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Help me if I can't: Social interaction effects in adult contextual word learning

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ABSTRACT

A major challenge in second language acquisition is to build up new vocabulary. How is it possible to identify the meaning of a new word among several possible referents? Adult learners typically use contextual information, which reduces the number of possible referents a new word can have. Alternatively, a social partner may facilitate word learning by directing the learner's attention toward the correct new word meaning. While much is known about the role of this form of 'joint attention' in first language acquisition, little is known about its efficacy in second language acquisition. Consequently, we introduce and validate a novel visual word learning game to evaluate how joint attention affects the contextual learning of new words in a second language. Adult learners either acquired new words in a constant or variable sentence context by playing the game with a knowledgeable partner, or by playing the game alone on a computer. Results clearly show that participants who learned new words in social interaction (i) are faster in identifying a correct new word referent in variable sentence contexts, and (ii) temporally coordinate their behavior with a social partner. Testing the learned words in a post-learning recall or recognition task showed that participants, who learned interactively, better recognized words originally learned in a variable context. While this result may suggest that interactive learning facilitates the allocation of attention to a target referent, the differences in the performance during recognition and recall call for further studies investigating the effect of social interaction on learning performance. In summary, we provide first evidence on the role joint attention in second language learning. Furthermore, the new interactive learning game offers itself to further testing in complex neuroimaging research, where the lack of appropriate experimental set-ups has so far limited the investigation of the neural basis of adult word learning in social interaction.

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1. Introduction

Learning a new language is a complex task that an increasing number of adult learners is facing in the modern, multilingual world. New words—such as neologisms or English terms—can be encountered everyday when reading the newspaper or surfing the web. In this situation, the reader has to face a challenge, namely to assign a meaning to the new word (e.g., Horst, Scott, & Pollard, 2010; McMurray, Horst, & Samuelson, 2012). Despite the apparent simplicity of this task, every new word has multiple referents defined by cues that can be derived from the context a word is encountered in. However, next to a situational context, another person may also provide these cues non-verbally; in fact, most often language learning contexts are social contexts, in which a more knowledgeable person facilitates the learner's efforts to acquire new words. This is certainly the case for infants learning their first language (Csibra & Gergely, 2009; Gleitman, Newport, & Gleitman, 1984; Kuhl, 2007; Kuhl, Tsao, & Liu, 2003), but it may also be crucial for adults acquiring a second language (Jeong et al., 2010; Verga, Bigand, & Kotz, 2015; Verga & Kotz, 2013).

First language (L1) acquisition studies suggest that social interaction with a caregiver is fundamental to successfully developing communication skills (Bruner, 1974, 1983). In particular, sharing visual attention with a caregiver is a sine qua non condition for successful infant word learning (Kuhl et al., 2003; Waxman & Gelman, 2009) as a caregiver may direct the infant's attention toward the correct referent among many possible referents (Dominey & Dodane, 2004; Tomasello, 2000; Verga & Kotz, 2013). This form of 'joint attention' (Tomasello & Akhtar, 1995)

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during word learning may still apply in adult word learning (L2), as adult learners may also profit from joint attention, which could reduce the number of possible referents for a new word and improve learning (Louwerse, Dale, Bard, & Jeuniaux, 2012; Rader & Zukow-Goldring, 2012). Yet investigations in this domain are sparse.

Here, we investigated adult word learning taking on a social-interaction perspective. More specifically, we explored the possibility that adult learners—similarly to infants—may benefit from the presence of a knowledgeable partner and sharing attention when learning new words. In order to investigate this hypothesis, we developed and validated a learning game whose characteristics make it particularly well suited for social interaction studies even in complex learning settings (e.g. neuroimaging settings).

1.1. Social interaction in second language learning

Learning a new language in adulthood has long been considered as an imperfect process and strongly limited by the age of the learner; in other words, it has been hypothesized that only when a language is learned in early childhood is it possible to attain native-like proficiency (Lenneberg, Chomsky, & Marx, 1967; Penfield & Roberts, 1959). Decades of investigations in this domain allowed to discredit this reductionist view by highlighting how—in the right circumstances—even adult learners can attain native-like proficiency (Bongaerts, 1999; Bongaerts, Mennen, & Slik, 2000). For these learners, the pattern of activation when using L1 or L2 is remarkably similar (Abutalebi, 2008; Green, Crinion, & Price, 2006), leading to the hypothesis that L2 acquisition is based on an already specified L1 network, and receives convergent neural representation within the representations of the language learned as the L1 (Green, 2003). Importantly, the extent of convergence between L1 and L2 does not seem to depend upon the linguistic proximity between the two languages, as demonstrated in studies where L1 and L2 were, respectively, Italian and English or Catalan and Spanish (Perani et al., 1998) but also more distant languages such as English and Mandarin (Chee et al., 1999). Nevertheless, several factors have been proposed to contribute to a positive learning outcome, including age of acquisition (e.g., Bialystok & Hakuta, 1999; Birdsong, 1999), proficiency (Abutalebi, Cappa, & Perani, 2001; Perani et al., 1998), and exposure (Consonni et al., 2013; Perani et al., 2003).

Among these factors the role of exposure is perhaps the most elusive so far. Indeed, while it is self-evident that "exposure" includes social aspects, the extent to which these specifically contribute to L2 word learning remains largely unknown. A possible reason for this lies in the evidence that while social interaction may be important in word learning, we do know that adults may utilize other strategies when learning. For example, they often rely on a situational context when acquiring new words (e.g., they can obtain information from the situation the communication is taking place in—Laufer & Hulstijn, 2001; Nagy, Anderson, & Herman, 1987; Rodríguez-Fornells, Cunillera, Mestres-Missé, & de Diego-Balaguer, 2009; Swanborn & De Glopper, 1999). In this scenario, the mapping of a word with its meaning is critically dependent upon how variable the sentence context a word is presented in is; however, as of yet there is still a debate whether a more variable or more consistent context is more beneficial for learning or not with evidence either showing a prevalence for learning effects in consistent contexts (Dempster, 1987; Hicks, Marsh, & Cook, 2005; Koffka, 1935; Steyvers & Malmberg, 2003; Young & Bellezza, 1982) or the importance of variable contexts as a successful mnemonic device (Hills, Maouene, Riordan, & Smith, 2010; Smith, 2000). In the latter case, variability is claimed to improve the generalization to novel items in particular (Perry, Samuelson, Malloy, & Schiffer, 2010).

Given the fact that adult learners may learn either alone or with a partner, the question that arises is: Which type of word learning –alone or with a social partner– is more beneficial for an adult learner? This question is indicative of two opposing theoretical accounts: On the one hand, adults could be considered as self-sufficient word learners, cognitively equipped to acquire any information they need; thus, a social partner could be expected to not or only minimally influence their learning behavior (Pickering & Garrod, 2006; Stephens, Silbert, & Hasson, 2010). Therefore, a situational context providing enough information regarding a referent's characteristics (e.g., variable contexts, in which several cues suggest a word's meaning—Borovsky, Kutas, & Elman, 2010; Hills et al., 2010; Perry et al., 2010; Smith, 2000) should suffice to identify the correct referent of a new word. On the other hand, research in social cognition and neuroscience suggests that not only is an adult's behavior influenced by others, but also that this influence is qualitatively and quantitatively different when an adult is interacting with rather than merely observing someone (Bond & Titus, 1983; Ciaramidaro, Becchio, Colle, Bara, & Walter, 2014; Schilbach, 2014; Schilbach et al., 2013; Sebastiani et al., 2014; Zajonc, 1965).

One of the first studies investigating social word learning in adults—although not in a real-time social interaction—by Jeong et al. (2010), explored how adult Japanese speakers learned new Korean words. Participants watched movie clips depicting either a text-based learning context (new words were spoken by a person holding up their written translation) or a situation-based context (new words were exchanged between two actors). Post-learning functional magnetic resonance imaging (fMRI) revealed that the right supramarginal gyrus (rSMG) was involved in the retrieval of L2 words encoded in a social setting (Jeong et al., 2010). This result highlights the importance of considering social interaction not only as a context of a new word's acquisition but also as a context, in which the word will be used in. Indeed, the context a newly learned language is used in is often a social one: Even when L2 is learned with a textbook or computer program, its final use is to communicate with others. As consistency between learning and testing environments has been suggested to facilitate recall (Godden & Baddeley, 1975; Polyn, Norman, & Kahana, 2009; Stein, 1978; Tulving, 1979), using an L2 acquired via text book learning in a social context may be more difficult than learning the language directly with a partner. Accordingly, new words learned and retrieved in mismatched conditions (for example, learned via text and retrieved socially) activate brain areas involved in conflict resolutions (such as the inferior frontal gyrus), while new words learned and used socially elicit brain activity similar to L1 words (Jeong et al., 2010). This latter evidence suggests that L1 and L2 words learned in a social context may exploit similar mechanisms during acquisition.

A powerful social mechanism employed by children when acquiring new words is sharing attention with a caregiver (Tomasello & Akhtar, 1995). When several possible meanings for a new word are available in a context, a social partner may direct the learner's attention toward a new word's correct referent, thus facilitating learning. Would adult learners also benefit from sharing attention with a knowledgeable partner? Theoretically, even for L2 this should significantly reduce the number of possible referents a word can take during learning especially when the context of a word presentation includes several possible meanings (Louwerse et al., 2012; Rader & Zukow-Goldring, 2012). Supporting this hypothesis, studies investigating social interaction often report the activation of the right temporo-parietal junction (TPJ) for social stimuli. While activation in this region is consistent in social neuroscience studies, this area also engages in joint attention and visuo-spatial attention (Decety & Lamm, 2007) and has

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