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FlashReport

Goal-directed processing of self-relevant information is associated with less cognitive interference than the processing of information about other people

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HIGHLIGHTS

- We tested cognitive interference associated with goal-directed self-processing.
- Self-recognition was related to less interference than other-recognition.
- Goal-directed self-processing could easily co-occur with concurrent mental activity.

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ABSTRACT

Goal-directed mental processes focused on oneself often co-occur with goal-directed mental processes focused on other people or objects. However, little is known about the mechanisms of this fundamental type of cognitive interaction. The aim of this study was to determine the degree of cognitive interference associated with self-related processing compared with other-related processing. In two separate experiments, we found that an additional letter-case task interfered with self-recognition significantly less than with the recognition of famous and unknown others. This principal finding was consistent across the accuracy and latency of the participants' responses and across different categories of autobiographical stimuli. Together, these results suggest that the goal-directed processing of self-related stimuli is relatively effortless and that it could easily co-occur with additional mental tasks. Implications for models of access to self-concept and models of cognitive interference are discussed.

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1. Introduction

Many situations in everyday life involve an interaction between goal-directed attention focused on oneself and goal-directed attention focused on other people or objects. For example, one can monitor one's own tone of voice or gestures when giving a talk while simultaneously checking the reactions of people in the audience. Surprisingly, the mechanisms of this fundamental type of mental interaction remain largely unknown. In particular, it is unclear whether concurrent goal-directed self-processing and other-processing interfere with each other more or less than two goal-directed other-related mental processes.

To navigate the environment efficiently, people must rapidly select sensory information that is relevant to their current behavioral goals. They must also quickly redirect their attention and change their course of action when faced with novel, potentially threatening, or rewarding stimuli (Corbetta, Patel, & Shulman, 2008). These two types of processes refer to goal-directed and stimulus-driven attention, respectively. Many studies have focused on how sensory-driven (task-irrelevant) self-processing interacts with concurrent behavioral tasks (Alexopoulos, Muller, Ric, & Marendaz, 2012; Bargh & Pratto, 1986; Bundesen, Kyllingsbaek, Houmann, & Jensen, 1997; Gray, Ambady, Lowenthal, & Deldin, 2004; Moray, 1959; Wolford & Morrison, 1980). However, less is known about how goal-directed (task-relevant) self-processing interacts with additional mental tasks.

Automaticity develops as a function of repetition; the more frequently and consistently a mental representation is accessed, the lower its threshold of activation becomes (Bargh, 1994; Schneider & Chein, 2003). In other words, after sufficient training, the representation becomes activated by the mere presence of a trigger, involuntarily, unconsciously, and with minimal cognitive effort. In contrast, controlled processes are intentional, aware, and effortful. Crucially, two controlled mental processes interfere with each other to a greater degree than two automatic processes and more than one automatic and one controlled processes (Bargh, 1994; Moors, 2015; Schneider & Chein, 2003). The most common way of explaining this interference effect is to assume

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that people share processing capacity among mental processes; when more than one process occurs at any given moment, there is less capacity available for each individual process and performance is impaired (Pashler, 1994). Thus, cognitive interference is an indicator of cognitive effort. In the present study, we use this indicator to determine whether goal-directed self-processing is more or less effortless than other-processing (please note that other features of automaticity are outside the scope of this study).

Self-concept refers to one's mental representation of one's own identity, personality, social roles, and values (e.g., Oyserman, Elmore, & Smith, 2012). The abilities to construct and consciously access this representation (e.g., self-recognition or self-reflection) are considered hallmarks of the human mind, as both ontogenetically (Zelazo, 2004) and phylogenetically (Gallup, 1997), these abilities are among the last cognitive functions to develop. Notably, one's own name seems to have a central position in self-concept. The state of namelessness is considered equal to having no social identity (Watson, 1986). Even 5-month-old infants differentiate the sound of their own name from other names (Parise, Friederici, & Striano, 2010), and a preference for the letters in one's own name is regarded as an implicit measure of self-esteem (Gebauer, Riketta, Broemer, & Maio, 2008). Other autobiographical facts, such as one's date of birth, hometown, or nationality, are also crucial components of self-knowledge (Gray et al., 2004). In this study, we use the processing of autobiographical semantic stimuli to determine the degree of cognitive effort associated with access to self-concept.

Because people often refer to their representations of self (e.g., Greenwald, 1980; Greenwald & Banaji, 1989) and because automaticity develops as a function of repetition (see previous paragraphs), access to self-concept should be related to minimal cognitive interference. Indeed, Bargh (1982) showed that repeating aloud self-relevant trait adjectives presented in one ear impairs the performance of a concurrent visual detection task to a lesser extent than repeating self-irrelevant trait adjective does. Similarly, MacDonald and Kuiper (1985) found that better memory performance for self- than for other-related information is unaffected by the presence of an additional cognitive task during encoding. The subject's own name can also be reported with high accuracy even when presented immediately after another target stimulus; in contrast, other names are not noticed under such conditions (Giesbrecht, Sy, & Lewis, 2009; Shapiro, Caldwell, & Sorensen, 1997). The above studies suggest that goal-directed self-processing produces little cognitive interference.

However, self-relevant stimuli are also intrinsically salient (Sui, He, & Humphreys, 2012; Sui, Rotshtein, & Humphreys, 2013); they easily "grab" participants' attention (Bargh & Pratto, 1986; Moray, 1959; Wolford & Morrison, 1980), and they trigger increased attention allocation responses (Tacikowski, Cygan, & Nowicka, 2014; Tacikowski & Nowicka, 2010; Turk et al., 2011). If self-processing engages increased cognitive resources, then according to the capacity-sharing principle, self-processing should produce strong interference with concurrent tasks. Turk et al. (2013) directly supported this claim; the participants in their study categorized objects as belonging to themselves or to another person while attending to or ignoring numbers concurrently displayed on a computer screen. A later memory test showed that divided attention during encoding resulted in decreased retrieval of objects assigned to the self but not objects assigned to another person. Together, these findings suggest that goal-directed self-processing produces strong cognitive interference.

Certain methodological factors could underlie the abovementioned inconsistent findings. For example, simply repeating self-relevant trait adjectives (Bargh, 1982) or detecting one's own name among other stimuli (Giesbrecht et al., 2009; Shapiro et al., 1997) might not involve explicit goal-directed self-processing in the same way that self-reflection or self-recognition do. In turn, measuring the degree of interference in a post-experiment memory test (MacDonald & Kuiper, 1985; Turk et al., 2013) might be confounded by nonspecific factors that occur between the encoding and retrieval phases; such a post-experiment test does not measure interference when it actually takes place. Finally, all-or-none measures of interference, such as reportability or recall (Giesbrecht et al., 2009; Turk et al., 2013), might not be sensitive enough to capture the *degree* of interference associated with self-processing.

The aim of this study is to provide conclusive evidence regarding the degree of cognitive interference associated with goal-directed self-processing. Taking into account the abovementioned methodological issues, we made self-processing explicit and intentional by employing a self-recognition task. In addition, we assessed cognitive interference on a trial-by-trial basis (i.e., at the point when the two cognitive processes actually co-occur), and we used a continuous measure of interference (i.e., reaction times). Our study had a 2 × 2 factorial design with "person" (self vs. other) and "difficulty" (easy vs. hard) as the factors. During the "easy" session, the subjects were asked to determine whether a name, a surname, a birthplace, or a nationality code referred to themselves or to other people. In turn, during the "hard" session, the person-recognition task described above was accompanied by a letter-case task ("Decide whether a target is self- or other-related but only in trials where the targets are written in lowercase letters"). This additional "go/no-go" task had no particular relevance to our main research question; its only role was to compete for cognitive resources with the primary person-recognition task (Fig. 1A). As a result, there were four experimental conditions: self-easy (SE), other-easy (OE), self-hard (SH), and other-hard (OH). Our main dependent variables were error rates (ERs) and reaction times (RTs). We used these variables to calculate the degree of self-interference (S_i) and other-interference (O_i), as the SH > SE and OH > OE differences, respectively.

We hypothesized that if self-processing is more effortless than other-processing, then the letter-case task should impair self-recognition significantly less than it impairs other-recognition, as indicated by the $S_i^{ER} < O_i^{ER}$ and $S_i^{RT} < O_i^{RT}$ differences. In contrast, if self-processing is more effortful than other-processing, then effects in the opposite direction should occur (i.e., $S_i^{ER} > O_i^{ER}$ and $S_i^{RT} > O_i^{RT}$). We tested these alternative hypotheses in two separate experiments conducted with two different groups of participants. In the second experiment, we included a condition that featured famous celebrities rather than unknown others (as was used in the first experiment) to control the effect of sematic familiarity.

2. Experiment I

2.1. Materials and methods

2.1.1. Participants

Twenty-four naïve right-handed subjects (mean age: 26 ± 4 years, fourteen females) participated in this study. All participants were healthy, reported no history of psychiatric illness or neurological disorder, and had normal or corrected-to-normal vision. All participants gave their written informed consent before the start of the experiment. The Regional Ethical Review Board of Stockholm approved the study.

2.1.2. Stimuli and procedure

As experimental stimuli, we used first names, surnames, nationality codes (e.g., "FRA" for France), and places of birth (names of villages, towns, or cities) that were either self- or other-related. All words were written in white letters ("Arial" font) and were presented centrally on a black background. The viewing distance was kept constant for all participants (chin-rest placed 70 cm away from the computer screen). All stimuli in the "self" and "other" conditions had the same number of letters to match the stimuli size.

In the "easy" session, the subjects had to keep track of only one stimulus feature (identity), whereas in the "hard" session, the participants had to pay attention to two features (identity and letter case). All other aspects of stimuli presentation (stimuli, durations, order, etc.)

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