framework allowing for states of partial awareness, here we further elaborate our view that visual experience, as it is most often investigated in the literature, is both graded and all-or-none. Low-level visual experience is graded, whereas high-level visual experience is all-or-none. We then present a conceptual analysis starting from the notion that consciousness is a general concept. We specify a number of different subconcepts present in the literature on consciousness, and outline how each of them may be seen as either graded, all-or-none, or both. We argue that such specifications are necessary to lead to a detailed and integrated understanding of how consciousness should be conceived of as graded and all-or-none.

1. Introduction

The quest of consciousness is an endeavor, which has solicited tremendous research efforts. What is it like to be a bat? This short thought experiment, first formulated by Timothy Sprigge and later spread by Thomas Nagel in a classic paper in 1974 (Nagel, 1974), characterizes subjective experience in an almost simplistic and circular way. How does it feel like to be a bat? At the same time it captures strikingly well the intuition we have about conscious experience. According to Chalmers (1996), even an advanced understanding of the nervous system and the dynamics of brain activity will not bring us closer to solving the mystery of consciousness, namely how these neurons and their activity patterns bring about consciousness. More specifically, the same goes for visual experience. How do our brains' neurons generate visual experiences of the world? Despite continuing disagreement on whether "the hard problem" (1996) and hence an upper limit to our fundamental understanding of consciousness and visual experience will remain, undoubtedly enormous progress has been made in characterizing conscious experience and the neural states that generate it. One of the central theories in consciousness research, and probably the most extensively developed and supported, is the Global Workspace Theory (GWT).

Originally put forward by Baars (1988, 1997, 2002), it assumes that the function of consciousness is essentially integrative. The brain can be seen as a collection of sub-networks processing specific inputs, in which consciousness makes this information available to a wide range of networks. We can more specifically refer to this as access consciousness. This model

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was further elaborated upon by Dehaene and colleagues via computational modeling (and later Dehaene & Changeux, 2005; Dehaene, Kerszberg, & Changeux, 1998; Dehaene & Naccache, 2001; Dehaene, Sergent, & Changeux, 2003), and via an impressive amount of neuroimaging studies (for reviews, see Dehaene & Changeux, 2011; Dehaene, Changeux, Naccache, Sackur, & Sergent, 2006; Dehaene, Charles, King, & Marti, 2014). The Global Neuronal Workspace Theory (GNWT), as put forward in Dehaene et al. (2006), essentially revolves around two dimensions: top-down attention and bottom-up stimulus strength. Only when the bottom-up strength of the sensory event is sufficient, for example when the word is not shown for a brief flash but for a sufficiently long duration, and attention is directed to the word, the word will be consciously visible. The moment at which a sensory event becomes consciously visible is when ignition in the global neuronal workspace takes place: top-down attention amplifies the processing related to the stimulus, thus broadcasting it to a wide set of brain regions, rendering it available for report. A state of global synchrony is thus installed based on long-range connections. Ignition is a non-linear phenomenon, appearing with a sudden onset, associated with the precise moment at which the stimulus goes from unseen to seen. According to GNWT, consciousness is thus an all-or-none phenomenon, with visual experience of a stimulus being dichotomous. Either it is present or absent.

However, just as for the dichotomous account of visual experience according to GNWT, there is also a growing body of evidence for a more graded characterization of consciousness. According to this view, conscious perception is not an all-or-none but a graded phenomenon, arguing that the transition from unconscious to conscious processing is gradual and involves multiple stages, including intermediate states of experience, where visual stimuli are not completely invisible but also not fully visible. We refer to a previous paper in which empirical evidence for both the dichotomous and the graded account from behavioral, computational modeling, and neuroimaging studies is discussed in detail (Windey, Vermeiren, Atas, & Cleeremans, 2014). In short, in many studies, a psychophysical design is used. Masked stimuli are presented for a range of different brief durations, and subjects are instructed to perform a categorization task on these stimuli. Frequently this discrimination task is followed by a subjective measure. Subjects are thus asked to provide a personal indication of how clearly visible the stimulus was (Ramsoy & Overgaard, 2004), how confident they are with regard to their categorization accuracy (Dienes & Perner, 2004), or how much money they would wager on their response (Persaud, Mcleod, & Cowey, 2007). A number of different analyses have been carried out to claim evidence for either the graded or the dichotomous account. For instance, psychophysical curves showing a linear relationship between accuracy or subjective clarity and stimulus durations have been linked to graded visual experience (Overgaard, Rote, Mouridsen, & Ramsoy, 2006), whereas more non-linear curve profiles were linked to dichotomous experience (Del Cul, Baillet, & Dehaene, 2007). Also the distribution of subjective ratings across all trials has been analyzed. More spread-out distributions indicating the existence of intermediate states of experience have supported the graded account (Overgaard et al., 2006), whereas distributions that appeared to cluster at the outermost ends of subjective scales have supported the dichotomous account (Del Cul et al., 2007; Sergent & Dehaene, 2004).

Given the wealth of evidence for consciousness as a graded as well as an all-or-none phenomenon, it is worth asking, what we should conclude from these two contradictory sets of evidence. Is visual experience graded or all-or-none? To illustrate the complexity of the issue, imagine being Paul Cézanne, standing behind his easel, looking in the distance at Mont Sainte-Victoire, studying the landscape. Imagine the tree leaves gently dancing up and down, rustling, a farmer walking down his land, a couple of birds flying over. Far away a steam train runs slowly across the bridge. Shadows subtly change with the hours passing by. Now consider whether to map this overall experience onto a single label "graded" or "dichotomous". Looking around, do we gradually become more aware of things while accumulating sensory information about them? Or is consciousness more of an on–off phenomenon: either we perceive something, or we do not, without intermediate states of awareness? As the description makes clear, it seems challenging to capture all the aspects of visual experience, let alone consciousness, with a single term. Many objects in the scene are present very clearly, but even more seem to be not completely present, while still making a contribution to our experience at the moment. Claiming that consciousness or visual experience is only a matter of "seen" and "unseen" states alternating with non-linear dynamics does not seem to encompass the massive complexity of the multifeatural nature of our visual experience of the environment (i.e., the GNWT approach). Could a single seen/unseen distinction be a hallmark signature of consciousness? Arguably, if something is "a little bit there", on a fundamental level it "is there", and hence probably it could be seen as present or conscious.

This highlights the importance of being precise in what aspect of consciousness we want to characterize as being graded or dichotomous, or gradual or all-or-none. Whenever the term "consciousness" is used in consciousness research, this term in fact may refer to several different aspects of consciousness, such as momentary subjective visual experience as opposed to unconscious processing, reportability, or the stream of consciousness as it evolves over time, response patterns of subjects reporting on their visual experience, and potentially many other concepts. In order to make progress in the debate at hand, we need to specify explicitly what aspect we want to determine to be graded or dichotomous. A given aspect of consciousness may be graded and dichotomous, and different aspects of consciousness may be studied and found to be either graded, dichotomous, or both. Only a framework on a finer scale will allow going beyond intuition. In this conceptual analysis we will attempt to be specific in what we consider to be graded or dichotomous. We focus on *the nature of subjective visual experience when stimuli are transitioning from unconscious to conscious*. We will argue that the former specific aspect of consciousness should be conceived of as both graded and all-or-none. However, after addressing this issue in detail, we will also specify which other aspects of consciousness could be considered, and whether these in turn may be graded or dichotomous. We have started testing certain elements of this conceptual analysis, and whenever relevant the results of these studies will be briefly summarized.

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2. Subjective visual experience

The framework from which we start is the Partial Awareness Hypothesis (PAH; Kouider, de Gardelle, Sackur, & Dupoux, 2010). It starts from the notion that perception, such as processing a word that is displayed on a screen, occurs over a hierarchy of representational levels. A reasoning based on a series of levels of processing can be found in traditional cognitive psychology approaches (Craik & Lockhart, 1972; Lockhart & Craik, 1990; and see Petersen, Fox, Posner, Mintun, & Raichle, 1988; Posner & Mitchell, 1967; and see also Hochstein & Ahissar, 2002). Cells with increasingly larger receptive fields process features, sets of integrated features up to words and objects. These different levels can be accessed independently which results in the possibility of states with partial awareness. Participants in an experiment could see one or two stimulus features without seeing an entire letter, or they could see two letters of a four-letter word, and hence not see the word entirely. Similarly, when we observe a scene we could for example be conscious of a set of low-level properties of something which falls out of the foveal part of the visual field (e.g., "I saw something with a bright color moving fast away from me."), without having seen the object entirely and without having a clear idea of what it was precisely.

Visual experience of a complete stimulus can, when transitioning from unconscious to conscious, occur at any level of processing (for example due to a lack of stimulus strength, e.g., due to masking). Given that any level of processing thus represents a potential state of partial awareness, a graded spectrum is achieved, even when each level as such may still be accessed in a dichotomous manner. This is particularly imaginable in the example of words, where it is easily conceivable how one may be conscious of one or two letters without having seen the entire word. This already offers an intuitively plausible way out of the graded and dichotomous debate. We agree with such a spectrum ranging from unconscious over partially conscious up to fully conscious processing, but from here we will go further with the analysis of what could or should be seen as graded and dichotomous in several ways. To start, essential to our argument is the idea that the PAH is strongly focused on linguistic stimuli, while a considerable body of studies on graded or dichotomous visual experience have in fact been carried out with much more low-level stimuli that are not as easily captured in the PAH framework as it is currently described (cf. Windey et al., 2014).

As a first step, we zoom in further on the nature of visual experience, down to the pixel level, arguing that every pixel, which is added to an experience, represents something that is seen additionally, as opposed to when it is not seen. Of course, this is taking the argument to the extreme, but conceptually it makes sense to use the seen/unseen dichotomy to this extent. Compatible with the above, the entire range from no pixels (i.e., the unconscious end of the spectrum) to all pixels (i.e., the fully conscious end of the spectrum) can be seen as graded. Yet, in combination with the reasoning that every pixel from a stimulus display can be present or absent from our visual experience both when looking at the levels of processing and at the pixels, is still highly reminiscent of how in the PAH a graded spectrum is produced by a set of all-or-none steps. Subjective visual experience consists of many different objects, consisting of many different features, in turn consisting of many pixels, giving a gradually increasing number of pixels, features and objects present in the visual field. It is conceivable that none of it is seen, or everything, but also all the intermediate states are possible. From this point of view the spectrum from unconscious to conscious processing can be seen as graded. Conversely, every pixel will be seen or will remain unseen, and every feature and object is included in the experience or not, congruent with a level of processing account. In this respect the spectrum is dichotomous.

However, our view begins with the central claim that, despite the possibility to appreciate the spectrum described above as both graded and dichotomous, subjective visual experience can be seen as more graded for the lower level range of the spectrum and more dichotomous for the higher level range of the spectrum. While the spectrum representing the transition from unconscious to conscious processing can indeed be called graded and dichotomous, we propose that stimuli that are built from elements processed at a low level of processing (e.g., colors or orientations consisting of pixels) will be experienced in a more graded way, whereas stimuli that are processed at a high level of processing (e.g., words or numbers built out of letters or number features) will be experienced in a more dichotomous way. While this reasoning at first may seem contradictory to the one expressed above, it will become clear how low level stimuli can be thought of as more graded and high level stimuli as dichotomous, because of their different *nature* and hence how they are *labeled*.

We base our view on the assumption that stimuli at the low-level end of the spectrum are of a more non-semantic nature compared to semantic or even linguistic stimuli at the higher end of the spectrum. While the latter type, such as letters, numbers and words, are typically representing one precise concept, low-level stimuli cannot typically be associated easily to a single label. Hence, in this paper we would like to make a case for characterizing the lower level end of the spectrum as more graded, and the higher level end as more dichotomous or all-or-none (see Fig. 1). When we go from the first level of processing (i.e., energy) to the second level (i.e., the feature level) this remains the same patch of color or the oriented bar. No matter what proportion of pixels we see from a color patch or an orientation, as such it will still be the same color or orientation, and it will receive the same color or orientation label. In addition, colors (and comparably for orientations) differentiate themselves from other colors in a graded way. There is no absolute boundary or threshold that indicates when yellow becomes red or orange. We argue that in this respect color or orientation identity, and hence low-level visual experience, should be seen as graded. The evolution is different at the higher-level end of the spectrum, from for example the letter level of processing to the word level. Only at a given proportion of pixels, enough pixels are seen of all the letters to be able to see the word. Seeing three letters of a four-letter word does not provide you with access consciousness of the word level. Only when all four letters are sufficiently seen one has access consciousness to the word level. Contrary to the lower level

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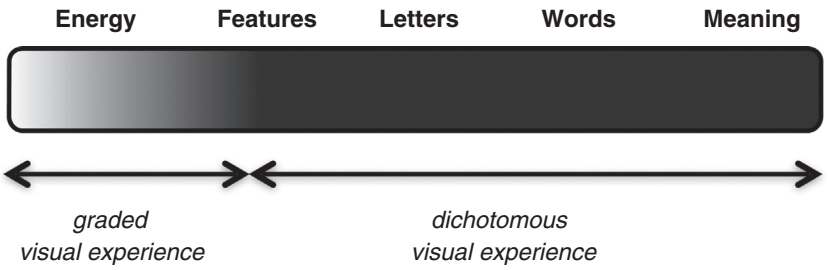

Fig. 1. The spectrum as proposed in the PAH is seen on top (Kouider et al., 2010). Here we propose that the transition from the energy level to the feature level should be conceived of as graded, rather than all-or-none. This is indicated through the white-to-gray gradient. The transitions from the feature level to the higher levels of processing should be conceived of as graded. To indicate the difference with the graded transition at the low level end of the spectrum, the dichotomous end of the spectrum is shown in black.

end of the spectrum, at the higher level end one needs a certain amount of information which will then cause us to conclude that we do not just see letters, but a word, thus receiving also another label (i.e., not "B" or "BA" anymore, but "BAT"). In other words, on each high level of processing you are seeing something functionally very different. Note that within the current scope we leave aside predictive processes. It may be possible on the basis of three letters to predict what the word may be, but this does not necessarily imply visual perception of the word. An illusory perceptual reconstruction may also be possible according to PAH (Kouider & Dupoux, 2004; Kouider et al., 2010), but if it is the case that one can see a full word on the basis of access to letters and strong priors, then one is still seeing the full word, maintaining an all-or-none transition from the letter to the word level. In addition, and contrary to stimuli at the low-level end of the spectrum, letters and words do not "flow over" in one another. Whereas yellow differs from orange in a gradual way, even quantifiable with RGB values, letters do differ in an all-or-none way from each other, just as different words refer to different concepts (and the same goes for letters versus words). We thus propose that high-level stimulus identity and high-level visual experience is a more dichotomous phenomenon. This all-or-none character can be typically associated with the non-linear dynamics from GNWT. A final example combines the low-level and high-level characteristics: the word "BOW", written in a red font color. Whether you observe 5%, 50% or 95% of all the pixels, you will have always an experience of the same red. But these different proportions will clearly put you in different distinct high-level perceptual categories, allowing you to see perhaps a letter, several letters, and the entire word.

In summary, instead of proposing an all-or-none transition for all levels of processing as in the PAH, we hypothesized that low-level visual experience in and of itself should be seen as graded (i.e. the transition from "energy" to the "feature" level), as opposed to the more dichotomous nature of high-level visual experience. We thus predicted that experimental designs using low-level stimuli would find evidence for graded visual experience, whereas studies using high-level stimuli will tend to report evidence for dichotomous visual experience. We indeed found that evidence in the literature on gradedness and dichotomy appears to be well clustered into evidence obtained for the graded account with low-level stimuli, and evidence obtained for the dichotomous account with high-level stimuli. We thus set out to compare low-level and high-level tasks on the very same stimuli, by manipulating task instructions (see Anzulewicz et al., submitted for publication; Windey, Gevers, & Cleeremans, 2013; Windey et al., 2014 for more details on the paradigm and the results).

In a first study we compared a color categorization task with a number categorization task, after which participants also expressed subjective visibility judgments by means of a Perceptual Awareness Scale (PAS; Ramsoy & Overgaard, 2004). The results of the first study showed that psychophysical curves for accuracy and subjective visibility were both significantly more non-linear for the high-level task than for the low-level task (Windey et al., 2013). This result however, did not allow us to directly disentangle graded from dichotomous visual experience (see also Windey et al., 2014 for more details), but did mirror the pattern of results previously found in studies supporting the graded or the dichotomous account. Therefore this study showed that level of processing was indeed a factor susceptible to make it possible to integrate both views about the nature of visual experience. In the next studies (Anzulewicz et al., submitted for publication; Windey et al., 2014), we pursued our "level of processing" approach with an analysis of the distribution of subjective ratings. We recently found evidence for a significant increase in middle rating usage frequency during a low-level task compared a the high-level task (Anzulewicz et al., submitted for publication). This points to more graded visual experience in the low-level task. However, we could not find evidence for such a pattern with a paradigm involving a color (i.e. low level of processing) and word categorization task (i.e., high level of processing; Windey et al., 2014). Yet, analysis of the evolution of accuracy across subjective ratings showed an all-or-none pattern in the high-level task, and a gradual increase in the low-level task. Subjects made use of all subjective ratings even if the underlying accuracy pattern showed only two states, namely on-chance performance and ceiling performance (see also below). This finding suggests that they either saw or did not see the high-level stimulus. This mirrors closely our hypothesis of a modulation of visual experience by level of processing. Low-level visual experience appears to be graded, whereas high-level visual experience of more semantic content appears to be all-or-none.

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We will now turn our discussion to which other aspects of conscious experience could be considered as graded or dichotomous. As announced, we do not only want to describe precisely what in our view above is meant by "consciousness" (i.e., visual experience from unconscious to conscious) and "graded" and "dichotomous", although it appears that this is the aspect which has been treated most extensively by previous work. We also wish to distinguish what we described above from other aspects of the transition from unconscious to conscious visual experience (Section 3), other processes preceding or following conscious experience (Section 4), and aspects of conscious experience in general which we do not consider here (Section 5). All of those could also be seen as graded or dichotomous, and perhaps in different ways than what we described above.

3. Alternative ways of approaching subjective visual experience

First, while in our own studies we focused on the nature of visual experience as a function of level of processing of what is experienced, there are a series of implicit choices in the experimental designs that cause us to focus on certain aspects of visual experience. For instance, we use centrally presented targets, and in most studies we only used one subjective measure in each experiment (i.e., questions on subjective visibility). Other approaches may want to emphasize and contrast other aspects of subjective visual experience of the transition from unconscious to conscious processing. There are potentially many ways in which to consider visual experience. Maybe other researchers want to contrast subjective experience of foveal with parafoveal content. Experiments could verify this by manipulating the amount of visual degrees from the center of the screen at which stimuli are presented. Subjective experience can be verified with a scale, and the analysis can point out whether graded or all-or-none patterns of ratings are observed for stimuli presented in the center versus the periphery. It remains to be seen whether we would observe differences in the nature of visual experience, and how the result can be fitted in an encompassing framework on gradedness and dichotomy. Another possibility is to consider gradedness and dichotomy of visual experience across *a set* of variables (e.g., "I think I did not see the stimulus very clearly, but I am fairly confident about what it was, yet I probably would not bet a lot of money on it."), rather than the *single* variable of subjective visibility from unconscious to conscious which we were considering above (i.e. "Have I seen a stimulus clearly or not?"). Previous experiments reported in the literature have not yet emphasized what these dissociations imply for graded or all-or-none conceptualizations of consciousness. The approach may lead you to other conclusions on what is graded and dichotomous than the approach we advocated above.

4. Prerequisites and consequences of visual experience

Subjective visual experience can be conceptually distinguished from processes preceding and following visual experience (for reviews, see Aru, Bachmann, Singer, & Melloni, 2012; de Graaf, Hsieh, & Sack, 2011), and also those other aspects of consciousness may be graded or dichotomous. Visual experience is preceded by the input being registered by the retina, and unconscious processes before (e.g., pre-stimulus neural excitability, Aru et al., 2012) or after the input has been presented. As mentioned above, we hypothesize that the level of processing of the input is in fact influencing the subjective experience of the input. Unconscious processing of the input could also involve graded or dichotomous processes, which does not necessarily imply direct consequences on the gradedness or dichotomy of our subjective visual experience as considered above (e.g., gradually changing firing rate of a particular neuron in the ventral stream versus the all-or-none action potential of that neuron). Next, post-perceptual processes such as metacognitive reflection about a perceptual experience, and its report also have to be disentangled from the visual experience itself. To categorize a visual experience a behavioral report will demand gradual evidence accumulation (e.g., as measured by Lateralized Readiness Potentials, LRP, an indicator of response activation; De Jong, Wierda, Mulder, & Mulder, 1988; Gratton, Coles, Sirevaag, Eriksen, & Donchin, 1988) and a build-up of muscle activity (e.g., as measured by electromyography). Then, the nature of pressing or not pressing a key appears to be an all-or-none matter. Finally, we have several methods to measure either graded or dichotomous responses (or responses patterns). Observers can report on a subjective experience by means of subjective scales. They are asked to indicate for example to what extent a stimulus was visible and to give a clarity rating with a key press. These subjective scales have a certain amount of scale points (i.e., 2, 3, or more) from which observers can choose. These subjective scales themselves could hence be called graded or dichotomous scales, when there are more than two or only two scale points, respectively. Also the pattern of ratings can be called graded or dichotomous. As introduced earlier, a graded pattern on a scale with four scale points would be found if observers use the two intermediate ratings frequently, whereas a dichotomous rating pattern would be found if only the two outermost ratings are used. Not only the level of processing of the input may influence visual experience, but also the instrument we use to measure gradedness and dichotomy may influence whether we observe graded or dichotomous patterns behaviorally.

In the study comparing a color task with an "animal or object" word categorization task on colored words (cf. above), which we introduced above, we found that subjects used all subjective ratings including the intermediate one. However, the average accuracy for each subjective rating showed a very different pattern. While the performance increase across the different ratings was gradual in the low-level task, accuracy was at chance level for the lowest visibility rating, and at 90% for both the intermediate and highest rating in the high-level task (Windey et al., 2014). The latter pattern of results suggests two states of all-or-none perception during the high-level semantic task, whereas the subjects made use of all

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the subjective ratings. One possibility is that subjects perhaps use all ratings to satisfy perceived demand characteristics of the experiment. In addition, although subjects either have seen the word or not, they may use the intermediate rating to indicate that they did see one or more letters of the word, but hence did not see the entire word. Another experiment showed that also the continuous scale (i.e., the SDS scale) suffers from a scale bias (Windey & Cleeremans, submitted for publication). This scale consists of 21 scale points. Our results do not appear to suggest a scale bias to the extent that a spread-out unimodal distribution is transformed in a bimodal distribution. However, we found evidence for significantly increased subjective ratings near the outermost ends of the scale. This result indicates that usage of a scale with 21 scale points induces a more all-or-none rating pattern, regardless the underlying subjective visual experience.

It appears that in addition to a repeated usage of stimuli and tasks pertaining to a particular level of processing, the confusion between the graded and the dichotomous account has been complicated further by a consistent usage of discrete and continuous scales in studies that have supported the graded or the dichotomous account, respectively. In general it is clear that the methods, both regarding the selection of stimuli and tasks, and in the selection of subjective measures of visual experience, have profoundly influenced research on the nature of visual experience.

5. Alternative ways of approaching consciousness

There are aspects of conscious experience other than the nature of subjective visual experience when transitioning from unconscious to conscious, which again might also be considered as graded or dichotomous. Until now, we were concerned with the observation of a static stimulus, or a static scene. In natural vision of course there is the factor of the changing visual environment over time (e.g., observing a flickering red light bulb). The debate on whether subjective experience evolving over time is graded or not is an issue, which should be distinguished conceptually from observing static stimuli or scenes. How perception may evolve over time is discussed in more detail in Vanrullen and Koch (2003). The debate on whether subjective visual experience when transitioning from unconscious to conscious experience is graded or dichotomous seems to be partially independent of the discussion whether perception is discrete or continuous. Even if perception over time is continuous, features or objects may pop up in an all-or-none way or appear more gradually. Another aspect which is studied is the factor learning, which makes people gradually more aware of the same content (Cleeremans, 2008, 2011). When observers are being trained on a given perceptual task, performance and subjective clarity increase gradually (Schwiedrzik, Singer, & Melloni, 2009, 2011; Seitz & Dinse, 2007; Vermeiren et al., submitted for publication).

6. Conclusion

When overseeing the above conceptual analysis it appears that whether "consciousness" should be characterized as graded or dichotomous depends strongly on which aspect of consciousness is addressed. A similar conclusion can be reached even when considering visual experience specifically. Taken together it appears to be in any case very difficult to hold on to either a graded or a dichotomous view in general. This can be coupled back to our description above: was the visual experience of Cézanne looking at Mont Saint-Victoire graded or dichotomous? We seem to have to conclude that it was both graded and dichotomous. The graded account fails to recognize the hierarchical nature of stimuli built of elements from the higher-level end of the spectrum. Conversely, the dichotomous account (i.e., predominantly GNWT) fails to recognize graded stimulus characteristics at the low level end of the spectrum, dissociations between different subjective measures, etc. In general we want to suggest that terminology such as "consciousness" and "graded" and "dichotomous" is generic, and whenever claims are made on the nature of consciousness it should be specified which aspect of consciousness or visual experience is studied. In accordance with our view that many aspects of visual experience can be investigated, we do not want to claim that the aspects on which we focused here are somehow central to consciousness or more important than other aspects. The overall goal remains a thorough understanding of the nature of consciousness in all its aspects. In our experiments, we focused on the nature of visual experience when transitioning from unconscious to conscious (after observation of a static stimulus or scene), and how measures may have perturbed conclusions on gradedness and dichotomy. We suggest that low-level visual stimuli engender a more graded experience whereas high-level semantic stimuli engender a more dichotomous experience.

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