Children's interpretation of referential ambiguities and pragmatic inference*

SERGE BREDART
University of Liège

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ABSTRACT

The verbal responses of 22 second graders, 24 fourth graders and 22 sixth graders to ambiguous and clear messages were recorded. Children's referential choices were analysed. After the ambiguous messages, children (from the age of seven years) chose preferentially a referent with only the feature described in the message rather than a referent with this feature plus another one. The results support the Jackson & Jacobs' hypothesis (1982) that children use an interpretative strategy based on a presupposition about the speaker's co-operation. But the results may also support a hypothesis that children use an information-processing rule not necessarily related to a presupposition about the speaker's co-operation.

INTRODUCTION

Most developmental studies of responses to referential ambiguities conclude that children up to about seven or eight years old generally fail to detect ambiguous messages (for reviews, see Asher 1979, Patterson & Kister 1981). As Jackson & Jacobs (1982) have pointed out, it is sometimes assumed in these works that children choose a referent in an arbitrary, idiosyncratic, subjective or fortuitous way. Researchers considered that children's referential choices reflect cognitive inabilities (Asher 1976, 1979, Bearison & Levey 1977) or, more specifically, metacommunicative inabilities (Robinson 1981, Singer & Flavell 1981) in the treatment of information.

In Jackson & Jacobs’ work (1982), the data suggest that referential choices of a third graders' group (age range: 8;4–9;4) could be based on a quantity maxim strategy. After the message 'I am thinking of the happy one', children chose more often a smiling clown without flower in a referential field.

[*] The author is a researcher of the Belgian National Foundation For Scientific Research. Thanks are due to J. A. Rondal for his comments on an earlier version of this paper. Address for correspondence: Service de Psychologie du Langage, Institut de Psychologie et des Sciences de l’Education, Université de Liège au Sart-Tilman, B-4000 Liège 1, Belgium.
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containing also a smiling clown with a red flower, a smiling clown with a blue flower and three different sad clowns. For Jackson & Jacobs, the children chose this referent because the message described all and only the features relevant to this referent. Children would assume that the speaker is cooperative and would draw an implicature on the basis of Grice’s quantity maxim (Grice 1975). This maxim instructs a speaker to be informative enough but not more informative than is necessary.

The following experiment has been designed to test Jackson & Jacobs’ hypothesis. Some methodological changes have been made. First, subjects were really naive; the task did not follow a participation of other games of referential communication as was the case in Jackson & Jacobs’ study. Secondly, several messages were used in order to be able to determine the existence of a listening strategy from a constancy of responses and not only from one response to a single message.

METHOD

Subjects

Twenty-two second graders (mean age = 7;5, range 6;11–7;10), 24 fourth graders (mean age = 9;4, range 8;11–9;11) and 22 sixth graders (mean age = 11;6, range 11;1–11;11) participated. The children were taken from schools serving middle–high income communities in Liège (Belgium). Thirty-three children were girls.

Materials

A cardboard surface of 250 x 37 cm was used. A circuit with 109 cases and 16 perpendicular axes was drawn on this surface. On each axis appeared three plastic figures (see Fig. 1). The figures standing on the same axis were identical except for the object(s) they held. A set of three figures appearing on the same axis will be called a REFERENTIAL FIELD. For the ambiguous messages, the objects held by the figures were defined by the different combinations of two objects excluding the absence of object. For the elements hatchet and scoop, one figure with a hatchet only, one figure with a scoop only and one figure with a hatchet and a scoop appeared. For the unambiguous messages, two types of referential field were used. Given three objects X, Y and Z (where Z is the referent), one figure was used with X, one figure with X and Y, and either one figure with Z or one with Z and Y. All the messages had the following structure: ‘It is the figure with a ...’. A message was considered to be unambiguous (or uni-referential) if it designated an object held by only one figure, and to be ambiguous (or multireferential) if it designated an object held by two figures. A dice and another figure were also present next to the cardboard.

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![Diagram showing different referential fields and their combinations](image)

**Fig. 1.** Examples of the different types of referential fields used. The A field appeared with ambiguous messages such as 'It is the figure with a hatchet'. The B and C fields appeared with unambiguous messages such as 'It is the figure with a lantern' or 'It is the figure with an umbrella'.

**Procedure**

The experimenter was presented to the children by the teacher as a member of a team constructing games for children. At the beginning of the experimental session the principles of a game were explained: two players are needed; one of them receives a figure called 'the traveller'; the other player receives all the figures standing on the surface; on each island (the perpendicular axis) there is one thief among the three figures; the thief has a golden coin hidden under his hair; the traveller has to catch the thieves and take the coins. It is also explained how the figures can be moved with a dice and that each player...
casts the dice in turn. The child’s attention is drawn to the need to know who has the golden coin on each island, since only this figure is to be caught. Then it is added that this information will be found on a cassette, and that the experimenter is coming to the school to obtain the children’s reaction to various messages, in order to prepare such a cassette. The child is then instructed as follows: ‘If you see clearly who the figure is I am talking about, take it up and show it to me. If you have a doubt, if you are not quite sure, do not hesitate to tell me that you are not sure. This is the best way to help me.’ Two unambiguous messages were used for the familiarization to the task. The experimenter then produced the 14 messages of the experiment (7 unambiguous and 7 ambiguous messages). The order of presentation was identical for all subjects. Each message was read once. When a child expressed a doubt, he was asked to explain it. When no response was made within 15 seconds (from the last word of a message), the experimenter said ‘I think you are hesitating, tell me why’. When a choice was made for the last message (an ambiguous one) the child was asked to justify it. This request was always made in the following manner: ‘How do you know I was talking about this one (the chosen referent) and not that one (the non-chosen one) when I said it was the figure with a hatchet?’.

RESULTS

First, the choice consistent with a strategy based on an implicature must be defined. Let us consider the message ‘It is the figure with an X’ and a referential field composed of three figures holding respectively the objects X, X+Y and Y. The choice of the figure with X has been considered as the only choice consistent with a child’s supposition that the speaker was sufficiently informative and gave no more information than is necessary.

A Kruskall–Wallis analysis of variance revealed no significant age effect on the numbers of choices following the ambiguous messages (corrected $\chi^2 = 0.4347$, d.f. = 2). A second Kruskall–Wallis analysis revealed no significant age effect on the numbers of choices consistent with the strategy (S choices) after the ambiguous messages (corrected $\chi^2 = 0.6097$, d.f. = 2). Errors of choice following the uni-referential messages were quite rare; six errors appeared in 476 choices (see Table 1).

Following the ambiguous messages, children always chose one of the figures holding the object cited in the message. So all the choices ‘non-consistent’ with the strategy (NS choices) were made on the figure holding this object plus another one. Only the two figures holding the cited object were considered as possible referents. After an ambiguous message, if a choice

[1] The experimenter and the children were French-speaking. The experimenter’s instructions and the children’s commentaries have been translated as exactly as possible.
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Table 1. Distribution of choices as function of message type and grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Ambiguous messages</th>
<th>Unambiguous messages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S choices</td>
<td>NS choices</td>
</tr>
<tr>
<td>Second graders</td>
<td>130</td>
<td>11</td>
</tr>
<tr>
<td>Fourth graders</td>
<td>139</td>
<td>7</td>
</tr>
<tr>
<td>Sixth graders</td>
<td>135</td>
<td>5</td>
</tr>
</tbody>
</table>

occurred and was made randomly, the probability of making an S choice would be 0.50. The data show that in each age-group the proportion of S choices is significantly more important than the random proportion (binomial tests; \( P < 0.01 \) for each group separately; see Table 1).

A pattern of choices was considered to be systematic enough if its probability to appear randomly (\( P \)) was less than 0.05. Only the three following patterns fitted this condition: seven S choices out of seven choices \( (P = (\frac{1}{7})^7 = 78 \times 10^{-4}) \), six S choices out of six choices \( (P = (\frac{1}{6})^6 = 0.0156) \) and five S choices out of five choices \( (P = (\frac{1}{5})^5 = 0.0312) \). The majority of the children (73.3%) made systematically seven S choices (see Table 2); no

Table 2. Distribution of subjects as a function of grade and pattern of choices

<table>
<thead>
<tr>
<th>Pattern of choice</th>
<th>Second graders</th>
<th>Fourth graders</th>
<th>Sixth graders</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 choices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 S choices</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>6 S choices</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3 to 5 S choices</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6 choices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 S choices</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

subject made five S choices. No significant age effect on the proportions of subjects with a systematic S pattern was obtained \( (\chi^2 = 0.170; \text{ d.f.} = 2) \).

Sixty-two subjects made a choice following the last message and were asked to justify it. Children's verbal responses to this request have been classified into four categories. Six subjects made an NS choice; among them five

[2] For this analysis, only the children having made five choices at least have been considered. This is because the probability to obtain \( x \) times the same type of choice is superior to 0.05 from \( x = 4 \) and less.
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changed their mind and chose the S figure after the experimenter’s request. Each child was placed in one of the following categories.

Category A. These were justifications in which the children said that the chosen figure had a hatchet only and/or the non-chosen figure had another object (a scoop). These subjects did not mention the message explicitly.

Category B. These were justifications in which children said that the message did not contain any information about the second object. For instance:

(7;7) You did not say there was a scoop too.
(9;3) Because you spoke about the hatchet, you did not speak about a scoop.
(9;5) Because it is not said there is another thing.

Category C. These were justifications in which the children commented explicitly on what would have been the speaker’s message for the NS figure. For instance:

(7;7) Because he (S) has no scoop, this one (NS) he has a scoop and for him you would say the one with a scoop and a hatchet.
(9;4) That one (NS) has another tool. You would say, if it was that one, you would say it is the figure with a hatchet and a scoop.
(8;11) If it was this one (NS), you would have said a scoop and a hatchet.

Category D. These were subjects who judged the messages to be ambiguous after the experimenter’s request for justification.

Only one second grader could not justify his choice. No age effect on the distribution of subjects in these categories is revealed ($\chi^2 = 5.42$; d.f. = 6; see Table 3). The justifications for B and C categories seem to make explicit a supposition that the second object would have been cited in the message if the NS figure had been the referent. These justifications are frequent (66.1%). In the justifications of Category A, this supposition remains more implicit. Nevertheless, all the subjects in this category formulated a message in which both objects are cited after the question ‘What should I have said if I had spoken about that one (NS)?’ So it seems that for these children too the NS figure had to be described with both elements.

### Table 3. Distribution of subjects as a function of grade and category of justification

<table>
<thead>
<tr>
<th>Grade</th>
<th>Category of justification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Second graders</td>
<td>7</td>
</tr>
<tr>
<td>Fourth graders</td>
<td>6</td>
</tr>
<tr>
<td>Sixth graders</td>
<td>4</td>
</tr>
</tbody>
</table>
The results show that school-aged children do not make referential choices at random following the type of multireferential messages used. They choose the referent with only the feature described in the message. A global analysis shows that these choices represent 94.6% of the referential choices. An individualized analysis shows that 73.3% of the subjects chose systematically in this way, despite the strictness of the criterion used to define a systematic pattern of choices. In their justifications, subjects generally stated that the speaker had to mention an additional feature to designate the other possible referent.

In our situation no developmental evolution was obtained regarding the types of choices. Jackson & Jacobs (1982) found choices consistent with an implicature based on the quantity maxim mainly in children from 8; 4 to 9; 4 and significantly less often in younger children. This discrepancy in the results can be explained by the difference in the methods used in the two studies. Jackson & Jacobs mainly observed choices consistent with a strategy based on a maxim of antecedence in younger children (age range: 6; 4–7; 4). In using this strategy, the child is supposed to search for an antecedent among referents mentioned before the speaker's message, more precisely during another game with the same material. Contrary to Jackson & Jacobs’ study, no other game preceded the reception task in our experiment. A strategy based on a maxim of antecedence could not appear, therefore. Besides the difference in the methods the younger children in the present study were older (about 6 or 7 months, apparently) than the younger subjects in Jackson & Jacobs’ study. Nevertheless, we do not believe this difference in the ages can explain the whole discrepancy between the results of the two studies. Indeed, in another study with the same general procedure (Bredart 1983), it was shown that 6; 1–7; 1 children preferentially made S choices (96.8% of the choices). Most of these first graders also chose systematically in this way (77.2%; the criterion used to define a systematic pattern was the same as the one used in the present study).

Finally, it seems necessary to put the following question: do the children really make S choices by drawing an implicature based on a co-operation maxim? In fact, children could make this type of choice by following an information-processing rule such as 'If in a given referential field an element is described exhaustively by the message then this message cannot designate another element it describes less completely'. Knowing and using such a rule could be independent from any presupposition about the speaker's co-operation. Most of the justifications (categories A, B and C) seem to be quite consistent with such a hypothesis too. It is not possible to answer this question here. Further experiments are needed.
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REFERENCES


