The comprehension of simple sentences. Ontogenesis of modes of processing in French

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Studies and research

The comprehension of simple sentences: ontogenesis of modes of processing in French

J. P. BRONCKART, M. GENNARI and G. DE WECK

Abstract

The present study investigated 252 French-speaking children aged 3.6 to 10.5 years of age, divided into seven age groups of 36 subjects each. Using the classical comprehension paradigm, children were asked to act out 18 sentences which had a specific propositional content. Sentences expressed reversible or non-reversible events, were in the standard, emphatic or pronominal form and in the active or passive voice. The analysis of data enabled us to distinguish the extraction of cues from the utilization or relevant processing of these cues. Pragmatic processing is observed in four-year-old children, morphosyntactic processing appears between six and ten years of age. Positional processing is less frequent than anticipated; it is observed in six-year-old children and exclusively when morphosyntactic processing is not efficient. Few individual strategies of comprehension were evidenced; half of the subjects consistently exploited pragmatic cues, ten per cent of the subjects exploited morphosyntactic cues, and no positional strategy was observed.

Introduction

In a previous paper in this journal (‘The representative perspective and the communicative perspective’, hence referred to as RPCP) we proposed a synthesis of presently available data concerning the comprehension of simple sentences; we also underlined some of the questions that are raised by the interpretation and the status of the data obtained experimentally. The experimental work that will be presented here pursued three main aims: (1) to support previous results obtained on French language, using
optimal methodological conditions; (2) to refine the analysis and interpretation of comprehension procedures; (3) to interpret the data within the frame of reference presented in RPCP.

(1) Concerning the methodological level, given the importance of inter-individual differences in language acquisition, it seemed to us indispensable to test a significantly greater number of subjects than in the original experiments (Sinclair and Ferreiro, 1970; Sinclair and Bronckart, 1972; Bronckart, 1979). We also aimed at controlling more systematically the role of the order of items and above all the possible influence of the meaning of each sentence (cf. on this issue Hupet’s criticism, 1983).

(2) Among the numerous problems of interpretation mentioned in RPCP, we shall first expand on the problem of the definition of procedures evidenced experimentally; are they authentic strategies, i.e. rules internalized at the individual level or are they modes of processing, i.e. procedures that are dominant at a given age? We shall attempt to answer this question as far as the comprehension of simple sentences in French is concerned. We shall also try to distinguish more clearly two phases in each procedure: the extraction of cues, and the utilisation of the extracted cues. Indeed a variation of pragmatic, positional or morphosyntactic information available in the utterance may result in a change in subject’s responses; this point concerns the extraction of cues, which does not necessarily correspond to a ‘correct’ comprehension of the utterance. The comprehension of an utterance depends in fact on the interpretation or the processing of the cue itself, i.e. on the adoption of an adequate system of reference. Distinguishing these two phases should enable us to handle more efficiently the problem of morphosyntactic processing; the emergence of morphosyntactic processing in French was described either as rather late in development (Bronckart et al., 1976; Noizet, 1977) or, on the contrary, as rather precocious (Vion, 1980); but it is not always possible to find out on which phase the author’s interpretation is based. Concerning positional processing, the major question refers to the system of interpretation adopted by children; is the law ‘N₁ = agent’ induced from observed regularities in the surface structure or does it result from the application of a perceptual and cognitive law, in Bever’s (1970) or Segalowitz and Galang’s (1978) acception?

(3) Our work refers to the representative or referential perspective, the limits of which were underlined in RPCP. It is legitimate only to the extent that it refers to a more global approach of language in which clauses (or sentences) are studied in relation to communicative and textual strategies (cf. on this issue Bronckart and Schneuwly, in press). Furthermore it can be interpreted only to the extent that the four levels of analysis mentioned elsewhere (see Bronckart, 1982, 1983, as well as RPCP) are distinguished. More concretely, the utterances used in our experimental work belong to level 4; they contain potential cues of the surface structure that are controlled experimentally, thus forming the independent variables. Subject’s behavior in response to these utterances belongs to level 1; it corresponds to actions of varying complexity, the physical characteristics of which may be enumerated. The description and classification of these actions is a cognitive operation and, consequently, it belongs to level 2. Interpreting and explaining the various behaviors is possible if the two phases suggested above are distinguished: the identification of the extracted cues and the identification of the adopted system of reference. Concerning this last problem, the question is to determine whether the system is cognitive (level 2) or, on the contrary, linguistic (level 3).

Nevertheless, it is clear that a refined analysis of the linguistic level requires comparative experiments (cf. Bronckart and Idiazabal, 1982).

Experimental approach

Subjects

The subjects, numbering 252, attending nursery and primary schools in Geneva, were tested. They were divided into seven age groups:

Group I: 3;6 to 4;5 median age: 4, 36 subjects.
Group II: 4;6 to 5;5 median age: 5, 36 subjects.
Experimental procedure

The child is seated at a table on which 32 different toys are displayed. Once the experimenter has checked that the child knows the name of each toy, he gives the following instruction: 'I'm going to tell you a little story; you will listen to it carefully and you will do with the toys exactly what the story tells'. The experimenter then gives three training items:

- Le chien saute (the dog jumps);
- Le monsieur marche (the man walks);
- Le singe prend la boîte (the monkey takes the box).

If the child succeeds with the three items, he is given the 18 experimental items.

Experimental items

Eighteen propositional contents (PC) were selected, i.e. 18 sets of two nouns and a verb presented in sentences of different forms (see below). In the active form the 18 PC were as follows:

PC1: le singe pousse le ballon (the monkey pushes the ball).
PC2: le garçon prend le bol (the boy takes the bowl).
PC3: la maman lave l'assiette (the mother washes the plate).
PC4: le fermier nettoie le tracteur (the farmer cleans the tractor).
PC5: la maîtresse ouvre la boîte (the teacher opens the box).
PC6: la fille renverse la bouteille (the girl spills the bottle).
PC7: le monsieur pousse le pompier (the man pushes the fireman).
PC8: le marin bat le gendarme (the sailor hits the policeman).

PC9: la chienne caresse la chatte (the dog pets the cat).
PC10: le tracteur renverse le camion (the tractor overthrows the truck).
PC11: la lionne mord la girafe (the lion bites the giraffe).
PC12: le policier bouscule le voleur (the policeman jostles the thief).
PC13: le pompier pousse le monsieur (the fireman pushes the man).
PC14: le gendarme bat le marin (the policeman hits the sailor).
PC15: la chatte caresse la chienne (the cat pets the dog).
PC16: le camion renverse le tracteur (the truck overthrows the tractor).
PC17: la girafe mord la lionne (the giraffe bites the lion).
PC18: le voleur bouscule le policier (the thief jostles the policeman).

As can be seen, events expressed in utterances PC1 to PC6 are not reversible (NR), whereas in utterances PC7 to PC18 they are reversible, the order of nouns being alternated: Ra from PC7 to PC12 and Rb from PC13 to PC18. Each of these propositional contents was presented under six different sentence forms: active NVV (S₁a), also called standard sentence; passive NVV (S₁p) or simple passive; active NNV (S₂a), called emphatic active; passive NNV (S₂p) called emphatic passive; active VNN (S₃a): it is preceded by a pronoun and for this reason it is called pronominal active; passive VNN (S₃p) called pronominal passive. Taking PC1 as an example, the six different sentence forms were as follows:

S₁a: le singe pousse le ballon.
S₁b: le ballon est poussé par le singe.
S₂a: c'est le ballon que le singe pousse.
S₂b: c'est par le singe que le ballon est poussé.
S₃a: il pousse le ballon, le singe.*
S₃b: il est poussé par le singe, le ballon.*

(*These forms are quite frequent in spoken French.)

Three categories of factors were controlled experimentally: the reversibility of events (NR, Ra or Rb), the sentence structure (S₁, S₂ or S₃) and the voice (a or p).
Experimental design

For each age-group, six subgroups were constituted in order to present, within a same subcategory of reversibility each of the six propositional contents under the six possible forms. Table 1 presents the experimental design for Ra subcategory.

Within each subgroup three pairs of subjects were given the experimental items in three different random orders.

Table 1. Example of the distribution of sentence forms for the subcategory of reversibility $R_a$

<table>
<thead>
<tr>
<th>Subgroups of subjects</th>
<th>Propositional contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>$S_{1a}$</td>
</tr>
<tr>
<td>b</td>
<td>$S_{1p}$</td>
</tr>
<tr>
<td>c</td>
<td>$S_{2a}$</td>
</tr>
<tr>
<td>d</td>
<td>$S_{2p}$</td>
</tr>
<tr>
<td>e</td>
<td>$S_{3a}$</td>
</tr>
<tr>
<td>f</td>
<td>$S_{3p}$</td>
</tr>
</tbody>
</table>

Results

Categories of responses

The different types of behavior in response to the experimental items were grouped into six categories:

$R_1$: the first noun in the sentence is interpreted as the agent, the second as the patient.

$R_2$: the first noun in the sentence is interpreted as the patient, the second as the agent.

$R_3$: reciprocal action: each of the two nouns is taken alternately as the agent and the patient.

$R_4$: 'X-agent': the subject performs himself the action expressed by the verb, using one noun or the two nouns as patient(s).

$R_5$: under this category are grouped two forms of 'primary' responses: simple designation ($R_4$) and execution of an intransitive action involving one or two nouns ($R_5$).

$R_6$: no action is performed (no response).

The frequency of $R_3$, $R_4$, $R_5$ and $R_6$ being very low, especially in the oldest age-groups, these types of responses were in most cases grouped under a supercategory $R_n$.

Methodological controls

Subgroup influence. This control had two aims: to check whether the response distribution did not depend on variations of the combinations of propositional content and sentence type and to see whether there were no effect of the order of items. For each age-group, we plotted the distribution of response categories against each subgroup and computed a $X^2$ and a coefficient of contingency. None of the statistical tests enabled us to reject the null hypothesis ($C$ varies from 0.04 to 0.12 and for $X^2 P > 0.05$). Consequently, we consider that the distribution of responses does not depend on the fact that subjects belong to a particular subgroup.

Influence of propositional content. For each reversibility categories, we plotted the distribution of response categories against the PC and computed a $X^2$ and a coefficient of contingency. Concerning non-reversible events, no statistical test enabled us to reject the null hypothesis ($C$ varies from 0.04 to 0.11). On the other hand, concerning $R_{as}$, the statistical analysis yielded significant results for group I (4 year olds), the distribution of responses to PC11 being significantly different from the distribution of responses to other PCs. When all PCs but PC11 were taken into account, the statistical analysis did not yield significant differences. Consequently, data concerning responses to PC11 in Group I were not included in the analysis. For all other age-groups
with $R_a$ and $R_b$ events, the statistical analysis did not yield significant differences ($C$ varies from 0.07 to 0.20 and for $X^2 P > 0.05$). Consequently, with the exception of Group I with PC11, the distribution of responses does not depend on the variations of propositional content.

Finally, it should be noted that, with the exception of the contrast between PC11 and PC17 in Group I, the distribution of responses in $R_a$ may be considered as similar to the distribution of responses in $R_b$, the change in the order of the two nouns having no influence.

**Processing of the different sentence forms**

For each of the six sentence forms, there is only one response corresponding to 'correct' comprehension: $R_1$ for $S_1a$, $S_2p$ and $S_3p$ forms, $R_2$ for $S_1p$, $S_2a$ and $S_3a$ forms. We consider that 'a form is acquired' when at a given age about 80% subjects produce the correct response. Errors may consist of an inverse transitive response ($R_1$ which corresponds to $R_3$ and $R_4$, depending on the type of utterance) or one of the four other responses ($R_5$ to $R_8$).

**Non-reversible events (NR).** Out of the 1,512 responses obtained, 1,324 (87%) were correct; comprehension of this category of sentence did not raise problems; it should be noted, however, that performance increases regularly with age (from 76% in four-year-olds to 96% in ten-year-olds), that comprehension of active sentences is significantly better than comprehension of passive ones, and that NVN ($S_1$) structure is easier than NNV ($S_2$) and VNN ($S_3$) structures.

As shown in Figure 1, simple active sentences ($S_1a$) are quite well understood even by the youngest. Simple passive sentences ($S_1p$) on the other hand are mastered only from Group III on. Four- and five-year-old children make significantly more errors with passive than with active sentences. The development of comprehension of emphatic active and passive sentences ($S_2a$ and $S_2p$) is similar; after poor performance (about 65%) at four and five years of age, comprehension is correct at six years of age.
particularly numerous in the first two age-groups. The frequency of the three other types of error is extremely low (12 inverse responses, two reciprocal responses and 14 no responses). It should be noted, however, that all these errors are observed in response to passive sentences and this fact accounts for the difference in the processing of active and passive sentences.

When sentences express a non-reversible event, the six types of sentence are understood as early as six years of age. Before that age, in most cases comprehension is correct but the five types of 'nonstandard' sentence elicit incomplete processing ($R_4$ and $R_5$).

Table 2. Non-reversible events: distribution of errors in active and passive sentences

<table>
<thead>
<tr>
<th></th>
<th>$R_4$</th>
<th>$R_5$</th>
<th>$R_X$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actives</td>
<td>45</td>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>Passives</td>
<td>58</td>
<td>35</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>61</td>
<td>24</td>
</tr>
</tbody>
</table>
Errors consisting of an inversion are extremely infrequent, and occur only with passive sentences.

Reversible events (R). Following methodological controls, 2,952 sentences were taken into consideration; they elicited 2,019 correct responses (68%), 543 inverse responses (19%) and 390 miscellaneous responses (13%). In general terms, sentences expressing reversible events raise more problems than sentences referring to non-reversible events.

The increase in performance with age is clear and significant. Three levels of development may be distinguished: four- and five-year-old children give few correct responses (48% and 49% respectively); at six, seven, and eight years of age the percentage of correct responses is 71% and it is only in the oldest age-group that comprehension of this type of sentence is acquired.

Concerning the type of structure, NVN (S₁) sentences give rise to a better comprehension than NNV (S₂) and VNN (S₃) structures. Finally, concerning the voice, it is very surprising to find that performance with passive sentences is higher than active sentences (X² significant at P > 0.01).

Inversion of agent and patient when the action is transitive (R₄) constitutes the main type of error (58%).

Table 3 presents the distribution of the five categories of error for each sentence type.

It can be seen that the results for the standard sentence (S₁a) are very different from the others; the number of R₄ responses is much lower than the number of R₆. It should also be noted that two-thirds of the X-agent responses are elicited by the two pronominal sentences (S₃a and S₃p). The number of errors decreases with age, but the amount of decrease differs in R₁ and R₆. R₆ are the most frequent errors at four and five years of age, and then decrease from six years of age on. From four to five years of age there are less R₁ than R₆; at six years of age, R₁ have a maximal frequency and remain quite frequent until nine years of age.

These general results reveal only a general tendency, each type of sentence giving rise to a particular response configuration and a specific development, as can be seen in Figures 2, 3, and 4.
Simple passive sentences ($S_1p$). As can be seen in Figure 2(b), only 50% children aged four and five years interpret this sentence properly (38% and 49% correct responses, respectively). As early as six years of age, the amount of correct responses is 80%, but up to ten years of age, there remains a fairly consequent number of errors. More than half of the errors consist of inversions of agent and patient ($R_i$); such errors are observed in all age-groups and decrease linearly with age. Other types of errors consist of simple designations ($R_s$) and reciprocal actions ($R_3$); they are observed mainly in children aged four, five and seven years. It should be emphasized that in each age-group the number of correct responses is higher than the number of errors consisting of an inversion of agent and patient.

Standard sentences ($S_1a$). Figure 2a presents the development of correct responses, inverse responses and other types of responses ($R_n$) for each age-group. Even though younger children give two-thirds transitive correct responses, full comprehension is established only in Group III (5.6 to 6.5 years of age). A third type of error consists of $R_i$; they are observed mainly in children aged 3.6 to 5.5 years. The two other types of error consist of responses of designation which are frequent before six years of age, and of reciprocal responses which are found from four to eight years of age.
Errors consisting of a simple designation and no response (R₁₅ and R₆) are mainly observed in four to seven-year-old children and reciprocal responses are still observed in nine-year-old children.

Emphatic passive sentences (S₃p). As can be seen in Figure 3, comprehension of this type of sentence is easier than the corresponding active sentence (S₃a). Children aged four and five give 50% correct responses; at six years of age performance is fairly good (74%) and full comprehension is reached at eight years of age (82%). With the exception of Group II (five-year-olds), the number of correct responses is always higher than the number of

Active emphatic sentences (S₃a). This sentence type is the most difficult for children. As can be seen in Figure 3 it is only from 9½ years of age on that the percentage of correct responses is satisfactory (78% correct responses). The increase in correct responses from four years of age (25%) to nine years of age (55%) is linear and the increase in performance is significant. Concerning errors, inverse responses are clearly dominant (70% of errors); in spite of its frequency, this type of response is always lower than the amount of correct responses, with the exception of Group 1.
errors. Among errors, inverse responses are dominant (59%); they are observed in all age-groups and decrease linearly. \( R_n \) are observed only from four to seven years of age; the four types of errors occur at four and five years of age, while only errors consisting of simple designation and reciprocal actions are observed in six- and seven-year-old children.

- **Pronominal active sentences (S\(_3\)a).** The development of response categories with age is much less clear than it is with simple and emphatic sentences. As can be seen in Figure 4(a), the development of correct responses is irregular; while there is an increase in the number of correct responses from four to six years of age (43\% and 68\%, respectively), there is a decrease at seven and eight years of age (60\% and 49\%, respectively); finally, there is an increase at nine years of age where comprehension seems to be acquired (91\%); however, in ten-year-old children again there is a decrease (67\%). These variations cannot be accounted for by inverse responses since the amount of such responses is stable from four to eight years of age (about 25\% of the whole number of errors); other types of errors (\( R_n \)) are in covariation with correct responses; they increase when correct responses decrease, and conversely. The four categories of \( R_n \) are observed in four- and five-year-old children but responses of designation (\( R_s \)) and no response (\( R_d \)) are dominant. Reciprocals are still observed in nine-year-old children, the maximal frequency occurring between five and seven years of age. Finally, X-agent responses which are rather infrequent when other types of sentences are concerned are rather frequent in the present case (20\% of the total number of responses) in children aged eight to ten years.

It should be underlined that \( S_3 \) sentences raise a particular problem since they introduce a pronoun ('he' or 'she' before the VNN sequence). Children have to search for the pronoun referent, and this search leads them to find it outside the sentence itself, which explains the frequency of X-agent responses. With this type of sentence, one might distinguish errors related to pronominalization (X-agent) from those due to the VNN structure (all other types of errors, \( R_i \) errors included). Such an analysis reveals that the difficulty of the VNN structure is solved progressively, performance being good at eight years of age. Surprisingly, problems due to pronominalization are solved only by nine-year-old children.

- **Pronominal passive sentences (S\(_3\)p).** As can be seen in Figure 4b, the increase in correct responses is more regular for this type of sentence than for the corresponding active form (S\(_3\)a); the best
performance is observed in children aged nine years (82%), and at ten years of age, there is also a decrease as for the pronominal active sentence. Errors consisting of an inversion of patient and agent are always less frequent than correct responses; they represent 30% of the total of responses at four and six years of age and 15% from seven to ten years of age. Other types of errors (R_a) are rather infrequent (14% of the total number of responses); the four types of errors are observed in the youngest children, and reciprocal errors are observed up to seven years of age. As for the preceding type of sentence, X-agent errors are observed in seven-, eight- and ten-year-old children; in the same age-groups, intransitive responses (R_b) in which the agent is an element external to the sentence are observed. No doubt the two last types of error are related to the problem of pronominalization.

If two types of error are distinguished, as in the case of pronominal active sentences, a linear improvement in solving passive VNN structures is observed; mean performance is better and comprehension occurs earlier (78% at seven years of age) than with active VNN sentences. Problems related to pronominalization are solved only by children aged nine; X-agent responses and intransitive responses reflect the difficulties experienced by children aged seven, eight and ten.

Modes of sentence processing in children

Three categories of independent variables were introduced in our experiment: reversibility, sentence structure and voice. Among the three types of reversibility used here (NR, R_a and R_b), only the contrast NR/R is relevant and is the origin of pragmatic cues. The three types of structure (NVN, NNV and VNN) put into play positional cues on the one hand (nouns are presented in a certain order and their proximity to the verb varies) and morphosyntactic cues on the other hand: cues of emphasis (emp) for the NNV structure ('it is he or she ... who') and cues of pronominalization (pro) for the VNN structure ('He or she'). Finally, the voice is expressed by two types of morphosyntactic cues: Ø for the active voice, and the combination PASSIVE VERBAL FORM + 'BY' for the passive voice (p). We shall propose a synthesis of the data analyzed by distinguishing the processing of each of these categories of cues.

Pragmatic processing. From four and up to ten years of age, the distribution of responses is significantly different for reversible and non-reversible events; the simple apprehension of the propositional content leads the child to distinguish these two categories of event. Concerning the extraction of cues, it is as though the child attributed to one of the two nouns a higher degree of 'agentivity'. It is the exploitation of this 'agentivity' which defines the pragmatic processing itself. This type of processing is dominant at four and five years of age and explains the good performance in four- and five-year-old children with NR sentences; it becomes systematic from six years of age on.

Morphosyntactic processing. Comparing the results obtained when two sentences differ only by a single morphosyntactic mark enables us to determine at which age the potential cue that this mark represents is extracted by the child. The p cue (passivation) is the only element which differentiates the standard sentence (S_1a) from the simple passive sentence (S_1p); since the distribution of the three categories of response already differs significantly for these two sentences in children aged four years and in all age-groups one can conclude that the p cue is apprehended by all subjects. The emp (emphasis) cue is the only element which differentiates the standard sentence from the active emphatic sentence (S_2a); in all age-groups, the distribution of responses differs significantly and it can be then concluded that this cue is also apprehended from four years of age. The comparison of standard sentence and pronominal active sentence (S_3a) leads to an analogous conclusion concerning the pro cue which already has a significant influence on the responses in four-year-old children.

Since morphosyntactic cues are extracted at an early age, by four years of age, the way children utilize these cues should be analyzed by examining the percentage of correct responses in each age group. The results obtained with simple passive sentences clearly show that it is only from six years of age on that children
are capable of interpreting accurately the *p* cue. Results with emphatic active sentences reveal that the *emp* cue is processed properly only after 9.6 years of age. Finally, concerning the *pro* cue, the results for pronominal active sentences reveal the existence of two phases in the processing: as early as eight years of age, children fully understand the relation verb-object, as evidenced by the high amount (about 80%) of correct responses and of responses falling into the 'X-agent' category. But the problem of the relation between the pronoun and \( N_2 \) is not totally solved by 10 years of age. Therefore the *p* cue would be already interpreted adequately by 5.6-year-old children, the *emp* cue would be understood from 9.6 years of age up, and the *pro* cue only after 10.5 years of age.

At this point, it should be noted that when *p* and *emp* cues are combined, which characterizes the emphatic passive sentence, children as young as six years of age have a good comprehension. Since the emphatic active sentence is understood at only ten years of age, one might conclude that adding the *p* cue to the emphasis greatly improves comprehension. An analogous phenomenon occurs with pronominal passive sentences. The relation verb-subject is properly interpreted by six-year-old children, their responses being correct or intransitive, and the problem of the relation between the pronoun and \( N_2 \) is solved properly by eight-year-old children. Adding the *p* cue to pronominalization seems also to improve performance. We shall see that the improvement of performance is accounted for by positional processing.

**Positional processing.** Our investigation did not involve any condition enabling us to test the apprehension of positional cues. But in previous studies (see Sinclair and Bronckart, 1972) we gave evidence of the apprehension of these cues; concerning NNV and VVN structures, 71% of inversion errors consisted of attributing the function of agent to the noun coming first. Consequently, it can be considered that children as young as four years of age take into account the position of nouns and that the dominant utilization of this cue conforms to the rule ‘\( N_1 = \text{agent} \)’. The question is then to know the power of this rule.

Let us compare the results for \( S_{1a} \) and \( S_{1p} \). In all age-groups the distribution of responses differs significantly, especially concerning the frequency of responses in which the first noun is given the status of agent; the utilization of the positional cue is then far from being general, and in no age-group is the law ‘\( N_1 = \text{agent} \)’ imperative. Regarding the simple passive sentence \( (S_{2p}) \), the morphosyntactic *p* cue is poorly interpreted by the majority of four- and five-year-old children, but, however, correct responses are always more frequent than responses involving an inversion (\( N_1 = \text{agent} \)); inversion errors represent only 50% of total errors. However it should be noted that by six years of age, the age at which comprehension becomes established, all errors (the percentage of which is 20%) are due to the application of the positional rule. Regarding the \( S_{2a} \) sentence type, we have seen that the morphosyntactic *emp* cue was used properly only from ten years of age on. The analysis of errors enables us to distinguish very clearly two phases in the development: in four- and five-year-old children \( R_n \) and \( R_1 \) responses (\( N_1 = \text{agent} \)) have a similar frequency, in six-, seven-, eight- and nine-year-old children, on the contrary, \( R_1 \) positional errors are dominant and account for the poor performance.

In the same age-groups, it is the application of the rule \( N_1 = \text{agent} \) that explains the better performance with \( S_{2p} \) rather than a hypothetical positive effect of the combination of *p* and *emp* cues.

Positional cues are utilized quite similarly in the case of pronominal sentences but the problems related to pronominal coreference make the analysis more complex. For sentences \( S_{3a} \) and \( S_{3p} \), \( R_n \) and \( R_1 \) responses have the same frequency. From six years of age on, errors which are not due to difficulties in finding the coreferent consist mainly of attributing the status of agent to \( N_1 \), which accounts for the fact that the relation between the verb and \( N_1 \) is interpreted properly by seven-year-old children in the case of passive sentences \( (S_{3p}) \) whereas the same relation is not yet understood by 8-year-old children in the case of active sentences \( (S_{3a}) \).

It follows from this analysis that positional processing is already present but not dominant in four- and five-year-old children; from six years of age on, it constitutes the main source of errors and interferes with morphosyntactic processing. In the case of simple
passive sentences, the intervention of the positional rule has no effect since it is also by six years of age that the morphosyntactic p cue is properly interpreted by most children. In the case of pronominal sentences, the positional rule runs against the processing of the pro cue up to eight years of age, and in the case of emphatic sentences the effect of the positional rule is observed until ten years of age.

Comprehension strategies

As underscored in RPCP, comprehension strategies are defined by the rule underlying a subject's behavior and consist of applying the same processing to all utterances.

If it is considered — as it was above — that pragmatic processing is characterized by the exploitation of a more marked agentivity of one of the noun phrases in the sentence, the pragmatic strategy would be attested only in responses to non-reversible sentences. As shown in Table 4, such a strategy was observed in 140 subjects (55%); furthermore, there is an increase with age, since 25% of children are consistent at four and five years of age, 50% of children are so at six and seven years of age, and 75% of children are so at eight and ten years of age.

Applying an integral morphosyntactic strategy would imply a successful comprehension of all 18 sentences. Only 26 subjects may be considered as having adopted this strategy and, as can be seen in Table 4, 19 out of them are nine or ten years old.

If reversible sentences only are considered, the notion of positional strategy implies that a same subject applies the same rule to the 12 experimental items, be it an order rule (N1 = agent) or a proximity rule (the noun nearest to the verb is the agent). No such regularity was observed, which means that none of the 252 children applied the same positional rule to the three types of \( S_1 \), \( S_2 \) and \( S_3 \) structures. Consequently, no positional strategy is found and furthermore Table 4 shows that only few children process in a systematic way the four occurrences of \( S_1 \), \( S_2 \) and \( S_3 \). Only 10% of subjects decode the four NNV (\( S_2 \)) sentences by attributing the status of agent to the first noun.

<table>
<thead>
<tr>
<th></th>
<th>PRAGMATIC</th>
<th>POSITIONAL</th>
<th>MORPHO-SYNTACTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( S_1 )</td>
<td>( S_2 )</td>
<td>( S_3 )</td>
</tr>
<tr>
<td>I</td>
<td>9</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>21</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>19</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>26</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>VI</td>
<td>32</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>VII</td>
<td>28</td>
<td>1</td>
<td>3</td>
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<td>T</td>
<td>140</td>
<td>5</td>
<td>26</td>
</tr>
</tbody>
</table>

With the exception of pragmatic strategies which are observed in all age groups and are frequent from six years of age on, it does not seem that the notion of strategy may characterize the processes involved in the comprehension of simple sentences; there is no evidence of positional strategy; morphosyntactic strategies are infrequent and observed very late in development.

Discussion

The first aim of the present study was methodological: we wanted to work on a representative sample and control that responses did not depend on uncontrolled variables such as propositional content or item order. This goal was reached.

The second aim concerned the interpretation of data. It has been possible to discriminate very clearly the extraction of cues and the processing itself. The three forms of cue extraction are precocious and it can be said that at four years of age children take into consideration the agentivity of nouns, their position and other morphosyntactic cues in the sentence. It seems that the utilization of these pragmatic cues is immediate (as early as four years of age in our study), the utilization of morphosyntactic cues being observed between six and ten years of age (see supra). Positional cues are partially exploited from six years of age on only, when other morphosyntactic marks are not properly interpreted.
With the exception of pragmatic procedures, what is observed is dominant procedures in a given age-group, and these procedures are not systematic and not 'internalized' by children.

Within the theoretical framework outlined in RPCP, it should be noted that the extraction of cues in the sentence (level 4) does not raise problems from 3.6 years of age. Concerning the system of reference adopted in the exploitation of cues, it should be mentioned that empirical knowledge of events (level 2, cognitive) is a system which is already available to children aged 3.6 years and that it is generally efficient by this age; this system becomes totally efficient by six years of age. The knowledge of the functional meaning of morphosyntactic marks characterizing a language (level 3) constitutes a system that can be utilized only from six years of age on, and even in children aged ten years it is not yet totally efficient. Concerning positional processing, it should be noted that it is established at the same time as morphosyntactic processing and that in some way the two types of processing are concurrent. In order to determine whether the nature of the system of reference is cognitive (perceptual laws) or linguistic (induction of regularities), comparative studies would have to be examined.

References


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