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The perception of visual emotion: Comparing different measures of awareness

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ABSTRACT

Here, we explore the sensitivity of different awareness scales in revealing conscious reports on visual emotion perception. Participants were exposed to a backward masking task involving fearful faces and asked to rate their conscious awareness in perceiving emotion in facial expression using three different subjective measures: confidence ratings (CRs), with the conventional taxonomy of certainty, the perceptual awareness scale (PAS), through which participants categorize “raw” visual experience, and post-decision wagering (PDW), which involves economic categorization. Our results show that the CR measure was the most exhaustive and the most graded. In contrast, the PAS and PDW measures suggested instead that consciousness of emotional stimuli is dichotomous. Possible explanations of the inconsistency were discussed. Finally, our results also indicate that PDW biases awareness ratings by enhancing first-order accuracy of emotion perception. This effect was possibly a result of higher motivation induced by monetary incentives.

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1. Introduction

Correct discrimination of facial emotion expressions and their prioritization over other available stimuli is crucial for adaptive behavior, especially in the context of social interactions (Atkinson & Adolphs, 2005). Interestingly, people often claim to be unaware of the influence of facial expressions of others, but still seem to react as if the emotional cues were processed (Li, Zinbarg, Boehm, & Paller, 2008). This suggests that the perception of facial expressions may involve both unconscious, early visual information processing as well as higher-level processing that makes us aware of the stimulus and of its influence (Atkinson & Adolphs, 2005).

The role of awareness in visual emotion perception is important in the context of the relationship between cognition and emotion. For example, it seems essential to find out whether accurate discrimination below the subjective threshold of awareness is possible; or whether the level of awareness associated with visual emotion perception is comparable with awareness of emotionally neutral stimuli. However, before addressing such research questions, we should first take a step back and select a reliable measure of awareness that can be used in the context of visual emotion perception. That is the central question that we address in this article.

Any study investigating conscious processing requires measures that will quantify participants' conscious reports. Recently, conscious awareness of different cognitive processes has often been investigated with so called subjective measures of consciousness (Dienes & Seth, 2010; Pessoa, Japee, Sturman, & Ungerleider, 2006; Sandberg, Timmermans, Overgaard, & Cleeremans, 2010; Szczepanowski, 2011; Szczepanowski & Pessoa, 2007). However, research on visual perception with

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subjective scales suggests that reports on conscious awareness of a percept vary depending on which awareness measure is used (Sandberg et al., 2010). There is also substantial evidence that calibration of awareness ratings can be influenced by the type of subjective measure applied (Wierzchoń, Asanowicz, Paulewicz, & Cleeremans, 2012).

In the present study, we compare three different subjective measures in the context of a backward masking task. The study aims to contribute to ongoing discussion about the differences between subjective measures of awareness (see: Sandberg et al., 2010; Wierzchoń et al., 2012). Here, we extend these findings to a new domain by showing that reports on visual emotion perception vary when conscious responses are calibrated with different awareness scales.

1.1. Subjective measures of awareness

The most commonly used subjective measures of awareness are: confidence ratings (CRs), the perceptual awareness scale (PAS) and post-decision wagering (PDW). Confidence ratings (CRs) are metacognitive judgments in which participants express their confidence about how certain they are of having perceived a stimulus (Cheesman & Merikle, 1984), or about how accurate their response was (Sandberg et al., 2010). In both situations, high confidence should be associated with correct responses. Typically, when asked to perform a discrimination task, participants indicate their level of confidence in their prior judgments. When participants are aware of the stimuli, their confidence is related to the accuracy of stimuli discriminations, i.e. higher confidence is correlated with higher accuracy (Szczepanowski & Pessoa, 2007). Confidence ratings may be expressed on a dichotomous scale (“guess/know”; where “guessing” indicates that the participant suspects that his or her judgments were mere guesses, and “knowing” indicates that the participant is convinced that the judgments comprised knowledge at some point (Dienes, 2007) or on a more continuous scale (e.g. the 4-point scale: Sandberg et al., 2010). CR constitute the simplest measure of awareness and may be best suited to participants who are not flexible at making introspective judgments about their conscious knowledge (Sandberg et al., 2010).

The perceptual awareness scale (PAS, Ramsøy & Overgaard, 2004) is a 4-point verbal scale that attempts to measure the quality of conscious experience directly. It asks participants to evaluate the visibility of the percept as subjective certainty of its presence (the metacognitive judgment of a percept’s accessibility). The scale was developed by analysing participants’ free reports while performing visual discrimination tasks (Ramsøy & Overgaard, 2004). The lowest point indicates no visual experience of a stimulus, while the other three points grades the clarity of the visual experience (i.e. ‘Weak glimpse’, ‘Almost clear image’, and ‘Clear image’). Findings by Ramsøy and Overgaard (2004) seem to support the claim that PAS is an intuitive measure that affords “direct” access to people’s experience of vision. The scale correlates with the accuracy of visual discrimination, and can reflect a gradual relationship between awareness taxonomy and performance (Overgaard, Rote, Mouridsen, & Ramsøy, 2006). It is well suited to purely perceptual tasks but less so in the case of complex visual experiences (e.g. complex visual scenes – see: overflow argument, Block, 2011) or memory performance (see Wierzchoń et al., 2012). Moreover, it might be more challenging to use for people who have limited introspection skills (Sandberg et al., 2010).

Monetary scales are relatively novel methods of measuring conscious experience. Post-decision wagering (PDW, Persaud & McLeod, 2008; Persaud, McLeod, & Cowey, 2007; Ruffman, Garnham, Import, & Connolly, 2001) is a confidence-based scale where confidence levels are expressed in terms of the amount of money the participants bet on their judgments. Under post-decision wagering, the participant has to bet on the accuracy of the yes–no judgments (for instance, whether or not the target was present) by placing either high or low bets. Correct wagers are accumulated while incorrect wagers results in a loss, and are being deducted from earnings. The post-wagering scale is claimed to be more intuitive for participants than the CR scale, but is also more likely to be influenced by loss aversion (Schurger & Sher, 2008). Another concern is that participants who use wagering may be fully aware but still bet low, for example, when faced with weak sensory evidence (Clifford, Arabzadeh, & Harris, 2008).

1.2. Awareness of visual emotion perception and its modulation

Typically, the perception of visual emotion is investigated with a backward masking task involving emotional faces. Participants are typically presented with masked stimuli and instructed to indicate whether or not emotion is present in the facial percept, and then to report the level of subjective confidence in their yes/no responses (Szczepanowski & Pessoa, 2007). Conscious perception of emotion in the visual percept can be demonstrated by so called “zero-correlation criterion” (Dienes, 2007; Dienes & Perner, 2004), i.e. by showing a positive relationship between awareness ratings (e.g., subjective confidence judgments) and accuracy in the discrimination task (Sandberg et al., 2010; Szczepanowski, 2010). Any increase in accuracy observed for the higher rates tell us that knowledge contributes in conscious perception (i.e. that participants are aware of what was presented), whereas comparable accuracy rates observed for both lower and higher rates of awareness indicate non-significant contribution of knowledge in perception.

As already stated, the nature of the scale used to collect awareness judgments may influence the reports themselves. This also seems relevant in the case of the visual emotion perception. Apparently, there are also evidences showing that the use of taxonomic categories involved in subjective reports can also shape the clarity of the visual percept either during its formation or at some high-level visual representation. In particular, a repetition priming study with emotional faces (Gendron, Lindquist, Barsalou, & Barrett, 2012) has demonstrated effects of language-based modulation on emotion perception: the perceptual representation of emotional faces was shaped by accessibility of the relevant emotion word (such as ‘anger’ can influence the way participants construct perceptual representation of the scowling faces). Evidence to support the idea of knowledge-based

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