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Conscious awareness of self-relevant information is necessary for an incidental self-memory advantage

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ABSTRACT

Co-presenting an item with self-relevant *vs.* other-relevant information under a non-self-referential encoding context can produce a memory advantage. The present study examined the relative contributions of conscious *vs.* unconscious processing of self-cues to this incidental self-memory advantage. During encoding, the participant's own or another person's name was presented supraliminally or subliminally prior to the presentation of each target word. Consistent across two experiments, we found better memory for words preceded by the own name *vs.* another name but only when the names were presented supraliminally. The masked priming effect produced by the own name in Experiment 2 suggests that the absence of a self-memory advantage following subliminal name presentation was unlikely due to subliminal self-processing being too weak. Our findings suggest that conscious awareness of self-cues is necessary for an incidental self-memory advantage. Potential qualitative differences between conscious *vs.* unconscious self-processing mediating the impact of self on memory are discussed.

1. Introduction

A sense of 'self' constitutes a central feature of human experience that provides stability and continuity to subjective experiences across time and space (Neisser, 1988). The pivotal role of self in human everyday functioning is evidenced by the many empirical efforts to chart its influence on cognition and behavior. In particular, since the demonstration of a memory advantage produced by relating new information to the self at encoding (self-reference effect [SRE], Rogers, Kuiper, & Kirker, 1977), understanding the role of self in memory has been one of the major focuses. Typically, the SRE has been observed in self-referencing paradigms in which people are explicitly asked to process stimuli in relation to themselves. For instance, the most widely used trait-evaluation task requires people to judge whether personality-trait words are descriptive of themselves or another person at encoding, and words judged in relation to the self are later better remembered than those judged in relation to someone else (e.g., Conway & Dewhurst, 1995; Ferguson, Brendan, & Carlson, 1983; Kuiper & Rogers, 1979). The SRE has been attributed to enhanced elaboration and organization of incoming information afforded by the use of well-established, highly organized self-concept/knowledge at encoding (Conway & Dewhurst, 1995; Keenan & Baillet, 1980; Klein & Loftus, 1988).

Notably, subsequent studies moved beyond explicit self-referencing paradigms to examine the impact of self on memory in more naturalistic, everyday contexts in which the self creates associations with external stimuli in the absence of explicit self-reflection or evaluative appraisal of the stimuli's self-relevancy (Cunningham, Turk, MacDonald, & Macrae, 2008; Turk, Cunningham, & Macrae, 2008; Van den Bos, Cunningham, Conway, & Turk, 2010). Of most importance for the present study, Turk et al. (2008) showed that

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simply co-presenting a target stimulus with a self-relevant cue under a non-evaluative, relational encoding context can produce a SRE. In their study, participants were presented with a self-relevant (one's own name or face) or an other-relevant (name or face of another person) cue simultaneously with a personality-trait word, and their task was to judge the location of each word in relation to the cue (i.e., above or below the cue). A subsequent memory test revealed better recognition of words that were presented with the self-relevant cue compared to those that were presented with the other-relevant cue. Turk et al.'s finding suggests that the explicit self-reflection or evaluative appraisal of self-relevance is not necessary for the SRE but rather a mere incidental association between the self and a stimulus at encoding is sufficient to elicit the SRE. Recent studies replicated this non-evaluative, "incidental" SRE not only for target items themselves (i.e., item memory) but also for contextual features associated with the items (i.e., source memory, Johnson, Hashtroudi, & Lindsay, 1993; Cunningham, Brebner, Quinn, & Turk, 2014; Kim, Johnson, Rothschild, & Johnson, 2018). The incidental SRE is suggested to be underpinned by automatic attentional responses to self-relevant information (i.e., "attention-capturing" capacity of self-cues; e.g., Bargh, 1982; Gray, Ambady, Lowenthal, & Deldin, 2004; Moray, 1959) that promote enhanced encoding of stimuli co-occurring with the self-relevant cues in the environment (Cunningham et al., 2014; Turk et al., 2008; Turk et al., 2011; see Turk et al., 2013, for the role of attention during encoding in the emergence of the SRE; see Gronau, Cohen, & Ben-Shakhar, 2003; Kawahara & Yamada, 2004; Kim et al., 2018, for the role of task context in determining the likelihood of a self-advantage in attention and memory). Indeed, as suggested elsewhere, one of the major functions of the self-system may be to ensure that information of potential relevance to the self is preferentially attended and retained (Cunningham, Brady-Van den Bos, Gill, & Turk, 2013; Turk et al., 2008).

A recent revival of research interests in self-related biases in cognition has witnessed several demonstrations of the "prioritized" processing of self-relevant information in unconscious stages of information processing hierarchy (for self-face: Geng, Zhang, Li, Tao, & Xu, 2012; Pannese & Hirch, 2010, 2011; for self-name: Alexopoulos, Muller, Ric, & Marendaz, 2012; Maoz, Breska, & Ben-Shakhar, 2012; Pfister, Pohl, Kiesel, & Kunde, 2012; Tacikowski, Berger, & Ehrsson, 2017; for self-associated geometric shapes: Macrae, Visokomogilski, Golubickis, Cunningham, & Sahraie, 2017; Sui & Humphreys, 2017; but see Noel, Blanke, Serino, & Salomon, 2017; Stein, Siebold, & Van Zoest, 2016; Tacikowski & Ehrsson, 2016). For instance, when rendered invisible within a continuous flash suppression paradigm, self-relevant stimuli such as one's own face or self-associated geometric shapes were associated with reduced suppression times (i.e., faster breaking into awareness) compared to other-relevant stimuli (Geng et al., 2012; Macrae et al., 2017). When presented briefly below conscious awareness, one's own name but not other names facilitated the detection of a target stimulus subsequently appearing in the same location (i.e., the cueing effect), suggesting that attention was preferentially attracted by subliminal self-relevant cues (Alexopoulos et al., 2012). In addition, subliminal presentation of one's own name was found to elicit stronger skin conductance responses (SCRs), a measure of autonomic arousal often assumed to index attentional orienting (Öhman, 1979), compared to other non-self-relevant names (Maoz et al., 2012).

The presence of the "self-prioritization effect" at both the conscious and unconscious stages of information processing raises an important question of how conscious and unconscious factors contribute to the incidental SRE. So far, the incidental SRE has only been demonstrated under conditions in which the participants were fully aware of the presence of the self-relevant information (Cunningham et al., 2014; Kim et al., 2018; Turk et al., 2008). Thus, it remains unknown if and the extent to which unconsciously processed self-relevant information influences subsequent memory for target items presented in close spatiotemporal proximity. Is conscious awareness of the self-relevant cues in the external environment necessary for the self-system to give rise to a self-memory advantage? Or, is unconscious processing of the self-relevant cues sufficient to elicit a self-memory advantage? Addressing these questions is important because it can (a) help elucidate the relative contributions of early, awareness-independent self-processing *vs.* relatively late, awareness-dependent self-processing to the incidental SRE and (b) potentially suggest a boundary condition for the impact of self on memory.

Following the design of Turk et al. (2008), in two experiments, we presented self-relevant (one's own name) or other-relevant (another person's name) information that was immediately followed by a target word to which the participants made a location judgment. Critically, the names were presented supraliminally (i.e., with no mask) or subliminally (i.e., with forward and backward masks). A subsequent surprise memory test assessed participants' recognition memory for the target words. In the supraliminal, unmasked name condition, we expected to observe a SRE, replicating previous findings (Cunningham et al., 2014; Kim et al., 2018; Turk et al., 2008). In the subliminal, masked name condition, we predicted two different patterns of results: (a) if awareness-dependent processing of self-relevant information mainly contributes to the incidental SRE, then the magnitude of the SRE would be attenuated or even eliminated compared to that observed in the supraliminal name condition, producing an interaction between "name identity" (self-name *vs.* other-name) and "masking" (unmasked *vs.* masked) factors. Alternatively, (b) if awareness-independent processing of self-relevant information mainly contributes to the incidental SRE, then the magnitude of the SRE would be equivalent to that observed in the supraliminal name condition, producing a main effect of "name identity" in the absence of a "name identity" × "masking" interaction (see Tacikowski & Ehrsson, 2016 for similar logic).

2. Experiment I

2.1. Materials and methods

2.1.1. Participants and design

Seventy undergraduate students (47 females; mean age = 19.10 [± 1.11]) participated in this study.[1] All participants were

[1] For both Experiments 1 and 2, the sample size was predetermined based on a small-to-medium effect size (Macrae et al., 2017; Pfister et al., 2012) using G*Power 3 (f = .17, a = .05, power = 0.8) and counterbalancing constraints.