NEUROPSYCHOLOGIA

Neuropsychologia 43 (2005) 2024–2040

www.elsevier.com/locate/neuropsychologia

# Exploring the functional architecture of person recognition system with event-related potentials in a within- and cross-domain self-priming of faces

Boutheina Jemel [a,b,d,*], Michèle Pisani [c,d], Laurence Rousselle [d], Marc Crommelinck [e], Raymond Bruyer [d]

[a] Service de Recherche, Hôpital Rivière des Prairies, 7070 Blv Perras, Montréal, Que., Canada H1E 1A4
[b] Centre de Recherche Fernand-Seguin, Montréal, Canada
[c] Vision Research Group, Department Psychology, Royal Holloway, University of London, UK
[d] Unité de Neurosciences Cognitives (NESC), Université Catholique de Louvain-La-Neuve (UCL), Belgium
[e] Laboratoire de Neurophysiologie (NEFY), Université Catholique de Louvain-La-Neuve (UCL), Belgium

Received 14 March 2005; accepted 18 March 2005
Available online 20 April 2005

**Abstract**

In this paper, we explored the functional properties of person recognition system by investigating the onset, magnitude, and scalp distribution of within- and cross-domain self-priming effects on event-related potentials (ERPs). Recognition of degraded pictures of famous people was enhanced by a prior exposure to the same person's face (within-domain self-priming) or name (cross-domain self-priming) as compared to those preceded by neutral or unrelated primes. The ERP results showed first that the amplitude of the N170 component to famous face targets was modulated by within- and cross-domain self-priming, suggesting not only that the N170 component can be affected by top–down influences but also that this top–down effect crosses domains. Second, similar to our behavioral data, later ERPs to famous faces showed larger ERP self-priming effects in the within-domain than in the cross-domain condition. In addition, the present data dissociated between two topographically and temporally overlapping priming-sensitive ERP components: the first one, with a strongly posterior distribution arising at an early onset, was modulated more by within-domain priming irrespective whether the repeated face was familiar or not. The second component, with a relatively uniform scalp distribution, was modulated by within- and cross-domain priming of familiar faces. Moreover, there was no evidence for ERP-induced modulations for unfamiliar face targets in the cross-domain condition. Together, our findings suggest that multiple neurocognitive events that are possibly mediated by distinct brain loci contribute to face priming effects.


*Keywords:* Self-priming; Unrelatedness; Top–down effect; Face; Name; ERPs

## 1. Introduction

Any member of a species with a complex social organization needs to be able to recognize other individuals in order to interact with them in different ways. For humans, the ability to recognize and distinguish one person from another is usually dependent on people's face or name, but other clues can help, such as the person's voice, posture, clothing, etc. One set of fundamental questions in face recognition literature concerns the issue of how these subsets of information are linked together and organized in the memory system, and how they interact with one another. Several research approaches have been taken in addressing this issue, and the general consensus that has been reached supports the view that personal identity knowledge is stored in a common neurocognitive system wherein domain-specific perceptual circuits underlying face and name processing converge. For example, in functional neuroimaging studies using positron emission tomography (PET) and functional magnetic resonance imaging (fMRI)

* Corresponding author. Tel.: +1 514 323 7260; fax: +1 514 328 3530.
*E-mail address:* Boutheina.Jemel.hrdp@ssss.gouv.qc.ca (B. Jemel).

0028-3932/$ – see front matter 
doi:10.1016/j.neuropsychologia.2005.03.016

techniques, it has been shown that recognition of familiar faces and names involve different neural substrates specific to each input domain, but also share a common modality- and domain-independent cerebral structures (Gorno Tempini et al., 1998; Sergent, MacDonald, & Zuck, 1994). In addition to the activation of the right fusiform and lingual gyri by faces (Gorno Tempini et al., 1998; Kanwisher, McDermott, & Chun, 1997; Puce, Allison, Spencer, & McCarthy, 1997; Sergent et al., 1994), and of the left posterior middle temporal gyrus and superior temporal sulcus by names (Gorno Tempini et al., 1998; Sergent et al., 1994), bilateral fronto-temporal regions have been activated for familiar materials irrespective of the input domain.

These and other landmark studies are quite consistent with the theoretical models of face and name recognition (Bruce & Young, 1986; Burton, Bruce, & Johnston, 1990; Valentine, Brédart, Lawson, & Ward, 1991). Accordingly, at the entry level of the person recognition system, face and name inputs are perceptually processed by specific mechanisms devoted for each input domain. The perception of a familiar face activates its corresponding face recognition unit (FRU), which contains structural, view-independent representation of that face, while the processing of a familiar name within the word analysis system activates its corresponding name recognition unit (NRU). If a sufficient match with any of these stored representations is found, there is activation of contentless gateway units, called person identity nodes (PINs), which are required for subsequent retrieval of further biographic or semantic information about a known person. Unlike the face recognition units (or name recognition units) that respond only to faces (or names), person identity nodes respond to a variety of information (face, name, voice, etc.). Considering this and the hierarchical structure of person cognitive models, information conveyed by a face and a name are assumed to communicate with one another at a later stage of processing within the cognitive system, at the level of a modality- and domain-free interface, namely the person identity node, wherein face- and name-specific perceptual processing converge.

### *1.1. Cognitive models' account for priming effects*

One way of investigating the level at which face and name information interact within the person cognitive system is the study of repetition and semantic priming effects. Priming is measured as the decrease in response time in recognizing target familiar faces that have been seen in a previous occasion (i.e., repetition priming; Bruce, 1983; Bruce & Valentine, 1985) or those preceded by a closely related prime (i.e., semantic or associative priming; Bruce & Valentine, 1986). Repetition and semantic priming qualitatively differ in their duration and domain-specificity. Repetition priming can survive over lengthy intervals of time (Bruce & Valentine, 1985) and is largely domain- and item-specific (Bruce, Burton, Carson, Hanna, & Mason, 1994); e.g., priming effect on familiar face recognition was found to be abolished by a previous presentation of the familiar person's name or pictures of bodies (Bruce & Valentine, 1985; Burton, Kelly, & Bruce, 1998; Ellis, Flude, Young, & Burton, 1996; Ellis, Young, Flude, & Hay, 1987), and is reduced when a change in facial view occurred between first and second presentations (Bruce & Valentine, 1985; Ellis et al., 1987). In contrast, semantic priming dissipates within a few seconds (Bruce, 1986), and does cross stimulus domains; e.g., recognition of a familiar person's face is facilitated if it is immediately preceded by the face or name of a related familiar person (Schweinberger, 1996; Young, Hellawell, & De Haan, 1988). These characteristics of repetition and semantic priming suggest that they may result from a different locus from the person recognition system. It has been proposed that repetition priming depends on structural changes within the systems responsible for recognizing familiar stimuli while semantic priming acts on a processing stage that is common to face and name recognition (Bruce & Valentine, 1986). Bruce and Young (1986) ascribed repetition priming effects to a lowering of the activation threshold of domain-specific representation (FRUs, NRUs) while it is captured in the IAC model (Burton et al., 1990) through the strengthening of the link between domain-specific representation (FRUs, NRUs) and person identity nodes. Furthermore, the proposed mechanism to account for semantic priming involves the interaction between person identity nodes and semantic representation (Burton et al., 1990). Semantic priming can cross input domains since both person identity node and semantic representation are essentially amodal in nature.

There is now evidence that repetition priming can cross domain inputs when the face of a familiar person is *immediately* preceded by the same person's name (or vice versa). This is the effect of persons priming themselves, which is referred to as within-domain (i.e., face–face, name–name) and cross-domain (i.e., face–name, name–face) self-priming (Burton et al., 1990; Calder & Young, 1996; Calder, Young, Benson, & Perrett, 1996). Nevertheless, the amount of self-priming is larger in the within-domain than the cross-domain condition (Calder & Young, 1996; Calder et al., 1996), which suggests that some information is transferable across domains, and some is not. Information that is lost in cross-domain priming is specific to the perceptual aspect of the domain input, while a perceptually non-specific component supports cross-domain priming.

Although the majority of findings from face priming studies has been interpreted as a manifestation of a representational locus of priming effects, other behavioral results are consistent with a perceptual account. Using blurred and intact faces, Bruce and Valentine (1986) found greater within-domain semantic priming effects for blurred than for intact faces. Similarly, Rhodes and Tremewan (1993) found that cross-domain semantic priming effects influenced, or interacted with, low-level perceptual processes (visibility, distinctiveness). Based on the additive factor logic (Sternberg, 1969), such an interaction between priming and perceptual factors is classically taken as evidence that priming and