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ABSTRACT

Most linguists assume that bound anaphors such as "himself" are connected with their antecedents in a different way from free anaphors such as "him." Bound anaphora resolution is deterministic, based on Principle A of Chomsky's binding theory. Free anaphors, pronominals, cannot be bound in the domain of reflexives (principle B); their interpretation is largely determined by non-grammatical factors. Thus, the resolution of bound and free anaphors explcits different modules of knowledge. Since different kinds of knowledge are involved, a reasonable expectation is that a different development can be found for the two kinds of anaphor resolution in language acquisition. To test this expectation, experimental studies investigated how Dutch children aged 4 to 10 interpret sentences involving reflexive and non-reflexive anaphors. The results showed a difference in the rates of acquisition for the two types of anaphors. This experimental finding is taken as support for the view that bound and free anaphora resolution involve different kinds of knowledge. (Author/MSE)

THE ACQU_ _TION OF BOUND AND FREE ANAPHORA

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Most linguists assume that bound anaphors, like himself, are connected with their antecedents in a different way from free anaphors, like him. Bound anaphora resolution is deterministic, based on principle A of Chomsky's binding theory. Free anaphors, pronominals, cannot be bound in the domain of reflexives (principle B); their interpretation is largely determined by non-grammatical factors. Thus, the resolution of bound and free anaphors exploits different modules of knowledge. Since different kinds of knowledge are involved, a reasonable expectation is that a different development can be found for the two kinds of anaphor resolution in language acquisition.

To test this expectation, experimental studies were designed to investigate how Dutch children (4 to 10 years old) interpret sentences involving reflexive and non-reflexive anaphors. The results showed a difference in the rates of acquisition for the two types of anaphors. This experimental finding is taken as support for the view that bound and free anaphora resolution involve different kinds of knowledge.

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The Acquisition of Bound and Free Anaphora

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The research reported here was carried out together with Werner Deutsch at the Max Planck Institute and Norbert Corver at Tilburg University in the Netherlands.

According to the theory we adopt here, language acquisition involves the maturation and interaction of various modules, some of them purely linguistic, others more general in that they also may play a role in the maturation of other capacities and states of knowledge. We will present some experiments concerning the acquisition of bound and free anaphora in Dutch children between 4 and 10 years old. Before giving you the experimental details, we would first like to sketch some of our background assumptions.

Our starting point is the fairly traditional idea that there is a sharp distinction between bound anaphors such as himself and free anaphors such as him. In current GB theory, the distinction is in part expressed by the principles A and B of the binding theory. Principle A concerns anaphors such as himself (among others), principle B concerns free anaphors or pronominals such as him (see also transparency 1):

(1) Principle A
An anaphor must be bound in its governing category.

Principle B
A pronominal must be free in its governing category.

These principles are supposed to express the purely linguistic knowledge involved in actual behavior such as anaphor resolution. Anaphor resolution is the act of finding a proper antecedent to a given anaphor or pronominal.

One of our major assumptions is that the resolution of bound anaphors is largely determined by the linguistic knowledge expressed in principle A of the binding theory while the resolution of pronominals is generally determined by other types of knowledge. In the latter case, the purely linguistic knowledge, expressed by principle B, only plays a negative role in certain contexts. We can illustrate this with the following examples (see also transparency 1):

(2a) John saw himself
(2b) John told Bill that Peter liked him

In (2a), principle A of the binding theory determines that John is the antecedent of himself. In example (2b), principle B only determines that Peter can not be the antecedent of him. But in this case, linguistic theory does not determine the actual antecedent. It can be John, Bill, or someone else, depending on context and situation. In short, contrary to what we see in (2a), anaphor resolution in (2b) largely depends on non-linguistic knowledge.

The background idea of our experiments is the expectation that the two types of anaphor resolutions involve a different pattern of development. In order to test this expectation, we have carried out a series of experiments with test sentences involving both kinds of anaphor resolution. The actual test sentences were in Dutch, but for the sake of exposition, I will give you close English equivalents.

In the first experiment, two types of possessive constructions were used, the brother of John and John's brother. These two NP-types were combined with either a pronominal or an anaphor, resulting in the following pattern (see also transparency 1):

(3) The brother of John washes him
John's brother washes himself

For him, John is the correct antecedent, while for himself the more inclusive NP (John's brother, or the brother of John) is the only possible correct antecedent, that is, the only c-commanding NP in the sentence. In sentences like (3), there are two possible antecedents (NPs), one included in the other. Furthermore linear order is varied, that is, John either precedes or follows brother.

In the second experiment, there were again two potential antecedents, again such that one c-commands the target words (him, himself), while the other does not. As before, the linear order of the two possible antecedents was varied (see also transparency 1):

(4) John shoots with Peter's pistol at him
With Peter's pistol, John shoots at himself

The main difference with the first set of sentences is that in this case the second NP (Peter) is not included in the c-commanding NP (John).

A complication not brought out by the English examples is that Dutch has two kinds of reflexives, zich and zichzelf, which have somewhat different distributional properties (see Koster (1985)). In the first experiment zich (himself) was used as anaphor and hem (him) as pronominal. In the second experiment, zichzelf was used (together with hem).

Charlotte will tell you more now about the experiments.

In these experiments, we investigated how Dutch children between 4 and 10 yrs of age interpret the sentences Jan just showed you in which both bound and free anaphoric relations are expressed. The first experiment was a sentence-picture choice

task using this type of sentences and 4 systematically composed pictures per sentence (see transparency 2). The original pictures were of course much more attractive than these simple sketches. With the sentence The brother of John washes himself, there is one correct picture - the brother of John washing himself. There are three incorrect pictures. The different errors that a child can make are - a wrong antecedent choice. John washing himself, a wrong anaphor orientation, the brother washing John, and a double error, the wrong person carries out the wrong action. This 4 picture array made it possible to investigate exactly what the child's misinterpretation was when he did not choose the correct picture.

After an introductory period during which the child learned the boys' names and their kinship relation, he would then hear a sentence, repeat it, and then be presented with a 4-picture array out of which he could choose an appropriate picture. The filler sentence-picture arrays were very useful in demonstrating that the children actually did know the names and kinship relations. Twelve 4 year olds and thirty two 6, 8, and 10 year olds participated in this study. There was also a control group of adult subjects.

If we look at the percentages of correct responses to sentences with bound and free anaphors (see transparency 2), we see the following: Correct performance on sentences with bound anaphors is quite poor, significantly worse than on free anaphor sentences, at 4 years of age. But performance on these sentences improves quickly and dramatically. Even though performance on free anaphor sentences is initially better than on bound anaphor sentences, the free anaphor improvement is sluggish and after 6 years of age it even significantly lags behind performance on

bound anaphor sentences. Details about the 6, 8, and 10 year old error analysis, that is - which incorrect pictures does the child choose when he misinterprets a test sentence, can be found in our paper (Deutsch, Koster, and Koster (1986)).

The second experiment was a doll acting-out task using this type of sentences and two flexible dolls hanging from metal standards with their possessions - a stick, a ruler, a fork and a pistol - lying in front of them (see transparency 2). With the sentence John points with Peter's stick at himself, the purple doll is made to point at himself, using the green stick. In this task there are also several types of errors or combinations of error types that a child can make: the antecedent, the anaphor orientation, or the possessor of the objects.

After an introductory period during which the child learned the boys names and their possessions, he would then hear a sentence, repeat it and then be allowed to act-out his interpretation of the sentence, using the dolls in front of him. Eighty children, twenty per age group participated and there was also an adult control group.

If we look at these percentages of correct responses to sentences with bound and free anaphors (see transparency 2), we see the following: Again the correct performance on sentences with reflexives at the 4 year level is below that of sentences with non-reflexives. But here too, the rate of improvement on sentences with bound anaphors is really remarkably fast. Performance on sentences with free anaphors starts off a bit better than bound anaphor sentences. But there is a stagnation in correct performance until beyond the 6 year age group, when, finally, free anaphor sentences begin to show a steady improvement. This improvement, however, continues to lag behind

the bound anaphor improvement rate. There is not enough time today to get into the error analysis, that is, what the children do wrong when they incorrectly act out a sentence.

These two experiments use different tasks, different sentence constructions and even different forms of the Dutch third person singular reflexive himself. But as you can see, both correct results patterns are still remarkably similar. In each study, the 8 and 10 year olds seem to show the tail-end of both bound and free anaphor development, with sentences involving the syntactically determined bound anaphor resolution doing consistently better than those with free anaphors. The really interesting puzzle is - what is happening with bound and free anaphor development at around age 6?

To get a more complete picture about the pattern of anaphora development at around 4 to 6 years of age, it would be enlightening to know more about the earliest development, before the 6 year age level. Luckily, this information is at hand in a study by Wexler and Chien (1985), who have recently carried out picture choice and acting out experiments using test sentences which more or less resemble ours - but of course in English. Their subjects were American children between 2 1/2 and 6 1/2 yrs of age.

Wexler and Chien found performance on bound anaphor sentences to be very poor with their youngest children, but it improved quickly. Free anaphor performance started out relatively good in comparison, but did not really improve - all the way up to their highest age group, the children between 6 and 6 1/2 years old.

Backed by these studies, we conclude that the phenomena under investigation have been shown to be robust; the results are

not tied to a particular sentence construction type, or to a particular experimental task, or even to one particular language. It now seems possible to give a pretty clear picture (see transparency 3) of the simultaneous development of bound (reflexive) and free (pronominal) anaphor resolution from an early to a later age (from 2 to 10 years of age). What we see is the following: Bound anaphora shows a quick and steady rate of development, from poor at 2 1/2 to successful at 8-10 years of age. Sentence-internal free anaphora starts off o.k. - the pronominal him is already known lexically and is probably already being used in other ways (e.g., deictic, discourse) at this early age. But, at the sentence internal level, free anaphor resolution doesn't really start to improve until around 6-8 years of age. Even after this improvement sets in, it continuously lags behind bound anaphor resolution.

We suppose that these two different patterns of acquisition reflect the (partially) different types of knowledge involved in bound and free anaphor resolution - bound anaphors being guided by the deterministic syntactic knowledge of principle A - which is responsible for the steady, quick acquisition pattern. Free anaphor resolution is a non-deterministic process involving the syntactic knowledge of principle B, plus other types of knowledge that are necessary for resolution - and this combination results in a different, later developmental pattern than that of bound anaphor resolution.

Reference

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BINDING THEORY:

PRINCIPLE A: an anaphor must be bound in its governing category

PRINCIPLE B: a pronominal must be free in its governing category

- John saw himself

- John told Bill that Peter liked him

TEST SENTENCES:

The brother of John / John's brother } washes { himself / him
The brother of Pete / Pete's brother }

John shoots with Pete's pistol / With Pete's pistol John shoots / Pete shoots with John's pistol / With John's pistol Pete shoots } at { himself / him

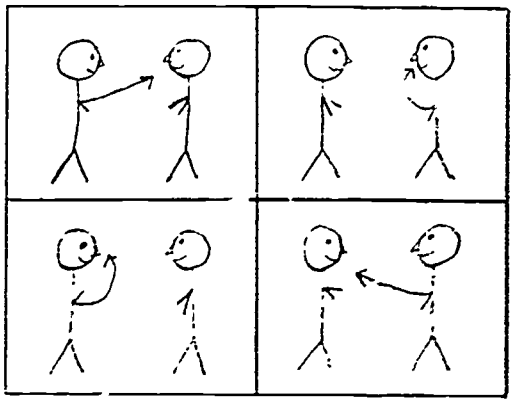
IN DUTCH:

himself = zich, zichzelf

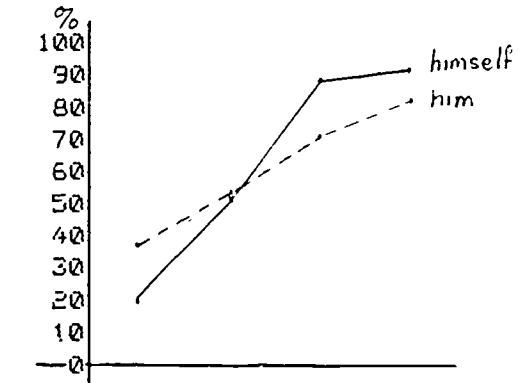
him = hem

SENTENCE PICTURES CHOICE TASK: one sentence presented with four pictures

THE BROTHER OF JOHN / JOHN'S BROTHER } WASHES { HIMSELF / HIM



CORRECT RESPONSES

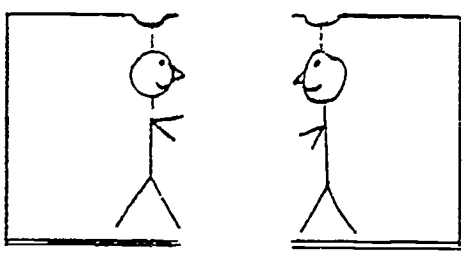


	age	4	6	8	10
Bound (zich):		22%	53%	87%	90%
Free (hem):		37%	54%	71%	81%

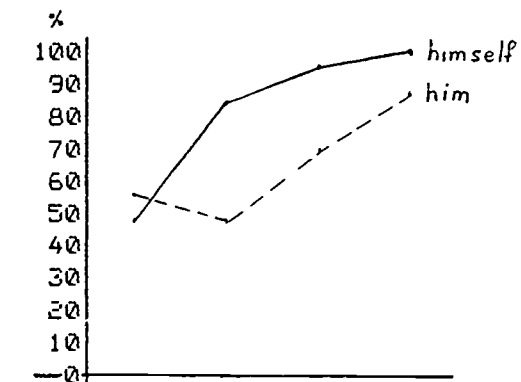
PAPER: Deutsch, Koster & Koster (1986). What can we learn from children's errors in understanding anaphora? Linguistics 24, 203-225.

DOLL ACTING OUT TASK: one sentence presented with two dolls and their attributes

JOHN POINTS WITH PETE'S STICK / WITH PETE'S STICK JOHN POINTS } AT { HIMSELF / HIM



CORRECT RESPONSES

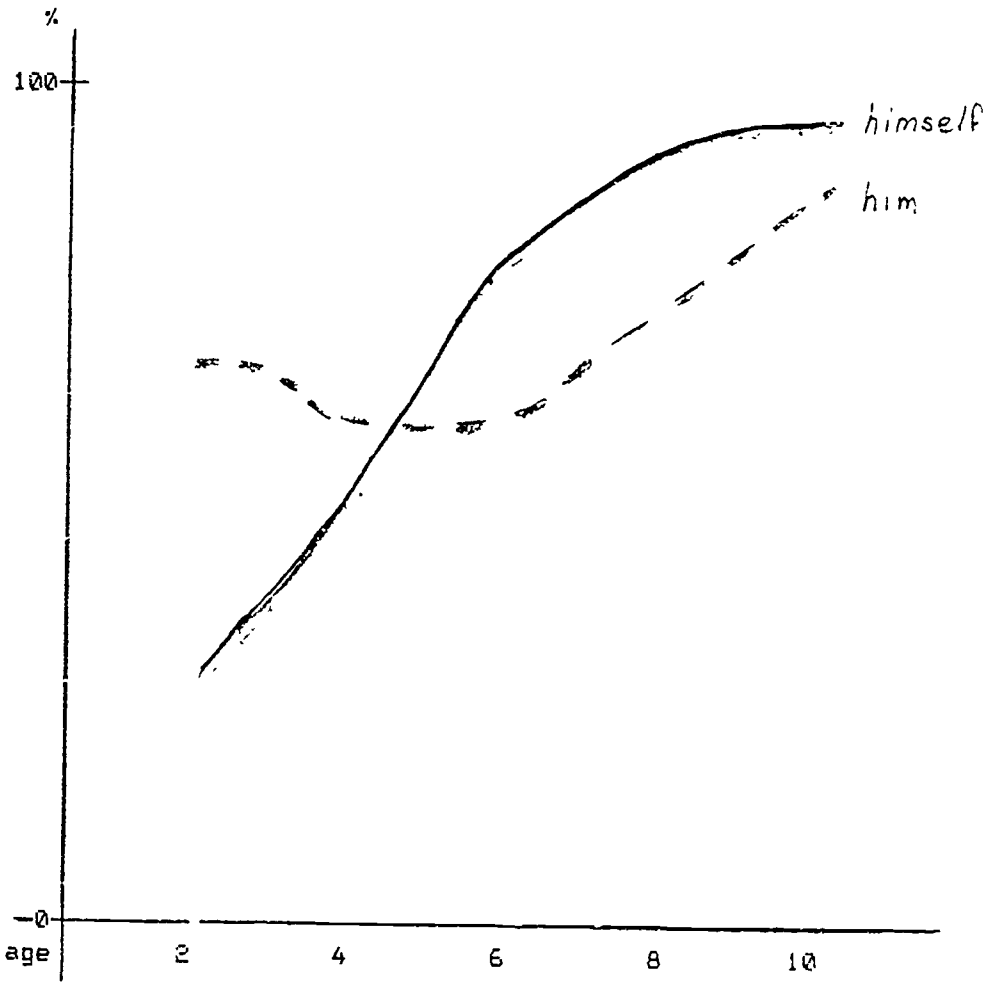


	age	4	6	8	10
Bound (zichzelf)		49%	84%	96%	99%
Free (hem):		57%	49%	70%	89%

PAPER: in preparation

GENERAL CORRECT RESPONSE PATTERN

For the acquisition of flexives (bound anaphors) and pronominals (free anaphors).



W+C: 2 1/2 - 6 1/2 yr. (data estimated)

D,K,K and C,D,K,K: 4 -10 yr.