Cognition 152 (2016) 20–31

Contents lists available at ScienceDirect

Cognition

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

Cumulative semantic interference for associative relations in language production

Sebastian Benjamin Rose *, Rasha Abdel Rahman

Institut für Psychologie, Humboldt-Universität zu Berlin, Rudower Chaussee 18, 12489 Berlin, Germany

ARTICLE INFO

Article history:
Received 5 February 2015
Revised 9 March 2016
Accepted 11 March 2016

Keywords:
Language production
Semantic interference
Continuous naming paradigm
Thematic associations

ABSTRACT

Associations between conceptual representations and thematic relations play an important role in the organization of semantic memory. However, language production research on semantic context effects shows that associative (e.g., dog and bone) and categorical relations (dog and horse) seem to diverge. While categorical contexts typically induce semantic interference that has traditionally been taken to reflect competitive lexical selection, evidence for comparable associative modulations is rare. In three experiments we tested whether thematic associations between objects induce cumulative interference in the continuous naming paradigm, assuming that this paradigm hampers lexical selection via the activation of highly active lexical cohorts steadily increasing in size. Indeed, naming times increased linearly with each newly named member of thematic contexts irrespective of the pre-activation of associations before the naming task (Experiment 1), and irrespective of whether categorical links were partially included (Experiments 1 and 2) or entirely absent (Experiment 3). These findings demonstrate that different types of semantic relations induce interference.

1. Introduction

Language production involves conceptual, lexical and morpho-phonological processes (cf. Levelt, 1992; Levelt, Roelofs, & Meyer, 1999). For instance, during picture naming the visual presentation of an object triggers the activation of its concept (e.g., dog), and in turn the activation of the corresponding lexical entry, the lemma (*dog*). Simultaneously, activation spreads to semantically related concepts (e.g., horse, cat, mouse, etc.) and their lexical representations, resulting in the reciprocal activation of related items at the conceptual and lexical level. The selection of the target from among several co-activated lemmas is a core aspect of language production (e.g., Dell, 1986; Levelt et al., 1999; Mahon, Costa, Peterson, Vargas, & Caramazza, 2007; Roelofs, 1992; Roelofs, 2003).

Different semantic context manipulations have been employed to gain insight into the mechanisms underlying lexical selection. For example, in the picture word interference (PWI) paradigm a picture is named while a simultaneously presented distractor word should be ignored. When the word is categorically related (target: dog, distractor: horse), naming times are longer than in an unrelated condition (e.g., Damian & Bowers, 2003; Glaser & Dungelhoff, 1984; Glaser & Glaser, 1989; Hantsch, Jescheniak, & Schriefers, 2005; La Heij, 1988; Schriefers, Meyer, & Levelt, 1990; Vitkovitch & Tyrrell, 1999). Interference has also been observed in the cyclic naming paradigm in which pictures are repeatedly named in blocks consisting of objects from the same category (all objects are animals; homogeneous blocks) or from different semantic categories (heterogeneous blocks) (e.g., Belke, Meyer, & Damian, 2005; Damian & Als, 2005; Damian, Vigliocco, & Levelt, 2001; Kroll & Stewart, 1994; Schnur, Schwartz, Brecher, & Hodgson, 2006; Vigliocco, Vinson, Damian, & Levelt, 2002). These semantic interference effects have traditionally been taken to reflect lexical competition during lemma retrieval (e.g., Levelt et al., 1999; Roelofs, 1992). Specifically, it is assumed that co-activated lemmas directly compete with the target for selection, thus delaying selection (for current alternative accounts, see Section 5.1).

Evidence for semantic interference stems predominantly from investigations of categorical relations. Even though word meaning is not exclusively composed of categorical relations, and even though non-categorical semantic links such as associations and thematic ties play an important role in the organization of the conceptual system (Barsalou, 2008; Estes, Golonka, & Jones, 2011; McRae, Khalkhali, & Hare, 2012), non-categorical associative context effects have thus far received comparatively little attention in language production research. In contrast to category members that share semantic features and category nodes, associatively

* Corresponding author.
E-mail addresses: sebastian.rose@hu-berlin.de (S.B. Rose), rasha.abdel.rahman@hu-berlin.de (R. Abdel Rahman).

http://dx.doi.org/10.1016/j.cognition.2016.03.013
0010-0277/

related concepts can be viewed as elements of specific situations or thematic contexts, with little or no overlap between their semantic features (e.g., farm: cow and tractor) (Abdel Rahman & Melinger, 2007; Abdel Rahman & Melinger, 2011; Barsalou, 1983; Estes et al., 2011). Such relations may help us to communicate and interact appropriately with our environment, for instance, by generating hypotheses about what to expect in specific situations or during conversations (e.g., Bar, 2004; Bar & Aminoff, 2003; Estes et al., 2011; Kveraga et al., 2011; McRae et al., 2012; van der Meer, 1991). Yet, most PWI studies found that associatively related distractors have no effects or facilitate naming, in contrast to the interference robustly observed for categorically related words (e.g., Abdel Rahman & Melinger, 2007; Alario, Segui, & Ferrand, 2000; Aristei, Melinger, & Abdel Rahman, 2010; de Zubicaray, Hansen, & McMahon, 2013; La Heij, Dirkx, & Kramer, 1990; for part–whole relations: Costa, Alario, & Caramazza, 2005). Thus, empirical reports of associative interference are rare, and the question whether they affect lexical–semantic processes during speech planning in a similar way as categorical relations remains open.

It has been argued that context induced facilitation effects contradict lexical competition models, and that the "default" pattern in language production is facilitation, rather than interference (Mahon et al., 2007; Navarrete, Del Prato, & Mahon, 2012; Navarrete, Del Prato, Peressotti, & Mahon, 2014). However, semantic facilitation is not per se at odds with competition models, as recently discussed, for instance, by Roelofs and Piai (2015; see also: Roelofs, 2003), showing that WEAVER++ could also simulate facilitation for associatively related distractors in a Stroop task (see also Mahon, Garcea, & Navarrete, 2012; Mahon & Navarrete, 2014; Roelofs & Piai, 2013; Roelofs & Piai, 2015). Indeed, many production models incorporate the idea of concurrent activation patterns with priming at the conceptual level and interference at the lexical level (e.g., Belke, 2013; Levelt et al., 1999; Roelofs, 1992, 2003). This aspect has been highlighted most explicitly in the swinging lexical network account (SLN) (Abdel Rahman & Melinger, 2009a, 2009b). In the SLN, semantic context effects are assumed to be the product of a trade-off between facilitatory semantic priming at the conceptual level and concomitant inhibitory competition at the lexical level. Hence, semantic facilitation and interference are two sides of the same coin, and the polarity of the overall net effects depends on the outcome of the trade-off, with facilitation when conceptual priming dominates and inhibition when lexical interference dominates. The main factor for lexical competition to outweigh conceptual facilitation is the activation of a lexical cohort, that is, the activation of a number of co-activated and inter-related competitors that mutually enhance each other's levels of activation, with each competitor contributing to the competition, resulting in strong overall semantic interference.

Importantly, according to the SLN associatively and categorically related concepts differ in their capacity to induce the activation of lexical cohorts. Categorical relations (e.g., cat and horse) naturally share semantic features (e.g., fur, four legs, etc.) and category nodes (mammals), thus co-activating other category members sharing these features (Abdel Rahman & Melinger, 2007; Estes et al., 2011; McRae et al., 2012; Rabovsky, Schad, & Abdel Rahman, 2016). In contrast, associatively related concepts (e.g., pitchfork and hay bale) usually serve Complementary roles within specific contexts or themes, and do not share category nodes or a significant number of semantic features (cf. Muehlhaus et al., 2013; Muehlhaus et al., 2014; Sass et al., 2010; Schwartz et al., 2011). Therefore, lexical cohort activation and semantic interference effects are less likely for associates, and conceptual facilitation typically dominates. Accordingly, in the PWI task categorically related words induce the activation of a lexical cohort of inter-related items mutually co-activating each other, whereas associative distractors tend to have a one-to-one relation with the target picture, and no reciprocal activation between interrelated nodes is achieved (Abdel Rahman & Melinger, 2007; de Zubicaray, Hansen, et al., 2013; see also Muehlhaus et al., 2014; Sailor & Brooks, 2014; Vieth, McMahon, & de Zubicaray, 2014b, for similar argumentations for part–whole relations). Therefore, semantic interference will not outperform facilitative conceptual effects, and facilitation should be observed (Abdel Rahman & Melinger, 2009a, 2009b; Melinger & Abdel Rahman, 2013). In other words, associatively and categorically related word distractors induce conceptual facilitation and simultaneous lexical interference – with the critical difference that interference will typically dominate in the latter case because cohort-induced competition outweighs facilitation, whereas (weak) facilitation or no effects dominate in the former case because associates tend to have one-to-one relations and do not activate lexical cohorts.

The SLN predicts associatively induced interference should be observed when the activation of a lexical cohort is promoted and/or when conceptual facilitation is minimized. Indeed, Abdel Rahman and Melinger (2007) demonstrated interference when associates were inter-related by a common theme (e.g., apiary: bee, honey, honey comb, etc.) in the cyclic blocking paradigm. In contrast to the one-to-one activation pattern in the PWI task, the blocked and repeated presentation of associatively related items belonging to a given theme resulted in a higher degree of lexical cohort activation, and this was reflected in semantic interference – even though the effects were smaller and seemed to be less stable than categorical effects (cf. de Zubicaray, Johnson, Howard, & McMahon, 2014). Furthermore, in a PWI task, the presentation of word distractors that are phonologically related (e.g., camera) to an associate (camel) of a target (pyramid) yielded small traces of mediated semantic interference effects (Melinger & Abdel Rahman, 2013). This is because the distractors activate the lexical competitor via shared phonology while the activation of the associate's conceptual representations should be minimized. Just like in the blocking paradigm, this effect was small, and present only when the associates were parts of the response set. Taken together, even though rare, some observations of associative interference suggest that these relations are co-activated at the lexical level. However, the effects reported thus far in the PWI and cyclic blocking paradigm are relatively subtle and need replications (cf. de Zubicaray et al., 2014). The aim of the present study was to test for associative interference by employing a different naming paradigm, the continuous version of the cyclic semantic blocking task (Brown, 1981; Howard, Nickels, Coltheart, & Cole-Virtue, 2006). This paradigm should reveal stronger interference for associates than reported before, as outlined below.

1.1. Cumulative associative interference in the continuous naming paradigm

In the continuous naming task objects are presented and named in a seemingly random sequence. However, within the sequence different members of semantic categories are presented, separated by 2–8 unrelated objects (Howard et al., 2006). In this task, naming times increase linearly with each new member of the category being named, that is, with the ordinal position of an object within the presented category. This effect is independent of the number of intervening unrelated items (e.g., Belke, 2013; Belke & Stielow, 2013; Costa, Strijkers, Martin, & Thierry, 2009; Howard et al., 2006; Navarrete, Mahon, & Caramazza, 2010; Schnur, 2014).

To account for cumulative interference irrespective of lag length additional learning mechanisms have been proposed (Belke, 2013; Howard et al., 2006; Oppenheim, Dell, & Schwartz, 2010). According to Howard and colleagues (2006), the connection strength