



Brief report

Infants can rapidly learn words in a foreign language

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ABSTRACT

The present study used an object manipulation task to explore whether infants are able to learn words in a foreign language. French-learning 20-month-olds, who were taught new words in either English or French by a bilingual French-English speaker, succeeded in both language conditions.

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Extensive research carried out on infants raised in monolingual environments has shown that they start learning the sound system of their native language during the first year of life. Evidence was found for an onset of the acquisition of the phonetic properties of the native language (Kuhl, Williams, Lacerda, Stevens, & Lindblom., 1992; Werker & Tees, 1984), its rhythmic structure (Nazzi, Jusczyk, & Johnson, 2000), its prosodic characteristics (Jusczyk, Cutler, & Redanz, 1993; Mattock & Burnham, 2006) and its words (Hallé & de Boysson-Bardies, 1994) between 6 and 12 months of age, and some evidence of syntactic acquisition as early as 17 months (Golinkoff et al., 1987, for word order). These early acquisitions raise the issue of whether and how the ability to learn more than one language changes over development, whether there is a critical period after which it becomes impossible to learn a language with native-like proficiency, and whether or not the nature and timing of these changes is dependent on the linguistic level (phonological, lexical, syntactic, ...) under consideration.

Recently, it has been argued that the “human mind is as prepared to acquire two first languages as it is to acquire one,” but “but that bilingual and monolingual acquisition nonetheless differ in some nontrivial ways” even for the case of early simultaneous bilingualism (Werker & Byers-Heinlein, 2008). For example, it has been shown that simultaneous bilinguals differ from monolinguals in their phonological (Bosch & Sebastian-Galles, 2003) and lexical (Fennell, Byers-Heinlein, & Werker, 2007) acquisition. With respect to lexical acquisition, which is the level explored in the present study, Fennell et al. (2007) found, using an associative word learning task, that monolingual infants start succeeding with a phonetically minimal pair (*bih-dih*) by 17 months of age, while bilingual infants do not succeed until 20 months of age.

This suggests not only that bilingual exposure impacts language acquisition, but also that language acquisition processes might rapidly become specialized in the processing of the native language and as a corollary, less efficient at processing foreign languages. This might have an even more significant impact on the acquisition of two languages by non-simultaneous bilinguals, a numerically important population given that, due to important migration movements, many children are confronted with a language outside the home different from their native language, the language spoken at home by their parents

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(Bijeljac-Babic, 2008). It is thus an issue to determine how and how rapidly these children will acquire both that foreign language, and their native language following exposure to the foreign language. In the present study, we are concerned with one particular aspect of this problem, lexical acquisition in a foreign language, which we will explore in infants 20 months of age.

Before presenting our study in more details, it is worth mentioning that several studies have reported life-span abilities to process information at various linguistic levels when hearing foreign languages. For phonetic discrimination, there is ample evidence that discrimination of contrasts not present in the native language can be improved through extensive training, as is the case for example of Japanese adults' discrimination of the /l/r contrast (Bradlow, Akahane-Yamada, Pisoni, & Tohkura, 1999). One study even found evidence of apparently total phonological reorganization in a very special situation, the case of Korean adoptees that had been placed in families speaking only French in childhood. Tested in adulthood, they appeared to have lost all traces of Korean phonology and it was not possible to find differences between them and native French adults at the phonological level (Ventureyra, Pallier, & Yoo, 2004). More related to our developmental concern, one recent study found some evidence of rapid phonological changes in infants. Indeed, English-learning 10–12-month-olds were found to be better at discriminating Chinese phonetic contrasts after a few hours of interaction with a Chinese-speaker (watching the same scene on TV did not work, Kuhl, Tsao, & Liu, 2003).

The convergent evidence of rapid perceptual adaptations suggested by the above studies, though important, is however limited to one linguistic domain, phonology. In the present study, we focus on a different domain, the lexical level, as words are the building blocks of sentences and grammar, and lexical acquisition is a strong predictor of later language/cognitive achievements (Bates & Goodman, 1997). We use an object manipulation procedure previously used to investigate word learning in the native language between 16 and 30 months (Havy & Nazzi, 2009; Nazzi & Gopnik, 2001; Nazzi, Floccia, Moquet, & Butler, 2009) to explore whether infants can learn words in a foreign language through interaction with an adult speaker of that language. Our basic goal is to determine whether infants hearing a speaker talking in a foreign language and labeling a given object in six different sentences will be able to learn the name of that object.

For the present study, 20-month-olds were tested given that many other studies show important word learning improvements in the first half of the second year of life (Golinkoff et al., 2000), and it has been suggested that 20-month-olds have developed mature word learning mechanisms (Nazzi & Bertoncini, 2003). The age also corresponds to the age at which simultaneous bilinguals appear to become more proficient at learning words in one of their native languages (Fennell et al., 2007).

1. Methods

The participants were 24 infants (mean age = 20 months, 13 days; 11 boys, 13 girls) from monolingual French-speaking families. Seven additional infants failed to complete the session due to fussiness.

The stimuli used consisted of unfamiliar objects and pseudowords. We used eight triads of very distinct novel objects for which infants had no names. We also used eight pairs of very distinct pseudowords to name the objects: *chook/dal*, *moz/jig*, *buff/keeb*, *toop/hidge*, *vab/newk*, *nol/cag*, *ged/lif*, *flush/soik*. In the English trials, the pseudowords were pronounced as English words embedded in English carrier sentences. In the French trials, they were pronounced as French words embedded in French carrier sentences.

Infants were tested individually in a quiet room. The experiment took place in the following way. Infants were seated with their mothers at a table across a fluent French-English bilingual female experimenter. The session started in French (the infants' native language) with two training trials in which the experimenter presented a pair of familiar objects for which infants were likely to have a name (car/ball and horse/spoon). Then, the experimenter took a second visually different exemplar of one of the familiar objects, put it in a cup and asked the infant to put the other one in the cup.

The goal of these two training trials was to familiarize the infants with the experimental set-up and procedure, which was very similar in training and test, but with two major differences. First, during training, infants were presented with familiar objects, while in the test itself, they were presented with unfamiliar objects and pseudowords and had to learn new words.

Second, while training was conducted in French, the native language of the infants, the first four test trials were conducted in a language not known to the infants: English. During these four trials, the experimenter spoke English and only English (see Fig. 1 for an example of the sentences used). After these four test trials, four additional test trials were conducted in French. The goal of these trials was to make sure that these infants could perform the task in their native language (as previously found by Havy & Nazzi, 2009; Nazzi & Gopnik, 2001; Nazzi et al., 2009) in the event that they would fail in the foreign language condition.

Each of the eight test trials were composed of two phases. First, one at a time, two objects were presented and named six times with different pseudowords, e.g., *chook/dal*, before being placed on the table. Second, the experimenter tested word learning by presenting a *third* object, naming it, e.g., a *chook*, putting it in a cup and asking the infant to put the other *chook* in the cup (Fig. 1). The left/right position of the target object on the table was counterbalanced within participants.

2. Results and discussion

For each trial, infants were given a score of 1 when they chose the object with the correct name (Fig. 2). Total scores were calculated for each language condition and then converted into percentages, chance being 50%.

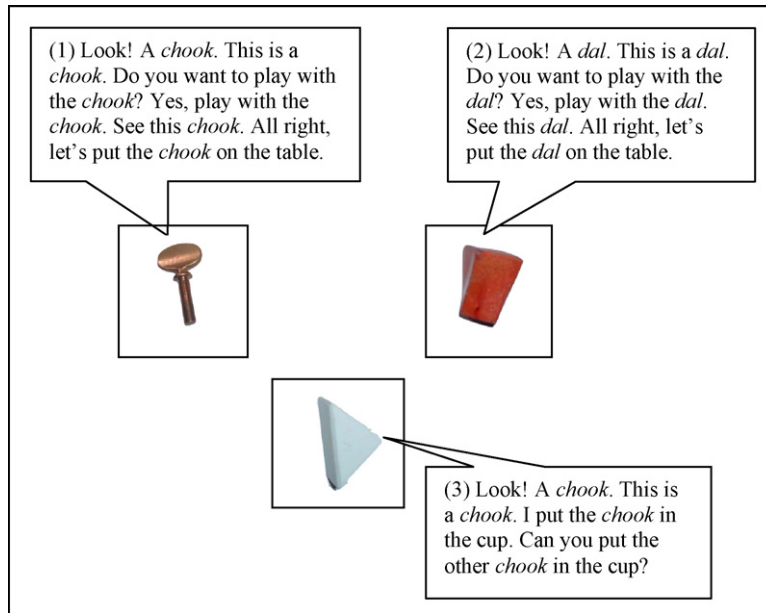


Fig. 1. Illustration of the procedure for one of the eight triads of objects used in the present study (the two objects used in the presentation phase, and which of these two objects related to the object used in the test phase were counterbalanced between participants).

In the foreign language condition, infants chose the correct object 60.42% of the time, above chance level, $t(23)=2.46$, $p=.01$, 1-tailed. The present study thus shows for the first time that 20-month-old infants can easily and rapidly learn words in a foreign language. This positive evidence was obtained following a very short warm-up in the native language (the two training trials). Therefore, it appears that these infants were able to rapidly grasp the word learning nature of the task we used and use this to learn new words in a language unknown to them, indirectly attesting refined social and pragmatic skills.

In the native language condition (the control condition, conducted in case infants had failed the foreign language condition), infants chose the correct object 62.50% of the time, also above chance level, $t(23)=2.77$, $p=.006$, 1-tailed. Overall performance for the two language conditions was not significantly different, $t(23)=.65$, $p=.74$, 2-tailed.

A close analysis of Fig. 2 suggests that performance might vary across the testing session, performance appearing to decrease through the first four trials (foreign language), then increasing for the first two trials in the native language and decreasing again. An ANOVA with the trial factor (eight trials) failed to reveal a significance effect, $F(1, 7)=1.28$, $p=.26$, but 1-tailed t -tests revealed a marginal increase in performance between the last two trials in the foreign language and the first

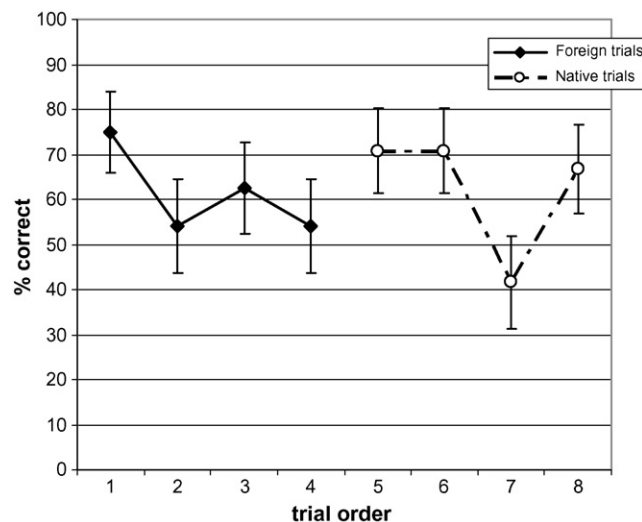


Fig. 2. Mean correct responses in percentage (and S.E.) for the four trials in the foreign language (trials 1–4) and the four trials in the native language (trials 5–8).

two trials in the native language, $t(23) = 1.45, p = .08$, and a significant decrease between the first two versus the last two trials in the native language, $t(23) = 1.70, p = .05$ (all other changes across consecutive trials were non-significant).

From this trial order analysis, it first appears that performance across the foreign language trials was relatively stable (if anything, there is a non-significant tendency for performance to decrease). Thus, from the beginning of the testing session, infants were successful at learning the words; learning in the foreign language does not seem to be particularly problematic for these infants. Second, the changes in performance for the first two native language trials suggest that infants noticed the switch to their native language, which led to a small and temporary increase in performance before a decrease possibly due to tiredness or loss of interest.

The present finding that 20-month-old infants can learn words in a foreign language has several implications. One is that it demonstrates that even in a foreign language, these infants were able to locate in and segment from the sentences spoken to them the sound patterns of the words (repeated six times) referring to the object they were seeing. This is a non-trivial result given previous studies having shown that by 8–12 months of age, English- and French-learning infants use different procedures to segment words from fluent speech (Jusczyk, Houston, & Newsome, 1999; Nazzi, Iakimova, Bertoncini, Frédonie, & Alcantara, 2006). Possibly infants succeeded in the present experiment because monosyllabic pseudowords were used; they might have failed with pseudowords of two or more syllables. Another element that might have helped infants is the fact that the pseudowords were almost always presented in sentence-final position, a position which has been found to facilitate early word segmentation (Seidl & Johnson, 2006). Note that this positional effect might also explain why American and Turkish mothers tend to place new words at the end of sentences, even if this means producing ungrammatical sentences (Aslin, Woodward, LaMendola, & Bever, 1996).

Second, the present results show that even though these sound patterns were pronounced in a foreign phonology, infants were able to represent them and build sound pattern-object representations. Although it remains to be seen whether similar results could be found for a language more distant from French than English, such as Chinese, a language using tonal distinctions at the lexical level, the present finding is remarkable given evidence that phonological skills become language-specific by the end of the first year of life (Kuhl et al., 1992; Werker & Tees, 1984). Our study thus concurs with previous studies, especially Kuhl et al.'s (2003) finding of flexibility at the phonological level, in showing the incredible ease with which infants can learn more than one language. However, the present study goes beyond previous findings by establishing flexibility at the lexical level, showing that by 20 months of age, infants' language learning abilities are still flexible enough to allow word learning in more than one language, even with very minimal exposure to a given language. It will be interesting to determine in the future whether there is an age beyond which lexical acquisitions would not be so easy any more, which would point towards the existence of a critical period for word learning. Note that this notion, which is often discussed with respect to the acquisition of the phonology (Genesee, 2001) or syntax (Flege, Yeni-Komshian, & Liu, 1999; Meisel, 1994) of a second/foreign language, is rarely mentioned at the lexical level, possibly because word learning continues throughout the life span in the native language. Nevertheless, the ability to use linguistic sounds with a non-native phonology might decrease over development, just like infants stop considering non-linguistic sounds or gestures as possible word labels between 18 and 26 months of age (Namy & Waxman, 1998).

At this point, we would like to discuss the fact that if the present study establishes that learning words in a foreign language might not be such a problem at 20 months (which has positive implications for infants of immigrant parents), future studies will have to specify the constraints that apply on this ability by addressing the following (non-exhaustive) issues.

First, infants in the present study were presented with pairs of very different words, such as *chook* and *dal*. Thus, they could have succeeded by relying on salient features of the words. They could have built incomplete representations of the words, or representations of the words following the phonology of their native language. This raises the question of whether they would have succeeded if the words used had only differed by one phonetic feature, especially given the developmental delay observed for bilinguals in such conditions (Fennell et al., 2007). This issue should be investigated in the future, and it should be done in a way controlling for the relation between the phonetic categories of the native and foreign languages.

Second, future research will have to specify whether the same mechanisms are used to learn foreign versus native words. One possible way to address this issue would be to determine whether the same constraints apply to both types of acquisitions. In this context, one could investigate whether the privileged status of consonantal over vocalic information found in infants learning words in their native language (Havy & Nazzi, 2009; Nazzi, 2005; Nazzi & Bertoncini, 2009; Nazzi et al., 2009; Nazzi & New, 2007; Werker, Fennell, Corcoran, & Stager, 2002) also applies to the learning of words in a foreign language.

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