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*Retrieving the meaning of words from noun and verb grammatical contexts:
Interindividual variation in a comprehension study of 2- to 4-year-old French-
acquiring children¹*

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Abstract

Ninety French-speaking children aged 2- to 4 years were asked to retrieve the meaning of homophonous or nonce words presented in noun and verb grammatical contexts and whose object or action meaning is identifiable on the sole basis of the preceding grammatical morpheme. Items with these words in noun and verb contexts are presented to the same children in order to assess their ability to provide appropriate contrastive interpretations. Results show that, at all ages, items were correctly identified beyond chance, with 4-year-olds outperforming the 2- and 3-year-olds. On an individual subject basis, however, only part of the children, even in the 4-years old group, performed beyond chance level, suggesting substantial interindividual variability and that, at these ages, children's grammatical knowledge may not yet be sufficiently robust to tackle situations offering minimal information. The issue of variation in modality (production vs comprehension) is also raised and results of a pilot study on their developmental relation are reported.

Keywords: first language acquisition; grammatical morphemes; comprehension; noun-verb distinction; syntax development, relation between production and comprehension

*Retrieving the meaning of words from noun and verb grammatical cues:
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Nouns and verbs are generally regarded as the two most fundamental word categories in language. They are found in every language description (Pullum, 1999) and are considered as the most basic word categories in linguistic theories. The lexical categories to which words belong determine the way in which words are allowed to follow each other in a sentence, the contexts in which a word is allowed to appear, the transformations that words can or should undergo as well as the inferences that can be made about the meaning of words encountered for the first time (e.g. Gillette, Gleitman, Gleitman & Lederer, 1999; Surugue, 1984). Although there is no biunivocal relations between word category and meaning, words that are nouns tend to refer to objects and entities, while words that are verbs tend to refer to actions or states. And what assigns words to a given category are the morphosyntactic contexts in which they occur (e.g., Clairis, 1984; Lazard, 1984; Maratsos & Chalkley, 1980).

In French, the grammatical features of the immediate constituents of words greatly contribute to their identification as Nouns or Verbs. Nouns are usually preceded by determiners while verbs may be preceded by different grammatical elements such as a subject NP (a clitic pronoun or a nominal), may occur in VPs preceded by an auxiliary, a modal or a preposition, but may also occur "bare" in the imperative form.

When and how are children able to use morphosyntactic information of this kind in their language? This information is especially important for retrieving the

meaning of words encountered for the first time, or in cases of homophony.

In production, young children utter words that are nouns and verbs in the language (Bassano, 2000) but it is not until the late part of the second year that children start distinguishing these words using primitive morphosyntactic means such as *fillers* (e.g., Veneziano & Sinclair, 2000; Veneziano, 2003), and different kinds of bound morphology on words that are verbs (*casse/cassé*) (e.g., Tomasello, 1990; Veneziano & Parisse, 2010), a competence that improves with age (e.g. Bassano, Eme, & Champaud, 2005).

However, production data may both underestimate and overestimate children's morphosyntactic knowledge. On the one hand, it may underestimate it because of performance factors, such as children's poor motor control over the phonological complexities of articulation (Smith, 1988; Thelen, 1991) and the slow development of articulatory fluidity and planning abilities. On the other hand, it may overestimate children's morphosyntactic knowledge because production relies on familiar and recurrent contexts, both situational and linguistic, and on cooperative interactional partners. Moreover, with production data alone, children may be credited to have more syntactic knowledge than what they actually have. Indeed it may be the case that nouns and verbs embedded in categorially-adapted syntactic contexts (i.e. determiners before nouns and personal pronouns before verbs in French) may in fact be 'amalgams' or 'frozen forms' (e.g., Lieven, Pine & Baldwin, 1997).

In reception, several studies have demonstrated the existence of children's sensitivity to prelexical markers (see Shi, 2014, for a review). Perception studies have shown young infants' sensitivity to differences between function and non function words

(Shi, Werker, & Morgan, 1999). Between 12 and 16 months, children can use function words (but not nonce segments or infrequent morphemes) to isolate the following nonce sequence (Shi and Lepage, 2008). They look longer at sequences containing real English functors than at sequences containing nonce functors (Shi, Wexler & Cutler, 2006), and they differentiate noun from verb contexts for pseudowords (Höhle, Weissenborn, Kiefer, Schulz, & Schmitz, 2004 ; Mintz, 2006).

In studies requiring more active comprehension by the child, it was shown, for example, that children in their second year responded better to utterances containing function morphemes than to telegraphic utterances (Petretic & Tweney, 1977; Shipley, Smith, & Gleitman, 1969) or to utterances containing grammatical instead of ungrammatical function words (Gerken & MacIntosh, 1993). Katz, Baker & MacNamara (1974) showed that two-year-olds (and 18-month-old girls) have a tendency to consider nonce words presented with an indefinite article (e.g., "a dax") as common nouns and nonce words presented without an article as proper names. More recently, Bernal, Lidz, Millotte, & Christophe (2007) focused more specifically on children's comprehension of verb frames, where nonce words were preceded by a subject pronoun (e.g., *il poune là* 'he/it *poune(s)* there'). Using a fairly complex experimental procedure, they showed that children chose more often the clip containing the object undergoing the specific movement to which the nonce word was associated with during the training phase (e.g., a flower rotating), compared to the clip where the same object underwent a different movement (e.g., a flower jumping). By contrast, a control group of children trained with noun frames for the same nonce words on the same visual stimuli -- used to control that the choices of the verb frame group was not dictated by familiarization or holistic

preferences -- showed the opposite pattern of preferences².

Studies such as those mentioned above indeed suggest that young children can pay attention to function words, distinguish nominal from verbal contexts, and infer respectively object or action meanings accordingly (see also Naigles, 1990; Waxman, Lidz, Braun, & Lavin, 2009). However, even in studies that require active behavior from the children, it is not clear what children actually understand about the category-specific morphological functors present in the utterances (e.g., Tomasello & Abbot-Smith, 2002). Moreover, studies not always compare directly verb and noun frames in the same children, nor these frames are presented in minimally contrasted grammatical contexts. For example, in the Barnal et al. (2007) study nonce words inserted in noun and verb frames occurred in various grammatical contexts. For example, for noun frames, children heard not only ‘la x est là’ (the x is there), but also ‘tu vois ce que fait la x’ (do you see what the x is doing), ‘la x est encore là’ (the x is there again), and for verb frames, ‘elle x par là’ (she/it x-es there), as well as ‘tu vois comment elle x’ (you see how sh/it x-es), ‘elle x encore là’ (she/it x-es there again) – where ‘x’ represents the same nonce word.

The present study aims to provide further and clearer information on children’s ability to retrieve the object or action meanings of words on the sole basis of category-specific minimally contrasted grammatical morphemes, without the help of any other syntactic information. It presents several original features: 1. It uses homophones, words existing in spoken French, whose object or action meaning can be disambiguated only by the noun or verb grammatical functors that precede them. For example /pus/ can

² Although the hypothesis should have predicted an outcome of no preference, with the outcome observed explained by the greater interest for the novel action clip, the important point here is the difference observed between the two groups.

correspond to either the noun *pouce* ('thumb') or the verb *pousse* ('push'), depending on whether it is preceded by the definite article /le/ -- /lə pus/ -- in which case it is interpreted as 'the thumb' -- or by a subject pronoun like /il/ - and then it is interpreted as /il pus/ 'he pushes'; 2. The grammatical context differentiating the interpretation as noun or as verb was kept to its minimal expression -- a definite article for nouns and a subject clitic pronoun for verbs; 3. Each child was presented with both noun and verb contexts (but not for the same lexical item so as to avoid testing simultaneously categorial flexibility) in order to assess children's capacity to provide contrastive interpretations according to the grammatical context; 4. Children's choices required their active engagement, their pointing to the chosen interpretation; 5. Results will be provided not only for groups -- as is most often done in this kind of studies -- but also for the performance of individual children. Considering how each individual child performs on the whole set of items presented will provide important information the individual children's ability to attribute contrastive interpretations according to the differential grammatical contexts in which the words appear, and will contribute precious information about both individual and age group variation. Information about individual differences in studies of early speech/language perception or comprehension is seldom provided (but see Höhle et al. (2004) who report that only 35% of the subjects performed in line with the results indicated by the group analyses). Indeed, information about interindividual variation for tasks such as those under study, for which group differences are the main source of information, are particularly needed at a time when individual differences have become an important source of data to predict later outcomes (e.g. Cristia et al., 2014; Martin, Ziv & Sommerville, 2016); and, 6. the same paradigm was presented to 2- 3- and

4-year-old children to evaluate the developmental pattern of the abilities focused here.

Finally, this chapter will consider the issue of modality variation through the developmental relation between production and comprehension skills. It will present results of a longitudinal study in which comprehension of grammatical competence was assessed monthly with the same procedure for the present cross-sectional study, while spontaneous interactional data was being videorecorded, monthly as well.

Method

Participants

Ninety children from monolingual, middle-class, French-speaking homes participated in the study – 47 girls, mean age 3;5 months ($SD = 0;11$), 43 boys, mean age 3;7 ($SD = 0;11$). There were 30 children in each of three age groups: 2-year-olds (mean age = 2;4 years, $SD = 0;5$), 3-year-olds (mean age = 3;7 years, $SD = 0;3$), and 4-year-olds (mean age = 4;7 years, $SD = 0;3$). The two-year-olds were recruited in a nursery school; the 3- and 4-year-olds were recruited in a public preschool. Both schools were located in Paris. All the children were described as typically-developing by the professional caretakers in contact with them. One of the parents signed a form authorizing the child to participate in the study.

Procedure

For the 2-year-old group, the experimenter visited the nursery school for three half days before starting the procedure, in order to familiarize the young children with the

experimenter, and minimize the unwillingness of children to participate in the study³. Children were tested individually in a quiet room. The experimenter ensured that the child was comfortable by engaging him/her in a brief conversation, talking about nursery and/or home activities, and exchanging over a picture book.

With the 3- and 4-year-olds, no familiarization was necessary and the procedure started right away upon the arrival of the child in the room.

During the experimental procedure, children were confronted with a computer screen presenting two pictures side by side (see Annex 1). Children were instructed to point to the image corresponding to what the experimenter requested.

The test items were preceded by four training items. The first two presented a single image and were meant to ensure that children knew how to point to an image on the screen. The next two items presented two images simultaneously – first two objects, and then an object and an action performed by a person -- and were meant to ensure that children understood the instruction and could point to one of the two images according to what they heard.

The testing phase began immediately after with the presentation of the 15 test items presented one after the other. For each item, children were asked: “*montre-moi* [show me] definite article/third person pronoun X” where X was either a homophonous or a nonce word (see table 1 for the list of items) that could function as either a noun or a verb, depending on whether it was preceded by the definite article or by the third person pronoun. Each child was confronted with only one of the two grammatical contexts per

³ This familiarization phase was introduced because, in a pilot study effectuated without this phase, several two-year-olds were intimidated and could not cooperate with the experimenter, some even crying immediately after starting the experiment. With the familiarization phase, all the children contacted for the present study participated willingly.

homophonous or nonce word. The noun and verb contexts for each of the homophonous or nonce words were evenly distributed among the children within each age group.

All sessions were videorecorded. The pointing responses of the children were coded during the experiment and were double checked later from the videorecordings.

Material

The list of items is presented in Table 1. The meanings of the words presented in the noun and verb contexts were represented by pairs of pictures, one of an object and one of an action performed by a person. Children were asked to point at the image that corresponded to what they heard.

-- Insert Table 1 --

In order to control for the order of presentation, the requested item (either the noun or the verb context) and the position on the screen of the image corresponding to the requested item (on the right or on the left of the screen), four lists were prepared and each child was presented one of them. The lists were used in a sequential order (list 1 with child A, list 2 with child B, list 3 with child C, list 4 with child D, and then starting again, list 1 with child E, and so on).

For the noun context of nonce words, the corresponding picture represented an unfamiliar object that did not have a precise name in adult language. For the verb context of nonce words, the corresponding picture represented a person performing an action that could not be described in French by an available verb (other than a generic verb such as 'moving').

Since frequency has an impact on children's lexical knowledge (Huttenlocher, Haight, Bryk, Seltzer, Lyons, 1991), the frequency of the homophonous words used was checked.

Since no reference work on word frequencies exists for French child-directed speech (CDS), nor even for oral adult French (see below), we analyzed the French data available in the CHILDES database (MacWhinney, 2000) and the data used in Veneziano and Parisse (2010), to get information about word frequencies in CDS. We analyzed a corpus containing 1'913'796 words. Results show that to the exception of the verb *trancher* [to slice], all the French words used in our experiment were present in the CDS samples analyzed, some occurring with greater frequency than others. The frequencies of the noun and verb homophonous words were close. In only one case there was a disparity between them: the noun *marche* [step] occurred infrequently whereas the verb *marche* [walks] occurred very frequently. The results obtained on the CDS corpus were confirmed by the frequencies of the Lexique 3.55 database (<http://www.lexique.org>, New et al., 2001, 2004) for French. This database (counting 50 million words) consists of books and movie subtitles, with the latter considered to provide a better frequency estimate for oral language than classical texts. Table 2 presents the frequencies of the homophonous words, as nouns and verbs, in both the CDS and the *Lexique* databases.

- Insert Table 2 about here -

Given that the verb version of the homophonous words was used in the experiment with only one argument (the subject as agent), we checked whether these verbs were usually used with one or with more arguments (object and/or beneficiary). The Veneziano and Parisse corpus of child-directed speech - consisting of 46,397 words – was used as

the database for this analysis. Of the nine verbs found in the corpus⁴, only *porter* (to carry) was used more often in a two argument than in a one-argument structure (3.5 times more). All the other verbs were used more frequently in a one-argument structure (one-argument structure $M = 36.6$, $SD = 35.5$; two-argument structure, $M = 7.6$, $SD = 7.12$; Wilcoxon rank sum test, $W = 13.5$, $p = .019$), which corresponds to the one used in the present study.

Results

1. Group results

1.1. Success rate: All items

Children chose the image corresponding to the requested item 74% of the time. That is, they chose the image of the object when the homophonous or nonce word was presented in a noun grammatical context, and the image of the person performing an action when the homophonous or nonce word was presented in the verb grammatical context.

No significant correlation was found between the frequency of the words in CDS and the percentage of correct responses (Kendall's rank correlation, $z = 1.28$, $p = 0.19$).

This rate of success is significantly higher than chance level (50%)⁵: $t(178) = 15.97$, $p < .001$ ⁶ ($M = 11.14$, $SD = 4.68$). This is the case also for each of the three

⁴ *rire* [to laugh], *trancher* [to slice] and *téléphoner* [to phone] were not found in this corpus

⁵ The difference was tested by comparing the subjects' scores to a theoretical sample succeeding by chance ($15 \times 0.5 = 7.5$ items).

⁶ All probabilities in the current and the following section are one-tailed.

age groups. For the 2-year-old group, $t(58) = 6.69, p < .001$ ($M = 10.16, SD = 4.76$); for the 3-year-old group: $t(58) = 9.89, p < .001$ ($M = 10.96, SD = 3.68$); for the 4-year-old group: $t(58) = 13.99, p < .001$ ($M = 12.3, SD = 3.52$).

Figure 1 shows the mean number of items correctly identified (that is, pointing to the picture of an object for items presented in noun contexts, and to the picture of an action for verb contexts), overall and by age group. The horizontal line is set at 50% of success expected by chance.

-- Insert Figure 1 about here --

1.2. Success rate: Meaningful and nonce words

Overall, children identified correctly as many meaningful homophonous words as nonce words (75% of correct identification for both) and both were identified correctly significantly more than expected by chance. The t-test, applied in the same way as above to the scores obtained for meaningful homophonous words⁷, showed that children succeeded significantly better than chance level ($M = 8.95, SD = 3.46, t(178) = 15.07, p < .001$). This was the case also for each of the three age groups. For the 2-year-olds: $t(58) = 6.67, p < .001$ ($M = 8.33, SD = 3.68$); for the 3-year-olds: $t(58) = 8.76, p < .001$ ($M = 8.67, SD = 2.78$); for the 4-year-olds: $t(58) = 12.63, p < .001$ ($M = 9.87, SD = 2.8$).

⁷ The difference was tested by comparing the subjects' scores obtained on homophonous words to a theoretical sample succeeding by chance ($12 \times 0.5 = 6$ items)

Similar results were obtained for nonce words: the success rate for nonce items was significantly better than expected by chance⁸ ($M = 2.18$, $SD = 0.53$, $t(178) = 8.92$, $p < .001$). This was the case also for each of the three age groups.: for the 2-year-olds: $t(58) = 2.30$, $p = .012$ ($M = 1.83$, $SD = 0.63$); for the 3-year-olds: $t(58) = 7.35$, $p < .001$ ($M = 2.3$, $SD = 0.35$); for the 4-year-olds: $t(58) = 7.53$, $p < .001$ ($M = 2.43$, $SD = 0.46$).

1.3. Effect of age on success rate: All items

The effect of age on the children's success rate was tested by a one-way analysis of variance. Results of the ANOVA showed a significant difference in the number of items identified correctly by the three age groups: $F(2, 87) = 6.31$, $p = .0027$. Post-hoc comparisons⁹ indicate that the 4-year-olds ($M = 12.3$, $SD = 1.88$) performed better than the 2-year-olds ($M = 10.17$, $SD = 2.18$, $p = .0002$), and 3-year-olds ($M = 10.97$, $SD = 1.92$, $p = .03$). No significant differences were found between the 2- and 3-year-olds ($p = .272$).

1.4. Effect of age on success rate: Meaningful and nonce words

Very similar results were obtained for the meaningful homophonous words considered separately. The one-way analysis of variance showed a significant difference by age: $F(2, 87) = 8.72$, $p = .00035$. The post-hoc comparisons⁹ indicate that the 4-year-olds ($M = 9.86$, $SD = 1.67$) were better than the 2-year-olds ($M =$

⁸ The difference was tested by comparing the subjects' scores obtained on nonce words to a theoretical sample succeeding by chance ($3 \times .05 = 1.5$ items)

⁹ Results of post-hoc comparisons use the Tukey's HSD criterion (with the Bonferroni adjustment of the alpha level to $.017$ for three comparisons ($0.05/3 = 0.017$))

8.33, $SD = 1.92$, $p = .003$) and 3-year-olds ($M = 8.67$, $SD = 1.67$, $p = .026$). No significant differences were found between the 2- and 3 year olds ($p = .743$).

Concerning nonce words, the one-way ANOVA again showed a significant difference among the three age groups: $F(2, 87) = 6.19$, $p = .0003$. The post-hoc comparisons⁷ indicate that 2-year-olds ($M = 1.83$, $SD = 0.79$) performed significantly less well than 4-year-olds ($M = 2.43$, $SD = 0.68$, $p = .003$) and 3-year-olds ($M = 2.3$, $SD = 0.59$, $p = .028$). No significant differences were found between the 3- and 4-year-olds ($p = .737$).

To summarize the results obtained for group analyses, children in all three age groups correctly interpreted any kind of items better than would have been expected if they were choosing the image on a chance basis. For all items, 2-year-olds succeeded less well than the older children; 3-year-olds were close to the 4-year-olds for the nonce items, but closer to the 2-year-olds for the meaningful homophonous words.

2. Individual Subjects' results

In order to better understand how each individual child performed on the entire set of items, we effectuated an analysis by subject. Individual performances will not only provide information on interindividual variation, but will also provide a much clearer picture on children's ability to correctly identify, beyond chance level, a sufficient number of minimally contrasted items where homophonous or nonce words occur in either noun or verb grammatical contexts.

2.1. All items

Setting the α level at .05, the number of total items that was needed for the set to be considered correctly identified beyond chance, was at least 12 out of the 15 items proposed¹⁰. This criterion was reached by 30% of the 2-year-olds, 33% of the 3-year-olds and 67% of the 4-year-olds (see Figure 2). The chi-square test¹¹ shows an overall age difference ($\chi^2(2, N=90) = 22.35, p = .0000012$). The post-hoc comparisons¹² show that the criterion is reached by more 4-year-olds than by 2- and 3-year-olds (4 vs. 2: $\chi^2(1, N = 60) = 6.67, p = .009$; 4 vs. 3: $\chi^2(1, N = 60) = 5.4, p = .02$). Instead, no significant difference was found between the 2- and 3-year-olds (2 vs. 3: $\chi^2(1, N = 60) = 0, p = 1.0$).

-- Insert Figure 2 about here --

¹⁰ The probability of identifying correctly 12 out of 15 items by chance is .011, with $p = q = 0.5$.

¹¹ The chi-square test was applied to a 3x2 contingency table, for 3 age levels x 2 outcomes

¹² The post-hoc comparisons were performed with 2x2 contingency tables, with the Bonferroni adjustment of the alpha level to .017 for three comparisons.

2.2. Meaningful homophonous and nonce words

The number of meaningful homophones that children needed to correctly identify was at least 10 out of the 12 items proposed¹³. This criterion was reached by 27%, 30% and 60% respectively of the 2-, 3- and 4-year-olds (see Figure 2). The chi-square test⁹ shows an overall age difference ($\chi^2 (2, N = 90) = 10.04, p = .0015$). The post-hoc comparisons¹⁰ show that the criterion is reached by more 4-year-olds than by 2-year-olds (4 vs. 2: $\chi^2 (1, N = 60) = 5.49, p = .019$) and 3-year-olds (4 vs. 3: $\chi^2 (1, N = 60) = 4.30, p = .037$). No significant difference was found between the 2- and 3-year-olds (2 vs. 3: $\chi^2 (1, N = 60) = 0, p = 1.0$).

Concerning homophonous nonce words, the correct identification of all the three items has a chance probability of .112, which is greater than the α level of .05. It is nevertheless interesting to note that the three items were correctly identified by an increasing number of children as a function of age, 17%, 37% and 57% respectively of the 2-, 3- and 4-year-olds (see Figure 2). The chi-square test⁹ shows an overall age difference ($\chi^2 (2, N = 90) = 8.82, p = .003$). The post-hoc comparisons¹⁰ show that the number of 4-year-olds who successfully identified all three nonce words is significantly greater than the number of 2-year-olds (4 vs. 2: $\chi^2 (1, N = 60) = 7.32, p = .006$). The number of 3-year-olds falls between the other

¹³ The probability of identifying correctly 10 out of 12 items by chance is .019, with $p = q = 0.5$.

two, but it is not statistically different from either group (4 vs. 3: $\chi^2(1, N = 60) = 1.07, p = .299$; 3 vs. 2: $\chi^2(1, N = 60) = 2.13, p = .14$).

3. Modality variation: A pilot study of the relation between production and comprehension.

How do these results on children's comprehension relate to children's production? Some indications come from studies of the production of *fillers* – underdetermined, mainly vocalic, elements occurring most frequently in prelexical position (e.g., Bassano, 2000; Peters & Menn, 1993; Taelman, Durieux & Gillis, 2009; Veneziano & Sinclair, 2000). It has been shown that, between 18 and 22 months, children differentiate nouns and verbs by producing fillers differently in prenominal and preverbal position contexts (Veneziano 2001, 2003), and from this age on these protomorphemes are progressively substituted by phonologically well-formed grammatical morphemes, although children still make errors of omission and of commission (that is, in the choice of the grammatical morpheme).

Thus, it might be supposed that, at least some children, might produce grammatical morphemes before they use them for comprehension purposes.

A pilot study was performed to test this hypothesis in the case study of a middle-class French-acquiring child living in a Parisian suburb¹⁴. During the videorecorded longitudinal collection of production data, where the child interacted

¹⁴ We thank Marie Collombel-Leroy et Aliyah Morgenstern for the collection of the production and comprehension data and the ANR for support.

naturally with familiar adults in her home environment, once a month she was confronted with the items of this study.

She started to produce fillers at 1;6. Until 1;10 these fillers were not produced differently in prenominal and preverbal positions. At 1;10 the types of fillers she produced in those positions started to be significantly different, with /a/, /e/, /ɔ/, and /o/, /n/ and /yn/ in prenominal position and /i/, /ɔ/ and a great proportion of /o/ in preverbal positions.

At 2;0, full-fledged grammatical morphemes increased significantly (from 16% at 1;10 to 69% of nouns and verbs together), and the errors of omission and commission decreased, particularly in noun contexts.

However it was only two months later, at 2;2 that the child correctly associated homophonous or nonce words in noun contexts with objects and homophonous or nonce words in verb contexts with actions. This occurs about four months after she started differentiating nouns from verbs with fillers, and two months after the proportional increase in full-fledged grammatical morphemes.

It might seem then that production precedes comprehension. It should however be pointed out that producing different fillers, or even phonologically well-formed grammatical morphemes in expected positions, does not require the same knowledge children need to perform correctly in our comprehension study. The differentiation of fillers and, later, of full-fledged grammatical morphemes, might rather reflect, at first, children's apprehension and memorization of surface regularities and distributional co-occurrences, instead of a clear understanding of the structural meaning of these grammatical elements.

Discussion

The aim of this study was to assess the extent to which 2- to 4-year-old children could use category-specific grammatical morphemes -- a definite article for nouns, a third person subject clitic pronoun for verbs -- to retrieve the meaning of homophonous words, that in adult language are either nouns or verbs, or of nonce words produced in noun or verb syntactic contexts. Thus if the homophone /pus/ was preceded by the definite article /lə/, it should have been identified as [the thumb]; if it was preceded by the subject clitic pronoun /il/ it should have been identified as [he pushes]. The nonce words were introduced to see whether children could identify an unknown word as having either noun or verb value as a function of the grammatical functor preceding it, and thus infer accordingly that the nonce word refers to an object or to an action.

Results show that children tended to chose the picture of an object when the homophonous or nonce word was in a noun grammatical context, and the picture of a person performing an action when the homophonous or nonce word was in a verb grammatical context. This was the case for children in the three age groups, with 4-year-olds making the right choices more often than the 2- and 3-year-olds, the last two age groups performing at about the same level.

Since children could make their choices uniquely on the basis of the category-specific grammatical functors that preceded the meaningful homophones or nonce words, it can be stated that they seem to know the structural meaning of these

grammatical morphemes and of the related noun and verb prevalent meaning associations.

This result is in agreement with the studies presented above and demonstrates, with even greater clarity, children's ability to use this grammatical information. Indeed, in this study, the same children were confronted with both noun and verb contexts and, when they made their choices correctly (beyond chance level), they revealed being able to interpret *contrastively* the two grammatical contexts.

Earlier studies using children's pointing choices provide only group results. In Bernal et al. (2007), for example, a small number of children might have been responsible for the difference found between the experimental group (where the children were confronted only with verb grammatical contexts) and the control group (where the children were confronted only with noun grammatical contexts).

To better understand the extent to which children grasp the function of category-specific grammatical morphemes, here we also assessed the individual performance of each participant in the study. In this way, we found that only 30% of the 2-year-olds correctly made at least 12/15 correct choices (the number of items needed to consider the performance beyond chance level). This percentage is close to that reported by Höhle et al. (2004), one of the very few studies where this analysis was performed. They report that only 17 of the 48 subjects aged 14-16 months (35%) showed a dishabituation response to a change from noun to verb grammatical context. In our study, developmental data indicate that the percentage of 3-year-olds who correctly identified 12/15 items (33%) is similar to that of 2-

year-olds (30%), while twice as many 4-year-olds (67%) reach the criterion. Children who correctly identified this many items may be thought to already have a good grasp of the distinctive significance of the grammatical functors that distinguish nouns from verbs. But, as we have seen, the proportion of children who can do it, is not very high until four years of age.

What about the children who do not reach the criterion? Children do not seem to respond on a random basis, since most of them inspect the two images before pointing. Some of these children may use the immediately preceding syntactic context to attribute noun or verb meaning to the content words but their knowledge may not be as yet sufficiently abstract to be easily generalized.

The results of the individual profiles point to important interindividual variation in this capacity, particularly at the earlier ages, a variation that needs to be seriously taken into account for a finer-tuned understanding of development, and that can reveal itself essential in predicting later outcomes in language proficiency, with implications for the efficient planification of intervention studies

Although children seem to differentiate nouns from verbs in production before they succeed in our comprehension task, it can be argued that the former does not require the same knowledge as the latter. While the early differentiation found in production might rely on children's treatment of surface regularities and distributional co-occurrences of the input, the systematic correct interpretations of the minimally contrasted noun and verb contexts require a higher order understanding of the structural meaning of grammatical morphemes.

Further research effectuated with this paradigm, should use a greater number of nonce words to test more stringently the capacity of individual children to identify novel words as either nouns or verbs on the basis of their syntactic context and to attribute to them object or action meaning accordingly.

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Table 1: The 15 items used in the study, divided into homophonous and nonce words, and listed in alphabetical order within each

Homophones	Noun context	Phonetics	English meaning	Verb context	Phonetics	English meaning
Aleatory homophones						
/lɔ̃bwa/	le bois	/lɔ̃ bwa/	the wood (pieces of)	elle boit	/il bwa/	she drinks
/kɔ̃ʁ/	la cour	/la kɔ̃ʁ/	the courtyard	il court	/il kɔ̃ʁ/	he runs
/fɛ̃ʁm/	la ferme	/la fɛ̃ʁm/	the farm	elle ferme	/ɛl fɛ̃ʁm/	she closes
/ʒu/	la joue	/la ʒu/	the cheek	ils jouent	/il ʒu/	they play
/li/	le lit	/lɔ̃ li/	the bed	elle lit	/ɛl li/	she reads
/mɑ̃ʁʃ/	les marches	/la mɑ̃ʁʃ/	the steps	ils marchent	/il mɑ̃ʁʃ/	they walk
/mɔ̃ʁ/	la montre	/la mɔ̃ʁ/	the watch	elle montre	/ɛl mɔ̃ʁ/	she shows
/pɔ̃ʁt/	la porte	/la pɔ̃ʁt/	the door	il porte	/il pɔ̃ʁt/	he carries
/pus/	le pouce	/lɔ̃ pus/	the thumb	il pousse	/il pus/	he pushes
/ʁi/	le riz	/lɔ̃ ʁi/	the rice	elle rit	/ɛl ʁi/	she laughs
/tɛlɛfɔ̃n/	le téléphone	/lɔ̃ tɛlɛfɔ̃n/	the telephone	il téléphone	/il tɛlɛfɔ̃n/	he telephones
/trɑ̃ʃ/	la tranche	/la trɑ̃ʃ/	the slice	elle tranche	/ɛl trɑ̃ʃ/	she slices
Nonce words						
/ʃim/	la chime	/la ʃim/		elle chime	/ɛl ʃim/	
/dav/	le dave	/lɔ̃ dav/		elle dave	/il dav/	
/got/	la gotte	/la got/		elle gotte	/ɛl got/	

Table 2: Frequencies of the homophonous words used in the test items, in their noun and verb uses, in two kinds of databases: Child-directed Speech and Movie subtitles^a

Word category	orthographic form	phonological form	CDS raw frequency	Subtitles frequency
Noun	ferme (farm)	/fɛʁm/	105	73.53
Verb	fermer (close)		258	48.85
Noun	joue (cheek)	/ʒu/	105	25.57
Verb	jouer (play)		623	225.84
Noun	marche (step)	/mɑʁʃ/	65	46.61
Verb	marcher (walk)		547	85.34
Noun	cour (courtyard)	/kuʁ/	24	71.8
Verb	courir (run)		131	47.19
Noun	lit (bed)	/li/	443	176.1
Verb	lire (read)		202	89.58
Noun	porte (door)	/pɔʁt/	381	288.39
Verb	porter (carry)		98	79.04
Noun	bois (wood)	/bwa/	126	115.56
Verb	boire (drink)		214	142.15
Noun	pouce (thumb)	/pus/	67	11.89
Verb	pousser (push)		235	27.51
Noun	riz (rice)	/ʁi/	27	18.49
Verb	rire (laugh)		30	63.29
Noun	montre (watch)	/mɔ̃tʁ/	381	43.91
Verb	montrer (show)		582	136.2
Noun	tranche (slice)	/tʁɑ̃ʃ/	11	5.28
Verb	trancher (slice)		0	3.88
Noun	téléphone (telephone)	/telefon/	131	155.68
Verb	téléphoner (phone)		34	20.22

^aFrequencies correspond to words per million of occurrences. The correlation between the Subtitles and the CDS database is significant, $r = .63$, $t(22) = 3.88$, $p = .0008$. The only notable differences between Subtitles and CDS are the opposite frequencies of ‘ferme’ as a noun (farm) and as a verb (close), that ‘rire’ as verb (laugh) is less frequent, and that ‘tranche’ as verb (slice) is not found in the CDS database. The average frequencies are higher for CDS ($M = 200$ /million, $SD = 191$ /million) than for Subtitles ($M = 107$ /million, $SD = 120$ /million), suggesting that the words used in our experiment are likely to be heard by the children.

Figure 1: Mean number of items correctly interpreted, overall and by age group (the horizontal line is set at the 50% chance level)

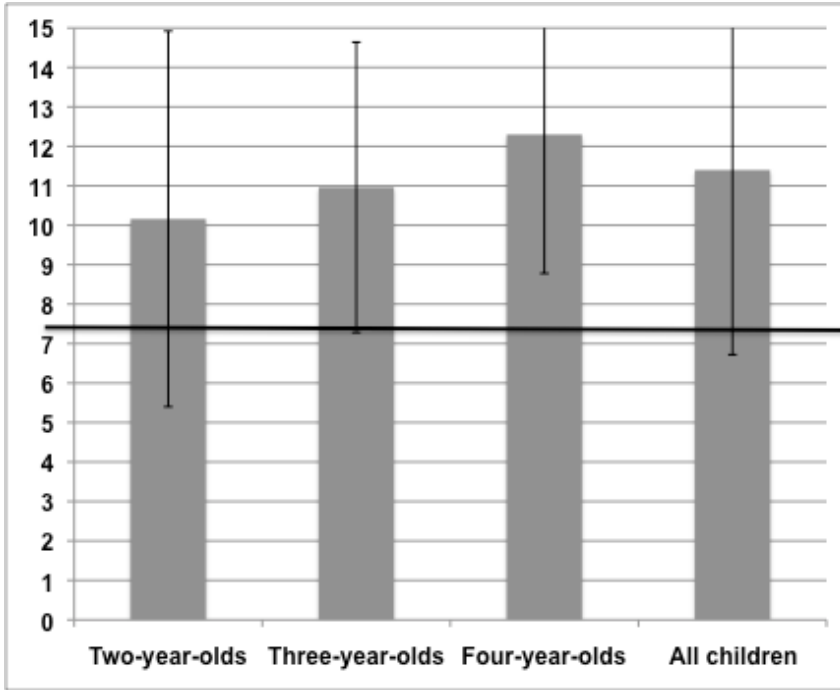
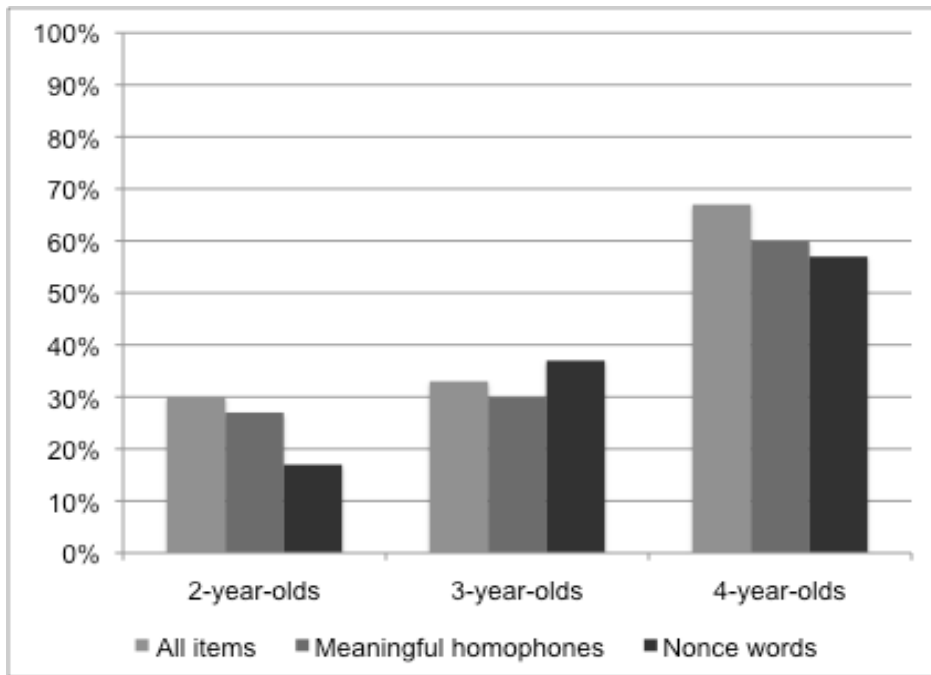


Figure 2: Percentage of children correctly interpreting, beyond chance level, all words, meaningful homophones, and nonce words, by age.



Annexe 1: Examples of screen display for the items presented to the children

a) Choice for /li/ ('bed/read') : *on the left* when presented in noun frame (*le lit* 'the bed') ; on the right when presented in verb frame (*elle lit* 'she reads')



b) Choice for nonce word /ʃim/: *on the left* when presented in noun frame (*la chime*) ; on the right when presented in verb frame (*elle chime*)

