Mem Cogn (2014) 42:525–537
DOI 10.3758/s13421-013-0376-8

Is naming faces different from naming objects? Semantic interference in a face- and object-naming task

Alejandra Marful · Daniela Paolieri · M. Teresa Bajo

Published online: 16 October 2013
© Psychonomic Society, Inc. 2013

Abstract A current debate regarding face and object naming concerns whether they are equally vulnerable to semantic interference. Although some studies have shown similar patterns of interference, others have revealed different effects for faces and objects. In Experiment 1, we compared face naming to object naming when exemplars were presented in a semantically homogeneous context (grouped by their category) or in a semantically heterogeneous context (mixed) across four cycles. The data revealed significant slowing for both face and object naming in the homogeneous context. This semantic interference was explained as being due to lexical competition from the conceptual activation of category members. When focusing on the first cycle, a facilitation effect for objects but not for faces appeared. This result permits us to explain the previously observed discrepancies between face and object naming. Experiment 2 was identical to Experiment 1, with the exception that half of the stimuli were presented as face/object names for reading. Semantic interference was present for both face and object naming, suggesting that faces and objects behave similarly during naming. Interestingly, during reading, semantic interference was observed for face names but not for object names. This pattern is consistent with previous assumptions proposing the activation of a person identity during face name reading.

Keywords Semantic memory · Face processing · Interference/inhibition · Memory retrieval · Language production

A. Marful (✉)
Department of Psychology, University of Jaén, Campus Las Lagunillas, C-5, 23071 Jaén, Spain
e-mail: mmarful@ujaen.es

D. Paolieri · M. T. Bajo
Research Center for Mind, Brain and Behavior, University of Granada, Granada, Spain

Introduction

We have all suffered from the embarrassing experience of not being able to retrieve the name of a well-known person. Actually, empirical data show that face naming is a difficult process: For example, relative to object naming, face naming is slower and more error prone (Johnston & Bruce, 1990; Young, Ellis, & Flude, 1988; Young, Hay, & Ellis, 1985; Young, McWeeny, Ellis, & Hay, 1986).

Different theoretical models have been proposed to explain these naming difficulties. Thus, most models of face processing (Burton, Bruce, & Johnston, 1990; Valentine, Brennen, & Brédart, 1996) assume connectionist architectures with bidirectional excitatory links between different unit pools. In this way, seeing the face of a known person activates its stored representation at the face recognition unit (FRU), which spreads to the person identity node (PIN), where the face is identified as being familiar. These PINs are considered to be token markers that provide parallel access to both semantic information and name representations, which can be stored together (Burton et al., 1990) at the semantic information unit (SIU) or in separate pools (Valentine et al., 1996). In addition, due to the bidirectional excitatory links, the activation of semantic features can activate related identities at the PIN unit (e.g., seeing the face of *John Wayne* may activate *Clint Eastwood*'s identity).

Representations at the PIN level are specific to face naming, since they are not needed in object naming, in which semantic activation spreads directly to the lexical level (Brédart, Brennen, & Valentine, 1997; Valentine, Hollis, & Moore, 1998). In addition, whereas lexical entries during face naming are only activated by unique links from the PINs pool—that is, there is only one *John Wayne*—the lexical representations during object naming can receive activation from several concepts—that is, there are many types of *chairs* (Levelt, Roelofs, & Meyer, 1999). For this reason, proper names receive less activation than do common names, making face naming more difficult than object naming.

In sum, for both faces and objects the activation of semantic features spreads to lexical entries during speech, via the PIN in face naming, or directly in object naming. This semantic activation is assumed to be the cause of interference in object naming. For instance, many object naming experiments have demonstrated that naming a target can be impaired by the presentation of a semantically related distractor (Glaser & Düngelhoff, 1984; Lupker, 1979; Rosinski, Golinkoff, & Kukish, 1975). This semantic interference is thought to reflect competition at the level of lexical node selection (Roelofs, 1992; Schriefers, Meyer, & Levelt, 1990; see Mahon, Costa, Peterson, Vargas, & Caramazza, 2007, for noncompetitive lexical selection mechanisms). For example, Levelt et al. (1999) suggested that seeing an object (e.g., a chair) activates its corresponding concept, which in turn activates its lexical entry (the lemma *chair*). This activation spreads to semantically related concepts and their lemmas so that they compete for selection and elicit semantic interference. This effect illustrates the sequence of processes involved in object lexical access but also has been used as a tool to explore the organization of semantic memory for objects. In this way, semantic interference (or the opposite effect—i.e., semantic facilitation) in object naming is taken as evidence supporting the categorical organization of semantic memory. Similarly, some face-processing models also predict categorical effects for people representations (Brédart et al., 1997; Burton et al., 1990). These models suggest that if two known people share semantic information (e.g., both are actors), they will share semantic nodes at the SIU level of representation. Activation of a SIU unit would spread to the connected identities at the PIN level via the bidirectional excitatory links. Thus, categorical effects should appear because of the shared links at the SIU level. However, whereas there is consensus on the categorical organization of object representations (Barry, Johnston, & Scanlan, 1998; Lupker, 1988) and their vulnerability to semantic interference (Glaser & Düngelhoff, 1984; Lupker, 1979; Rosinski et al., 1975), empirical data in the face-processing field have yielded a number of inconsistent results.

First, several face-processing studies have found data that are similar to those observed with objects (Brédart & Valentine, 1992; Darling & Valentine, 2005). For example, Darling and Valentine conducted a proper name memory task using a version of the “release from proactive interference” task (Loess, 1968). Proactive interference refers to the impairment in the retrieval of information by the previous recall of similar information. Interference is “released” if the type of the retrieved material changes (e.g., retrieve fruits and then tools). Darling and Valentine presented names of famous people for a later memory test and showed proactive interference when recovered names belonged to the same semantic category (e.g., actors) and release from interference when the category changed (e.g., musicians). Thus, these data supported the relevance of categorical organization of proper name representations.

Second, other studies have shown that face naming is also vulnerable to interference, but this interference only arises when target and distractor are associatively related but not categorically related (Izaute & Bonin, 2006; Young et al., 1986). For example, Young et al. employed a version of the picture–word interference paradigm (Glaser & Düngelhoff, 1984), presenting famous faces as targets for naming and printed names as distractors. Their results showed semantic interference when famous faces and distractor names were both associatively and categorically related (e.g., the tennis players *John McEnroe* and *Jimmy Connors*). However, interference was not present when the pairs were only categorically related and visual similarity was minimized (e.g., the singers *Pavarotti* and *Kylie Minogue*), suggesting that faces, unlike objects, are represented associatively more than categorically. On the contrary, Carson and Burton (2001) argued in favor of categorical organization for personal representations by noticing in the literature a number of small but not-reliable effects with categorically related famous faces (Barry et al., 1998; Young, Flude, Hellawell, & Ellis, 1994). In their own study, they reinforced the categorical relations between exemplars by multiple prime presentations and succeeded in finding the categorical effect. They claimed that categorical relations are weaker than associative relations, since close associates share more semantic information (SIU) than do merely categorically related pairs, but that both types can explain how personal information is organized.

However, other studies have failed to replicate with faces the interference effect that is usually found in object-naming studies. Thus, in a first study, Vitkovitch, Rutter, and Read (2001) presented objects for naming in a semantic competition paradigm. In this naming task, they presented semantically related (related condition) or semantically unrelated (unrelated condition) primes, three trials before a target. For example, in the related condition, the sequence of pictures for naming could be *airplane*, *giraffe*, *shoe*, *helicopter*, whereas in the unrelated condition, the sequence could be *violin*, *giraffe*, *shoe*, *helicopter*. They found evidence for semantic competition—that is, an increase in error rates and latencies in naming the target in the related condition as compared to the unrelated condition. However, when Vitkovitch, Potton, Bakogianni, and Kinch (2006) used this very same paradigm, but employing faces for naming (e.g., in the related condition, *Julia Roberts*, *Pavarotti*, *Elton John*, *Nicole Kidman*; in the unrelated condition, *Victoria Wood*, *Pavarotti*, *Elton John*, *Nicole Kidman*), the results did not show evidence of semantic competition, but the opposite effect (facilitation). Nevertheless, Marful, Ortega, and Bajo (2010) employed this same paradigm but introduced three naming cycles in which members of the same face category were presented in the related condition in each cycle. For example, in the related condition a pair of singers was presented in the first cycle for naming—*Ricky Martin*, [filler], [filler], *Enrique Iglesias*; another pair of singers appeared in the second cycle—*David Bisbal*, [filler], [filler], *Miguel Bosé*; and another pair of singers was presented in the third cycle—*Joaquín Sabina*, [filler], [filler], *Alejandro Sanz*. Similarly, unrelated pairs across the cycles were composed of targets from the same categories but preceded by unrelated primes. The results showed that facilitation was present in the first cycle and decreased as the number of cycles increased, suggesting that the main differences between face and object naming are observed during the first cycles of presentation; when more presentation cycles are included, these differences tend to disappear. Unfortunately, in this last study participants only performed a face-naming task, and therefore it was not possible to compare face and object naming across cycles.

Given these discrepancies, the aim of this study was to explore semantic interference in face naming across cycles and compare it to that observed with object naming by employing a cyclic semantic-blocking paradigm (Belke, Meyer, & Damian, 2005; Damian, Vigliocco, & Levelt, 2001). This paradigm consisted of the presentation of pictures of objects for naming in a homogeneous context (grouped by category: *armchair*, *table*, *lamp*, etc.) or in a heterogeneous context (alternating exemplars from different categories: *armchair*, *mouse*, *train*, etc.). These stimuli were repeated for naming multiple times. Each presentation of the same set of items is traditionally called a *cycle*. The results typically show that, except for the first cycle of presentation, naming latencies are slower in the homogeneous condition than in the heterogeneous condition. This pattern is usually explained by lexical competition due to the semantic activation of the category members in the homogeneous context (Damian et al., 2001). Thus, naming a category exemplar—for example, *flute*—would strengthen the link between its lexical and semantic representations and, at the same time, *flute* would act as a strong competitor when other related exemplars were presented for naming (see, e.g., Damian & Als, 2005). Regarding the first cycle of presentation, most previous studies have shown no differences between conditions (Belke, Brysbaert, Meyer, & Ghyselinck, 2005; Belke et al. 2005; Damian et al. 2001), or even facilitation (Abdel Rahman & Melinger, 2007; Navarrete, Del Prato, & Mahon, 2012; Oppenheim, Dell, & Schwartz, 2010). The absence of interference during the first cycle has been traditionally explained by assuming that this is the moment when context is established (Belke et al. 2005; Belke et al. 2005; Damian et al. 2001). Similarly, several explanations have been offered for first-cycle facilitation. For example, Abdel Rahman and Melinger (2007) suggested that first cycle facilitation may be produced by easier object identification during the first cycle in the homogeneous condition. Thus, participants who started with a homogeneous block more easily identified the items in the later heterogeneous blocks, whereas, participants starting with a heterogeneous block had more problems identifying objects relative to the later homogeneous block (facilitation). Similarly, Oppenheim et al. (2010) explained first-cycle facilitation effects by proposing that conscious strategic processes (i.e., participants' expectations) more than lexical retrieval takes place during the initial cycle. During this first cycle, participants use the context to set up expectations and this would be more easily done for the homogeneous than the heterogeneous condition. Participants' expectations, then, could facilitate responding during the first cycle of the homogeneous list, resulting in faster responses relative to the heterogeneous condition. Indirect support for this idea comes from a study by Belke (2008) observing that the introduction of a working memory load disrupted this first cycle facilitation but maintained interference.

From a different view, Damian and Als (2005) proposed that facilitation effects during the first cycle might be due to short-lasting semantic priming. That is, each item in the first homogeneous condition would prime the semantically related adjacent item. The absence of interference, and even facilitation, relative to the heterogeneous condition would occur when this short-lasting priming counteracts the interference effect observed in the cyclic paradigm. In support of this process, the authors observed that when unrelated items were alternated with the targets, an interference effect also emerged in the first cycle, indicating that the mechanisms involved in the first cycle effect are short-lived.

The semantic-blocking procedure offers many advantages over the previously described interference paradigms: The same items are named in both high- and low-competition conditions, error rates are low, and the effects are robust and well known (Schnur et al., 2009). Moreover, it allows us to study the dynamics of interference across different cycles of presentation. This is especially relevant because we are suggesting that previously described differences in face- and object-naming interference could be located at the first cycles of presentation, when the context is not yet established and specific processes are still at play. These differences would decrease or disappear during the following cycles, and eventually would change to interference. Hence, we will compare the pattern of facilitation/interference across cycles. We predicted that objects and faces would behave differently during the first cycle, when the context has not been established (and performance could depend on strategic processes, ease of identification or short lag priming), but that they would behave similarly in later cycles, when the context has been set up.

To test these predictions, in Experiment 1 four cycles of face and object naming were presented in either a homogeneous or a heterogeneous context. If face and object naming are equally susceptible to semantic interference, we should find slower naming times in the homogeneous condition than in the heterogeneous condition for both faces and objects. Moreover, we would expect that this interference effect would be modulated by the presentation cycle, with competition appearing after the first cycle.

Experiment 1

Method

Participants A group of 24 students at the Universities of Granada and Jaén (mean age = 24.5, *SD* = 7.2) participated for course credits.

Materials and design A set of 25 line drawings of common objects belonging to five semantic categories were selected from the database of Lotto, Dell'Acqua, and Job (2001). The object names had a mean frequency of 16.7 occurrences per million (Alameda & Cuetos, 1995).

In addition, 25 photographs of famous people from five semantic categories were selected from the database of Marful et al. (2010) and from other internet resources. Both face and object exemplars, were selected to minimize within-category visual similarity, associative relations between exemplars and overlap of the initial phonemes.

The stimuli (see Appendix) were arranged in two matrixes (one for faces and other for objects) of 5 × 5 items. Columns corresponded to categories and formed homogeneous sets, whereas rows formed the heterogeneous sets (Damian et al., 2001). Thus, five blocks with the five items from the same semantic category and five blocks with the same number of items from different semantic categories were created. Each block contained four repetitions of each item (four presentation cycles), for a total of 20 trials per block. Each item occurred once on each position within a cycle. The last and first items of successive cycles were never the same to avoid repetition (Belke et al. 2005).

Five different homogeneous lists and five different heterogeneous lists were created from the combination of the ten blocks as in a Latin square design. The presentation of the homogeneous and heterogeneous lists were blocked and counterbalanced across participants. The order of presentation of each one of these lists in the homogeneous or the heterogeneous context was counterbalanced across participants. There was a pause after each list. Each participant performed both the face-naming and the object-naming task, in a counterbalanced order.

In summary, three variables were manipulated within subjects: stimuli (object, faces), context (homogeneous, heterogeneous), and cycle (first, second, third, fourth).

Procedure Before each naming task (objects or faces), participants were familiarised with the materials: The stimuli were presented with their corresponding name printed below and participants were asked to read the name.

A naming trial consisted of a fixation cross centered on the screen (500 ms); the stimulus until the response, or for a maximum of 3,000 ms; and a blank interval (500 ms). Participants were instructed to name each item as quickly and accurately as possible. The experimenter recorded errors and equipment failures.

Results

Four types of responses were excluded from the analysis: naming errors, verbal dysfluencies, voice key failures (6 % and 24 % of the data points for objects and faces, respectively), and responses exceeding two standard deviations above the mean.

Response times We analyzed the data by performing a linear mixed-model analysis with Context (heterogeneous, homogeneous) and Cycle of Presentation (first, second, third, fourth) as fixed factors,[1] Participants and Items as random factors (see Baayen, Davidson, & Bates, 2008; Brysbaert, 2007), and response times (RTs) as the dependent variable, using the lmer function from the R package lme4, version 0.999999-2 (Bates, Maechler, & Bolker, 2011). Different intercepts for each participant and item (i.e., we could expect different baseline levels for both participants and items) were allowed. The *p* values were obtained by employing the Markov chain Monte Carlo (MCMC) sampling method (with a sample size of 10,000; Baayen et al., 2008). See Table 1 for a description of the linear mixed-model results. The mean RTs for correct responses are depicted in Fig. 1.

Analyses on the face-naming data showed a general decrease in RTs across cycles and, more importantly, that RTs in the homogeneous condition were slower than RTs in the heterogeneous condition, showing semantic interference. The effect of context did not interact with the effect of cycle [when we compared a model with only the fixed effects and a model with the fixed effects plus the interaction, we found no differences between the models; in consequence the more parsimonious model, without the interaction, was preferred, $\chi^2(1) = 1.3796$, $p = .24$].[2]

[1] If the factor Type of Stimuli (faces, objects) was added, the resultant model failed to reach convergence, so this variable was discarded, and we carried out separate analyses for objects and faces.

[2] In a recent article, Barr, Levy, Scheepers, and Tily (2013) suggested the convenience of taking into account, besides the random intercepts, the random slopes that are justified by the design. When we included different slopes for context and participants and for context and items (i.e., the context slope was allowed to differ between participants and items), we observed the same pattern of results: interference for faces [β=38.70, SE = 11.87, t = –3.26, p = .001] and objects [β = 17.576, SE = 8.166, t = 2.15, p = .03] when the first cycle was removed, and an absence of interference for faces [β = 12.49, SE = 27.29, t = 0.46, p = .64] and facilitation for objects [β = –32.65, SE = 12.05, t = –2.71, p = .006] during the first cycle (p values were estimated from the standard normal distribution instead of via the MCMC sampling method, as in Barr et al., 2013).

Table 1 Linear mixed-model analyses on response times in Experiment 1, with fixed effects of context and cycle, both for all cycles (1– 4) and without the first cycle (2– 4), presented separately for face naming and object naming

	Face Naming				Object Naming			
Fixed Effects	*β*	Std. Error	*t*	*p*	*β*	Std. Error	*t*	*p*
Cycles 1–4								
Cycle	−51.255	2.638	−19.43	.0001	−22.035	1.746	−12.62	.0001
Context	30.980	5.830	5.31	.0001	−38.544	6.810	−5.66	.0001
Cycle × Context	–	–	–	–	17.348	2.473	7.02	.0001
Cycles 2–4								
Cycle	−21.418	3.781	−5.66	.0001	−8.371	1.860	−4.50	.0001
Context	36.519	6.173	5.92	.0001	17.116	3.041	5.63	.0001
Cycle × Context	–	–	–	–	–	–	–	–

To interpret the sign of the estimates, take into account that lme4 orders the variables following an alphabetic order; thus, the positive sign of the slope indicates that response times (RTs) to the heterogeneous condition were faster than RTs to the homogeneous condition

Since most studies with this procedure usually exclude the data from the first cycle (e.g., Belke et al. 2005; Damian & Als, 2005), we carried out these analyses on data from the second to fourth cycles. The results again showed a decrease in RTs across cycles and, more importantly, an interference effect. The effect of context did not interact with the effect of cycle [$\chi^2(1) = 0.1298$, $p = .7$].

Analyses performed on the object-naming data also showed a decreased in RTs across cycles. Although we did not find a context effect, the statistically significant Context × Cycle interaction [$\chi^2(1) = 48.982$, $p < .0001$] showed that the effect of context was modulated by the presentation cycle. Thus, during the first cycle a facilitation effect appeared [$\beta = -32.294$, $SE = 6.012$, $t = -5.37$, $p < .0001$]. When this first cycle was removed, we again observed a decrease in RTs across cycles, and more importantly, an interference effect emerged. The effect of context did not interact with the effect of cycle [$\chi^2(1) = 3.0508$, $p = .08$].

The percentages of naming errors (i.e., producing an incorrect name) are summarized in Table 2. Since the frequency of these naming errors was very low, we did not analyze these data.

Discussion

The results from Experiment 1 showed semantic interference for both faces and objects. However, faces and objects presented a different pattern during the first presentation cycle. Thus, during the first cycle, naming latencies to faces did not differ for the homogeneous and heterogeneous condition, whereas, similar to other studies, object-naming latencies in the homogeneous condition were facilitated (Abdel Rahman & Melinger, 2007; Oppenheim et al., 2010). Additionally, when the first cycle was not considered, objects and faces did not differ. These results suggest that differences in face and object naming mainly occur at the first cycle; later, both faces and objects seem to show similar patterns of interference. These results are important because they could permit us to reconcile the previous data.

The absence of interference (Belke et al. 2005; Schnur, Schwartz, Brecher, & Hodgson, 2006) and/or a facilitation effect (Abdel Rahman & Melinger, 2007) during the first cycle can be easily explained by both the conscious strategic (Oppenheim et al., 2010) and the easier object identification hypotheses (Abdel Rahman & Melinger, 2007) that assume

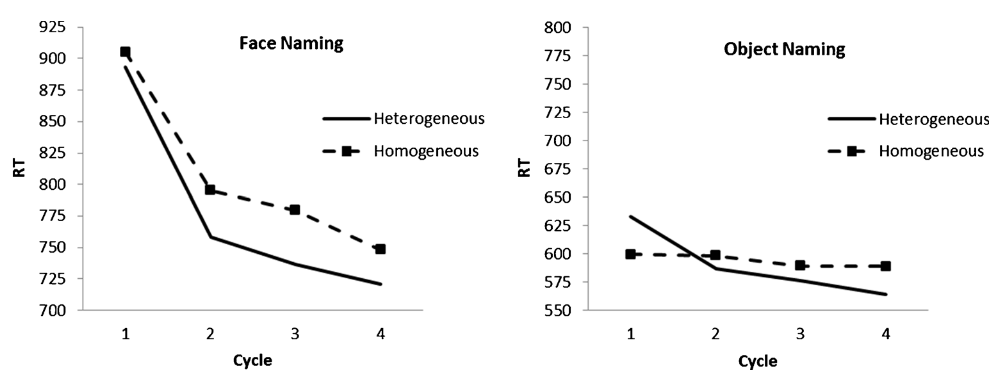

Fig. 1 Mean response times (RTs) by context (homogeneous, heterogeneous) and presentation cycle for face naming and object naming in Experiment 1

Table 2 Percentages of naming errors in Experiments 1 and 2 as a function of context (heterogeneous [HE] or homogeneous [HO]) and cycle (1–4), presented separately for face naming and object naming

		Face Naming				Object Naming			
	Cycle	1	2	3	4	1	2	3	4
Experiment 1									
Context	HE	1.5	0.7	1.0	0.5	0.2	0.5	0.2	0.3
	HO	1.3	0.7	1.7	1.5	0.7	0.7	0.8	0.2
Experiment 2									
Context	HE	1.6	0.8	0.6	0.8	1.6	0.2	0.5	0.2
	HO	1.4	0.6	1.1	1.1	0.5	0.6	0.8	0.5

that participants starting with the heterogeneous lists will have more difficulties during this block than during the later homogeneous block. These faster responses during the later homogeneous block would elicit a facilitation effect. Results from the present experiment support this assumption. For objects, facilitation appeared only when participants started with the heterogeneous block [$\beta = -72.058$, $SE = 8.357$, $t = -8.62$, $p < .0001$], this facilitation was not present in the group that started with the homogeneous blocks [$\beta = 6.459$, $SE = 8.241$, $t = 0.78$, $p = .44$].

Similarly, for faces, participants that started with the heterogeneous blocks showed facilitation [$\beta = -96.61$, $SE = 20.81$, $t = -4.64$, $p < .0001$], whereas participants starting with the homogeneous block showed interference [$\beta = 114.98$, $SE = 17.02$, $t = 6.754$, $p < .0001$]. The reason why interference still appeared for faces during the first cycle in the homogeneous block condition may be that face naming is a more difficult process, so that participants who started with the homogeneous block may have had at least the same difficulties identifying the items that participants did who had started with the heterogeneous block. Nevertheless, the main point is that the first cycle can be subject to specific processes (e.g., easier object identification, conscious strategic processes, etc.) that may differ for objects and faces, but that similar linguistic processes occur for both faces and objects once the first cycle is past and the context has been established.

One intriguing question is if these specific first-cycle processes could explain the differences observed in other experimental paradigms. For example, as we described before, Vitkovitch and colleagues presented semantically related or unrelated primes three trials before the target appeared during a naming task. They observed facilitation in the related condition when the stimuli were faces (Vitkovitch et al., 2006) and interference in the related condition when the stimuli were objects (Vitkovitch et al., 2001). The authors explained these differences by adding a modification to previous models of face processing. Unfortunately, neither the conscious strategic nor the easier object identification hypotheses could be tested in this study, since the related and the unrelated trials were intermixed rather than presented in a blocked fashion. However, as mentioned in the introduction, the main point is that when more face-naming cycles were added (see Marful et al., 2010), the facilitation effect decreased, indicating that the results from the first cycle need to be taken with caution.

From a different perspective, the presence of semantic context effects for both faces and objects also provides support for the claim that faces, like objects, are categorically organized (Carson & Burton, 2001), and contrasts with the suggestions that the organization of semantic information for faces is mainly associative (Barry et al., 1998). Semantic interference in face naming can be explained by current models of face naming. Although these models contemplate different architectures for face naming (Bruce & Young, 1986; Burton et al., 1990; Valentine et al., 1996), they all would predict that semantic activation would be stronger in the homogeneous than in the heterogeneous condition. This semantic activation will spread to semantically related PINs, that in turn, would activate related names eliciting the observed facilitation during the first cycle and later will lead to competition between related names. Thus, these models easily accommodate the results obtained with faces and the fact that this pattern was similar to the one observed with objects in the blocking paradigm.[3] However, these models could predict different results with faces and objects if some variations were made in this paradigm. This issue will be analyzed in Experiment 2.

[3] Some have argued that findings supporting categorical organization for faces may be due to visual similarity (see, e.g., Young et al., 1986). To rule out this possibility, 26 participants rated the degrees of semantic relatedness and visual similarity of each face pair used in Experiment 1 on two 5-point scales (1 = *semantically unrelated* or *visually dissimilar*, 5 = *semantically related* or *visually similar*). We observed that faces in the homogeneous and heterogeneous lists differed only in semantic relatedness [4.22 vs.1.54; $F(1, 25) = 281.68$, $p < .0001$], but not in visual similarity [1.43 vs. 1.48; $F(1, 25) = 1.06$, $p = .32$]. Thus, semantic interference in the homogeneous list can only be explained by semantic relatedness, and not by the visual similarity of the presented exemplars.

We also collected visual and semantic similarity ratings for the objects. We observed that the heterogeneous and homogeneous lists differed in semantic relatedness [means = 1,15 vs. 4,65, respectively; $F(1, 25) = 2{,}716{,}572$, $p < .0001$] and in visual similarity [1.41 vs. 1.63; $F(1, 25) = 11.30$, $p = .002$]. However, when we excluded from the analysis the three most visually similar pairs (artichoke–onion, trumpet–flute, and aubergine–onion), no differences in visual similarity emerged between the heterogeneous and homogeneous sets [1.41 vs. 1.51; $F(1, 25) = 2.29$, $p = .14$]. More importantly, when we excluded these items from the analysis, the significant Context × Cycle interaction [$\beta = 12.414$, $SE = 2.736$, $t = 4.54$, $p = .0001$] revealed semantic facilitation during the first cycle [$\beta = -23.093$, $SE = 6.684$, $t = -3.45$, $p = .0008$] that changed to interference when this first cycle was excluded [$\beta = 7.920$, $SE = 3.367$, $t = 2.35$, $p = .02$]. These data are consistent with previous studies that have demonstrated that context effects do not depend on visual similarity (e.g., Damian et al., 2001).

Experiment 2

The face-naming interference observed in Experiment 1 resembled the seminal data reported by Kroll and Stewart (1994). They explained their semantic interference effect as due to lexical competition because of the conceptual activation of the category members. Accordingly, interference should only appear when lexical selection of a candidate is required. Since word reading can be achieved via a fast route that bypasses the lexical/semantic level (Glaser & Düngelhoff, 1984; Roelofs, 2006) intermixing words for reading should diminish conceptual activation and consequently semantic interference should also be reduced. They tested this hypothesis in an experiment in which they presented a list of alternated words and pictures in a heterogeneous context and another list of word and pictures in a homogeneous context. In these conditions, no effect of the homogeneous context emerged. Although this null effect should be considered with caution in light of more recent contrasting results (Damian & Als, 2005, see below for a discussion), the authors suggested that conceptual activation during this task was not enough to elicit interference.

In contrast, face-processing models predict semantic interference even in conditions in which names and faces are interleaved. Several studies on face priming have consistently shown that reading aloud a famous name (from now on, face name reading) can activate its PIN and consequently, reinforce the link between PIN and name representations. Thus, because PINs are activated by personal information independently of whether this information is presented as a face or as a name, face naming would be facilitated by reading its corresponding name or a semantically related name (Burton, Kelly, & Bruce, 1998; Ellis, Flude, Young, & Burton, 1996; Valentine & Moore, 1995; Vitkovitch et al., 2006; Young et al., 1994). Therefore, in a task that intermixes face naming and face name reading, both faces and names would activate their corresponding PIN, and some evidence of semantic interference in a homogeneous relative to a heterogeneous condition would be expected. In consequence, from this perspective, we could anticipate semantic interference effects for both face naming and face name reading.

A secondary aim of Experiment 2 was to try to clarify previous contrasting results. As we mentioned, Kroll and Stewart (1994) showed that alternating words for reading (from now on, object name reading) and pictures for naming in the semantic-blocking procedure made semantic interference disappear. However, in a more recent study that employed the cyclic semantic-blocking paradigm, Damian and Als (2005) observed that semantic interference was unaffected when introducing interspersed filler items. These authors concluded that the context effect typically observed in the cyclic semantic-blocking paradigm is long lasting and can be maintained across unrelated trials.

These contrasting results (an absence of interference for Kroll & Stewart, 1994, and interference for Damian & Als, 2005) could be motivated by two critical differences between these studies. First, Damian and Als inserted unrelated items between the target-naming trials, whereas in the picture-naming task developed for Kroll and Stewart's study, the words selected for reading were semantically related to the pictures for naming. Second, whereas Damian and Als employed the cyclic semantic-blocking procedure and, in consequence, presented each stimulus several times, Kroll and Stewart showed each item only once. However, as was described before, data from the first cycle may differ greatly from the results obtained during later cycles.

In Experiment 2, we tried to clarify this discrepancy by replicating the naming/reading task developed by Kroll and Stewart (1994; i.e., by presenting part of the stimuli as written names), but employing the cyclic semantic-blocking procedure. Thus, whereas Experiment 1 tested competition during naming, in Experiment 2 we studied the effect of reducing lexical competition by interleaving reading trials. This manipulation is relevant in light of the previous contrasting results during face name reading and object name reading (Burton et al., 1998; Ellis et al., 1996; Valentine & Moore, 1995; Vitkovitch et al., 2006; Young et al., 1994).

Thus, in Experiment 2 we replicated the procedure of Experiment 1, with only the exception that half of the items in each block were replaced by their written names for reading. These written names were alternated in the face-/object-naming tasks (e.g., a block could contain a photograph for naming the football player David Beckham, followed by the written name of the politician Barack Obama). Regarding object naming and object name reading, two opposite predictions could be anticipated: (a) If intermixing reading and naming trials of category exemplars minimizes lexical competition (as was suggested by Kroll & Stewart, 1994), we would not expect to find a context effect in Experiment 2; (b) if the context effect in the semantic-blocking paradigm is long-lasting and unaffected by the presence of related reading trials, we would expect to find a context effect in Experiment 2. Regarding the face-naming and face name reading conditions, because for both the corresponding PIN would be activated, we would anticipate semantic interference regardless of whether participants were asked to name faces or to read names.

Method

Participants A group of 48 students at the Universities of Granada and Jaén (mean age = 23.84 years, *SD* = 5.16) participated for course credits.

Stimuli, procedure and design The same set of stimuli was used as in the previous experiment, with the exception that each list contained alternating trials of words and pictures (as in Kroll & Stewart, 1994). The order of alternation was counterbalanced across lists; half of the items were randomly selected to appear as words, whereas the other half appeared as pictures. Participants were instructed to name aloud whatever stimulus appeared.

Four variables were manipulated within subjects: task (naming, reading), stimuli (people, objects), cycle (first, second, third, fourth), and context (homogeneous, heterogeneous).

Results

The same exclusion criteria were applied as in Experiment 1. Naming errors, verbal dysfluencies, and voice key failures accounted for 6 % and 12 % of the data points for objects and faces, respectively.

The mean RTs for correct responses are reported in Fig. 2, and the data analyses are summarized in Table 3.

Naming A decrease in RTs across cycles was observed for faces. The effect of context was modulated by the Cycle × Context interaction [$\chi^2(1) = 225.45$, $p < .0001$]. Thus, a facilitation effect emerged during the first cycle [$\beta = -38.12$, $SE = 12.92$, $t = -2.95$, $p = .004$].

When this first cycle was removed, a significant Context × Cycle interaction [$\chi^2(1) = 7.0701$, $p = .008$] indicated that this facilitation effect disappeared during the second cycle [$\beta = -13.44$, $SE = 10.43$, $t = -1.29$, $p = .2$] and changed to interference during the third and four cycles [$\beta = 31.03$, $SE = 6.66$, $t = 4.65$, $p = .0002$]. A general decrease in RTs was again observed.

For objects, the results revealed a decrease in RTs across cycles and a significant Cycle × Context interaction [$\chi^2(1) = 13.248$, $p = .0002$]. This interaction indicated that, as with faces, a facilitation effect was present during the first cycle [$\beta = -13.800$, $SE = 6.231$, $t = -2.21$, $p = .02$] that, when the first cycle was removed, changed into interference.

Reading When the task was face name reading, the results again revealed a general decrease in RT across cycles. More interestingly, the effect of context showed slower responses in the homogeneous than in the heterogeneous condition. The Cycle × Context interaction did not reach significance [$\chi^2(1) = 0.0369$, $p = .84$]. The same pattern emerged when the first cycle of presentation was not considered in the analysis.

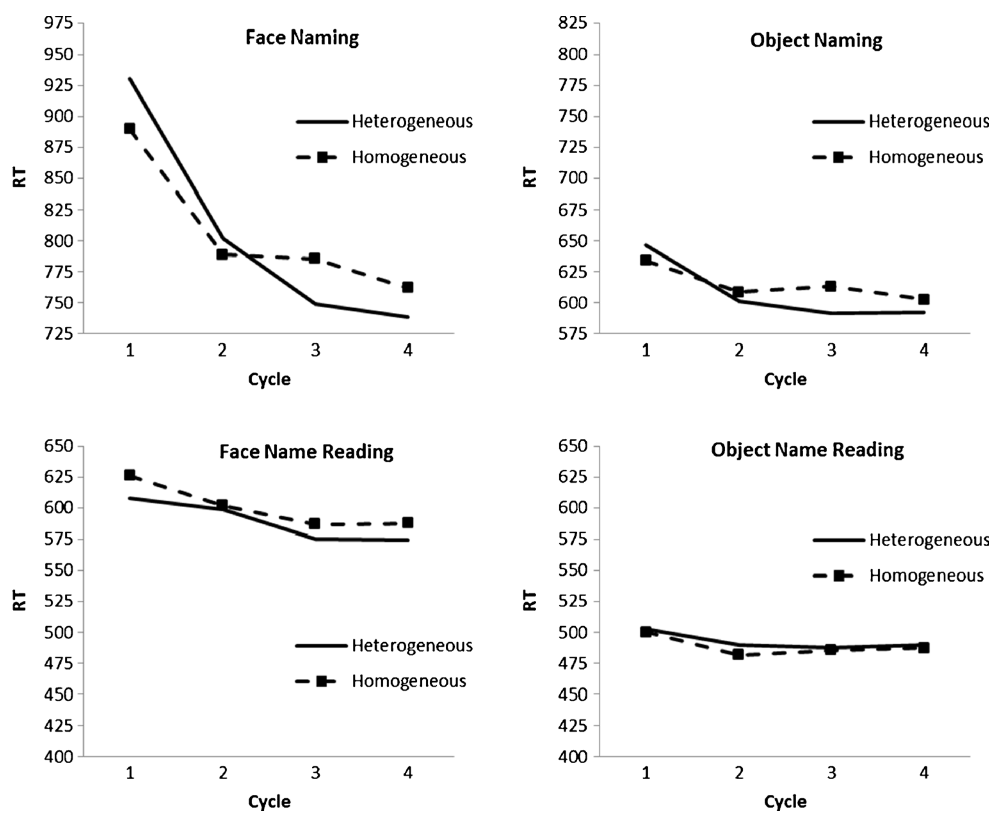

Fig. 2 Mean response times (RTs) by context (homogeneous, heterogeneous) and presentation cycle (1, 2, 3, 4) for face naming, object naming, face name reading, and object name reading in Experiment 2

Table 3 Linear mixed-model analyses in Experiment 2 with fixed effects of context and cycle, both for all cycles (1– 4) and without the first cycle (2– 4), presented separately for face naming, object naming, face name reading, and object name reading

Source	β	Std. Error	t	p	β	Std. Error	t	p
Naming	Faces				Objects			
Cycles 1–4								
Cycle	−62.320	3.422	−18.21	.0001	−18.004	1.801	−10.00	.0001
Context	−59.006	13.596	−4.34	.0001	−16.473	6.973	−2.36	.017
Cycle × Context	24.521	4.855	5.05	.0001	9.221	2.532	3.64	.0001
Cycles 2–4								
Cycle	−32.325	4.886	−6.62	.0001	−4.452	1.907	−2.33	.02
Context	−38.904	21.610	−1.80	.07	13.477	3.106	4.34	.0001
Cycle × Context	18.435	6.933	2.66	.007	–	–	–	–
Reading	Face Names				Object Names			
Cycles 1–4								
Cycle	−14.446	1.190	−12.14	.0001	−4.0473	0.8021	−5.05	.0001
Context	12.249	2.633	4.65	.0001	−2.7076	1.7823	−1.52	.13
Cycle × Context	–	–	–	–	–	–	–	
Cycles 2–4								
Cycle	−10.298	1.793	−5.74	.0001	1.012	1.178	0.86	.11
Context	9.934	2.933	3.39	.0006	−3.018	1.934	−1.56	.39
Cycle × Context	–	–	–	–	–	–	–	

To interpret the sign of the estimates, take into account that lme4 orders the variables following an alphabetic order, thus, the positive sign of the slope indicates that response times (RTs) to the heterogeneous condition were faster than RTs to the homogeneous condition

However, when we tested object name reading, neither the effect of context nor the interaction reached statistical significance [$\chi^2(1) = 0.1471, p = .70$]. As previously, a decrease in RTs across cycles was observed.

When the first cycle of presentation was excluded from the analysis, none of the effects nor the interaction reached significance [$\chi^2(1) = 0.97, p = .32$].

Regarding the errors in Experiment 2, we observed only five and six errors in the reading tasks, for face names and object names, respectively. The numbers of naming errors produced in Experiment 2 appear in Table 2.

Discussion

In Experiment 2, naming trials were interspersed with reading trials during a cyclic semantic-blocking task for both faces and objects. In naming, once the first cycles were excluded, a context effect emerged for both faces and objects. These results are consistent with those reported by Damian and Als (2005), and more recently by Navarrete et al. (2012), showing that semantic interference in the cyclic semantic-blocking paradigm was unaffected when interspersed filler items were introduced. Note, however, that this interference effect during Experiment 2 seems to have been weaker than the interference effect observed during Experiment 1.[4] The presence of this long-lag semantic interference contrasts with the results of Kroll and Stewart (1994), in which semantic interference for objects disappeared when words were alternated for reading. These different patterns of results can be explained by the fact that Kroll and Stewart presented each item only once (i.e., only one cycle), whereas other previously reported studies employed several cycles and, importantly, have usually excluded data from the first cycle.

During the first cycle of the naming task, we observed facilitation for both faces and objects. These results are in contrast with previous studies with the cyclic semantic-blocking paradigm in which the facilitation effect disappeared if filler items were interleaved (Damian & Als, 2005; Navarrete et al., 2012). However, they also found that the semantic interference effect observed in the later cycles

[4] When we compared naming latencies in Experiments 1 and 2 in each cycle separately, we observed that, whereas interference emerged during the second cycle in Experiment 1 for both faces ($p = .003$) and objects ($p = .03$), it was absent in Experiment 2 for faces ($p = .19$) and for objects ($p = .27$; note that although we observed a significant context effect for Cycles 2–4 with objects, when the second cycle was isolated, this context effect did not reach significance). During Cycles 3 and 4, semantic interference for faces and objects appeared in both Experiments 1 and 2 (all ps $< .05$).

remained unaffected. They have argued that two effects are involved in the cyclic semantic-blocking paradigm: a short-lag semantic priming effect and a long-lag interference effect. During the first naming cycle, these two opposite effects counteracted (eliciting facilitation or a null effect) but, later, when the number of trials increases, the short-lag semantic priming decays and the long-lag interference effect emerges. For this reason, when filler items are interspersed, first-cycle facilitation (that depends on short lag priming) disappears, but semantic interference remains unaffected.

The reason why we found first-cycle facilitation in Experiment 2 may lie in the nature of the fillers. Although in the previous studies, the inserted filler items were unrelated to the target items (Damian & Als, 2005; Navarrete et al., 2012), in our Experiment 2, the selected words for reading were semantically related to the to-be-named target items. This way, some residual short lag activation may still be present during reading and give rise to facilitation.

Regarding the reading task, we observed an interesting pattern; as we mentioned earlier, unlike objects, words can be named via a fast route that bypasses the lexical semantic/syntactic level (Glaser & Düngelhoff, 1984; Roelofs, 2006). Hence, when participants had to read object names, lexical and conceptual activation was minimized, and consequently, semantic context effects disappeared.[5] However, when personal stimuli were presented and participants had to read face names, semantic interference effects were observed. This last result is not surprising since most models regarding faces and personal information (Burton et al., 1990; Valentine et al., 1996) assume that PINs are amodal and are activated by the presentation of both faces and names. These PINs would spread activation to the semantic system (SIUs) and semantic effects would appear for both face naming and face name reading. Contrary to the facilitation effect observed during the face-naming trials, the opposite effect of interference appeared during the first cycle of the face name reading task. The reason for this effect is not clear, but it is possible that these slower RTs during the homogeneous condition were a consequence of the task-switching cost when alternated between naming and reading trials. Thus, the overactivation (i.e., the facilitation effect) observed during the naming trials in the homogeneous condition would elicit a noticeable cost when switched to a reading trial. This cost would be weaker during the reading trials in the heterogeneous condition, since the heterogeneous naming trials were not facilitated.

In summary, face and object naming showed similar patterns of results, suggesting that (a) competition during face naming does not significantly differ from object naming, and (b) objects and faces differ during reading, so that objects do not elicit semantic interference, whereas personal representations (faces and face names) do exhibit semantic context effects.

General discussion

Two experiments have demonstrated that, in general, categorical information is processed in similar ways for face and object stimuli during a cyclic semantic-blocking task. Experiment 1 showed semantic interference in object and face naming when categorically related exemplars were blocked (homogeneous condition) relative to a condition in which exemplars were alternated (heterogeneous condition). This semantic interference persisted even when naming trials were interspersed with word reading (Exp. 2).

However, although the general results were similar for faces and objects, we observed two remarkable differences between these two types of stimuli:

First, as was just described, during a reading task we observed semantic interference for faces but not for object stimuli (Exp. 2). This different pattern has been explained in the context of current models of face processing that propose that PINs are amodal token markers that can be accessed by many routes: faces, written or spoken proper names, and voices (Burton et al., 1990; Valentine et al., 1996). Thus, the presentation of a face for naming or its name for reading can activate its corresponding PIN. This PIN would spread activation to the semantic system (SIUs) that can bypass the activation to other related PINs via the bidirectional excitatory links. These related PINs, in turn, would activate related names. Thus, in the homogeneous condition, when related faces for naming and face names for reading are presented sequentially, both kind of stimuli would activate their correspondent PINs and the related ones. When another stimulus is presented for naming, the activation of its PIN would activate its name, but the previously activated related names would produce interference. The same processes would happen with face names: the name would activate its PIN (and its lexical

[5] In a recent study, Navarrete, Mahon, and Caramazza (2010) investigated how object naming can produce interference in word reading. To be more precise, they studied the cumulative semantic cost effect (i.e., the monotonic increase in naming latencies with each additional naming of exemplars from the same category) and found that this cumulative semantic cost is transferred from determiner + object naming to determiner + word naming. The authors explained these results by considering that determiner + word naming implicates semantically driven lexical access. The previous object-naming trials would weaken the semantic-to-lexical connections for the related objects, eliciting a semantic cost during the later determiner + word-naming trial. It is important to note a relevant difference between Navarrete and colleague's (2010) study and the present experiment: Navarrete et al. (2010) asked their participants to produce the determiner during the word-naming task, whereas in the present study participants only read the words. In fact, employing the cyclic semantic-blocking paradigm, Damian et al. (2001) found that determiner + word naming produced the context effect, whereas word naming alone did not.

representation) and the previously activated related names would make the access to the target more difficult.

Similarly, when objects were presented for naming, a similar result was obtained. In the homogeneous context, naming an object activates its lexical entry and its corresponding concept. This activation spreads to semantically related concepts and their lemmas, eliciting interference. In addition, as proposed by Damian and Als (2005), this interference effect is long lasting and can be maintained across reading trials. However, since reading object names in alphabetic languages has been shown to be immune to effects of context stimuli (e.g., Glaser & Düngelhoff, 1984; Roelofs, 2003), interference would not appear during object name reading. In order to explain how object name reading is accomplished, the WEAVER++ model (e.g., Levelt et al., 1999; Roelofs, 1992, 2006) assumes that a words can be named via the fastest lexical–phonological route (or direct route) that bypasses the lexical semantic/syntactic level, when the task does not require this type of information (see Exp. 2).

The second main difference between faces and objects was located at the first cycle of Experiment 1. These data showed an absence of interference for faces, and facilitation for objects. As we mentioned, this first cycle has already been shown to behave differently to other cycles, and several studies have observed null effects (e.g., Belke et al. 2005; Schnur et al., 2006) and/or facilitation effects during this initial cycle (Abdel Rahman & Melinger, 2007, Navarrete et al., 2012). Null effects have typically been explained by the need to establish a context during the first cycle (Damian & Als, 2005). Oppenheim et al. (2010) proposed that this is a conscious strategic effect, whereas Damian and Als suggested a more linguistic explanation, considering that short-lag semantic priming takes place during this first cycle. Although the present study was not designed to disentangle this issue, the relevant finding was that the main differences when naming faces and objects were located at this first cycle, and when this first cycle was excluded, similar patterns were observed for both types of representations. In sum, these results could help to resolve the previously depicted controversy on the different vulnerabilities to interference for face and object naming (Izaute & Bonin, 2006; Marful et al., 2010; Vitkovitch et al., 2006).

In addition, we must note that these similarities in contextual effects during face and object naming are not exclusive of the traditional interference paradigms; semantic-priming studies have reported similar facilitation effects for both faces and objects. For example, Damian and Abdel Rahman (2003) presented categorically related prime words (category names for object and occupations for celebrities), followed by objects or faces for naming, and observed semantic facilitation for both objects and faces.

Finally, the data from these experiments also support the claim by Carson and Burton (2001) that sometimes categorical facilitation or interference with faces is not found because categorical relations might be weaker than associative relations. Consistent with this suggestion, our data provide evidence that this might be the reason why some research has failed to find categorical effects (Izaute & Bonin, 2006; Young et al., 1986): When categorical activation is strengthened by repeated presentations, interference effects are present.

Author note This research was supported by a grant from the program "Juan de la Cierva" to A.M., by grants from the Spanish Ministry of Innovation and Science (EDU2008-01111 and PSI2012-33625) and Junta de Andalucía (HUM-3600) to M.T.B., and by a Consolider-Ingenio 2010 grant (CSD2008-00048) from the MCINN to M.T.B. and D.P.

Appendix: Materials in Experiments 1 and 2

Table 4 Materials in Experiments 1 and 2

	Clothing	**Instruments**	**Mammals**	**Vegetables**	**Vehicles**
Objects	Corbata/tie	Flauta/flute	Elefante/elephant	Seta/mushroom	Barco/ship
	Falda/skirt	Violín/violin	Ardilla/squirrel	Berenjena/aubergine	Avión/plane
	Zapato/shoe	Piano/piano	Perro/dog	Espárrago/asparagus	Caravana/caravan
	Chaqueta/jacket	Trompeta/trumpet	Burro/donkey	Cebolla/onion	Bicicleta/bicycle
	Guante/glove	Tambor/drum	Jirafa/giraffe	Alcachofa/artichoke	Globo/balloon
	Actors	**Politicians**	**Royals**	**Singers**	**Sportsmen**
Faces	Demi Moore	Fidel Castro	Leticia Ortiz	Paulina Rubio	David Beckham
	Brad Pitt	Mariano Rajoy	Victoria de Suecia	Miguel Bosé	Gemma Mengual
	Nicole Kidman	Carme Chacón	Diana de Gales	Joaquín Sabina	Serena Williams
	Antonio Banderas	Tony Blair	Juan Carlos de Borbón	Rosario Flores	Rafael Nadal
	Penélope Cruz	Hillary Clinton	Alberto de Mónaco	Michael Jackson	Fernando Alonso

Columns and rows, respectively, formed the homogeneous and heterogeneous sets

References

Abdel Rahman, R., & Melinger, A. (2007). When bees hamper the production of honey: Lexical interference from associates in speech production. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33,* 604–614. doi:10.1037/0278-7393.33.3.604

Alameda, J. R., & Cuetos, F. (1995). *Diccionario de frecuencias de las unidades lingüísticas del castellano*. Oviedo: Servicio de Publicaciones de la Universidad de Oviedo.

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language, 59,* 390–412. doi:10.1016/j.jml.2007.12.005

Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language, 68,* 255–278. doi:10.1016/j.jml.2012.11.001

Barry, C., Johnston, R. A., & Scanlan, L. (1998). Are faces "special" objects? Associative and semantic priming of face and object naming and recognition. *Quarterly Journal of Experimental Psychology, 51A,* 853–882.

Bates, D., Maechler, M., & Bolker, B. (2011). lme4: Linear mixed-effects models using S4 classes [Software] (R package version 0.999375–41). Retrieved from http://CRAN.R-project.org/package=lme4

Belke, E. (2008). Effects of working memory load on lexical-semantic encoding in language production. *Psychonomic Bulletin & Review, 15,* 357–363.

Belke, E., Brysbaert, M., Meyer, A. S., & Ghyselinck, M. (2005a). Age of acquisition effects in picture naming: Evidence for a lexical–semantic competition hypothesis. *Cognition, 96,* 45–54.

Belke, E., Meyer, A., & Damian, M. F. (2005b). Refractory effect in picture naming as assessed in a semantic blocking paradigm. *Quarterly Journal of Experimental Psychology, 58A,* 667–692.

Brédart, S., Brennen, T., & Valentine, T. (1997). Dissociations between the processing of proper and common names. *Cognitive Neuropsychology, 14,* 209–217.

Brédart, S., & Valentine, T. (1992). From Monroe to Moreau: An analysis of face naming errors. *Cognition, 45,* 187–223.

Brysbaert, M. (2007). *The language-as-fixed-effect fallacy": Some simple SPSS solutions to a complex problem (Version 2.0) (Technical Report)*. London: Royal Holloway, University of London.

Bruce, V., & Young, A. (1986). Understanding face recognition. *British Journal of Psychology, 77,* 305–327.

Burton, A. M., Bruce, V., & Johnston, R. A. (1990). Understanding face recognition with an interactive activation model. *British Journal of Psychology, 81,* 361–380.

Burton, A. M., Kelly, S. W., & Bruce, V. (1998). Cross-domain repetition priming in person recognition. *Quarterly Journal of Experimental Psychology, 51A,* 515–529.

Carson, D. R., & Burton, A. M. (2001). Semantic priming of person recognition: Categorical priming may be a weaker form of the associative priming effect. *Quarterly Journal of Experimental Psychology, 54A,* 1155–1179.

Damian, M. F., & Abdel Rahman, R. (2003). Semantic priming in the naming of objects and famous faces. *British Journal of Psychology, 94,* 517–527. doi:10.1348/000712603322503079

Damian, M. F., & Als, L. C. (2005). Long-lasting semantic context effects in the spoken production of object names. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31,* 1372–1384. doi:10.1037/0278-7393.31.6.1372

Damian, M. F., Vigliocco, G., & Levelt, W. J. M. (2001). Effects of semantic context in the naming of pictures and words. *Cognition, 81,* 77–86.

Darling, S., & Valentine, T. (2005). The categorial structure of semantic memory for famous people: A new approach using release from proactive interference. *Cognition, 96,* 35–65. doi:10.1016/j.cognition.2004.03.007

Ellis, A. W., Flude, B. M., Young, A., & Burton, A. M. (1996). Two loci of repetition priming in the recognition of familiar faces. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22,* 295–308.

Glaser, W. R., & Düngelhoff, F. J. (1984). The time course of picture-word interference. *Journal of Experimental Psychology: Human Perception and Performance, 10,* 640–654. doi:10.1037/0096-1523.10.5.640

Izaute, M., & Bonin, P. (2006). Retrieval of names in face and object naming in an interference study. *Memory, 14,* 400–414.

Johnston, R. A., & Bruce, V. (1990). Lost properties? Retrieval differences between name codes and semantic codes for familiar people. *Psychological Research, 52,* 62–67.

Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language, 13,* 149–174. doi:10.1006/jmla.1994.1008

Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences, 22,* 1–38. disc. 38–75.

Loess, H. (1968). Short term memory and item similarity. *Journal of Verbal Learning and Verbal Behavior, 7,* 87–92.

Lotto, L., Dell'Acqua, R., & Job, R. (2001). Le figure PD/DPSS. Misure di accord sulnome, tipicità, familiarità, età di acquisizione e tempi di denominazione per 266 figure. *Giornale Italiano di Psicologia, 28,* 193–207.

Lupker, S. J. (1979). On the nature of perceptual information during letter perception. *Perception & Psychophysics, 25,* 303–312.

Lupker, S. J. (1988). Picture naming: An investigation of the nature of categorical priming. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 14,* 444–455.

Mahon, B. Z., Costa, A., Peterson, R., Vargas, K., & Caramazza, A. (2007). Lexical selection is not by competition: A reinterpretation of semantic interference and facilitation effects in the picture–word interference paradigm. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33,* 503–535.

Marful, A., Ortega, A., & Bajo, M. T. (2010). Perjudica Antonio Banderas a Javier Bardem? La competición semántica en tareas de nombrado de personas. *Psicológica, 31,* 219–239.

Navarrete, E., Del Prato, P., & Mahon, B. Z. (2012). Factors determining semantic facilitation and interference in the cyclic naming paradigm. *Frontiers in Language Sciences, 3,* 38.

Navarrete, E., Mahon, B. Z., & Caramazza, A. (2010). The cumulative semantic cost does not reflect lexical selection by competition. *Acta Psychologica, 134,* 279–289.

Oppenheim, G. M., Dell, G. S., & Schwartz, M. F. (2010). The dark side of incremental learning: A model of cumulative semantic interference during lexical access in speech production. *Cognition, 114,* 227–252.

Roelofs, A. (1992). A spreading-activation theory of lemma retrieval in speaking. *Cognition, 42,* 107–142. doi:10.1016/0010-0277(92)90041-F

Roelofs, A. (2003). Goal-referenced selection of verbal action: Modeling attentional control in the Stroop task. *Psychological Review, 110,* 88–125. doi:10.1037/0033-295X.110.1.88

Roelofs, A. (2006). Context effects of pictures and words in naming objects, reading words, and generating simple phrases. *Quarterly Journal of Experimental Psychology, 59,* 1764–1784. doi:10.1080/17470210500416052

Rosinski, R. R., Golinkoff, R. M., & Kukish, K. S. (1975). Automatic semantic processing in a picture–word interference task. *Child Development, 46,* 247–253.

Schnur, T. T., Schwartz, M. F., Brecher, A., & Hodgson, C. (2006). Semantic interference during blocked-cyclic naming: Evidence from aphasia. *Journal of Memory and Language, 54,* 199–227.

Schnur, T. T., Schwartz, M. F., Kimberg, D. Y., Hirshorn, E., Coslett, H. B., & Thompson-Schill, S. L. (2009). Localizing interference during naming: Convergent neuroimaging and neuropsychological evidence for the function of Broca's area. *Proceedings of the National Academy of Sciences, 106,* 322–327.

Schriefers, H., Meyer, A. S., & Levelt, W. J. M. (1990). Exploring the time course of lexical access in language production: Picture–word interference studies. *Journal of Memory and Language, 29,* 86–102.

Valentine, T., Brennen, T., & Brédart, S. (1996). *The cognitive psychology of proper names: On the importance of being Ernest*. London: Routledge.

Valentine, T., Hollis, J., & Moore, V. (1998). On the relationship between reading, listening, and speaking: It's different for people's names. *Memory & Cognition, 26,* 740–753. doi:10.3758/BF03211394

Valentine, T., & Moore, V. (1995). Naming faces: The effects of facial distinctiveness and surname frequency. *Quarterly Journal of Experimental Psychology, 48A,* 849–878.

Vitkovitch, M., Potton, A., Bakogianni, C., & Kinch, L. (2006). Will Julia Roberts harm Nicole Kidman? Semantic priming effects during face naming. *Quarterly Journal of Experimental Psychology, 59,* 1134–1152.

Vitkovitch, M., Rutter, C., & Read, A. (2001). Inhibitory effects during object name retrieval: The effect of interval between prime and target on picture naming responses. *British Journal of Psychology, 92,* 483–506.

Young, A. W., Ellis, A. W., & Flude, B. M. (1988). Accessing stored information about familiar people. *Psychological Research, 50,* 111–155.

Young, A. W., Flude, B. M., Hellawell, D. J., & Ellis, A. W. (1994). The nature of semantic priming effects in the recognition of familiar people. *British Journal of Psychology, 85,* 393–411.

Young, A. W., Hay, D. C., & Ellis, A. W. (1985). The faces that launched a thousand slips: Everyday difficulties and errors in recognizing people. *British Journal of Psychology, 76,* 495–523.

Young, A. W., McWeeny, K. H., Ellis, A. W., & Hay, D. C. (1986). Naming and categorizing faces and written names. *Quarterly Journal of Experimental Psychology, 38A,* 297–318.