Brief article

When we cannot speak: Eye contact disrupts resources available to cognitive control processes during verb generation

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A B S T R A C T

Although eye contact and verbal processing appear independent, people frequently avert their eyes from interlocutors during conversation. This suggests that there is interference between these processes. We hypothesized that such interference occurs because both processes share cognitive resources of a domain-general system and explored the influence of eye contact on simultaneous verb generation processes (i.e., retrieval and selection). In the present experiment, viewing a movie of faces with eyes directed toward the viewer delayed verbal generation more than a movie of faces with averted eyes; however, this effect was only present when both retrieval and selection demands were high. The results support the hypothesis that eye contact shares domain-general cognitive resource with verb generation. This further indicates that a full understanding of functional and dysfunctional communication must consider the interaction and interference of verbal and non-verbal channels.

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1. Introduction

Face-to-face communication is a complex and important aspect of human behavior. The simultaneous functioning of verbal and non-verbal processes, such as verb generation for nouns (Snyder & Munakata, 2008) and eye contact (Senju & Johnson, 2009), is essential for face-to-face communication. The difficulty of this simultaneous functioning is reflected in the frequent observation that people avert their eyes from interlocutors during conversation (Doherty-Sneddon, Bonner, & Bruce, 2001), despite the importance of face-to-face perception in regulating interactions (Kleinke, 1986; Uono & Hietanen, 2015). Indeed, the phenomenon that face-to-face contact disrupts verbal processing has been shown experimentally (e.g., answering general knowledge/mathematics questions; Glenberg, Schroeder, & Robertson, 1998).

Eye contact during face-to-face perception appears to have unique effect on cognitive control processes. For instance, Markson and Paterson (2009) found that maintaining eye contact with an experimenter disrupted participants' visuospatial imagination to a greater degree than did viewing a static or dynamic visual stimulus, and the effect got stronger as the task became more difficult (Buchanan et al., 2014). Additionally, a study using the visual word-color Stroop task with simultaneous presentation of gaze stimuli showed that being watched selectively disrupts inhibitory

control of the predominant response (Conty, Gimmig, Belletier, George, & Huguet, 2010). Although these intriguing results suggest that eye contact affects cognitive control processes, it remains unclear what aspects of cognitive control processes are affected by eye contact because these previous tasks included some visual factors that potentially compete with eye contact. For example, eye contact may compete with visuospatial imagination for visual domain-specific cognitive processes (Markson & Paterson, 2009), while the simultaneously presented eye stimulus during the visual color-word Stroop task could not be attended to at the same time as the Stroop stimulus (Conty et al., 2010), meaning that the results reflect the effect of being watched rather than the effect of eye contact.

In the present study, we attempted to clarify how eye contact interferes with cognitive control processes during verb generation which does not recruit visual processes but still comprises multiple, dissociable processes (Snyder & Munakata, 2008; Snyder et al., 2010). Verb generation requires the retrieval and selection of words from multiple possible alternatives. As cognitive demands of retrieval and selection processes vary depending on word properties (Fig. 1A), using the auditory version of the verb generation task (VGT), which empirically controls cognitive demands (Kajimura, Inohara, Utsumi, & Nomura, submitted for publication), would help to demonstrate which cognitive control processes are affected by eye contact, following the assumptions below.

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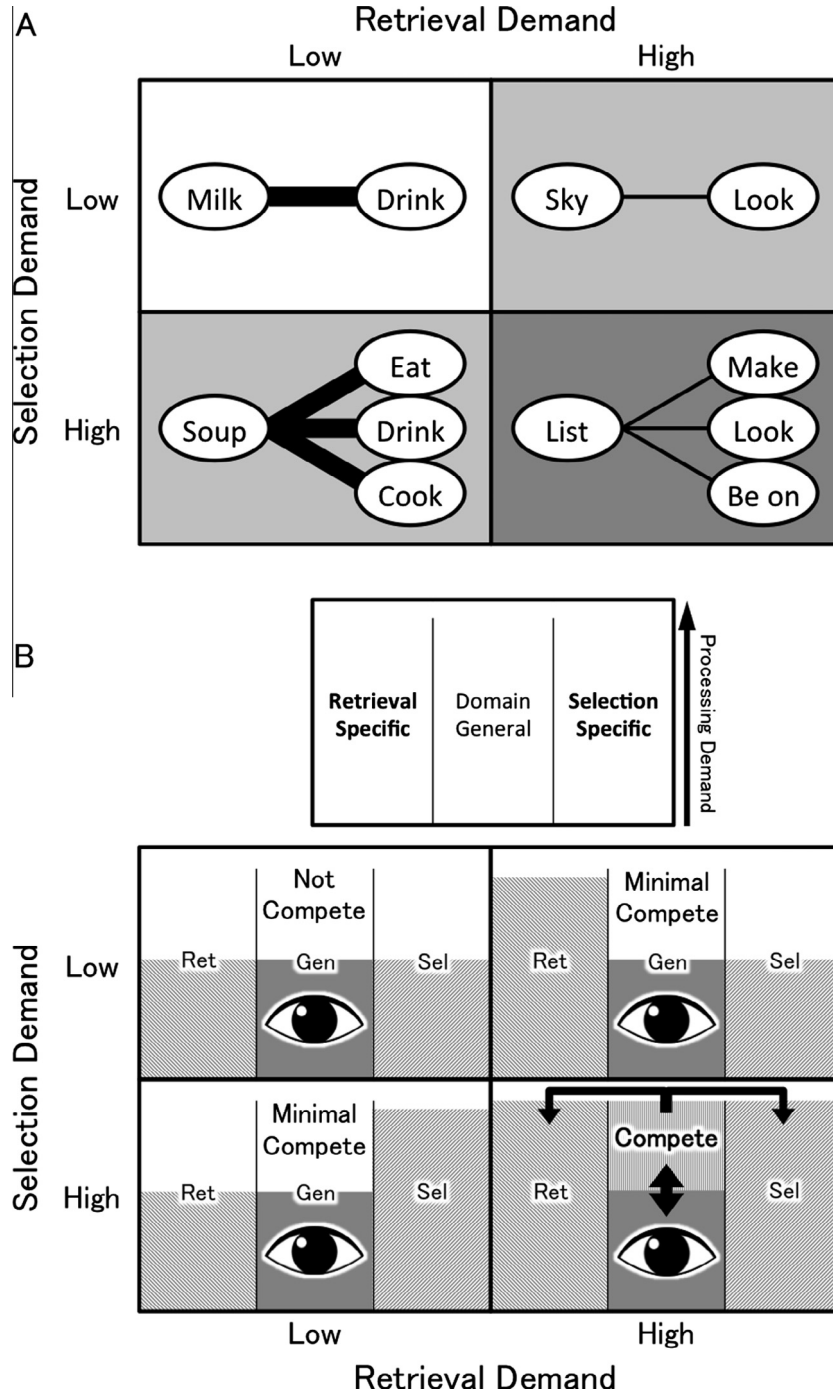
Fig. 1. Design of verb generation task and schematic illustration of one of the hypotheses. (A) This figure refers to Snyder, Banich, and Munakata's (2011) study. Selection demand (high vs. low competition) is crossed with retrieval demand (high vs. low association strength). (B) This figure represents the situation that verb generation under the current task condition recruits the domain-general cognitive system only when both retrieval and selection demands are high. If eye contact recruits only the domain-general cognitive system, it would not interfere with verb generation as long as verb generation is managed by domain-specific resources. However, when either demand is beyond the capacities of the domain-specific cognitive resources or coordinated operation of multiple domains is needed, the processes may recruit the domain-general resource only for supporting the domain-specific process or for coordinately operating them, resulting in competition with eye contact processing. Ret, retrieval-specific; Sel, selection-specific.

For the cognitive control processes of verb generation, we drew on the assumptions of working memory research regarding the conceptualization of domain-specific and domain-general processes (Fig. 1B; Baddeley, 2007; Logie, 2011): namely, (1) highly demanding cognitive processes require more cognitive resources for domain-specific processes than do less demanding processes, and (2) when cognitive demands are beyond the capacities of domain-specific cognitive resources or coordinated operation of multiple domains is needed, the domain-general cognitive system becomes influential. According to these assumptions, if eye contact recruits the domain-general cognitive system rather than the domain-specific system, it would disrupt verb generation only when the cognitive demands of verb generation are beyond the capacities of retrieval- and selection-specific resources or coordinated operation of retrieval and selection is needed (Fig. 1B represents the latter possibility). On the other hand, if eye contact