Acta Psychologica 153 (2014) 120–128

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/ locate/actpsy

Interference resolution in face perception and name retrieval ☆

Catarina S. Ferreira [a], Alejandra Marful [b,*], Teresa Bajo [a]

[a] Mind, Brain, and Behavior Research Center, University of Granada, Spain
[b] University of Jaén, Spain

ARTICLE INFO

Article history:
Received 2 August 2014
Accepted 27 September 2014
Available online 25 October 2014

PsycINFO classification:
2340
2343

Keywords:
Face processing
Face naming
Inhibition
Retrieval induced forgetting

ABSTRACT

Selective retrieval is a rather difficult task, and especially so when one attempts to retrieve personal representations such as faces or names. Retrieval of memories under strong competition conditions is pervasive in human memory and some have suggested that inhibitory control is used to overcome interference between competing stimuli. In the present study, we used the retrieval practice paradigm to investigate if competition among personal representations (such as facial features and names) is also resolved by inhibitory mechanisms. This question is theoretically relevant, since personal representations have been said to have a special status on cognition. Moreover, some models of face recognition assume that interference can arise between different representations, but that this interference would be automatically and rapidly solved, with no need for a controlled inhibitory mechanism to act. In two experiments we showed RIF for facial features and familiar names, but only when participants had to actively retrieve some information. This suggests that personal information is subject to mechanisms of inhibitory control, which could help explain everyday life difficulties in processes such as face feature recognition or name retrieval.

1. Introduction

Retrieval of specific information is not a trivial task. Imagine that in a conversation someone mentions the name of Kofi Annan. You will probably be able to retrieve some information about him, such as "he is the former UN's Secretary-General" or "he is from Ghana". However, it is also possible that you will associate these information to Morgan Freeman's face, given their similar facial features, and retrieve Morgan Freeman's face instead of Kofi Annan's. Likewise, confusion can arise from other features besides physical ones. For instance, semantic information may interfere with the retrieval of personal representation, so that if someone asks the name of the former UN's Secretary General you might access Ban Ki-moon instead of Kofi Annan.

This illustrates that remembering and recognizing a face or other personal representations such as names, are sometimes difficult (Bruce & Young, 1986). For example, in order to correctly recognize a face, one needs to be able to accurately discriminate and select from a multitude of very similar facial patterns the ones that are relevant to the person we are trying to recognize or retrieve (in the example, Kofi Annan's facial features) and reject the irrelevant ones (e.g. Morgan Freeman's). The same holds true for competition between representations that share semantic information (Kofi Annan and Ban-Ki moon, for instance). Thus, how our memory system deals with competition between these similar representations in order to retrieve the desired one is an important topic.

To explain the processes involved in the correct retrieval of personal representations, several models have been proposed (e.g., Brédart, Valentine, Calder, & Gassi, 1995; Bruce & Young, 1986; Burton, Bruce, & Hancock, 1999; Burton, Bruce, & Johnston, 1990). These models suggest different processing units, organized within different pools. The idea is that when one sees a face, a unit will become activated: a Face Recognition Unit (FRU). This unit contains representations of the structural features of familiar faces. This representation is independent of the way we see the face, that is, of its position, angle or lighting at the moment we see it.

The activation of a certain FRU leads to the activation of a unit in the next pool: the Person Identity Node (PIN). This unit can become active not only by the sight of a person's face, but also by its voice or its name. So, at this level, all the domains for recognition converge (Burton et al., 1999). Each FRU and each PIN are assigned to only one face or one person. In Burton et al. (1999) the PIN node is the locus of familiarity, which means that when a PIN reaches a threshold of activation, familiarity is signaled. The activation of a given PIN will allow access to the next pool, labeled Semantic Information Units (SIUs), which codes semantic information about known individuals, such as their profession, their hometown, or their name (names are located in a lexical unit in Brédart et al., 1995).

☆ Authors' Note: This research was supported by the doctoral research grant AP2009-2215 to Catarina S. Ferreira from the Spanish Ministry of Education, by grant PSI2013-46033 from the Spanish Ministry of Economy and Competitiveness to Alejandra Marful, and by grants EDU2008-01111 and PSI2012-33625 from the Spanish Ministry of Education to Teresa Bajo; and P08-HUM-03600 from the Andalusian Government to Teresa Bajo.

* Corresponding author at: Department of Psychology, University of Jaén, Paraje de las Lagunillas s/n, 23071 Jaén (Spain).
E-mail address: mmarful@ujaen.es (A. Marful).

http://dx.doi.org/10.1016/j.actpsy.2014.09.012
0001-6918/

Importantly for the scope of this work, these models assume that during retrieval, competition from different active nodes may arise and in order to correctly retrieve the desired representation, competition needs to be solved. From this perspective, retrieval of personal information would be subjected to the same type of interference processes than objects and other episodic information. However, several lines of research question this assumption.

First, faces have been said to enjoy a special status in cognition and accordingly are not always vulnerable to the same variables and mechanisms as other objects (e.g. Farah, 1996; Haxby, Hoffman, & Gobbini, 2000; McKone, Kanwisher, & Duchaine, 2007). For example, inversion of stimuli (i.e., its presentation in an upside down position) worsens facial recognition to a much larger extent than object recognition (Farah, 1996). Also, electrophysiological (Itier & Taylor, 2002; Rossion et al., 2000) and neuroimaging studies (Haxby, Hoffman, & Gobbini, 2002) seem to indicate that there are components and brain regions more sensitive to face processing and recognition. Taken together these studies suggest that perceiving and recognizing a face implies specific mechanisms, different from those involved in the perception of other types of stimuli. This could mean that facial and personal representations respond differently than objects to interference processes.

In fact, research comparing interference during object and face naming has yielded contrasting results. Whereas for objects there seems to be a consensus that naming a target can be impaired by the presentation of a semantically related distractor (Glaser & Düngelhoff, 1984; Lupker, 1979; Rosinski, Golinkoff, & Kukish, 1975), results for face naming are not as clear. Though some studies have found similar results when comparing face and object naming (e.g. Brédart & Valentine, 1992; Darling & Valentine, 2005), others have failed to replicate these results. For instance, in three experiments, Vitkovitch, Potton, Bakogianni, and Kinch (2006) did not obtain any evidence of interference in face naming when employing a paradigm that had previously been shown to elicit interference for objects (Vitkovitch, Rutter, & Read, 2001). In the first experiment, Vitkovitch et al. (2006) primed the target face with categorically related distractor faces; in the second study, the prime was associatively related, and in the last experiment they primed the target face with a categorically related distractor written name. None of these manipulations led to interference effects. Thus, the studies by Vitkovitch et al. (2006) using this paradigm convey the idea that interference might not be present during face naming.

Second, although some models (e.g. Burton et al., 1990, 1999) assume that related personal information interferes and competes for retrieval, the type of inhibitory mechanisms proposed by these models to deal with competition differs from that proposed for other type of information. Whereas face recognition models suggest that inhibitory links are built within the system to resolve competition, retrieval inhibition in episodic and semantic memory is assumed to be the result of a controlled mechanism external to the system (see, Anderson, 2005; Anderson, Bjork, & Bjork, 1994; Anderson & Spellman, 1995). Note that the term "controlled mechanism" does not necessarily involve intentionality. Instead, the term implies that executive control processes underlie the effects found in this paradigm and in fact, many recent studies speak in favor of this assumption (e.g., Román, Soriano, Gómez-Ariza, & Bajo, 2010; Ortega, Gómez-Ariza, Román, & Bajo, 2012).

Face recognition models propose that different pools of units are connected by excitatory links, whereas links within units of a same pool are inhibitory[1] in nature. Links between pools are bi-directional and have, initially, equal strength. Activation passes along these links from one unit to the other and the activation of these units changes over time and tends to stabilize. The total input that leads to the activation of a particular unit is the sum of the input it receives from other related units, plus any external input provided (Burton et al., 1990). This self-regulation mechanism posits that if many units in the same pool receive simultaneous activation, the unit that is activated the most will inhibit the others, forcing them to stabilize, that is, to go back to their initial level of strength (Burton et al., 1999). To make it clearer, imagine that two people sharing very similar facial features (as Kofi Annan and Morgan Freeman), become active and give rise to competition. This should be quickly solved given that one FRU will rapidly inhibit the other. The same would happen at all levels of representation, for instance, the activation of Kofi Annan and Ban Ki-moon (given their shared semantic features) would also imply that the person activated the most would automatically suppress its competitors. Hence, competition would be solved by means of automatic inhibitory links. Evidence for this inhibitory mechanism comes from semantic priming studies (Burton et al., 1990) showing that semantic priming disappears when subjects are asked to recognize a new face and that it does not last for more than 5 s (Burton et al., 1990, 1999).

However, outside the face recognition field, many studies have shown that competition during retrieval is solved by means of controlled inhibitory mechanisms that have long lasting consequences (e.g., Anderson & Spellman, 1995; Anderson et al., 1994). For example, Anderson (2005) has suggested that for a given retrieval cue, many memory representations may come to mind and compete for selection. In order to select the desired item, controlled inhibition is triggered to reduce the level of activation of the competing non-target memories (Anderson et al., 1994). Inhibition is thought to reduce the activation level for a given representation, preventing it from achieving threshold and reducing the level of competition.

Controlled inhibition in memory selection has been studied by means of the retrieval practice paradigm (Anderson et al., 1994). In the first phase of this paradigm participants study pairs of semantically associated words (e.g., FRUIT-Orange; FRUIT-Banana; ANIMAL–Elephant). Next, in the retrieval practice phase, participants practice half of the exemplars from half of the studied categories, given a retrieval cue (e.g. FRUIT-Or____). Finally, after a distractor task, participants are asked to retrieve all the exemplars from all studied categories. Therefore, after retrieval practice, we can distinguish three types of items: the practiced items of practiced categories, as Orange (Rp+); non-practiced items from practiced categories, for instance Banana (Rp-) and non-practiced items from non-practiced categories (Elephant; Nrp). These last provide a baseline against which the Rp + and Rp- can be compared.

What is usually found is that Rp + items are recalled above baseline (Nrp), which should reflect the effects of practice. More interestingly however, is that recall of the Rp- items is usually impaired in comparison to Nrp. This effect is known as Retrieval Induced Forgetting (RIF). The authors argue that the retrieval of some members of a given category (Rp+) impairs later recall of unpracticed items from the same category. During retrieval practice phase, Rp- items have to be inhibited in order to reduce their competing effects and facilitate the recall of the Rp + items.

Although non-inhibitory explanations have also been proposed (such as associative blocking; e.g., Raaijmakers & Jakab, 2012) or change of context (e.g. Jonker, Seli, & MacLeod, 2013), the amount of studies strongly supporting the inhibitory account of RIF is overwhelming (e.g. Anderson & Spellman, 1995; Anderson et al., 1994; Bajo, Gómez-Ariza, Fernandéz, & Marful, 2006; Hicks & Starns, 2004; Johansson, Aslan, Bäuml, Gäbel, & Mecklinger, 2007; Kuhl, Dudukovic, Kahn, & Wagner, 2007; Román et al., 2009; Staudigl, Hanslmayr, & Bäuml, 2010; Storm, Bjork, Bjork, & Nestojko, 2006; Veling & van Knippenberg, 2004; Wimber, Rutschmann, Greenlee, & Bäuml, 2009; see Storm & Levy, 2012 for a review). Moreover, the controlled nature of RIF is supported by behavioral studies that show that the effect disappears in populations with deficits of executive control (e.g. Soriano, Jiménez, Román, & Bajo, 2009), as well as by several electrophysiological (e.g. Ferreira, Marful, Staudigl, Bajo, & Hanslmayr, 2014;

[1] Although the seminal model of face processing developed by Bruce and Young (1986) did not consider inhibitory mechanisms to solve interference, most of the more recent face processing models do assume inhibitory links within same units (e.g., Brédart et al., 1995; Burton et al., 1990, 1999).