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**Intersentential Pronominal Reference
in Child and Adult Language**

Dagmar Bittner & Natalia Gagarina (eds.)

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Editorial preface

The 48th volume of the *ZAS Papers in Linguistics* presents selected papers from the conference on *Intersentential pronominal reference in child and adult language* held at the ZAS in December, 2006. The conference, organized by the project *Acquisition and disambiguation of intersentential pronominal reference*, brought together leading researchers dealing with anaphora resolution in diverse theoretical approaches and the acquisition perspective on pronominal reference taken by the ZAS project. The main aim of the conference was to discuss the following topics and questions:

1. The resolution of intersentential pronominal anaphora recently has become a much discussed topic in different theoretical approaches, such as the functional grammar of Givón, research on accessibility hierarchies and givenness, centering theory, bidirectional optimality theory, the theory of generalized conversational implicatures, among others; not to forget the developments in computational linguistics and information theory. Which are the commonalities between these approaches and what are the most striking differences? What are the central unresolved problems?
2. The discussion on the criteria guiding the resolution of anaphora shows that there are some discrepancies in the assumptions on which criteria are on the basis of the resolution process and how the various criteria involved interact with each other. Furthermore, although the notion of salience is considered the most important criterion since Lewis, there is no common understanding on how salience or different degrees of salience are inferred from the given linguistic data by the language user. What are the criteria that determine (the degree of) salience of antecedents? How do they interact? Is salience the most decisive notion?
3. Which hypotheses on the emergence and development of intersentential pronominal anaphora resolution in child language can be derived from the actual discussion in linguistic theory? To which extent may data from language acquisition contribute to our understanding of the adult competence in this domain?
4. What are actual findings on the role of the following properties of antecedents: *subject, topic, animacy, parallel syntactic function, distance in the discourse*, for the determination of salience (or, to be more careful, the choice of a referent as the antecedent of a pronominal anaphora). Which other criteria may emerge early in the acquisition process?
5. When and for which types of anaphoric relations do children obey the iconic relationship assumed in linguistic theory between salience of the

antecedent and the structural complexity of the pronominal anaphora (i.e., zero pronouns vs. personal pronouns vs. demonstrative pronouns, etc.)?

6. Finally, are there typological properties of languages that may result in differences between languages in the resolution of intersentential pronominal anaphora?

The intensive discussion of these and other questions by the presenters of the talks and the auditorium underlined the broad actual interest in theoretical description and explanation of the mechanisms underlying the production and comprehension of intersentential anaphora. Furthermore, the discussion showed that the acquisition perspective is a desideratum in this research area and that combining research on adult language and language acquisition is a promising path towards further insights into this grammatic-semantic-pragmatic domain.

The first part of the volume brings together four contributions on problems of intersentential anaphora resolution in adult language. The second part presents five papers on pronominal reference in language acquisition.

The editors are grateful to all authors for contributing to this volume.

Dagmar Bittner & Natalia Gagarina

Berlin in July 2007

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Children's Use of Referring Expressions: Some Implications for Theory of Mind*

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This paper presents results of corpus analytic investigations of children's use of referring expressions and considers possible implications of this work for questions relating to development of theory of mind. The study confirms previous findings that children use the full range of referring forms (definite and indefinite articles, demonstrative determiners, and demonstrative and personal pronouns) appropriately by age 3 or earlier. It also provides support for two distinct stages in mind-reading ability. The first, which is implicit and non-propositional, includes the ability to assess cognitive statuses such as familiarity and focus of attention in relation to the intended referent; the second, which is propositional and more conscious, includes the ability to assess epistemic states such as knowledge and belief. Distinguishing these two stages supports attempts to reconcile seemingly inconsistent results concerning the age at which children develop theory of mind. It also makes it possible to explain why children learn to use forms correctly before they exhibit the pragmatic ability to consider and calculate quantity implicatures.

1 Introduction

It is a characteristic (and probably unique) feature of human language that the same entity can be referred to in many different ways, using different forms such as *it*, *that*, *the restaurant*, *a restaurant*, *that great restaurant we went to in Berlin*, and so on. Unlike some other characteristic features of human language, syntactic properties such as recursion, for example, this feature appears to be necessarily rooted in the interactive function of language, i.e. in its use for the purpose of communication between two intentional agents.

* Earlier versions of this paper were presented at the Conference on Intersentential Pronouns, ZAS, Berlin, December 1, 2006 and at the Workshop on Information Structure in Adult and Child Language held at MPI Nijmegen March 31, 2007. We thank the participants at these events for their comments.

While accounts of nominal reference and use of referring expressions differ, it is now generally agreed that the particular forms a speaker/writer uses are at least partly constrained by her assessment of the addressee’s knowledge and attention state at the point in the discourse when the form is used. Gundel, Hedberg, and Zacharski (1988, 1989, 1993, and subsequent work) take this observation one step further by proposing that individual lexical items, specifically determiners and pronouns, encode, as part of their conventional meaning, information about the cognitive status of the intended referent/interpretation in the mind of the addressee at the point just before the nominal form is encountered. If this account is correct, the acquisition of such forms by children could shed light on the development of their sensitivity to the mental states of others, in particular when these are different from their own – what has sometimes been called ‘theory of mind’ (e.g. Premack and Woodruff 1978, Baron-Cohen 1995). The present paper reports on an ongoing study that aims to investigate the connection between theory of mind and children’s use of referring expression. Section 2 outlines the Givenness Hierarchy framework and some of its assumptions and predictions; in section 3 we report on a corpus study of children’s use of referring expression, and in section 4 we conclude with some preliminary implications of this work for issues related to the development of theory of mind.

2 The Givenness Hierarchy

Gundel, Hedberg and Zacharski (1993) propose that determiners and pronouns in natural language conventionally encode information about the cognitive status of the referent/interpretation for the addressee at the point just before the nominal form is encountered. The relevant statuses are listed below in (1) along with the English form that conventionally encodes that status (*it* stands for all unstressed personal pronouns, *SHE* for all stressed personal pronouns, and *N* for an NP complement of a determiner).

(1) Givenness Hierarchy (GH) (Gundel, Hedberg, and Zacharski 1993)

in		uniquely		type						
focus	>	activated	>	familiar	>	identifiable	>	referential	>	identifiable
<i>it</i>		<i>this/that/this N</i>		<i>that N</i>		<i>the N</i>		<i>indefinite this N</i>		<i>a N</i>

Statuses on the GH encode procedural information about the manner of accessibility¹ of the referent/interpretation, as described in (2).

¹ The Givenness Hierarchy is not, however, a hierarchy of **degrees** of accessibility in the sense of Ariel 1988, 1990, for example. This is so for two reasons. First, the statuses are in a unidirectional entailment and are therefore not mutually exclusive. Second, referents of forms that code statuses lower on the hierarchy are not necessarily more difficult to access

(2)	in focus:	associate representation in focus of attention
	activated:	associate representation in working memory
	familiar:	associate representation in memory
	uniquely identifiable:	associate unique representation with NP
	referential	associate unique representation
	type identifiable	associate type representation

For example, in the English sentence *That dog next door kept me awake*, the determiner *that* encodes the information that the addressee is expected to already have a representation of the dog in memory (familiar), and so can uniquely identify it (uniquely identifiable); in *The dog next door kept me awake*, the definite article *the* only encodes the information that the addressee is expected to associate a unique representation, however he can do that (by retrieving a representation from memory or by constructing a new one).

Statuses on the GH are in a unidirectional entailment (by definition); they are not mutually exclusive. Anything in focus is also activated, anything activated is also familiar, and so on. Thus, forms that explicitly encode particular statuses are underspecified for higher statuses rather than excluding them. This results in one-to-many mapping between statuses and the forms that explicitly encode them, as illustrated in (3) and (4).

- (3) A: So you've only known the dog how long did you say?
B: Well, about a year, I guess.
A: Oh well. Is it, uh, how old is the dog? (Switchboard Corpus)

- (4) Look. A man is hitting a dog/ The man is hitting a dog/ A man is hitting that dog/
That man is hitting a dog.²

In (3), A and B have been talking about B's dog, who is clearly in focus for B in A's second utterance, as it has been the topic of conversation and part of the interpretation of every utterance up to this point. Speaker A could have used a pronoun or a demonstrative determiner to refer to the dog (*How old is it? How old is this dog?*), but he used a full NP with a definite article instead. In (4), uttering *look*, which would normally be accompanied by a non-verbal gesture (e.g. eye gaze, with or without pointing) would be sufficient to activate both the man

than referents of forms that code higher statuses. For example, an entity that is at most uniquely identifiable and requires the addressee to construct a new representation may be easier to access than one that is at most familiar (familiar, but not activated) and must therefore be retrieved from long term memory. The Givenness Hierarchy framework does predict, however, in agreement with Ariel and others, that referents of pronouns, which encode the two highest statuses (in focus and activated) are the most accessible.

² Thanks to David Oshima for calling this example to our attention.

and the dog for the hearer, as evidenced by the fact that the sentence *that man is hitting that dog* would have been perfectly acceptable in this context; yet any of the other possibilities listed in (4) would have been acceptable as well, since anything that is activated is also familiar, uniquely identifiable, referential and type identifiable.

Unidirectional entailment of statuses on the GH gives rise to pragmatic inferences, specifically scalar implicatures (Horn 1972), resulting from the first part of the Maxim of Quantity (make your contribution as informative as required, Grice 1967). Just as *some* typically implicates *not all*, the indefinite article is rarely used for statuses higher than referential, and its use typically implicates that the addressee is unable to uniquely identify the referent (and it is also therefore not familiar, activated, etc.). Thus, both occurrences of a student in (5) would normally be interpreted as introducing a new entity into the discourse who is not uniquely identifiable, and therefore also not already familiar to the addressee.

(5) A student came to see me after class yesterday; a student came to see me today as well.

Similarly, demonstrative pronouns, which encode the status ‘activated’, often implicate that the referent is at most activated, i.e. not in focus. For example, *that* in (6) is interpreted as referring to the walk-through closet, not the in-focus kitchen.

(6) Anyway, going back from the kitchen then is a little hallway leading to a window. Across from the kitchen is a big walk-through closet. And next to that is
(from Gundel et al. 1993)

Within the GHZ framework, then, the non-familiarity interpretation associated with the indefinite article and the focus shift interpretation associated with demonstrative pronouns are treated as implicatures, rather than conventional meanings of these forms. This account is supported by data like those in (7)-(9). As (7) shows, the non-familiarity implicature associated with the indefinite article can be cancelled without contradiction.

(7) A student came to see me before class today; a student came to see me after class as well. In fact, it was the same student. (adapted from Hawkins 1991)

Also, the implicatures do not arise when the information that would be conveyed by the stronger form is irrelevant, as in (8)-(10).

(8) I’m not going along; I’ve been sitting in a car all day.
(adapted from Grice 1967).

(9) Look. A man is hitting a dog.

(10) I love John's kitchen. It's/That's my favorite room.

In (8), as Grice also points out, *a car* does not necessarily refer to a car that the addressee is unfamiliar with; it could in fact be a car jointly owned by the speaker and addressee. Since it is the property of being a car and not the identity of the particular car that is relevant, use of *a* does not implicate that the car is unfamiliar and not uniquely identifiable. Similarly, in (9) (example 4 above) it is the event of a man hitting a dog and not the identity of the particular man or dog that is relevant; thus, neither *a man* nor *a dog* implicate that the referent is not familiar or not uniquely identifiable; in fact, both have just been activated.

In (10), since there is only one activated entity, it is irrelevant whether or not that entity is focus; use of *that* therefore does not implicate that the referent is not in focus, and either *that* or *it* can be used to refer to the kitchen.

In some cases, the second part of Grice's Quantity Maxim (don't make your contribution more informative than required) blocks the implicature that the cognitive status encoded by a stronger form is not met. Thus, as discussed in Gundel, Hedberg and Zacharski (1993) and Gundel and Mulkern (1998), the definite article doesn't implicate non-familiarity. Since signaling that the addressee can uniquely identify the referent is usually sufficient to allow her to interpret it, given the encoded descriptive content and Relevance-driven pragmatic inferences (Matsui 1992, Sperber and Wilson 1995, Wilson 1992), the definite article typically provides sufficient information about cognitive status, and an explicit signal of familiarity (such a demonstrative determiner) is usually unnecessary.

3 The acquisition and use of referring forms by children

3.1 What children need to 'know'

Given the framework outlined above, the ability to correctly produce and understand referring forms involves at least the following kinds of knowledge and abilities.

Linguistic

knowing which linguistic forms encode which cognitive statuses, e.g. determiner *that* means 'familiar'. This must be learned, just as the meanings of other lexical items (e.g. knowing that *dog* means 'dog') must be learned.

Non-Linguistic

- ability to assess whether something has a particular status, e.g. whether it is already familiar to the addressee or not. This is analogous to being able

to assess whether something is a dog or not, i.e. understanding the concept ‘dog’ and recognizing one when you see one. As with concepts in general, it is unclear if there are already innate predispositions which constrain whether and how this is learned. In any case, the ability to assess whether or not something has a particular status involves ‘theory of mind’ in some sense, on the part of the speaker as well as the addressee.

- ability to assess when information about cognitive status is relevant, as this determines whether or not the strongest possible indicator of cognitive status will be used and when use of a weaker indicator will give rise to a scalar implicature; similar abilities are required to assess how much descriptive information is relevant, for example when one would say *the black dog* as opposed to simply *the dog*. Like the ability to determine what cognitive status the intended referent has for the addressee, the ability to assess when and how much information about cognitive status is relevant assumes theory of mind.

3.2 *Children’s Use of Referring Expressions*

Gundel and Page (1998), Gundel, Page and Sera (1999), and Gundel, Sera, Kowalsky, and Page (2001) conducted longitudinal investigations of use of referring expressions in dialogues involving 3 preschool children learning English and 2 preschool children learning Spanish, between the ages of 1.5 and 3.5 (CHILDES, MacWhinney 1995, Brown 1973, Bloom 1970). These studies address the following questions:

- When do children ‘master’ definite and indefinite articles, demonstratives, and personal pronouns?
- Is the appropriate use of these forms acquired idiosyncratically or is there a pattern that holds for all children, both within and across languages?
- If there is a developmental order, does this differ according to the language being acquired or is it the same for all languages?

The studies found that both English and Spanish speaking children use the full range of referring forms (definite and indefinite articles, demonstratives, personal pronouns) appropriately by age 3 or earlier. These findings are consistent with results of corpus-based studies for English as well as other languages reported by various researchers, for example, Bittner (2002, 2007), Bennett-Kastor (1981), Ntelitheos (2004), inter alia. They are at variance with some experimental studies, however, which suggest that children don’t master use of referring forms (pronouns, definite vs. indefinite article) until age 7 or even later.

The differences in findings may be due to methodology, as well as other factors. However, one also cannot conclude on the basis of use in spontaneous

dialogue alone that children have mastered linguistic and pragmatic conditions for using these forms in all contexts. As discussion settings tends to be restricted to objects and individuals in the immediate environment, appropriate use of referring forms may be simply a function of the restricted contexts in which the forms are used in the data (see Karmiloff-Smith 1981, Hickman 2003). With this in mind, the English data were reanalyzed, this time asking not only whether or not a form was used and whether its use seemed appropriate, but what cognitive status the interpretation of the form has, whether the full range of statuses that a form could be used for was represented (e.g. in adult use, the English definite article, *the*, is used for at most uniquely identifiable and all higher statuses, including in focus), and were there any forms that would not have been appropriate in the given context (i.e. could the child have made an error by using a different form).

3.2.1 Pronouns: Activated vs. In focus

The order of acquisition of forms that code cognitive statuses seems to parallel the order of forms on the Givenness Hierarchy, with pronouns, both demonstrative and personal, acquired first, and the indefinite article last. Thus, the child data in the earliest transcripts examined contains no articles or demonstratives, but it does contain some personal pronouns, used appropriately.

(11) Eve 1;6 (Brown 1973)

MOT: put the other one back
MOT: those break
MOT: put the two back
MOT: thank you
EVE: it break
EVE: oh it break
MOT: and those break too

Two things are noteworthy here. First, that the form *it* used by Eve is not simply a repetition of a form used by her mother, and second that the referent is clearly in focus for the mother at the point when Eve uses the form.

The example in (12), also from Eve but five months later, contains both demonstrative and personal pronouns. In line 55, Eve uses a demonstrative pronoun to refer to her father's shoes, which are in the immediate environment and therefore activated, but are not yet in focus at this point as they have not been previously mentioned and there is no reason to believe her father's attention has been focused on the shoes. Use of *it* or *they* to refer to the shoes would have been inappropriate here. In line 64, she uses the pronoun *it* to refer to one of the shoes, which is clearly in focus at this point as it has been mentioned (or is oth-

erwise part of the interpretation) of each of her father's previous three utterances.

(12) Eve 1;11.8 (Brown 1973)

55 EVE: that Papa shoes
56 %alt: Papa's
57 EVE: there
58 %act: *untied father's shoe*
59 FAT: what did you do?
60 FAT: well#you tie that right up
61 EVE: ok
62 FAT: right now
63 FAT: tie that shoe
64 EVE: Papa tie it

Later in the same transcript, Eve first uses a demonstrative pronoun for a referent that is probably already in focus for her mother and then later uses a personal pronoun for the same referent. Although she could have used a personal pronoun in line 363, the demonstrative is not inappropriate here, since anything in focus is also activated, and an adult might have used a demonstrative here as well. What is especially noteworthy is that Eve uses the weaker form before using the stronger one, not the other way around. It would have been less appropriate (and less adult-like) to use a form that clearly assumes the referent is in focus and then follow it up with a weaker form (i.e. 'it are hot' ... 'I better blow that'), and Eve does not do that either.

(13) Eve 1;11.8 (Brown 1973)

362 MOT: there# that one's just right
363 EVE: that are hot
364 MOT: well#it's not very hot
366 EVE: I better blow it

The other children we investigated are less precocious than Eve, but exhibit the same pattern of development. The examples in (14) and (15) are both from a 43 page transcript from Adam at age 2;5 which contains 24 pronouns (all used appropriately), one demonstrative determiner, and no definite or indefinite articles.

(14) Adam 2;5.12 (CHILDES; investigator Richard Cromer)

ADAM: screw # please
MOT: well, get down and get it
ADAM: daddy back dere # Daddy get screw
ADAM: daddy back dere?

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MOT: what?
ADAM: Daddy say back dere?
MOT: yes # Daddy said don't go back there#didn't he?
ADAM: yep # did he?
MOT: yes # but it's alright if you drop something
ADAM: drop
ADAM: get down
ADAM: drop it

The pronoun *it* in Adam's last utterance in (14) apparently refers to the screw that he dropped behind the couch. The screw is clearly in focus here as it is what this whole segment is about. A demonstrative pronoun (drop *that*), though licit, would not have been as appropriate here, as it would not as clearly pick out the in focus screw.

(15) ADAM: open dat
ADAM: open # mommy
ADAM: sarbaby??
MOT: sardines
ADAM: sardines

In (15), the demonstrative pronoun *dat* refers to the can of sardines that Adam wants his mother to open. Since the sardines have not been previously mentioned and there is no other reason to assume the mother's attention is focused on the sardines, the demonstrative is the strongest form that could have been used here, and a personal pronoun (open *it*) would have been inappropriate. The examples in (16) are from Peter at about the same age.

(16) Peter 2;5.23 (Bloom 1970)

(a) 362 LOI: all the furniture # the tables and the
lights and the beds# you can put in the house
363 PET: gonna. I'm gonna put them in the house

(b) (%act: *Peter has long wall in arms in 'guitar' position*)
4172 PET: This is a guitar
(%act: holding another wall)
4173 PET: awoh
4175 LOI: what's this?
4176 LOI: is that a guitar?
4177 PET: hm
4179 LOI: is that a guitar too?
4180 PET: yeah
4181 PET: two three guitars # here one# you
(%act: *Peter gives one of the 'guitars' to Patsy*)

4183 PAT: oh thank you

4184 PET: that's a guitar

(c) (%act: *stops playing, looks at Lois' big wall guitar, pointing to wall
Lois is holding, then to smaller one he has*)

4245 PET: no. that's my guitar and this is your guitar

3.2.2 *Demonstrative determiners*

All instances of demonstrative determiner usage in the data we examined were consistent with the minimum cognitive status required of the form in question (familiar for the distal demonstrative determiner *that/those* and activated for the proximal form *this/these*). However, demonstrative determiners are used more frequently than either definite or indefinite articles. This is in contrast to adult usage, where demonstrative determiners are relatively infrequent compared to articles, or bare nominals in languages that lack articles. (Ariel 1988, 1990, Gundel, Hedberg, and Zacharski 1993, *inter alia*)³. Moreover, while demonstratives are more frequent in adult speech to children than in adult speech in general, frequency in the input cannot completely account for the high instance of demonstratives relative to articles in children's speech, as their frequency in the input is still lower than that of definite or indefinite articles (Gundel and Page 1998). Gundel et al. 1993 attribute the relatively low frequency of demonstrative usage across languages to interaction of the Givenness Hierarchy with Grice's Maxim of Quantity: demonstrative pronouns typically implicate 'not in focus', and demonstrative determiners are mainly used only when signaling activation or familiarity is crucial. As noted above, for full noun phrases, signaling (by use of the definite article) that the addressee is able to uniquely identify the intended referent generally provides sufficient information about cognitive status to allow the addressee to assign the intended interpretation, given the descriptive content encoded in the phrase; and an explicit indicator of familiarity is thus usually unnecessary. Gundel and Page (1998) note that the relatively high frequency of demonstratives in child speech compared to adult speech suggests that children acquire the linguistic knowledge about appropriate use of different forms, i.e. the cognitive status meanings conventionally encoded by these forms, before they make referential choices driven by the Quantity Maxim. This is consistent with other findings about sensitivity to scalar implicatures developing relatively late in children (e.g. Noveck 2001, Papafragou and Musolino 2003, Verbuk 2007). It may also explain some apparently anomalous findings related to use of

³ It is of interest here that the definite article often develops from a (usually distal) demonstrative determiner across languages

indefinite article (e.g. Maratsos 1974, 1976). The examples in (17), (18), and (19) are typical of the children's 'overuse' of demonstrative determiners.

(17) Adam 2;5.12 (CHILDES)

ADAM: what dat?
URS: that's a paper clip
ADAM: what dat paper clip doing

(18) Peter 2;5.23 (Bloom 1970)

PET: having trouble. I found another light
(%act: *pulling out another lamp*)
LOI: mm# yes you did
PET: turn this light

In both (17) and (18), the referent of the demonstrative determiner phrase (*dat paper clip, dis light*) is in focus for the addressee at the point where the phrase in question occurs. Use of the demonstrative is therefore licit, as anything in focus is also familiar and activated. However, an adult may have been more likely to use the strongest possible form (*it*) or a weaker form (*the paper clip, the light*).

In (19), each of the individual uses of a demonstrative determiner (or pronoun) are appropriate and adult-like, but the sequence of 8 utterances, 6 of which contain a demonstrative determiner or pronoun, is not.

(19) Adam 2;6.3 (Brown 1973)

MOT: no # don't write in your book
ADAM: look at dat
ADAM: look at dat pencil (activated)
ADAM: look at dat
ADAM: go in there dis way (activated)
ADAM: what dat noise for
ADAM: where go?
ADAM: other side
ADAM: came from dis side

Example (20) is a more adult-like use of a demonstrative.

(20) Peter 2;5.23 (Bloom 1970)

(%act: *looking in bag for another slide*)
423 PET: where's that slide?

Note that a stronger form (*where's that, where is it*) would not have been appropriate here, as the referent is not activated for the addressee; it hasn't been recently mentioned and is also not visible). A definite article would probably have been too weak. Although the slide Peter is looking for is likely to be familiar to the addressee, the phrase *the slide* does not contain sufficient descriptive content to allow the addressee to identify it. Use of a demonstrative provides explicit information that this is a familiar slide that Peter is looking for. (21), from a later transcript, provides a similar example.

(21) Peter 2;8.12

(%act: *putting car down*)

PET: now I'm gonna get those tools *them/those

(%act: *walks back to bag, then begins picking up tools*)

3.2.3 Definite article

The definite article begins to appear around the middle of the third year, and somewhat earlier for Eve; though it is not used consistently at first, and not as frequently as the demonstrative determiners. All but one or two uses that we found in the data are appropriate. Though the full range of licit uses are found, from at most uniquely identifiable to in focus, most are for referents that are at least activated, as the children in these transcripts rarely talk about referents that have lower statuses. (22) illustrates an example of an early use of the definite article by Eve.

(22) Eve 1;11.8 (Brown 1973)

(%act: *looking at photographs*)

FAT: Eve # please

EVE: no # let me hold it

EVE: Eve in the snow

The snow is clearly activated here, as it is visible in the picture; but there is no reason to believe that it is in her father's focus of attention, and a personal pronoun (*Eve in it*) would therefore have been inappropriate. Note that Eve does use *it* in the previous utterance to refer to the photograph itself, which is clearly in her father's focus of attention, given the utterance that she is responding to. Even a demonstrative (*Eve in that*) would have been infelicitous here. Although the snow is activated, there are a number of other things that are activated as well. Two similar examples are provided in (23) and (24), from the same transcript.

- (23) 384 MOT: yeah # it's alright to eat
385 EVE: yeah # it's alright to eat
387 EVE: I got peanut butter on the paddle

- (24) 493 EVE: bowl
494 MOT: the bowl's right there
495 EVE: by the sugar

In (25), Adam uses a full determiner phrase with a definite article to clarify the referent that his mother was not able to identify from a demonstrative pronoun alone.

- (25) Adam 2;6.3 (Brown 1973)

ADAM: monkey get dat
MOT: what?
ADAM: monkey get de penny

In (26), from the same transcript, Adam uses a definite article to refer to a fireman that his mother has just introduced into the conversation.

- (26) ADAM: what dat fire engine doing
MOT: there isn't a fire engine there
MOT: there's just a fireman on a ladder
ADAM: what the fireman doing?
MOT: he may be going to help fight fire

(27) provides a similar example from Peter:

- (27) Peter 2;5.23

357 PET: what's over there?
358 LOI: over there behind Jenny?
359 PET: yeah
360 LOI: that's a house
361 PET: who's go in the house
362 LOI: what [!!] goes in the house??
362 PET: yeah

In (28), from a later transcript, Peter uses a definite article phrase to refer to the people he is looking for, which, given Pat's response, are clearly familiar and therefore uniquely identifiable to her. Note that a pronoun, either demonstrative or personal would have been inappropriate (*where they/those?*) as there would

be no reason to assume that the people are currently activated, i.e. in Pat's awareness/working memory.

(28) Peter 2;8.12

PET: where the people?
PAT: they're in the big bag over there
PET: bag
PAT: the big brown bag

(29), from the same transcript, is one of the few examples where a definite article is used for a referent that may be at most uniquely identifiable.

(29) PET: it's a big bulldozer
PAT: mhm
PET: a big bulldozer
PAT: a very big one
PET: here the wheels

Although the wheels of the bulldozer could be activated for PAT, as they are in the immediate environment, there is no reason to think that all parts of the bulldozer are in her awareness. It is more likely that she would construct a new unique representation via a bridging inference to the in focus bulldozer. In any case, a definite article phrase is the only form that would have been appropriate in this context (**here they/those are, *here are those wheels*), and this is the form the child used.

The only example of a possible misuse of the definite article was the following.

(30) Peter 2;5.23 (Bloom 1970)

4300 LOI: that guitar's almost as big as you are
4301 (%act: *puts her wall back in house*)
4302 PET: it's the guitar!!
4303 LOI: well I think's it's gonna be a wall right now
4304 PET: it's the guitar!!
4305 (%act: *bringing Lois her guitar*)
4306 PET: it's the guitar!!
4307 LOI: oh well # I don't want to play the guitar any more

It's not clear whether Peter was identifying this as the wall he had pretended was a guitar earlier (example 16 above, from the same transcript). If it is not, then Lois cannot assign a unique representation to the phrase *the guitar*, and the definite article is therefore inappropriate. It is possible (in fact likely), however, that

this is the same wall that Peter presented to Lois as a guitar earlier, in which case it is a particularly sophisticated example of definite article usage for an entity that is at most familiar at this point.

3.2.4 Indefinite article

The indefinite article appears to be acquired later than the other determiners and pronouns. (31) is a particularly compelling example of Eve's resistance to using this form, even though she apparently has some understanding of when it should be used.

(31) Eve 1;11.8

248 MOT: What do you want?
249 EVE: I want sandwich
251 MOT: You want what?
252 EVE: a sandwich
254 MOT: sandwich
255 EVE: yeah
257 MOT: well# what do you want to drink?
258 EVE: I want I want sandwich
260 MOT: you want a sandwich?
261 EVE: cheese sandwich

Similar omission of the indefinite article is found in the earlier transcripts from Adam.

(32) Adam 2;4.3 (Brown 1973)

178 ADAM: truck# look
179 MOT: <oh it's a truck>
180 ADAM: oh no busy bulldozer
181 MOT: <oh no #it's a busy bulldozer>
182 ADAM: dat busy bulldozer#truck

(33) Adam 2;6.3 (Brown 1973)

538 (%act: *shows to Richard*)
539 ADAM: penny in there
540 (%act: *shows to Richard*)
541 ADAM: look it penny in there
542 (%act: *shows to Richard*)
543 RIC: do you have a penny in there?
544 ADAM: in there
545 ADAM: I get it
546 ADAM: what that penny in there

When the indefinite article is used, however, it is used correctly, i.e. in contexts where a form that requires a stronger status would be inappropriate.

(34) Eve 2;2

EVE: I want my spoon
MOT: well# you have to have your spoon, yes
COL: (%act gets spoon for his coffee)
MOT: now you want a spoon # Eve
EVE: Fraser and Colin <have a > has a spoon for he cup
MOT: that's right

(35) Adam 2;6.3 (Brown 1973)

MOT: is that your garage?
ADAM: that's a little garage

In (34), a definite article (*Fraser and Colin has the spoon ...*) would have been inappropriate, as this is not a uniquely identifiable spoon, in fact it may not even be used referentially. Similarly, in (35) Adam is saying that the garage that his mother is referring to belongs to the type 'little garage'. He is not equating it with any particular garage.

4 Implications for Theory of Mind

While the research reported here is far from conclusive, it does show that children use the full range of cognitive status encoding determiners and pronouns, and use them appropriately, by the time they are 3. Moreover, these children are capable of using referring forms in a way that suggests they are sensitive to the memory and attention state of their interlocutors.⁴ Personal pronouns are used almost exclusively when the referent is clearly in focus, most definite article and demonstrative uses are for entities that are at least activated, though often not in focus, and there are occasional uses of the definite article before the age of 3 for at most uniquely identifiable or familiar entities. While these results are at variance with results of a number of early studies of acquisition of determiner and pronoun use which suggest that children don't master use of different referring forms until relatively late, 7-10 years according to some studies (see, Hickmann 2003 for extensive overview), they are corroborated by other, corpus-based stud-

⁴ This is not to say, of course, that young children (like adults) can't be so absorbed in something that they ignore the memory and attention states of others, or that they may even be more likely to do so than adults who are more experienced in interacting with others. The interesting thing is not so much that these children sometimes fail to take the mental state of their interlocutors into account, but that most of the time they do.

ies (see section 3.2) as well as by more recent experimental work which shows that children aged 3 and younger are able to appropriately choose and interpret referring forms, based on their interlocutors attention state (e.g. Matthews et al. 2006, O'Neill 1996, 2005, Wittek and Tomasello 2005, inter alia). In some sense, then, they have a theory of mind.

The term 'theory of mind' has been used for a wide range of phenomena, which have in common the ability to view others as mental beings with various mental states that may be different from one's own. It has also been associated more narrowly with the ability to verbally predict the behavior of others based on assessment of beliefs which may be wrong (e.g. Wimmer and Perner 1983). Such 'false belief' studies with children all over the world have shown that 3-year-old children are not able to verbally attribute beliefs to others that are different from their own beliefs. For example, if they know a toy is in the blue box, they will say that someone else thinks it is in the blue box as well, even if the other person has no basis for sharing that belief and actually would have reason to believe otherwise. Children aged 4 and older, however, attribute to others beliefs they would be expected to have based on their own experience even if this is different from what the child knows to be true. Such facts suggest that the kind of 'mind-reading' involved in appropriate use of forms that encode cognitive status is different from what is involved in the false belief tasks. First, in the investigations of children's use of referring forms in naturalistic settings, the mind-reading abilities are implicit and are measured on the basis of the children's behavior (their appropriate use of the different forms), while the abilities involved in the false belief tasks are explicit and measured by asking them what they think about the mental states or likely actions of others. The significance of this distinction is supported by results of studies that don't require children to verbalize beliefs. For example, Clements and Perner (1994) show that while 3-year-olds lack the ability to verbally attribute false beliefs to others, they do show an implicit ability to recognize false beliefs by looking to the place where they think people with such beliefs will look. Similarly, Repacholi and Gopnik 1997 show that children as young as 18 months are able to assess and act on other people's likes and dislikes by watching the expression on their faces. More recent studies of children's suggestibility and ability to assess speaker reliability also provide evidence that 3-year-olds who can't provide a verbal report of sources of their belief can decide who to believe and who not to believe at the time of input (e.g. Robinson and Whitcombe 2003). A related, and also possibly relevant, distinction is that the ability to assess epistemic states such as beliefs involves attributing propositional states to others, whereas the ability to attribute

cognitive statuses such as familiarity, focus of attention, or even ability to construct a unique representation, does not⁵.

A final distinction that may be important here is that between conceptual information, typically encoded by open class items, and procedural information encoded by closed class items. Matsui et al. (2006) found that children were better able to make use of information about evidentiality (i.e. a speaker's certainty with respect to some expressed proposition) when it was encoded by sentence final particles than when it was encoded by epistemic verbs such as *know* and *believe*. Matsui et al. note that closed class items typically encode non-representational, procedural information; they only manipulate representations and as such, are less accessible to consciousness and more implicit and automatic. Open class items, on the other hand, are declarative, representational and explicit, and therefore more accessible to conscious awareness and less automatic. Determiners and pronouns which code cognitive status are arguably more like the sentence final particles in this study than like verbs in that they are closed class and the information they encode is more procedural than conceptual (e.g. 'associate a representation from memory').

4 Conclusion

The Givenness Hierarchy theory proposed by Gundel, Hedberg and Zacharski allows a principled account of the distribution of different forms of referring expression both within and across languages and contributes to an explanation of how the intended interpretation of a referring expression is understood, given that the descriptive content encoded in the phrase rarely, if ever, uniquely determines a single interpretation. If this account is correct, the appropriate use of referring expressions involves the ability to take into account the mental states of others in at least two ways: (1) the ability to appropriately assess what cognitive status the intended interpretation has for the addressee at a given point in the discourse, e.g. whether it is in focus, activated, or familiar, and (2) the ability to assess how much information is sufficient and relevant for the addressee, both information about cognitive status (e.g. is it relevant to explicitly signal that the referent is familiar) and information about conceptual content (e.g. is it relevant to refer to an object as 'the red ball' or is it enough to simply refer to it as 'the ball'). We have suggested that the ability described in (1), which is necessary for assessing when the use of a particular determiner or pronoun is possible,

⁵ Cf. Baron-Cohen's steps 3 and 4 in the development of theory of mind. Step 3, the Shared Attention Mechanism (SAM), like the ability to assess cognitive statuses, is not propositional. It's function is to build 'triadic representations', specifying the relations between agent, self, and a third object (p. 44). Step 4, Theory of Mind Mechanism (TOMM), is a system for 'representing the set of epistemic mental states', such as belief (p. 51).

is implicit, non-propositional and relatively automatic; it corresponds to a kind of mind-reading ability that develops at a relatively early age in children (see Baron-Cohen 1995, Tomasello and Haberl 2003). This would explain why children by the age of 3 are able to use the full range of cognitive status signalling forms more or less correctly. The ability described in (2), on the other hand, appears to require more conscious reasoning about the epistemic states of others, and as such corresponds to a kind of mind-reading ability that is typically not fully developed until after the age of 4. This would explain the relatively late sensitivity to scalar implicatures in children, including the high frequency of demonstratives. If this account is correct, we would also expect younger children to be less competent in making decisions about how much descriptive/conceptual content is necessary in producing referring forms in different situations. Nadig and Sedivy (2002) found that 5- to 6-year-olds show robust evidence for taking the addressee's perspective into account both in production and understanding of referring forms. When presented with 4 objects in an array, they were more likely to use a descriptive adjective when more than one object of the same type (e.g. a big glass and a small glass) was visible to the adult than when they could see that one of the objects was blocked from the adult's view. They also were faster at understanding less descriptive referring expressions (e.g. *the glass* vs. *the tall glass*) when they could see that one of the objects of the same type was not visible to the adult. If the account we have proposed here is on the right track, we would expect children younger than 4 to perform significantly less well on such tasks.

There is clearly much more empirical work to be done in analyzing children's production and understanding of referring forms in both naturalistic settings and controlled experiments. It seems evident however that more fine-grained and primitive notions than salience, accessibility and given vs. new information are needed to serve as a fruitful basis both for investigating the development of children's abilities to produce and understand referring forms and for understanding the role of theory of mind in this development.

5 References

- Ariel, M. (1988). Referring and accessibility. *Journal of Linguistics*, 24:67-87.
- Ariel, M. (1990). *Accessing noun phrase antecedents*. London: Routledge.
- Astington, J. W. and J.A. Baird (2005). *Why language matters for theory of mind*. Oxford University Press, 84-105.
- Baron-Cohen, S. (1995). *Mindblindness. An essay on autism and theory of mind*. MIT Press.
- Bennett-Kastor, T. (1981). Noun phrases and coherence in child narratives. *Journal of Child Language* 10:135-149.

- Bittner, D. (2002). Emergence of grammatical complexity and markedness in the acquisition of verb and noun phrases in German. In: K. Dziubalska-Kolaczyk and J. Weckwerth (eds), *Future challenges for natural linguistics*. Lincom: Vienna, 25-56.
- Bittner, D. (2007). Early functions of definite determiners and DPs in German first language acquisition. In: Stark, E., E. Leiss and W. Abraham (eds.), *Nominal determination. Typology, context constraints and historical emergence*. Amsterdam/Philadelphia: Benjamins (Studies in Language Companion Series 89), 213-238.
- Bloom, L. (1970). *Language development: form and function in emerging grammars*. Cambridge, MA:MIT Press.
- Brown, R. (1973). *A first language*. Harvard University Press.
- Clements, W.A. and J. Perner (1994). Implicit understanding of belief. *Cognitive development* 9:377-395.
- Grice, H.P. (1975). Logic and conversation. In: P. Cole and J. Morgan (eds.) *Speech Acts*. New York:Academic Press, 41-58.
- Gundel, J.K., Hedberg, N., and R. Zacharski (1988). On the generation and interpretation of demonstrative expressions. *Proceedings of the XXIIth International Conference on Computational Linguistics*. John Von Neumann Society for the Computing Sciences, Budapest, 216-221.
- Gundel, J.K., Hedberg, N., and R. Zacharski (1989). Givenness, implicature, and demonstrative expressions in English discourse. *Chicago Linguistic Society* 25/2:89-103.
- Gundel, J.K., Hedberg, N., and R. Zacharski (1993). Cognitive status and the form of referring expressions in discourse. *Language*, 69:274-307.
- Gundel, J. and A. Mulkern (1998). Quantity implicatures in reference understanding. In: A. Kronfeld and L. Roberst (eds.), *The concept of reference in the cognitive sciences*. Special issue of *Pragmatics and Cognition*, 21-46.
- Gundel, J. and S. Page (1998). The givenness hierarchy and children's use of referring expressions. Paper presented at the Annual Meeting of the Linguistic Society of America, January 6, 1998.
- Gundel, J., Sera, M. and S. Page (1999). The acquisition of referring expressions in English and Spanish. Paper presented at the Child Language Research Forum, Stanford, April 10, 1999.
- Gundel, J., Sera, M., Kowalski, M., and S. Page (2001). Cognitive status, implicature, and children's use of referring forms in English and Spanish. Poster presentation. Society for Research in Child Development Annual Meeting. Minneapolis, May 2001.
- Hawkins, J. (1991). On (in)definite articles. *Journal of Linguistics* 27:405-42.
- Hickmann, M. (2003). *Children's discourse. Person, space and time across languages*. Cambridge University Press.
- Horn, L R. (1972). On the semantic properties of logical operators in English. UCLA dissertation, Los Angeles.
- MacWhinney, B. (1995). *The CHILDES project: tools for analyzing talk*. 2nd edition. Hillsdale, NJ: Lawrence Erlbaum Associates
- Maratsos, M. (1974). Preschool children's use of definite and indefinite articles. *Child Development* 45:446-455.
- Maratsos, M. (1976). *The use of definite and indefinite reference in young children*. Cambridge University Press.

- Matthews, D., Lieven, E., Theakston, A. and M. Tomasello (2006). The effect of perceptual availability and prior discourse on young children's use of referring expressions. *Applied Psycholinguistics*, 403-422.
- Matsui, T. (1995). *Bridging and Reference*. University College, London dissertation, London.
- Matsui, T., T. Yamamoto, and R. McCagg (2006). On the role of children's early understanding of others as epistemic beings. *Cognitive Development* 21:156-173
- Nadig, A.S. and J. C. Sedivy (2002). Evidence of perspective-taking constraints in children's on-line reference resolution. *Psychological Science* 13.4:329-336.
- Noveck, I. Al (2001). When children are more logical than adults: experimental investigation of scalar implicature. *Cognition* 78.2:165-188.
- Ntelitheos, D. and C. Manorohanta (2004). Case and the acquisition of the pronominal paradigm in Malagasy. Unpublished ms. UCLA.
- O'Neil, D. K. (1996). Two year old children's sensitivity to a parent's knowledge. *Child development* 67:659-677.
- O'Neil, D. K. (2005). Talking about "new information." The given-new distinction and children's developing theory of mind. In: J. W. Astington and J.A. Baird (eds.) *Why language matters for theory of mind*. Oxford University Press, 84-105.
- Papafragou, A. and J. Musolino (2003). Scalar implicatures: experiments at the semantic-pragmatic interface. *Cognition* 86.3:233-282.
- Premack, D. and G. Woodruff (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences* 1:515-526.
- Repacholi, B.M. and A. Gopnik (1997). Early reasoning about desires. Evidence from 14- and 18-month-olds. *Developmental Psychology* 33.1:12-21.
- Robinson, E.J. and E. Whitcombe (2003). Children's suggestibility in relation to their understanding about sources of knowledge. *Child Development* 74:48-62.
- Tomasello, M. and K. Haberl (2003). Understanding attention: 12- and 18-month-olds know what is new for other persons. *Developmental Psychology* 39:906-912.
- Verbuck, A. (2007). Why children do not compute irrelevant scalar implicatures. Paper presented at the Annual Meeting of the Linguistic Society of America, January 7, 2007, Anaheim, CA.
- Wilson, D. (1992). Reference and relevance. *UCL Working Papers in Linguistics*, 167-189.
- Wimmer, H. and J. Perner (1983). Beliefs about beliefs: representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition* 13:103-128.
- Wittek, A. and M. Tomasello (2005). Young children's sensitivity to listener knowledge and perceptual context in choosing referring expressions. *Applied Psycholinguistics* 26: 541-558.

The influence of “aboutness” on pronominal coreference

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Previous work examining the role of antecedent accessibility in pronominal coreference has often linked coreference to prominent structural positions that in turn are linked to information structure statuses such as topic. Three experiments examine the influence of topichood independently of structural prominence by exploring the influence of the pragmatic notion of aboutness on the written production of pronominal coreferring expressions. The results show that being mentioned in an *about*-phrase increases the likelihood that a referent will be selected as the future topic of a following sentence as well as increasing the proportion of responses with early, pronominal coreference to that referent, at the expense of coreference with the subject. These results suggest that coreference is sensitive to the status of other, structurally non-prominent referents in discourse, and that the pragmatic notion of aboutness influences pronominal coreference.

1 Introduction

Pronominal coreference poses a number of questions for language researchers, in large part because of the underspecified nature of the pronouns themselves. For example, because pronouns carry little in the way of semantic information compared to fuller forms of reference (e.g., descriptive noun phrases or names), one might expect pronouns to be more difficult to interpret and thus dispreferred as a reference form. Yet, this does not appear to be case and in fact under certain discourse conditions they appear to be strongly preferred, if not required, for coherence. This raises the question of what these discourse conditions are and what determines when a speaker or writer chooses to refer to something using a pronominal form. One potential influence comes from the information status that referents in a sentence hold: for example, a referent may be interpreted as

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what the proposition expressed by a sentence is *about* given the current discourse, in which case it is considered to be the topic of the sentence. This paper examines the influence of topic status and in particular this pragmatic notion of *aboutness* on the production of pronominal coreference.

2 Background

Many factors appear to be involved in processing pronominal coreference (see Garnham, 2001 for an overview), including the nature and position of the antecedent in the discourse (e.g., recency, frequency, grammatical role parallelism, structural prominence), the relationship between sentences containing the antecedent and the anaphor (e.g., coherence relations) and the type of predicates involved in the coreference (e.g., implicit causality). Focusing on the first type of factor, many studies have found a preference for pronominal coreference to antecedents that are mentioned prominently, either syntactically as the subject (Crawley, Stevenson & Kleinman, 1990) or in a clefted phrase (e.g., Cowles, Walenski & Kluender, in press), or linearly by being first-mentioned (e.g., Gernsbacher & Hargraves, 1988; Gernsbacher, Hargreaves & Beeman, 1989, but cf. Gordon, Hendrick & Foster, 2000; Cowles et al. in press). It is important to note that in many languages subject position is easily confounded with being first-mentioned, and in studies that have untangled these positions, there have been mixed results, with either a preference for subject antecedents (Cowles et al., in press; Kaiser & Trueswell, 2003) or indications that both factors influence pronoun interpretation independently (Jarvikivi, van Gompel, Hyona & Bertram, 2005).

The generalization made by many researchers is that pronouns are used to corefer with highly accessible antecedent referents, and these different ways of mentioning antecedents can be seen as influencing referent accessibility. A number of proposals (e.g., Ariel, 1990; Garrod, Freudenthal & Boyle, 1994; Gundel, Hedberg & Zacharski, 1993) have tied reference form to the status of antecedent referent in the cognitive representation of the discourse in this way, arguing that pronouns are used when referring to prominent or discourse-focused antecedent referents. A clear prediction of such approaches is that it is not subjecthood or first mention *per se* that is an attractor for pronominal coreference, but rather the effect that subject position or first mention has on the referent of the antecedent expression. This is in contrast to other approaches that emphasize the structural status or thematic role of the antecedent (e.g., Smyth, 1994; Chambers & Smyth, 1998). However, while the notions of cognitive status and accessibility have featured in many approaches to pronoun resolution, they are often tied to syntactic (e.g., Grosz, Joshi & Weinstein, 1995) position. If it is indeed the cognitive status of the antecedent referent that is one of the de-

termining factors in pronoun resolution, then non-syntactic manipulations of cognitive status should also influence pronoun resolution.

Another way to think about the issue of antecedent cognitive status and reference form is to consider the information structure of the utterance that contains the antecedent. For example, subjecthood is often a signal of topic status while clefts often signal (contrastive) focus status (e.g., Kiss, 1999). Word order variation, too, often has significant consequences for information structure, with fronted elements either having topic or focus status, depending on the construction used. Topic status is argued to be tied to prominent cognitive status (e.g., Lambrecht, 1999) and so is a good candidate for influencing pronominal resolution, and in fact has been included as one factor influencing pronominal coreference (Ariel, 1990). However, as we shall see below, topic status is also often associated with prominent syntactic positions, and so in order to investigate the influence of topic status while avoiding confounds with subject status or first-mention, we now turn to the pragmatic notion of *aboutness*, which can help tease apart topic status from structural prominence and primacy.

The notion of aboutness is considered to be a defining aspect of topic status by many researchers (e.g., Gundel, 1976; Reinhart, 1982, Lambrecht, 1994). In this view, the topic of a proposition expressed by an utterance is what the proposition is about, given a particular situation. That is, the topic is that part of the utterance that is the central interest or concern, and to which new information is being added (cf. Strawson, 1964). As just mentioned, topic status has been associated cross-linguistically with reduced forms of coreferring expressions, including pronouns (e.g., Ariel, 1988, 1990; Gundel et al., 1993).

Structurally, the precise mechanisms for encoding topic status differ cross-linguistically, but may involve both prosody and particular syntactic positions or constructions. In English, subject position is often associated with topic status, and may be seen as the unmarked topic position in canonical SVO sentences (Lambrecht, 1994). One classic diagnostic for topichood is the “about X” test in which a sentence is paraphrased such that the potential topic X is placed in an *about*-phrase and the felicity of this new paraphrase is determined (Gundel, 1976; Reinhart, 1982). This test is unfortunately not perfect, but suggests that mentioning a referent in an *about*-phrase may be a good way to signal (at least potential) topic status for a comprehender without using subject position, and thus it provides a way to examine topic status without confounding it with subject or other prominent syntactic positions.

Cowles (2003, Cowles & Ferreira, in prep) tested the influence of referents mentioned in *about*-phrases on the syntactic structure of spoken utterances. In one experiment, participants listened to sentences containing a target noun mentioned either in a post-verbal *about*-phrase (*A nurse noticed something about the lightning.*) or as the object of an embedded sentence complement (*The*

nurse noticed something as she watched the lightning.). After each sentence, they saw a theme-experiencer verb (e.g., *frightened*) followed by two nouns, one of which was the target (e.g., *baby*, *lightning*) and needed to verbally produced a sentence that used these three words and fit with the sentence that they just heard. Responses were coded according to whether the target noun was mentioned before (and in a higher syntactic position than) the other target noun. Crucially for present purposes, participants were instructed to use the nouns as they were presented with them, thus implicitly instructing them to not use other forms of reference to refer to the targets. Participants largely obeyed this constraint, and responses were only scored if they contained the full form of the target nouns (e.g., *lightning*). Cowles (2003) found a topic-mention advantage in which *about*-phrase targets were more likely to be produced early in an utterance compared with non *about*-phrase targets. Also, this effect was larger for theme targets than experiencer targets. These results support the idea that manipulations of topic status via *about*-phrases can have an impact on sentence production at a structural level, but do not provide evidence about whether reference form may also be affected. It is exactly this question that is addressed in the experiments that follow.

3 Experiments

3.1 Experiment 1

3.1.1 Methods

The goal of Experiment 1 was to examine whether *about*-phrases have an impact on the identification of the topic in the current sentence or influence predictions about the likely identity of the topic of the following utterance. To do this, materials were taken from Cowles (2003) and adapted for a questionnaire study in which participants were asked to indicate the topic of the current sentence and choose whether the target non-subject referent or something entirely new was most likely to be the topic of an immediately following sentence.

3.1.1.1 Participants

Forty members of the University of California, San Diego community participated.

3.1.1.2 Design and Materials

Setup sentences from experimental and filler items in Experiment 4-1 of Cowles (2003) were used. Experimental items consisted of 40 sentences that were constructed by crossing two factors: Target type (experiencer *vs.* theme) and infor-

mation status (given *vs.* about), for a total of four experimental conditions. An example is given in Table 1 below.

Table 1: Example of materials from Experiment 1

Target Type	Information Status	Setup Sentence
Experiencer	<i>Given</i>	The passenger realized something when he saw the <u>driver</u> .
	<i>About</i>	A passenger realized something about the <u>driver</u> .
Theme	<i>Given</i>	The passenger realized something when he saw the <u>traffic</u> .
	<i>About</i>	A passenger realized something about the <u>traffic</u> .

Cowles (2003) asked participants to produce sentences using theme-experiencer verbs and following this *target type* refers to whether the target argument in the setup sentence (underlined in Table 1) could be assigned the role of experiencer (e.g., driver) or theme (e.g., traffic) in the sentences that participants produced in that experiment. In all but one item target type also corresponded to a difference of animacy in which the experiencer arguments were all animate and the theme arguments were inanimate. The *about* condition was constructed by placing an indefinite noun in subject position followed by a verb followed by the word *something* and then the *about*-phase. The target argument was given as the object of the *about*-phrase. The *given* condition was constructed by using the same subject noun, but with a definite determiner, followed by a verb followed by the word *something* and then followed by a sentence complement. In this condition the target argument was always given as the object of the embedded verb.

Experimental items were divided into four lists using a Latin square design such that each item was given exactly once in each list and each list contained equal numbers of items from each condition (i.e. 10 of each condition). Forty filler items from Cowles (2003) were added to each list and then lists were pseudorandomized such that no two consecutive items were from the same condition and no more than three experimental items ever appeared in a row. Two versions of each list were created with different orders of items and fillers. This was to help prevent any spurious effects of item order within the lists.

3.1.1.3 Procedure

After giving informed consent, participants were seated in a quiet room and given the experimental materials in the form of a printed packet. All test items in the packet were presented as a sentence followed by two nouns. In experi-

mental trials, participants were given the setup sentences followed by the two possible target arguments (the theme and the experiencer). They were asked to do two things for each item in the packet. First, they needed to circle the part of the sentence that they considered to be the topic of that sentence. Then, they needed to choose one of the two following target arguments as the most likely topic of the next sentence². Because of the design of the setup sentences, one of these target arguments was always previously given in the setup sentence (either in the *about* or *given* condition) and the other argument was not previously mentioned at all.

3.1.2 Results

Two measures of participant responses were calculated: the proportion of times the target argument was chosen as the topic of the setup sentence (the current topic) and the proportion of times that the *theme* argument was chosen as the most likely topic of the next sentence (the future topic). Table 2 shows the results of these measures.

² Participants were given the following instructions:

In linguistic theory, most sentences are considered to have “topics”. The topic of a sentence is its central element, the part that any new information conveyed by the sentence is added to. For example, if you had a sentence like “As for the milkman, he noticed the yogurt had gone bad,” the milkman would be the topic because he’s the thing that the sentence has new information concerning, that is, that he noticed something. But, if the sentence was “As for the yogurt, the milkman noticed that it had gone bad,” then the yogurt would be the topic because it is now the yogurt that is having new information added to it – the fact that it had gone bad.

In the following pages, we’re going to show you the first sentence in a story. It will look something like this:

Current Topic?	Next Topic?
1. As for the milkman, he noticed that some yogurt had gone bad.	<input type="checkbox"/> milkman <input type="checkbox"/> mold

We want you to do two things with each sentence: First, we want you to determine what you think the topic of each sentence is, and then circle it in the sentence. Second, imagine that another sentence is going to be written that continues the story. We want you to decide which of the two things listed next to the sentence is most likely to be the topic of that next sentence, and check the box next to your choice.

Table 2: Results from Experiment 1: Proportions of responses with the target argument selected as the current topic and proportions of responses in which the theme argument was chosen as the most likely future topic. Standard errors are given in parentheses

Information status		
Current Topic		
Argument type	Given	About
Experiencer	.031 (.013)	.114 (.045)
Theme	.056 (.027)	.089 (.034)
Theme as Future Topic		
Argument type	Given	About
Experiencer	.292 (.039)	.181 (.038)
Theme	.647 (.045)	.817 (.039)

As Table 2 shows, for the current topic measure there was an overwhelming dispreference for the target argument, with the target circled only an average of 7% of the time (the subject of the main clause was chosen instead in all other cases). However, despite this overall dispreference, the target was still chosen relatively more often in the about condition compared to the given condition (10% vs. 4%). This effect appeared to be larger for experiencers (with an increase of 8%) than for themes (3%).

In the future topic measure there was an effect of given vs. new: participants showed a greater preference for the theme when it was previously mentioned in the setup sentence (selecting it as the most likely future topic 73% of the time) compared to when the experiencer argument had been mentioned instead (selecting the theme 24% of the time instead). There was an additional preference for the theme when it was mentioned in an *about*-phrase, which is reflected in the increase in theme selection in the theme-about condition compared to the theme-given condition. The decrease in theme selection in the experiencer-about condition compared to the experiencer-given condition also reflects a preference for selecting the about-mentioned argument as the future topic: greater experiencer selection in this condition is reflected as a decrease in theme selection.

Statistical analyses confirm these observations. For the current topic measure, two-factor (target type x information status) repeated measures ANOVAs with participants (F_1) and items (F_2) as random variables revealed a main effect of information status, such that target arguments were more likely to be chosen when they were mentioned in the about-phrase condition ($F_1(1,35) = 4.971, p < .032$; $F_2(1,39) = 6.67, p < .014$). There was no main effect of argument type, reflecting the fact that experiencers were no more likely to be chosen overall than themes ($F_s < 1$). However, there was an interaction of type and

status, reflecting the fact that the effect of status was larger for experiencers than themes ($F_1(1,35) = 4.565, p < .04$; $F_2(1,39) = 5.315, p < .027$). Planned pair-wise comparisons show that the effect of information status was significant for experiencers ($t_1(1,35) = 2.47, p < .02$; $t_2(1,39) = 2.78, p < .01$) but only marginal for themes ($t_1(1,35) = 1.78, p < .08$; $t_2(1,39) = 1.86, p < .07$).

For the future topic measure, two-factor (target mention x information status) repeated measures ANOVAs with participants (F_1) and items (F_2) as random variables revealed a main effect of argument type ($F_1(1,35) = 48.01, p < .001$; $F_2(1,39) = 230.6, p < .001$) reflecting the preference for theme when it was previously mentioned in the setup sentence. There was no effect of information status ($F_1(1,35) = 2.36, n.s.$; $F_2(1,39) = 1.78, n.s.$) but there was an interaction of mention and status ($F_1(1,35) = 25.93, p < .001$, $F_2(1,39) = 36.33, p < .001$), reflecting the fact that themes were chosen more when previously mentioned in the about condition and less when it was the experiencer that was mentioned in the about condition. Planned pairwise comparisons showed that the effect in information status was significant in both the theme-mentioned ($t_1(1,35) = 4.29, p < .001$; $t_2(1,39) = 5.26, p < .001$) and experiencer-mentioned ($t_1(1,35) = 4.26, p < .001$; $t_2(1,39) = 3.67, p < .001$) conditions.

The results support the hypothesis that *about*-phrases influence the topic status of their referents, with *about*-phrase referents being more likely to be chosen as topic, especially as the most likely future topic. For current topic selection, there was an overwhelming preference to select the subject of the main clause. However, aboutness still had an effect and in this case theme arguments showed a larger influence of *about*-phrase mention than experiencer arguments. Because theme arguments were inanimate in all but one item (and experiencers were always animate), this may reflect an interaction with animacy in which inanimate referents are most influenced by *about*-phrase mention, at least with respect to their information status in the current sentence. These results are similar to those reported in Cowles (2003), in which theme arguments were also more influenced by *about*-phrase mention than experiencer arguments.

3.2 Experiment 2a

Experiment 1 established that the materials from Cowles (2003) influence both current and future topic preferences, but with a much larger influence on future topic preference. Experiment 2 was designed to see whether this topic interpretation for the *about*-phrase referent would influence pronominal coreference production in a written sentence production task. Participants were given the theme setup sentences along with a theme-experiencer verb and asked to create a sentence using the verb that followed from the setup sentence.

3.2.1 Methods

3.2.1.1 Participants

Twelve members of the University of Florida community participated.

3.2.1.2 Design and Materials

This experiment had two conditions: About (when the target argument was mentioned in an *about*-phrase) vs. Given (when it was mentioned as the object in an embedded clause). The theme-given and theme-about conditions of all forty experimental items were taken from Experiment 1, as well as all filler items. Each setup sentence was paired with a theme-experiencer verb, also taken from Cowles (2003). Theme-experiencer verbs were chosen both here and in Cowles (2003) because they have been shown to be roughly equally biased in their use between passive and active voices (Altmann & Kemper, 2006; Ferreira, 1993). This was important in Cowles (2003) because the principle interest of that study was the role that topic status plays in the online production of syntactic structures, but is also useful for our present purposes because such verbs should not bias any particular argument toward subject position in the written responses elicited in these experiments.

Experimental items were divided into two lists using a latin-square design such that each item was given exactly once in each list and each list contained equal numbers of items from each condition (i.e. 10 of each condition). Forty filler items from Cowles (2003) were added to each list and then lists were pseudorandomized such that no two consecutive items were from the same condition and no more than three experimental items ever appeared in a row. Two versions of each list were created with different orders of items and fillers. This was help prevent any spurious effects of item order within the lists. Each list was formatted so that items appeared in a numbered list. Each item consisted of the setup sentence followed by the theme-experiencer verb in parentheses, presented in past tense/participle form. The verb was preceded by an arrow to help remind participants that they needed to use it in the sentence that they produced. Under each setup sentence there was a blank line for their response.

3.2.1.3 Procedure

After giving informed consent, participants were seated in a quiet room and were presented with the experimental materials in the form of a printed packet. Participants were given a set of written instructions in which they were told that they should read each sentence and following verb and then write down a sentence that used the verb and naturally followed and fit with the sentence they

had just read. They were also told that they could add new information in their sentence, but should try to keep the sentences relatively short.

3.2.2 Results

All 480 responses to experimental items were entered into a computer data file and coded in the following way. First, responses were excluded if they were ungrammatical, did not contain the given verb, or failed to use the verb appropriately (*i.e.*, as a verb). This removed 16 responses (3% of the data) from further analysis. Next, each response was coded (yes or no) for whether it contained coreference to the target noun in the setup sentence as well as whether it contained coreference to the subject. If it did contain coreference to either of these, then the form of the coreferring expression was coded (pronoun, repeated, other). Finally, each response was coded for whether the first-mentioned entity in the sentence corresponded to the subject or target in the setup sentence (or to something else). The results are given in Table 3 as proportions out of all analyzed responses³

Table 3: Results from Experiment 2a: Proportions of responses with coreference of subject and target arguments, both in any form as well as specifically in pronominal form, as well as proportion of first mention for subject and target. Standard errors are given in parentheses.

Information Status of Target		
	Given	About
Coreference (all forms)		
Subject	.74 (.05)	.61 (.04)
Target	.45 (.04)	.60 (.04)
Coreference (pronominal)		
Subject	.69 (.07)	.56 (.06)
Target	.16 (.03)	.30 (.04)
First Mentioned		
Subject	.45 (.07)	.32 (.05)
Target	.36 (.07)	.54 (.05)

The results show that mention in an *about*-phrase has a clear effect on how the target is treated in participants' responses. First, mention in an *about*-phrase resulted in more instances of coreference in any form with the target (.60) compared to when it was merely given as part of the subordinate clause (.45). Fur-

³ An analysis of proportion of pronominal coreference out of only those trials with coreference in any form was not possible for Experiment 2b due to items with no (esp. target) coreference. The measure of pronominal coreference out of all analyzable trials was used instead in order to allow better comparison between the experiments.

ther, *aboutness* caused an increase in use of pronouns as the form of coreferring expression. Finally, targets were also more likely to be mentioned first in the sentence when they had occurred in an *about*-phrase, in keeping with the results from Cowles (2003).

Turning to effects of target aboutness on the production of the subject, there is a similar, complementary effect. Subjects were *less* likely to be coreferenced overall when the theme had been mentioned in an *about*-phrase and were less likely to have coreference in pronominal form. Subjects were also less likely to be mentioned first when the target was previously mentioned in an *about*-phrase.

These observations are supported by statistical analyses. Paired-sample *t*-tests were used to compare proportions between the given and about conditions, with both participants (t_1) and items (t_2) as random factors. These analyses showed a significant difference for aboutness in all target measures: Overall coreference ($t_1(1,11) = 4.84, p < .001; t_2(1,39) = 3.36, p < .002$), pronoun coreference ($t_1(1,11) = 5.04, p < .001; t_2(1,39) = 4.46, p < .001$), and first mention ($t_1(1,11) = 4.55, p < .001; t_2(1,39) = 2.5, p < .02$). The analyses also showed a significant difference for overall coreference to subjects ($t_1(1,11) = 3.37, p < .006; t_2(1,39) = 3.36, p < .002$) as well as pronominal coreference ($t_1(1,11) = 3.2, p < .008, t_2(1,39) = 2.95, p .007$) but only a marginal difference for subject first mention ($t_1(1,11) = 1.89, p < .09; t_2(1,39) = 1.53, n.s.$).

3.3 Experiment 2b

The results of Experiment 2a suggest that aboutness influences coreference and the form of coreferential expressions. However, it is possible that the difference between the given and about conditions is not being driven by the *about*-phrase *per se* but rather by other differences between the conditions. There are two systematic differences in particular that are likely candidates: the difference in subject definiteness (subjects were always definite in the given condition and always indefinite in the about condition) and the extra coreference (always pronominal) to the subject in the given condition compared to the about condition. To examine this possibility, materials from the given condition in Experiment 2a were modified to make them more similar to the about condition and another sentence production experiment was conducted.

3.3.1 Methods

3.3.1.1 Participants

Twelve members of the University of Florida community participated. These participants did not take part in Experiment 2a.

3.3.1.2 Design and Materials

The materials were identical to those in Experiment 2a except for two changes in the given condition. First, the subject was made indefinite by using the determiner *a* instead of *the*. Second, the embedded clause was altered by removing the subject pronoun and inflecting the verb with the progressive *-ing*. Some verbs needed to be altered in order to keep the sentences as natural sounding as possible. In these cases, the verb was changed in the both the given and topic conditions. An example of the modified materials is given in Table 4 below.

Table 4: Example of materials from Experiment 2b

Setup sentence (prompt verb)	
Given	A nurse mentioned something while watching the lightning. (frightened)
About	A nurse mentioned something about the lightning. (frightened)

3.3.1.3 Procedure

The experimental procedure was identical to Experiment 2a.

3.3.2 Results

One item was dropped from analysis due to a typographical error for that item in the printed packet. All 468 responses to the remaining 39 experimental items were entered into a computer data file and coded in the same way as in Experiment 2a, with 9 responses (2%) removed from further analysis as a result of coding procedures. The results are given in Table 5.

Table 5: Results from Experiment 2b: Proportions of responses with coreference of subject and target arguments, both in any form as well as specifically in pronominal form, as well as proportion of first mention for subject and target. Standard errors are given in parentheses.

	Information Status of Target	
	Given	About
Coreference (all forms)		
Subject	.82 (.03)	.68 (.04)
Target	.43 (.04)	.53 (.03)
Coreference (pronominal)		
Subject	.75 (.05)	.63 (.04)
Target	.22 (.03)	.33 (.05)
First Mentioned		
Subject	.74 (.04)	.53 (.05)
Target	.18 (.03)	.31 (.04)

The results are very similar to those found in Experiment 2a: mention in an *about*-phrase had an effect on how both the target and subject were treated by participants in their response sentences. Once again, mention in an *about*-phrase resulted in more instances of coreference in any form (.53) with the target compared to when it was simply part of the subordinate clause (.43). *Aboutness* also resulted in an increase in the use of pronouns as the form of coreferring expression and targets were more likely to be mentioned first in the sentence when they had occurred in an *about*-phrase. In turn, subjects were *less* likely to be coreferenced overall when the theme had been mentioned in an *about*-phrase and were less likely to have coreference in pronominal form. Subjects were also less likely to be mentioned first when the target was previously mentioned in an *about*-phrase.

These observations are supported by statistical analyses. Paired-sample t-tests were used to compare proportions between the given and about conditions, with both participants (t_1) and items (t_2) as random factors. The difference in overall coreference to the target was marginal by participants and significant by items ($t_1(1,11) = 2.12, p < .06; t_2(1,38) = 2.10, p < .05$) and the same was also true for pronoun coreference to the target ($t_1(1,11) = 2.04, p < .07; t_2(1,38) = 2.62, p < .02$). The target was first-mentioned significantly more often when it was previously in an *about*-phrase ($t_1(1,11) = 4.52, p < .001; t_2(1,38) = 3.13, p < .003$). The analyses showed a significant difference for overall coreference to subjects ($t_1(1,11) = 3.23, p < .008; t_2(1,38) = 3.77, p < .001$) as well as pronominal coreference ($t_1(1,11) = 2.40, p < .04, t_2(1,38) = 2.65, p < .02$) and subject first mention ($t_1(1,11) = 4.84, p < .001; t_2(1,38) = 4.67, p < .001$).

4 Discussion

The results from Experiment 1 establish that the *about*-phrase manipulation had an effect on the selection of both the topic in the sentence containing the *about*-phrase and the topic of a hypothetical following sentence. While the influence on the current topic was significant, the preference for the target was very small, reflecting an overwhelming preference to view the subject of a simple, declarative sentence in a neutral context as the topic of the proposition expressed by that sentence. When presented with the choice between something previously mentioned and something new as the likely next topic of a following sentence, there was an unsurprising preference for the previously mentioned argument. However, there was an additional increase in preference for the previously mentioned argument when it had been in an *about*-phrase, suggesting that *about*-phrases do successfully influence the topic status of future mentions of the *about*-phrase referent. Additional work needs to be done to see how this preference stands up against the option of selecting the previous subject.

With the results of Experiment 1 in mind, we can turn to the written production data from Experiments 2a and 2b. The main goal in these experiments was to examine whether there would be an increase in pronominal coreference with referents that had been previously mentioned in an *about*-phrase compared to those that were not. In both experiments, the results show that there was such an increase, although it was attenuated in Experiment 2b. In fact, there was an increase in overall coreference to the *about*-phrase antecedent as well as pronominal reference. Further, an *about*-phrase antecedent was more likely to be mentioned first in the sentence than the same referent when it was not in an *about*-phrase. The pattern of results from all three of these measures is consistent with the idea that *aboutness* influences the status of referents in the discourse representation.

Interestingly, the status of the target also had an influence on coreference with the subject. In both experiments, the proportions of overall coreference to the subject as well as pronominal coreference decreased when the target was mentioned in an *about*-phrase. If the effect of *about*-phrase mention was only to increase the accessibility of the target, then one might expect to find differences only in measures of target coreference, because there is no reason why participants could not use pronouns to refer to both the subject and the target in the same response. But, clearly subject and target pronominal coreference in the responses was not independent: when target coreference increased, subject coreference decreased. This is consistent with two possibilities: first, that accessibility is related to attentional processing and thus a finite resource. From this perspective, increasing the accessibility of one referent necessarily decreases the accessibility of other referents (Arnold & Griffin, 2007) and so if aboutness increases the accessibility of a referent, then the subject referent must become less accessible. The second possibility is that *about*-phrase mention increases the likelihood that the target is interpreted as the topic of the next utterance. This topic assignment would be at the expense of the subject because there is normally only one topic in any given sentence. This second possibility, that topic status is being assigned to the target instead of the subject more often in the about condition, is supported by the fact that in Experiment 2a targets were first-mentioned more often (.54) than subjects (.32) when the target was mentioned in an *about*-phrase. Combined with the results from Experiment 1, this suggests that participants interpreted the target referent as the topic of the next sentence more often when it occurred in an *about*-phrase, and then encoded it as topic appropriately, placing it in subject position (and using pronominal coreference).

However, it is important to note that while *aboutness* had a significant effect in these different measures, *about*-phrase antecedents nearly always had lower proportions than subject antecedents. Thus, while overall it appears that *aboutness* influences coreferential form and position within a sentence, it does

not completely override the influence of being mentioned in subject position. This could be because subject position is a very strong cue to topic status in English, or it could be because of an independent structural preference for coreference with subject-mentioned antecedents that would not be diminished by a shift in topic status or accessibility of the target. That is, it may be that subject preference is really a combination of two factors: an increase in accessibility (due to topic status) and a preference for coreference with the particular structural position of subject. Further work is needed to tease these possibilities apart.

5 Conclusions

The results presented here show that the pragmatic notion of aboutness influences not only pronominal coreference to referents mentioned as objects of *about*-phrases, but also to referents mentioned first and in subject position. Although there is an overwhelming preference to interpret the subject of a sentence as the topic, *about*-phrases nonetheless appear to influence comprehenders' interpretations of both the topic of the current sentence as well as the most likely topic of a following utterance. Taken together with theoretical accounts of topichood, these results support the idea that *about*-phrases serve to guide topic interpretation, and suggest that topic status may influence pronominal coreference production even when it is not signaled via syntactic prominence or primacy. However, both of these latter factors still appear to have an important influence on the use of pronominal coreference, as the results of all the experiments showed a strong preference for using pronominal expressions to refer to subject, first-mentioned referents. Thus, while aboutness has a significant influence on pronominal coreference, it does not appear to override preferences for pronominal coreference derived from syntactic status or linear order.

6 References

- Altmann, L. & Kemper, S. (2006). Effects of age, animacy and activation order on sentence production. *Language and Cognitive Processes* 21: 322-354.
- Ariel, M. (1988). Referring and accessibility. *Journal of Linguistics* 24: 65-87.
- Ariel, M. (1990). *Accessing noun-phrase antecedents*. London: Routledge.
- Arnold, J. & Griffin, Z. (2007). The effect of additional characters on choice of referring expression: Everyone counts. *Journal of Memory and Language* 56: 521-536.
- Chambers, C. & Smyth, R. (1998). Structural parallelism and discourse coherence. *Journal of Memory and Language* 39: 593-608.
- Cowles, H.W. & Ferreira, V. (in prep). The influence of information structure on sentence production.
- Cowles, H.W. (2003). *Processing Information Structure: Evidence from Comprehension and Production*. Unpublished PhD Dissertation, UC San Diego.

- Cowles, H.W., Walenski, M. & Kluender, K. (in press). Linguistics and cognitive prominence in anaphor resolution: topic, contrastive focus and pronouns. *Topoi*, DOI 10.1007/s11245-006-9004-6.
- Crawley, R.A., Stevenson, R.J. & Kleinman, D. (1990). The use of heuristic strategies in the interpretation of pronouns. *Journal of Psycholinguistic Research* 19(4): 245–264.
- Ferreira, F. (1993). Choice of passive voice is affected by verb type and animacy. *Journal of Memory and Language* 33: 715-736.
- Garnham, A. (2001). *Mental models and the interpretation of anaphora*. Psychology Press, Hove East Sussex.
- Garrod, S. Freudenthal, D. & Boyle, E. (1994). The role of different types of anaphor in the on-line resolution of sentences in a discourse. *Journal of Memory and Language* 33: 39-68.
- Gernsbacher, M.A. & Hargreaves, D. (1988). Access sentence participants: the advantage of first mention. *Journal of Memory and Language* 27: 699–717.
- Gernsbacher, M.A., Hargreaves, D. & Beeman, M. (1989). Building and accessing clausal representations: the advantage of first mention versus the advantage of clause recency. *Journal of Memory and Language*, 28, 735–755.
- Gordon, P.C., Hendrick, R. & Foster, K.L. (2000). Language comprehension and probe-list memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 26(3): 766-775.
- Grosz, B., Joshi, A. & Weinstein, S. (1995). Centering: A framework for modeling the local coherence of discourse. *Computational Linguistics* 21(2): 203-226.
- Gundel, J. (1976). The role of topic and comment in linguistic theory. Indiana University Linguistics Club, Bloomington Indiana.
- Gundel, J., Hedberg, N. & Zacharski, R. (1993). Cognitive status and the form of referring expressions in discourse. *Language* 69(2): 274–307.
- Jarvikivi, J., van Gompel, R.P., Hyona, J. & Bertram, R. (2006). Ambiguous pronoun resolution: contrasting the first-mention and subject-preference accounts. *Psychological Science* 16(4): 260-264.
- Kaiser, E. & Trueswell, J. (2003, March). The quest for a referent: Investigating the interpretation of pronouns and demonstratives in real time. Poster presented at the 16th Annual CUNY Conference on Human Sentence Processing, Boston.
- Kiss, K. (1998). Identificational focus versus information focus. *Language* 74(2): 245–273.
- Lambrecht, K. (1994). *Information Structure and Sentence Form: Topic, Focus and the mental representations of discourse referents*. Cambridge, U.K.: Cambridge Press.
- Reinhart, T. (1982). Pragmatics and linguistics: an analysis of sentence topics. Indiana University Linguistics Club, Bloomington Indiana.
- Smyth, R. (1994). Grammatical determinants of ambiguous pronoun resolution. *Journal of Psycholinguistic Research* 23: 197–229.
- Strawson, P. (1964). Identifying reference and truth values. *Theoria* 30: 96-118.

Reference Determination for Demonstrative Pronouns

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This paper discusses results from a corpus study of German demonstrative and personal pronouns and from a reading time experiment in which we compared the interpretation options of the two types of pronouns (Bosch et al. 2003, 2007). A careful review of exceptions to a generalisation we had been suggesting in those papers (the Subject Hypothesis: "Personal pronouns prefer subject antecedents and demonstratives prefer non-subject antecedents") shows that, although this generalisation correctly describes a tendency in the data, it is quite wrong in claiming that the grammatical role of antecedents is the relevant parameter. In the current paper we argue that the generalisation should be formulated in terms of *information-structural properties of referents* rather than in terms of the *grammatical role of antecedent expressions*.

1 Introduction

Personal pronouns in English like in many other languages are notoriously ambiguous.¹ In the following sequence, for instance, *he* may equally well refer to Peter or to Paul.

- (1) Peter_i wanted to play tennis with Paul_k. But he_{i,k} was sick.

Dutch and German have an additional repertory of demonstrative pronoun forms that can sometimes reduce the ambiguity in such cases: If we translate (1) as in (2a) or (3a) the clearly preferred interpretation of the personal pronoun *er/hij* would be Peter; and if we translate (1) as in (2b) or (3b), using the demonstrative *der/die*, Paul is indeed the *only* possible referent.

¹ We are grateful to Graham Katz, Phil Cummins, Boris Gutbrod, Kyoung-ho Park, Tom Rozario, and Yufan Zhao who participated to an important extent in the research discussed in this paper.

- (2) a. Peter_i wollte mit Paul_k Tennis spielen. Doch er_{i,k} war krank.
b. Peter_i wollte mit Paul_k Tennis spielen. Doch der_k war krank.
- (3) a. Peter_i wilde met Paul_k gaan tennissen. Maar hij_{i,k} was ziek.
b. Peter_i wilde met Paul_k gaan tennissen. Maar die_k was ziek.

No similar contrast is found among English pronoun forms, at least not with pronouns referring to persons. But even though the difference between the interpretations of the Dutch and German personal and demonstrative pronouns is clear in the case at hand, it has proven difficult to get a clear picture of what exactly the difference in the constraints on the interpretation of demonstrative and personal pronouns is (cf. Comrie 1997, Zifonun et al. 1997, Abraham 2002, Kaiser & Trueswell 2004).

We carried out a number of corpus studies and a reading time experiment in order to learn more about this difference specifically in German (Bosch et al. 2003, 2007). In the current paper we will be fairly brief about these empirical studies and instead will re-discuss the conclusions to which we were lead in those papers.

2 Subject vs. Non-Subject Antecedents

2.1 *Corpus frequency*

An early result from our corpus studies (Bosch et al. 2003) was that personal pronouns in the large majority of cases had antecedents that were in the grammatical role of the subject (operationally the nominative NP) in the preceding sentence, while demonstratives in the majority of cases had non-subjects (non-nominatives) as their antecedents. This result is seen from Figure 1.

2.2 *Self-paced reading*

2.2.1 *The experiment*

This observation of different frequencies in the referent choice of the two pronoun forms is a good starting point and seems to indicate a clear tendency; it also fits in well with our intuitive judgements about the interpretation of the discourses in (2). But what causes the observed differences in frequencies?

First of all we wanted to know how strong these preferences in referent choice are. How do they behave in relation to preferences caused by mundane plausibility? Suppose you know already, when you read the discourses in (2), that either Peter or Paul is a notorious malingerer. Would that change the preferred interpretation?

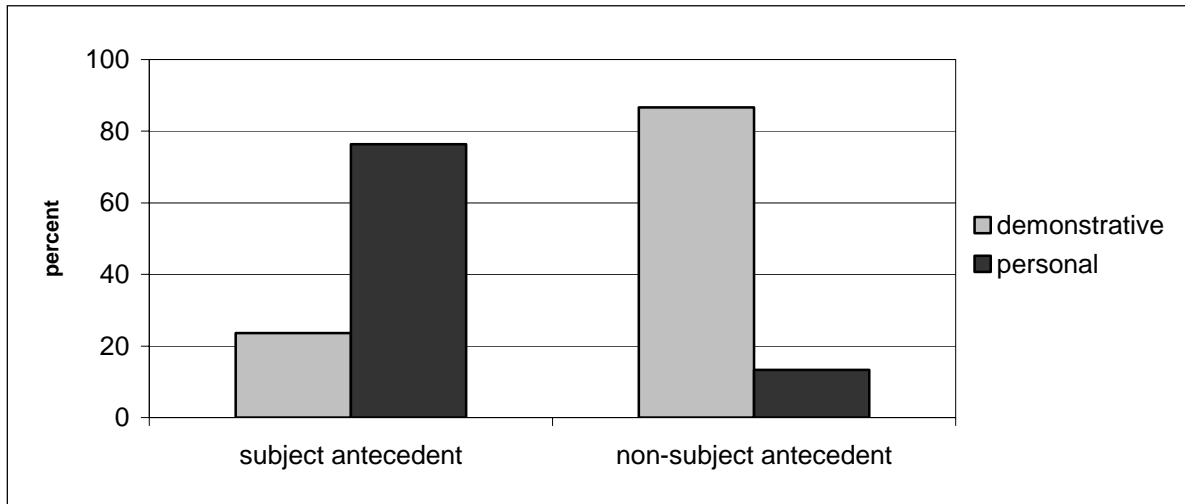


Figure 1: Distribution of antecedents of personal and demonstrative pronouns in preceding sentence (NEGRA Corpus, 355.000 words, 1436 personal pronouns, 180 demonstratives)

And, perhaps more interestingly, is the *grammatical role* of the antecedent indeed the relevant parameter? Could it not be that personal pronouns simply prefer referents that are mentioned first and demonstratives those that are mentioned later in the preceding sentence? Our corpus study could of course not tell the difference, because subjects, due to preferred SVO surface word order in German, just happen to occur most frequently sentence-initially.

headline		
(i)	Im Krankenhaus	[In hospital]
context sentence		
(ii)	(a)	Der Chefarzt untersucht den Patienten. (SVO)
	(b)	Den Patienten untersuchte der Chefarzt. (OVS)
		[The head doctor is examining the patient.]
target sentence		
(iii)	(a)	{ <u>Er</u> / <u>Der</u> } ist nämlich Herzspezialist. subject bias
		[He is a heart specialist.]
	(b)	{ <u>Er</u> / <u>Der</u> } muß sofort operiert werden. object bias
		[He must be operated on immediately.]
	(c)	{ <u>Er</u> / <u>Der</u> } ist gerade erst gekommen. unbiased
		[He has just arrived.]
completion task		
(iv)	(a)	Der _____ ist nämlich Herzspezialist.
	(b)	Der _____ muß sofort operiert werden.
	(c)	Der _____ ist gerade erst gekommen.

Box 1: Stimulus materials for self-paced reading

We investigated the two questions in a reading time study plus completion task with stimulus sets as in Box 1. Each stimulus set started with a lead-in headline (i) and was followed by a context sentence introducing two protagonists (ii). This sentence came in two versions: One with SVO word order and the other with the slightly marked OVS order. The target sentence followed in the third position (iii) and was varied for plausibility of content with a "subject bias", meaning that the content is biased for an interpretation that takes the subject of the preceding sentence as the antecedent of the pronoun, an "object bias" where plausibility prefers the object of the preceding sentence as the pronoun's antecedent, and an "unbiased" variant. Each of the target sentence variants was presented either with a demonstrative or a personal pronoun form.

These materials were presented on a computer screen word by word, the next word appearing when the subject pressed a button. Time lags between button presses were measured ("reading times" for the relevant words).

After each such story subjects were presented with a completion task in the form of a gap sentence, as in (iv) in Box 1, and were asked to type in the noun (e.g., "Chefarzt" or "Patient" in the (a) version) that made the sentence coherent with the preceding story. The (a) versions of sentence (iii) were followed by (a) versions of the comprehension question, and the (b) and (c) versions correspondingly by (b) and (c) versions. The sentences in (iv) are identical to those in (iii) except for the fact that we have definite NPs with a missing noun in (iv) where we have a pronoun in (iii).

The prediction was that we would find longer reading times where there is a conflict between mundane plausibility and linguistic preference of the pronoun interpretation. E.g., we expected that in a sequence like

- (ii) Der Chefarzt untersucht den Patienten.
- (iii) {Er/Der} ist nämlich Herzspezialist.
[The head doctor is examining the patient.
{PPro/DPro} is a heart specialist.]

the target sentence (iii) would take longer to read in the second variant (with a demonstrative pronoun), where plausibility requires the demonstrative to refer to the head doctor while the linguistic preference of the demonstrative would be for referent of the non-subject antecedents, i.e. the patient.

In the comprehension test we expected that more errors would occur in the case of a conflict between the linguistic preference of the pronoun and mundane plausibility, i.e., that the pronoun's referential preference would cause more answers deviating from the answer that would be plausible in the context of our story. For the unbiased cases we expected that the preference of the pronoun type would be straightforwardly reflected in the responses.

Finally, as for the SOV vs. OVS variation we had no predictions, because we simply had no theory that would prefer either the parameter grammatical role or the parameter order of mention.

2.2.2 The results

The reading time prediction came out significant for both SVO and OVS word order in the conditions where the plausibility brought in a subject bias. Here the demonstrative variants took significantly longer to read than the personal pronoun variants.

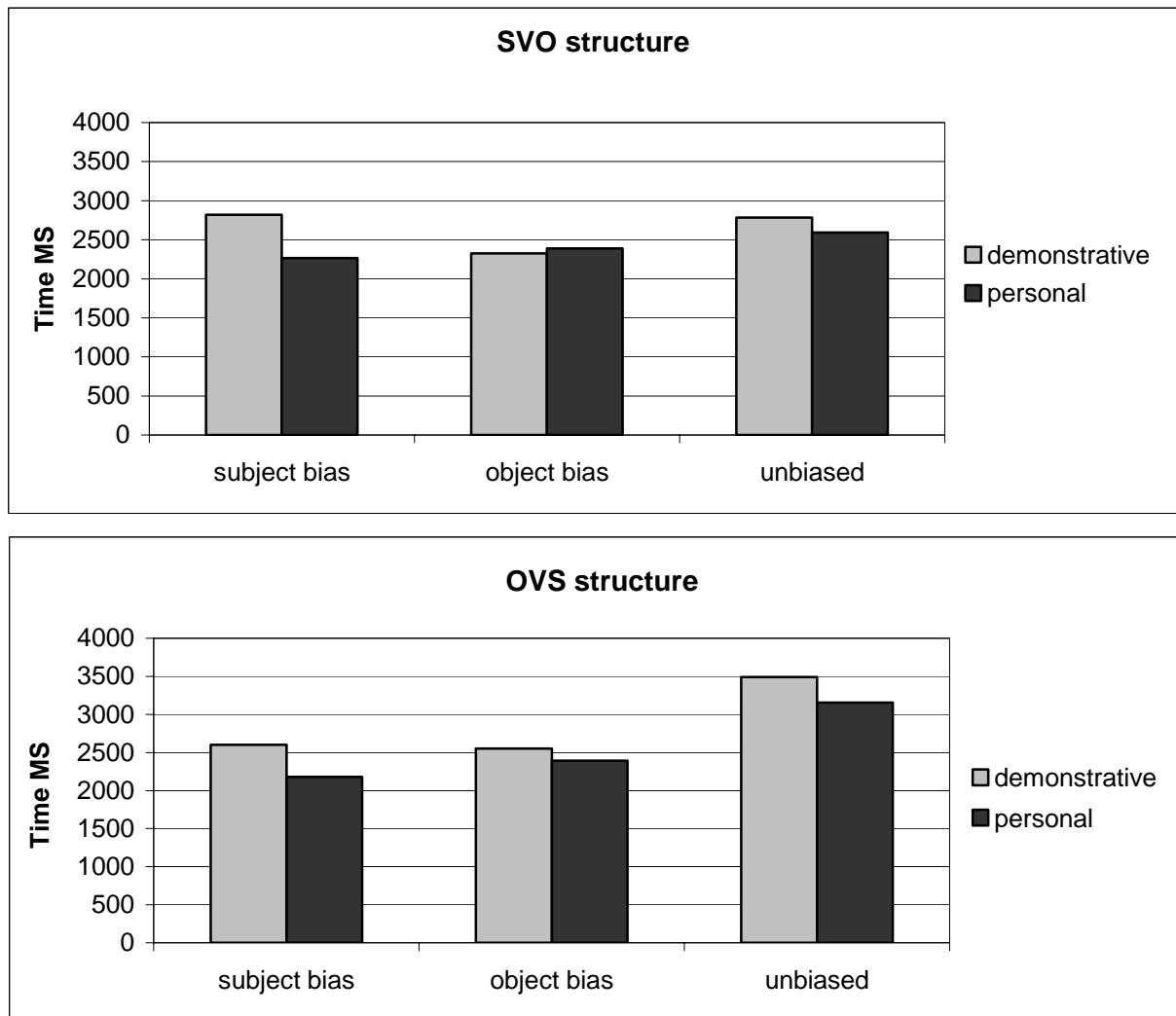


Figure 2: Reading times for target sentence when context sentence word order is either SVO or OVS. The difference between demonstratives and personal pronouns was significant only in the subject bias condition, both for SVO and OVS word order.

There was no significant result though for the conditions where the mundane plausibility of the story suggested a preference for the object antecedent, neither in the SVO nor the OVS variant; nor did the reading times indicate any signifi-

cant preferences in the unbiased conditions. These results are summarised in Fig. 2.

The results for the completion task showed significantly more errors where we had a subject bias in the story: The demonstrative caused more errors than the personal pronoun. However this result became significant only for SVO word order, not for OVS. Nor did we have significant results for the object bias conditions, in neither word order condition. The prediction for the unbiased cases was significant in both SVO and OVS, but only for the demonstrative pronoun.

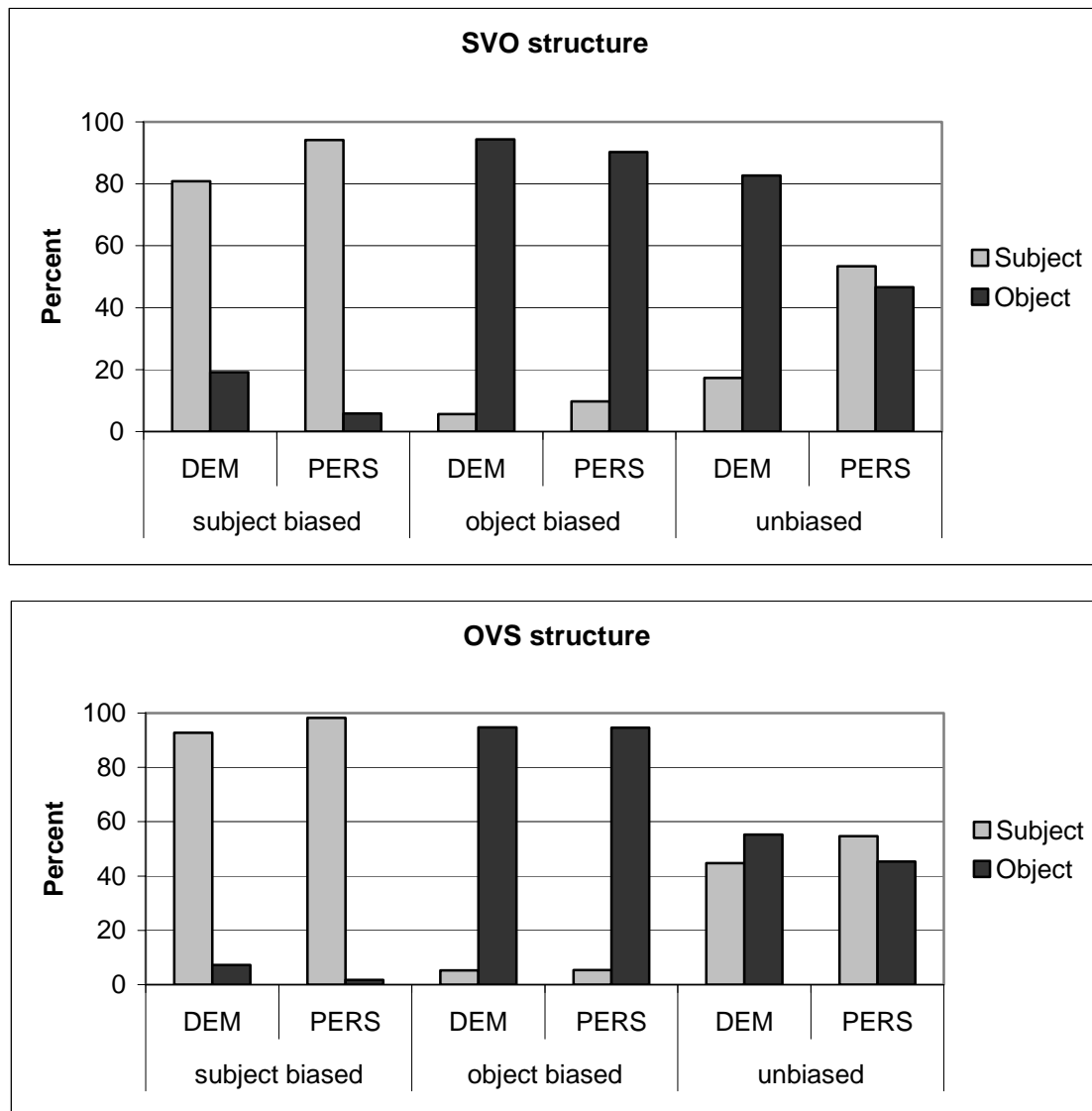


Figure 3: Completion task. Choice of referent for the target pronoun (either demonstrative or personal) is either the referent of the subject or the object expression of the context sentence.

This makes it look as if our predictions were basically on the right track, and that the relevant antecedent parameter would be rather *grammatical role* than

order of mention. – None of the significant results are in contradiction with this. Unfortunately though, as already mentioned, the predications did not come out significant in *all* the conditions. Here's a list of the significant and (in square brackets) the non-significant results.

reading time:

der + subject bias > er + subject bias	in SVO & OVS
[er + object bias > der + object bias	in SVO & OVS]
[der + unbiased: preference for the object	in SVO & OVS]
[er + unbiased: preference for the subject	in SVO & OVS]

completion task errors:

der + subject bias > er + subject bias	in SVO [&OVS]
[er + object bias > der + object bias	in SVO & OVS]

completion task preferences:

der + unbiased: preference for the object	in SVO & OVS
[er + unbiased: preference for the subject	in SVO & OVS]

In the next section we want to discuss some assumptions that we made and see how they may explain why our results did not become significant in some of the conditions.

3 Discussion

In this section we want to reflect upon two questions:

- a. Is there true complementarity in the behaviour of demonstrative and personal pronouns?
- b. Is grammatical role of the antecedent indeed the relevant parameter?

3.1 *Is there true complementarity of the pronoun types?*

In our initial corpus study it looked as if there was something like a complementary distribution of personal and demonstrative pronouns (cf. Figure 1). But upon closer inspection this impression turns out to be mistaken. Where the pronouns had a subject antecedent the pronoun type was a demonstrative in 23.6% of all cases and a personal pronoun in 76.4%. Where the antecedent was a non-subject, the pronoun was a demonstrative in 86.7% and a personal pronoun only in 13.2% of all cases. This shows clearly that the preference of the demonstrative for a non-subject antecedent is stronger than the preference of the personal pronoun for the subject antecedent. And this frequency fact is also supported by the intuitive judgements on the discourses in (2): The demonstrative in (2b) would *only* refer to Paul, the referent of the non-subject antecedent, while the personal pronoun in (2a), despite a certain preference for the referent of the sub-

ject antecedent, Peter, would not exclude an interpretation with reference to the non-subject antecedent, Paul.

The fact that the demonstrative's preference for the object antecedent became significant in the unbiased condition of the completion task, while the personal pronoun's preference for the subject antecedent did not is thus straightforwardly explained by the difference in the relative strength of the two preferences that we saw in the corpus study.

While the preferences of the two pronoun types for the two antecedent types are clearly of different strength this would of course not cause a reading time delay in the unbiased conditions. In the unbiased condition the reader *does not encounter any conflict* between different preferences the resolution of which would take time.

The failure to find significant results in the comparison of the preferences in the object-antecedent condition in both the reading time and the completion task can again be explained by the asymmetry in strength of the preferences of the two pronoun types, i.e., by the fact that the demonstrative's dislike for subject antecedents is stronger than the dislike of personal pronouns for non-subject antecedents.

This leaves us with only one apparent oddity in our results: The fact that the greater strength of the demonstrative's dislike for subject antecedents in the completion task became significant only in the SVO, but not in the OVS condition. This observation is indeed interesting. Why should the demonstrative dislike subject antecedents less when they are not in the regular subject position, i.e., in OVS word order? – For the moment let us just book this as a hint that grammatical role may not actually be the decisive factor in the antecedent selection for demonstratives, or at least not the only relevant factor. Demonstratives seem to shy away more strongly from subject antecedents that occur in canonical subject position than from subject antecedents that occur in canonical object position. We shall return to this point below in Section 4.2

In these reflections upon the conditions in which we did *not* have significant results in our experiment we have just seen that the lack of significance of some of the results only does not speak against our hypotheses, but may in fact be counted as evidence in favour of them.

3.2 Is grammatical role of the antecedent the truly relevant parameter?

There is a first indication that we may have been on the wrong track with our classification of antecedents, and indeed that any classification of antecedents could only be indirectly related to the relevant parameters, from the fact that demonstratives as well as personal pronouns can function perfectly well *without* antecedent expressions. Ever since substitutional accounts of pronouns (in the

style of Bloomfield) have fallen out of favour it has generally been agreed that the interpretation of personal pronouns (unbound pronouns to be precise) is more a matter of referent search than a search for coreferential antecedent expressions. Apart from bound pronouns of various kinds – where coreference with the antecedent is not really at issue anyhow – pronouns do not in general require explicit antecedent expressions; and if they have antecedents, they need not be coreferential with them, but the relation may be arbitrarily more complicated. One may think here of Donkey Pronouns (Kamp 1981) or E-type pronouns (Evans 1980), but also of pronouns whose referent must be inferred on the basis of one or more antecedent expressions with which the pronoun is not coreferential (Webber 1979). In particular, and this is the most striking case, there are also occurrences of both demonstrative and personal pronouns, that require no linguistic expression whatsoever that introduces a referent for the pronoun, and where we are still concerned with de-accented anaphoric uses and no physical pointing is required (cf. Bosch 1986):

- (4) (watching someone trying to move a book case full of books):
Wenn du die Bücher nicht rausnimmst, kriegst du {ihn/den} nie von der Stelle.
[If you won't take the books out, you'll never be able to move it {PPro/DPro}]

If pronouns can indeed function without antecedent expressions, it is plain that we cannot capture their interpretation constraints by looking at properties of antecedent expressions. In order to also capture antecedentless pronouns, we have to look at properties of their *referents*. We take this to be a decisive argument against any constraints that are formulated in terms of properties of antecedent expressions, in particular, against our own earlier formulations in terms of grammatical status of antecedent expressions.

4 Towards a Generalisation

The question then is how *referents* of personal pronouns differ from those of demonstrative pronouns. Bernard Comrie suggested, in an investigation of Dutch demonstrative pronouns (Comrie 1997), that demonstratives establish "less expected coreference" – which, for us, would qualify as a discourse property of referents. But he strangely uses expectability only as a way to distinguish between referents of different textually available antecedents. We shall not follow him in this respect and want to suggest instead that expectability of referents is a matter of the *information-structural properties* of the referent at a specific point in discourse – which may indeed be reflected in properties of antecedent expressions, provided there are any.

In order to find out what these referent properties could be and how they differ for the referents of personal and demonstrative pronouns in German, we

shall now discuss cases that form exceptions to our earlier Subject Hypothesis, i.e., cases where the preference of demonstratives for referents of preceding non-subject expressions and the preference of personal pronouns for referents of preceding subjects is violated. Let's see if we can capture these cases by regularities in terms of information structure.

4.1 *Exceptions to the subject hypothesis*

Counter to the Subject Hypothesis we also find personal pronouns that quite naturally pick up referents from non-subject antecedents (as the (a) and (b) examples show in (5) and (6); and demonstrative pronouns can also co-refer with a subject antecedent, as is shown in the (c) examples – at least in cases where no competing referents are around.

- (5) a. Woher ich das weiß? Ich habe mit Peter_i gesprochen. {Der_i/Er_i} war gerade hier.
[How do I know? I spoke to Peter_i. He {DPro_i/PPro_i} has just been here.]
- b. Woher ich das weiß? Ich habe es von Peter_i gehört. {Der_i/Er_i} war gerade hier.
[How do I know? I heard it from Peter_i. He {DPro_i/PPro_i} has just been here.]
- c. Woher ich das weiß? Peter_i hat es mir gesagt. {Der_i/Er_i} war gerade hier.
[How do I know? Peter_i told me. He {DPro_i/PPro_i} has just been here.]
- (6) a. Woher Maria_k das weiß? Sie_k hat mit Peter_i gesprochen. {Der_i/Er_i} war gerade hier.
[How does Maria_k know? She_k spoke to Peter_i. He {DPro_i/PPro_i} has just been here.]
- b. Woher Maria_k das weiß? Sie_k hat es von Peter_i gehört. {Der_i/Er_i} war gerade hier.
[How does Maria_k know? She_k heard it from Peter_i. He {DPro_i/PPro_i} has just been here.]
- c. Woher Maria_k das weiß? Peter_i hat es ihr_k gesagt. {Der_i/Er_i} war gerade hier.
[How does Maria_k know? Peter_i told her_k. He {DPro_i/PPro_i} has just been here.]

The same is not true when there are competing referents available. Then we are back with the preference of demonstratives for non-subject antecedents (7a & b). But (7c) is an exception: In (7c) the demonstrative not only accepts, but strongly prefers the referent of the subject antecedent.

- (7) a. Woher Karl_i das weiß? Er_i hat mit Peter_k gesprochen. {Der_k/Er_{j,k}} war gerade hier.
[How does Karl_i know? He_i spoke to Peter_k. He {DPro_k/PPro_{i,k}} has just been here.]
- b. Woher Karl_i das weiß? Er_i hat es von Peter_k gehört. {Der_k/Er_{j,k}} war gerade hier.
[How does Karl_i know? He_i heard it from Peter_k. He {DPro_k/PPro_{i,k}} has just been here.]
- c. Woher Karl_i das weiß? Peter_k hat es ihm_i gesagt. {Der_k/Er_{i,k}} war gerade hier.
[How does Karl_i know? Peter_k told him_i. He {DPro_k/PPro_{i,k}} has just been here.]

Again, in the examples in (8), while the demonstratives in (a & b) reject the subject antecedent as they should, the demonstrative in (c) also rejects the non-subject antecedent, even though there is no competition.

- (8) a. Woher Maria_i das weiß? Sie_i hat mit Peter gesprochen. {[?]Die_i/Sie_i} war gerade hier.
[How does Maria_i know? She_i spoke to Peter. She {DPro_i/PPro_i} has just been here.]
- b. Woher Maria_i das weiß? Sie_i hat es von Peter gehört. {[?]Die_i/Sie_i} war gerade hier.
[How does Maria_i know? She_i heard it from Peter. She {DPro_i/PPro_i} has just been here.]
- c. Woher Maria_i das weiß? Peter hat es ihr_i gesagt. {[?]Die_i/Sie_i} war gerade hier.
[How does Maria_i know? Peter told her_i. She {DPro_i/PPro_i} has just been here.]

4.2 What do these exceptions tell us?

Summarising what we saw in the previous section we may say that

- (A) Personal pronouns, despite a certain preference for subject antecedents, are not fussy about non-subject antecedents, even in competition situations.
- (B) Demonstrative pronouns, although they generally reject subject antecedents (7a,b & 8a,b),
- may also accept subject antecedents (5c, 6c), at least in non-competition situations;
 - may take a subject antecedent, as in (7c), with a strong preference over the non-subject antecedent;
 - and in (8c) the demonstrative rejects the non-subject antecedent, although there is no alternative.

The cases under (B) make it clear enough that the earlier generalisation in terms of grammatical role of the antecedent, although it is still a fair corpus generalization, definitely looks at the wrong parameter. – But what is the right parameter?

Take the hard core of the exceptions from (5)-(8): Demonstratives *accepting subject antecedents* (5c, 6c) and *excluding non-subject antecedents* (7c, 8c).

- (5c) Woher ich das weiß? Peter_i hat es mir gesagt. {Der_i/Er_i} war gerade hier.
[How do I know? Peter_i told me. He {DPro_i/PPro_i} has just been here.]
- (6c) Woher Maria_k das weiß? Peter_i hat es ihr_k gesagt. {Der_i/Er_i} war gerade hier.
[How does Maria_k know? Peter_i told her_k. He {DPro_i/PPro_i} has just been here.]

- (7c) Woher Karl_i das weiß? Peter_k hat es ihm_i gesagt. {Der_k/Er_{i,k}} war gerade hier.
 [How does Karl_i know? Peter_k told him_i. He {DPro_k/PPro_{i,k}} has just been here.]
- (8c) Woher Maria_i das weiß? Peter_k hat es ihr_i gesagt. {[?]Die_i/Sie_i} war gerade hier.
 [How does Maria_i know? Peter_k told her_i. She {DPro_i/PPro_j} has just been here.]

A generalisation that would be supported by these cases is that demonstratives *avoid referents that are discourse topics*.² Where by discourse topics we understand referents that are, in Prince's (1992) terms "discourse-old": They were introduced into the discourse before, not though as new referents in the immediately preceding sentence; they must have been discourse topics in the preceding sentence already. This condition is most clearly fulfilled in the case where a referent was referred to in the preceding sentence by an unstressed personal pronoun. – The referents of *ihm* and *ihr* in (7c) and (8c) are clear examples: They have the status of discourse topics in the sentences where *ihm* and *ihr* occur, while the referent of *Peter* in (5c) and (6c) does not have this status.

If this new generalisation is correct, it follows that the earlier generalisation in terms of subjects had to be *roughly correct*: Subjects *typically* refer to discourse topics – not though in the cases we have just been discussing, and less reliably when they do not occur in their canonical sentence-initial position (cf. section 3.1 above).

It also follows that what may well be the primeval use of demonstratives should be acceptable: Their use in physically *pointing to discourse-new referents* that were not previously mentioned and not referred to by antecedent expressions in discourse.

5 Conclusion

We can summarise the results of our discussion by the following characterisation of the interpretation options of German personal and demonstrative pronouns:

The preferred referents of personal pronouns are *discourse topics* which are – under an assumption of referential continuity of discourse – the most expectable referents.

Demonstrative pronouns choose their referents in contrast to the currently most expectable referent and thus *avoid discourse topics* as referents.

² As Comrie (1997) had found for Dutch, even though he spoke in terms of antecedents. Something very close to our proposal also seems intended in Zifonun et al. (1997, vol. 1:558), there formulated in terms of Theme and Rheme. Still Zifonun et al. also insist that both anaphoric personal pronouns and demonstratives are means of "thematic continuation", which would clearly contradict the generalisation we are proposing.

These still tentative results are compatible with all exceptions from our earlier Subject Hypothesis that we discussed and are they are supported by the results from our corpus study and the reading time experiment.

6 References

- Abraham, W. (2002). Pronomina im Diskurs: deutsche Personal- und Demonstrativpronomina unter 'Zentrierungsperspektive'. Grammatische Überlegungen zu einer Teiltheorie der Textkohärenz. *Sprachwissenschaft* 27.4: 447-491.
- Bosch, P. (1986). Pronouns under Control? - A Reply to Liliane Tasmowski and Paul Verluysen. *Journal of Semantics* 5: 65-78.
- Bosch, P., Rozario, T. & Zhao, Y. (2003). Demonstrative Pronouns and Personal Pronouns. German *der* vs. *er*. Proceedings of the EACL 2003. Budapest. *Workshop on The Computational Treatment of Anaphora*.
- Bosch, P., Katz, G. & Umbach, C. (2007). The Non-Subject Bias of German Demonstrative Pronouns. In: M. Schwarz-Friesel, M. Consten & M. Knees (eds.): *Anaphors in Text. Cognitive, formal, and applied approaches to anaphoric reference*. Amsterdam: John Benjamins.
- Comrie, B. (1997). Pragmatic Binding: Demonstratives as anaphors in Dutch. *Proceedings of the Annual Meeting of the Berkeley Linguistic Society* Vol. 23: 50-61.
- Evans, G. (1980). Pronouns. *Linguistic Inquiry* 11: 337-362.
- Kaiser, E., Trueswell, J. (2004). The referential properties of Dutch pronouns and demonstratives: Is salience enough? *Proceedings of Sinn und Bedeutung* 8, Arbeitspapier Nr. 1777, FB Sprachwissenschaft, Universität Konstanz.
- Kamp, H. (1981). A Theory of Truth and Semantic Representation. In: J. Groenendijk, T.M.V. Janssen & M. Stokhof (eds.): *Formal Methods in the Study of Language*. Amsterdam: Mathematisch Centrum, 277-322.
- Prince, E. F. (1992). The ZPG letter: subjects, definiteness and information-status. In S. Thompson & W. Mann (eds.): *Discourse Description: Diverse Analyses of a Fund Raising Text*. Amsterdam: John Benjamins.
- Webber, B. L. (1979). *A Formal Approach to Discourse Anaphora*. New York: Garland.
- Zifonun, G., Hoffmann, L. & Strecker, B. (1997). *Grammatik der deutschen Sprache*. Berlin: de Gruyter.

Coreference Preferences for Personal Pronouns in German

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This paper presents psycholinguistic evidence on the factors governing the resolution of German personal pronouns. To determine the relative influence of linear order versus grammatical function of potential antecedents, two interpretation-preference tasks were designed. Their specific aim was to disentangle salience factors conflated in previous research on pronoun interpretation, such as linear order, first mention and topicalization. Experiment 1 tested pronoun resolution to non-sentence-initial position (scrambling) and Experiment 2 tested pronoun resolution to sentence-initial position (topicalization). The results across different verb types and across different syntactic contexts in Experiments 1 and 2 show that grammatical function, yet neither linear order, first mention nor topicalization predicts pronoun resolution in German.

1 Introduction

Language comprehension involves the resolution of ambiguities, for instance, in determining co-reference relations between ambiguous pronouns and their potential antecedents. In order to elucidate the nature of these ambiguity resolution strategies, pronoun interpretation preferences have been investigated with reference to three types of factors: (a) world knowledge such as the plausibility of linking a pronoun to a particular antecedent; (b) linguistic constraints such as agreement or binding; and (c) psychological salience or activation of available referents. With respect to (c), researchers have proposed, for instance, NP-form, distance to the anaphor, position in the sentence and grammatical function as linguistic and (non)linguistic form aspects that influence salience. The relative impact of these factors has been explored cross-linguistically in corpus and computational research as well as psycholinguistic experimentation or introspection. However, especially for languages allowing for free word order, the results have proven inconclusive.

This paper aims to supply new evidence on the relative contribution of grammatical form aspects, namely, grammatical function (GF) and surface form

aspects, namely, linear order (LO) to the resolution of personal pronouns in German. Both GF and LO have been argued to underlie pronoun resolution preferences (e.g. Brennan, Friedman, and Pollard, 1987; Rambow, 1993; Strube and Hahn, 1999). We present two experiments to discriminate between GF and LO preferences in interpretation. These experiments investigate pronoun resolution in two different syntactic contexts in order to establish the scope of interpretive preferences for German personal pronouns.

In particular, we explore the idea that part of the conflicting previous findings on effects of LO and GF may result from methodological confounds of LO with first mention (FM) effects or information-structural effects of topicalization (TOP) in many of the previous studies. Since psycholinguistic studies on pronoun resolution have so far considered only word order variation in main clauses (e.g. SVO versus OVS), effects of LO, FM and TOP are conflated, as the first-mentioned entity in topicalized sentence-initial position is identical to the leftmost possible pronoun antecedent. Consider the German (1), taken from Bosch et al. (2007): The bolded sentence-initial NP in (1b) is topicalized, first-mentioned as well as leftmost.

- (1) a) Der Oberarzt untersucht den Notfallpatienten. (SVO)
 The senior physician.nom examines the emergency patient.acc
 The senior physician examinesthe emergency patient.
- b) **Den Notfallpatienten** untersucht der Oberarzt. (OVS)

Both FM and TOP have been advanced as factors affecting salience: First, Gernsbacher (e.g. Gernsbacher & Hargreaves, 1988) argues that the first-mentioned words in a sentence carry the highest salience due to general cognitive principles favouring initial information. Second, the information structure of topicalization has been shown to affect the relative salience of topicalized entities in sentence processing (see, e.g., Weskott, 2003).

In the two experiments in this paper, we first isolate effects of LO by testing LO against GF in non-sentence-initial position (Experiment 1) and, second, we consider potentially additive or interacting effects of LO, FM and TOP by testing LO against GF in sentence-initial topicalized position (Experiment 2).

Counter to previous research on German (e.g. Rambow, 1993; Strube and Hahn, 1999), both experiments document strong effects of GF, and no effects of LO for German. These results resonate with prior findings for other free word order languages, e.g. Finnish (Järvikivi et al., 2005; Kaiser and Trueswell, 2007). Our findings are near-identical for potential pronoun antecedents in sentence-initial and sentence-medial position, which suggests that the preference of personal pronouns for subject antecedents is robust against LO, FM as well as TOP.

This paper is structured as follows: In section 2, we summarize previous corpus and psycholinguistic research on effects of LO and GF in pronoun resolution. Section 3 illustrates word order variation in German and outlines differences between sentence-initial reordering (topicalization) and sentence-medial reordering (scrambling). In section 4, the first interpretation experiment on scrambling is presented and discussed. Section 5 reports the second interpretation experiment on topicalization. In section 6, we discuss the general findings and put them in perspective of previous research.

2 Previous research

Effects of grammatical function and surface order on pronoun resolution have been explored in computational and corpus research as well as psycholinguistic studies.

2.1 Computational and corpus research

Computational and corpus research on pronoun resolution has been mainly carried out within the framework of Centering Theory (CT), a theory of local discourse coherence (Grosz, Joshi, and Weinstein, 1995). Originally, CT proposed GF as the main determinant of salience: subjects are more salient than objects, which are more salient than other elements in an utterance. Although CT was not intended as a theory of anaphora resolution, it has inspired many such theories and systems. A well-known early example is Brennan, Friedman, and Pollard (1987), who implemented CT for pronoun resolution, and operationalized GF by ranking entities according to a refined obliqueness scale. Pitting GF against LO in a corpus-based computational evaluation, Poesio et al. (2004) report that substituting GF information by LO does not lead to substantially different results. Note, though, that the comparatively fixed word order of English leads to a close correspondence of linear order and grammatical function (subjecthood).

Thus, free word order languages are better suited to provide evidence that differentiates between LO or GF. For free(er)-word order languages like German, Strube & Hahn (1999) claim that information structure as expressed, *inter alii*, in LO of NPs underlies pronoun resolution; in their computational model that has been tested against corpus data, GF plays no role. On the other hand, corpus studies of newspaper texts by Bosch et al. (2003) and Wunsch (2006) identify GF, and specifically subjecthood, as the best predictor of referential antecedence for personal pronouns in German.

2.2 Psycholinguistic studies

Psycholinguistic studies conceptualize effects of GF and LO in terms of the status of grammatical (GF) and non-grammatical (LO) factors guiding the resolution of ambiguities in comprehension.

In the structure-building approach by Gernsbacher (Gernsbacher & Hargreaves, 1988; Gernsbacher, Hargreaves, & Beeman, 1989), LO is implemented as first mention (FM) of an entity in a sentence. According to Gernsbacher, the first-mentioned entity bears higher salience than later-mentioned entities, since it forms the foundation onto which later information in the sentence is mapped. In probe-recognition studies of sentences containing two noun phrases, Gernsbacher and Hargreaves (1988) and Carreiras, Gernsbacher and Villa (1995) report that probe recognition is faster for the first-mentioned noun phrase. Note, though, that neither study used pronoun probes. For pronouns, reading-time experiments by Frederiksen (1981) and Crawley, Stevenson and Kleinman (1990) report faster reading times for sentences beginning with a pronoun referring to the subject, rather than the object, in the preceding sentence. In consequence, these authors argue that grammatical information predominantly underlies strategies for pronoun resolution.

Since subjecthood usually coincides with first position in English, though, these results cannot discriminate between GF and LO or FM. However, Gordon, Grosz, and Gillom (1993) found increased reading times for repeated full NP versus pronoun subjects for both subjects or first mentioned NPs in the preceding sentence. Analogously to subjects, reaction times increased for first mentioned non-subject NPs, embedded in sentence-initial adverbials, such that Gordon et al. (1993) conclude that LO/FM is an (additional) salience factor in English.

Again, potentially more decisive evidence comes from free-word order languages. For Finnish, Kaiser and Trueswell (2007) tested pronoun resolution in relation to previous SVO and OVS sentences in order to establish the relative impacts of GF and surface order, i.e. LO/FM/TOP. In interpretation experiments as well as eye-tracking using the visual-world paradigm, they report that Finnish personal pronouns preferentially refer to subjects of preceding sentences, irrespective of whether these subjects are in sentence-initial pre-verbal position (SVO) or whether they follow the verb in sentences involving topicalization (OVS). Using similar materials in eye-tracking, Järvikivi et al. (2005) find that both subjecthood (GF) and FM/LO/TOP have effects on resolution preferences, although subjecthood seems to be a stronger factor than FM/LO/TOP. For German, however, judgement and eye-tracking studies by Hemforth and Konieczny (2002) find effects of LO, as realized in TOP, for personal pronouns in embedded clauses that refer to antecedents in the matrix clause. In off-line interpreta-

tion and completion tasks, Bosch et al. (2007) report a slight preference for German personal pronouns to refer to antecedent subjects, although this effect does not reach statistical significance. Unfortunately, none of these studies allows us to disentangle effects of LO from those of FM and TOP.

In contrast, Rambow (1993) claims – for the German *Mittelfeld* – that LO determines which NP is most likely to be the antecedent of a pronoun in discourse. To illustrate, Rambow argues that in the *Mittelfeld* – the topological field between the finite verb in second position, and the sentence final verb cluster – the predictive role of LO is borne out, outweighing any potential effects of GF in (2) and (3). (The indicated interpretation preferences are from Rambow, 1993.)

(2) Q: Glauben Sie,
Do you believe
dass [eine solche Massnahme] [der russischen Wirtschaft] helfen kann?
that such a measure.nom the Russian economy.dat help can
Do you believe that such a measure can help the Russian economy?

A: Nein, sie ist viel zu primitiv.
No, it (=the measure) is much too primitive.

(3) Q: Glauben Sie,
Do you believe
dass [der russischen Wirtschaft] [eine solche Massnahme] helfen kann?
that the Russian economy.dat such a measure.nom help can
Do you believe that such a measure can help the Russian economy?

A: Nein, sie ist viel zu primitiv.
No, it (=Russian economy) is much too primitive.

The grammatical functions, subject and indirect (dative) object, do not change between (2) and (3). However, according to Rambow, the interpretation of the pronoun in these answers is always the leftmost *Mittelfeld* NP of the preceding sentence, which does change between the examples. Importantly, the example from Rambow (1993) isolates LO by focussing on potential antecedents in non-initial positions; it thus abstracts away from effects of FM or TOP.

In sum, the cross-linguistic evidence on pronoun preferences to date remains inconclusive. For German, there is some corpus evidence pointing to GF as the main factor for disambiguating personal pronouns. However, this preference is, if at all, only weakly attested in psycholinguistic judgement and comprehension data. Rather, introspective judgement data attribute a greater role to LO than GF, at least for non-sentence-initial antecedents. Against this background, the present study presents novel data from two interpretation experi-

ments in German to establish whether effects of LO can be documented experimentally.

Across two experiments, we differentiate between GF and LO to identify their individual contributions. Starting from Rambow's (1993) observation on the role of LO in the German *Mittelfeld*, we first examine the effects of GF and LO in non-initial sentence position in Experiment 1. The second experiment probes whether the effects of GF and LO extend to sentence-initial antecedents, where LO coincides with FM and TOP. This way, we attempt to specify the contributions or interactions of these salience factors.

3 Two Types of Word Order Variation in German

German is an SOV language with verb-second order in main clauses, but it allows for a comparatively free word order with respect to the arguments. This property makes German suitable for an experiment contrasting GF and LO. German has two types of word order variation that may alternate the order of the arguments, which allows us to separate different aspects of LO.

The first type of word order variation in German is *topicalization*. In topicalization, a constituent is moved to the front of the clause, directly in front of the finite verb. If the fronted constituent is not the subject, the subject will appear postverbally. An example of topicalization was given in (1b). Topicalization of arguments is not an information-structurally uniform phenomenon. The fronted argument may express a topic and hence be out of focus, but in rarer cases it may also be a narrow focus or even the projecting part of a wider focus (Féry, 2007). Hence, topicalization serves multiple information-structural functions in that it allows, *inter alii*, for topic-topicalization and focus-topicalization (Gundel, 1988). Although effects of definiteness and givenness on topicalization can be observed (data in Weber and Muller, 2004), these effects are not categorical; the only near categorical constraint on topicalization is that reduced pronominal objects cannot topicalize (Travis, 1984).

Apart from argument topicalization to the front of main clauses, German allows for sentence-internal argument reordering, in the so called *Mittelfeld*. This type of word order variation is referred to as *scrambling*. Like topicalization, scrambling can lead to objects preceding the subject in terms of word order (see 2 & 3 above for indirect objects). A direct object and indirect objects may in principle also appear in either order.

- (4) a) Gern hat ein junger Geiger die Frauen geküßt.
Gladly has a young violinist.nom the women.nom/acc kissed
A young violinist was keen on kissing the women.
b) Gern hat die Frauen ein junger Geiger geküßt.
- (5) a) Der Mann sandte dem Bauern den Arbeiter.
The man sent the farmer.dat the worker.acc
The man sent the worker to the farmer.
b) Der Mann sandte den Arbeiter dem Bauern.

Scrambling is constrained by various factors, such as definiteness, animacy, and information structure (Müller, 1999). Constituents scramble felicitously only when they constitute given information and hence are defocussed, and scrambled word orders are considerably improved when the rightmost constituent is focussed (Haider and Rosengren, 1998; Lenerz, 1977). In other contexts, scrambling of objects across subjects is distinctly marked. In sum, as opposed to topicalization, scrambling shows uniform behaviour in terms of information structure.

Although both topicalization and scrambling implicate syntactic reordering of subject and object, scrambling neither involves the first position in a sentence, nor does it serve multiple information-structural functions.

In the next two sections, we present two experiments on pronoun resolution in German. The first experiment on scrambling investigates effects of GF and LO without the interference of FM or TOP, and the second experiment on topicalization investigates LO as realized in FM and TOP.

4 Experiment 1: Manipulating Word Order by Mittelfeld Scrambling

In order to investigate the relative importance of GF and LO in pronoun resolution in German, we designed an interpretation preference task. Subjects had to indicate their preferred co-reference interpretation for a pronoun in a small discourse. In this first experiment, we manipulated word order by varying the order of subject and object, or indirect object and direct object in the Mittelfeld, i.e., using scrambling. Since for scrambling, the constituents in question never appear in sentence-initial position, Experiment 1 tests the role of LO avoiding possible confounds of FM or TOP.

4.1 Materials, Procedure and Participants

The task manipulated the linear order and the grammatical function of NPs. The factor LO (left-right) was crossed with GF, defined as obliqueness of NPs (subject > indirect object > direct object). In a non-fully-factorial design, three conditions were constructed according to GF: *sudo* (subject-direct object (6)), *suio* (subject-indirect object (7)), and *iodo* (indirect object-direct object (8)). Example sentences for each condition are given below, with the (a) examples showing ordering by GF and the (b) examples showing syntactic reordering.

(6) *sudo* (a: *su* before *do*. b: *do* before *su*)

- a) Die Hoffnung war, dass [der Beschluss]_{SU} [den Plan]_{DO} beeinflussen würde.
 the hope was, that the decision.nom the plan.acc influence would
It was hoped that the decision would influence the plan.
- b) Die Hoffnung war, dass [den Plan]_{DO} [der Beschluss]_{SU} beeinflussen würde.

(7) *suio* (a: *su* before *io*. b: *io* before *su*)

- a) Alle dachten, dass [der Sohn]_{SU} [dem Vater]_{IO} ähnelte.
 Everybody thought, that the son.nom the father.dat resembled
Everybody thought that the son resembled the father.
- b) Alle dachten, dass [dem Vater]_{IO} [der Sohn]_{SU} ähnelte.

(8) *iodo* (a: *io* before *do*. b: *do* before *io*)

- a) Die Professorin stellte [dem Kollegen]_{IO} [den Studenten]_{DO} vor.
 the professor.f introduced the colleague.dat the student.acc vpart
The professor introduced the colleague to the student.
- b) Die Professorin stellte [den Studenten]_{DO} [dem Kollegen]_{IO} vor.

For each of the 3 conditions, 6 items were devised, yielding a total of 18 items. In the subject conditions (*sudo* and *suio*), the two potential antecedent NPs appeared in a subordinate clause (like in (6) and (7) above) to ensure both arguments' appearances in the Mittelfeld are unmarked. In the *iodo*-condition, the subject – ruled out as antecedent by means of gender agreement – was in sentence-initial position. All potential antecedent NPs were controlled and matched for animacy, definiteness, number and gender. In terms of information structure, both NPs were given since their referents were previously mentioned in an introduction sentence.

The ambiguous pronoun was introduced as the subject of a short third and final sentence after the introduction sentence and the context sentence. Gender and number agreement ensured that only two of the NPs appearing in the mini-discourse were available as antecedents. A complete stimulus, consisting of a

three-sentence discourse and a question with three answer options, is given in (9). The translations in italics were not present in the actual stimuli.

- (9) Das Gremium fasste einen Beschluss, der den Plan zur Umsatzsteigerung ändern sollte.
The board made a decision that should change the plan for increasing turnover (introduction sentence)
Die Hoffnung war, dass der Beschluss den Plan beeinflussen würde.
It was hoped that the decision.masc would affect the plan.masc (canonical word order, context sentence).
Aber er war zu unstrukturiert.
But it.masc was too unstructured (ambiguous pronoun).

Was war zu unstrukturiert?

What was too unstructured?

- a) Der Beschluss
The decision
- b) Der Plan
The plan
- c) Etwas anderes
Something else

Participants indicated their interpretation preference by answering a question about the discourse, using three fixed answers corresponding to either of the potential antecedent NPs in the context sentence, or something else. To control for plausibility of interpretation and to test for lexical biases in pronoun preferences, all items were tested in a plausibility-rating study with a separate group of 12 German natives. In this plausibility experiment, the discourses from the main experiment were taken, but with the ambiguous pronoun in the third sentence replaced by the two potential antecedent NPs. For the discourse in (9), example continuations are given in (10).

- (10) a) Aber der Plan war zu unstrukturiert.
But the plan was too unstructured.
b) Aber der Beschluss war zu unstrukturiert.
But the decision was too unstructured.

Participants were asked to indicate on a five point scale whether they considered continuation (a) or continuation (b) to be more plausible. On the basis of average plausibility ratings, 4 of the 18 items were excluded from analysis in the main experiment; 3 from the *sudo* condition and 1 from the *suio* condition. For the

remaining 14 items, order and syntactic function of the NPs constituted the only differences.

The untimed experiment was conducted online, using a simple web-based interface. Participants were not informed about linguistic concepts like pronoun interpretation, antecedents, etc.; however, they were given examples of how sentences and discourses can be ambiguous, and how, even in cases of ambiguity, it is possible that one reading is preferred over others. Participants were instructed to indicate their preferred interpretation by answering questions about the discourses, as outlined above. They were not able to change their answers once they had moved on to a new item. The 18 items were interspersed with 18 fillers, and distributed over 2 lists that balanced the order of the answers, the order of the items, as well as the order of the arguments in the context sentence. Each participant only saw each item once.

In Experiment 1, 38 adult, native speakers of German, who were recruited individually via email, participated.

4.2 Results

The results of Experiment 1 are summarized in Figure 1. The four groups of bars refer, from left to right, to the subject conditions individually (*sudo*, *suio*), the subject conditions collapsed (*su-X*), and the double object condition (*iodo*). The dark bars refer to the proportion of cases in which a subject was picked over an object (*sudo*, *suio*, *su-X*), or the indirect object over the direct object (*iodo*). The light bars refer to the proportion of cases in which the leftmost NP was preferred over the rightmost NP as an antecedent in each condition. The error bars indicate the 95% confidence intervals for the estimated proportions. There were three cases of participants answering 'something else', two in the *sudo*, one in the *suio* condition. These cases were removed from analysis.

In the conditions involving subjects (*sudo* and *suio*), roughly two-thirds of the time people prefer the subject over the object as the antecedent. In each subject condition, and in the collapsed conditions (*su-X*), the subject is chosen significantly more often than chance (*sudo*: 78/112=70%, $p<.001$; *suio*: 124/189=66%, $p<.001$; *su-X*: 202/301=67%, $p<.001$, all 2-tailed exact binomial tests, see also the confidence intervals in the chart). In the double object condition, the preference for the indirect objects over direct objects is not statistically significant (125/228=55%, $p=.164$, 2-t exact binomial). The results of Experiment 1 indicate that there is a preference for subject antecedents.

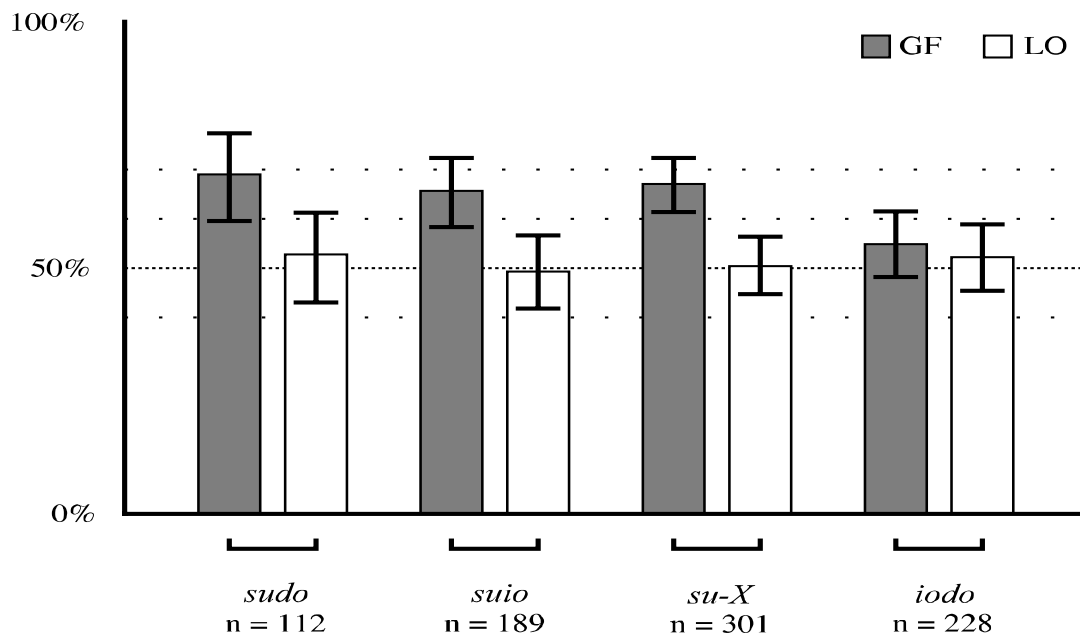


Figure 1: Results of Experiment 1, manipulating word order by scrambling. Error bars indicate 95% conf. int. for the probability of predictor being correct.

By contrast, there is no evidence in any of the conditions that participants select the leftmost potential antecedent more often than the rightmost (*sudo*: 59/112=53%, $p=.636$; *suio*: 93/189=49%, $p=.884$; *su-X*: 152/301=50%, $p=.908$; *iodo*: 119/228=52%, $p=.551$, all 2-t exact binomial tests).

Comparing the preferences for less oblique antecedents and leftmost antecedents directly, we find that participants select the least oblique NP significantly more often than they select the leftmost NP in the conditions *sudo* and *suio* (*sudo*: $p=.015$; *suio*: $p=.002$; *su-X*: $p<.001$, all 2-t exact sign tests); however, there is no significant difference between least oblique and leftmost antecedent in the *iodo* condition ($p=.152$). In the *sudo* and *suio* conditions, therefore, obliqueness is a better predictor of pronoun interpretation than linear order.

In summary, the data strongly suggests that LO is not a factor in pronoun interpretation, since there is no preference for the leftmost NP in any condition. By contrast, GF partially is a factor, since there is a strong subject preference.

Table 1: Breakdown of preferences in Experiment 1, per word order, per condition. None of the 2x2 sub-tables show significant associations.

Condition	Word order	GF	
		correct	incorrect
sudo	su before do	41	16
	do before su	37	18
suio	su before io	61	33
	io before su	63	32
iodo	io before do	63	47
	do before io	62	56

However, it might be the case that the general pattern we see in Figure 1 is due to a complex interaction between GF and LO. For instance, subjects might only be selected as antecedents when they appear as the leftmost NP. To investigate this possibility, we break down the results by word order in Table 1.

Table 1 shows that the subject preference does not interact with reordering, i.e. even when the more oblique noun phrase shifts leftwards, anaphoric preferences do not shift leftwards. Instead, anaphor resolution preferences remain oriented to the subject in the *sudo* and *suio* conditions; in the do-io condition, the preferences remain indeterminate. This further demonstrates that linear order does not underlie pronoun resolution in relation to NPs in the German Mittelfeld. None of the three 2x2 sub-tables show signs of association between word order and GF performance (all $ps > 0.5$, 2-t Fisher's Tests).

4.3 Discussion

The results of Experiment 1 show a clear effect of subjecthood on antecedent choice and, as such, point to the role of GF for personal pronoun resolution in German. At the same time, the results suggest that LO plays no role in pronoun resolution. With respect to subjecthood, our results are in line with Järvi­kivi et al. (2005), Kaiser (2003) for Finnish. However, since there were no effects of GF for the *iodo* condition, the data in this experiment do not support distinguishing further obliqueness levels, that is, distinguishing between indirect object and object (contra Brennan et al. 1987, for English).¹

By testing the influence of LO of arguments in the German Mittelfeld, we avoided the possible confound of a first mention (FM) effect, and a possibly related (but not well understood) information-structural effect of topicalization

¹ See the discussion of the results of Experiment 2 for a more detailed evaluation of the lack of an obliqueness effect in the double object data.

(TOP). Conversely, this also means that the lack of an LO effect in Experiment 1 does not rule out the existence of an FM effect, nor does it rule out a TOP effect., since scrambling and topicalization might have different influences on the salience of discourse referents. To cast light on these issues, Experiment 2 probes word order variation targeting the sentence-initial position.

5 Experiment 2: Manipulating Word Order by Topicalization

5.1 Materials and Procedure

In order to ensure the greatest degree of similarity between the two experiments for direct comparisons, we used the materials of Experiment 1, adapting them for topicalization. Apart from the syntax of the context sentence, all materials were identical to those for Experiment 1.

In Experiment 2, all potential pronoun antecedents were direct constituents of the main clause, so that topicalization was possible. In some cases auxiliary verbs and adverbial material were added to make the sentence more natural and to substitute for the meaning contribution of the deleted matrix clause material (e.g. ‘He thinks ...’) in the *sudo* and *suio* conditions of Experiment 1. In the double object conditions in Experiment 2, the subject (not a potential antecedent) always directly follows the verb, so that either of the objects appears in topicalized position. The counterparts to (6)–(8) in Experiment 2 are given in (11)–(13). Note that there is always one potential antecedent in sentence-initial position.

(11) *sudo* (a: *su* before *do*. b: *do* before *su*)

- a) [Der Beschluss]_{SU} sollte [den Plan]_{DO} beeinflussen.
 the decision.nom should the plan.acc influence
 The decision was intended to influence the plan.
- b) [Den Plan]_{DO} sollte [der Beschluss]_{SU} beeinflussen.

(12) *suio* (a: *su* before *io*. b: *io* before *su*)

- a) [Der Sohn]_{SU} ähnelte [dem Vater]_{IO} ein wenig.
 The son resembled the father a little.
 the son.nom resembled the father.dat a little
- b) [Dem Vater]_{IO} ähnelte [der Sohn]_{SU} ein wenig.

(13) *iodo* (a: *io* before *do*. b: *do* before *io*)

- a) [Dem Kollegen]_{IO} stellte die Professorin [den Studenten]_{DO} vor.
 the colleague.dat introduced the professor.f the student.acc vpart
 The professor introduced the student to the colleague.
- b) [Den Studenten]_{DO} stellte die Professorin [dem Kollegen]_{IO} vor.

The 18 items were again distributed over 2 balanced lists with fillers; recruiting and procedure were identical to Experiment 1. Forty-two adult native speakers of German participated in Experiment 2.

5.2 Results

The results of the second interpretation experiment are summarized in Figure 2. Four datapoints were excluded from analysis, because 'something else' had been answered (two in *suio*, two in *iodo*).

In all conditions, participants showed a significant preference for the least oblique possible NP over the more oblique NP, although this effect only just reaches significance in the double object condition (*sudo*: 81/126=64%, $p=.002$; *suio*: 128/208=62%, $p=.001$; *su-X*: 209/334=63%, $p<.001$; *iodo*: 141/250=56%, $p=.049$, all 2-t exact binomial tests). There is no evidence for a preference for the leftmost NP over the rightmost NP in any condition (*sudo*: 64/124=51%, $p=.788$; *suio*: 98/208=47%, $p=.446$; *su-X*: 162/334=49%, $p=.623$; *iodo*: 132/250=53%, $p=.411$, all 2-t exact binomial tests). Finally, the preference for the least oblique possible NP is significantly stronger than the preference for the leftmost possible NP in all conditions (*sudo*: $p=.043$; *suio*: $p=.004$; *su-X*: $p<.001$; *iodo*: $p=.049$, all 2-t exact sign tests). The results of Experiment 2 suggest that GF is a predictor of pronoun interpretation throughout, although the effect of subjecthood is the most robust. LO does not predict pronoun resolution.

As before, we can inspect the preferences for GF in comparison to word order, in order to see whether there is an interaction between preferences and order (Table 2). Again, there is no indication that the preference for GF is modulated by word order (Fisher's Tests for each 2x2, for all conditions: all $p>.4$). In other words, the null effect of LO remains even when the more oblique NP is leftmost.

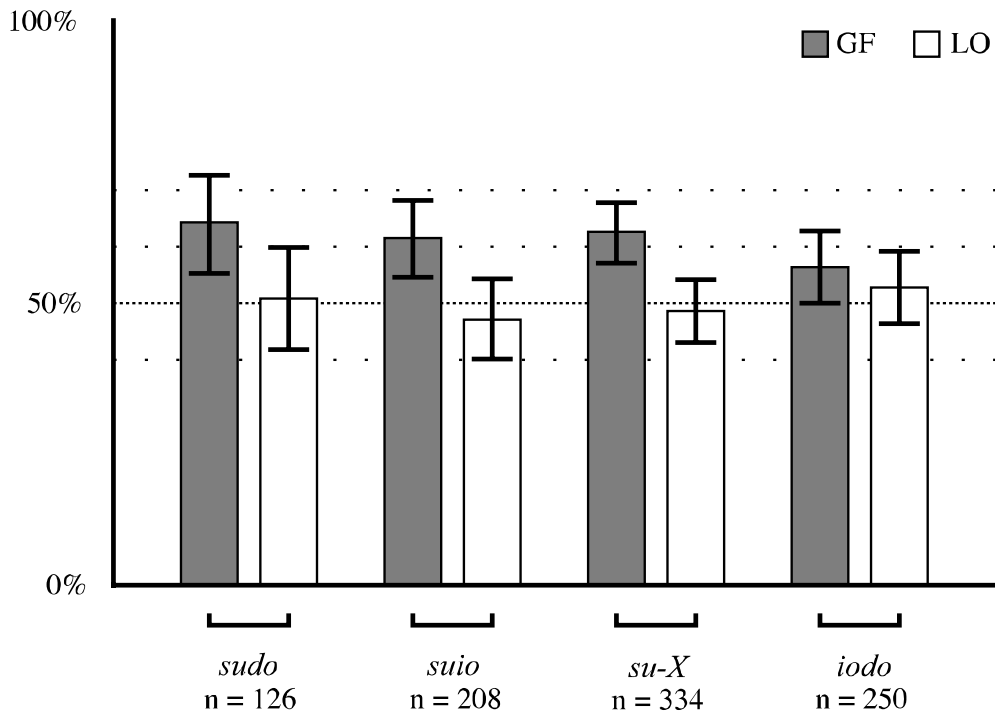


Figure 2: Results of Experiment 2, manipulating word order by topicalization

Table 2: Breakdown of preferences in Experiment 2, per word order, per condition. None of the 2x2 sub-tables show significant associations.

Condition	Word order	GF	
		correct	incorrect
<i>sudo</i>	su before do	41	22
	do before su	40	23
<i>suio</i>	su before io	61	43
	io before su	67	37
<i>iodo</i>	io before do	74	51
	do before io	67	58

5.3 Discussion

The results of Experiment 2 are virtually identical to the results of Experiment 1: There is a robust GF effect in the conditions that involve a possible subject antecedent, and there is no evidence for an LO effect in any of the conditions. Since word order variation in Experiment 2 targeted the sentence-initial position, we can conclude that there is no first mention effect (FM) on pronoun resolution in German. In the same vein, we conclude that the particular information-structural functions of topicalization (TOP) do not affect pronoun resolution preferences, at least when compared to scrambling.

At this stage we only have enough evidence to claim subjects are clearly more likely to be selected as antecedent, partially confirming GF. Our experiments therefore do not support discerning further levels of obliqueness, as proposed in Brennan et al (1987), for English. However, the fact that GF was a marginally significant predictor in the double object condition in Experiment 2, warrants further investigation of this data group. Note that the direction and size of the preferences in both experiments are very similar: in 55% respectively 56% of the cases, participants preferred the indirect object over the direct objects. This is in agreement with our formulation of GF: Subjects are preferred over indirect objects, which, in turn, are preferred over direct objects.

However, using such a scale of obliqueness presupposes that all verbs behave similarly with respect to this obliqueness hierarchy. In particular, it means assuming that the verbs used in the double object stimuli are a homogenous group. This need not be the case. For German, Haider (1993) points out that some verbs go with an unmarked word order of indirect object before direct object (in accordance with our obliqueness hierarchy), whereas with other verbs the preferred unmarked order seems to be direct object before indirect object. Of the six verbs in the double object condition, three display a preference for a direct object initial word order (*verschweigen* ‘not tell about’, *verbergen* ‘hide’ and *überweisen* ‘refer’). There is no consensus as to whether these word order preferences correspond to differences in the underlying syntactic structure (see, for instance, Müller, 1999, for an answer in the negative), that is, whether the objects of these verbs have different obliqueness hierarchies. Irrespective of the question of underlying order, it may still be the case that the preferences of the three verbs imply higher salience of the direct object. In this case, the lack of a clear GF effect in the double object condition may be attributed to the fact that there are two different verb classes showing dichotomous preferences.

Inspection of the data of Experiments 1 and 2 does not reveal a dichotomy between the three verbs mentioned and the remaining three verbs in terms of the preference for the indirect object NP as antecedent. However, the data are far from homogenous: three verbs show a consistent preference for the indirect object as antecedent (*empfehlen* ‘recommend’, *verschweigen* ‘not tell about’, *verbergen* ‘hide’), one verb does not show a clear trend (*überweisen* ‘refer’), and two verbs show a clear preference for the direct object (*vorstellen* ‘introduce’, *präsentieren* ‘present’). The double object data excluding the last two verbs show, in both experiments, an overall preference for the indirect object of a size similar to the subject preference in the other conditions (Experiment 1: 66%, Experiment 2: 70%). The two deviant verbs prefer the direct object in 67% and 73% of the cases respectively. Note that this pattern does not align with differences in markedness that potentially index different underlying argument orders; rather, the pattern cross-cuts these differences. At this point, we have no expla-

nation for this pattern in the data, although we would like to point out that it is possible that verb semantics play a role, given the fact that the two deviant verbs are near-synonyms. Because our plausibility study controlled for pragmatic or lexical plausibility of pronoun preferences, we deem it unlikely that plausibility alone could be responsible for the observed difference between verbs. It will be interesting to consider different verb types and different verb classes more systematically in future research in order to investigate effects of verb semantics and argument structure on pronoun preferences.

To summarize, we find a robust subject effect in both experiments, such that GF is partly confirmed. In conjunction, Experiments 1 and 2 document that LO, irrespective of whether conceptualized as LO, FM or TOP, does not have an effect on pronoun interpretation in German. Since our study involved off-line interpretation preferences, our results directly contradict the claims by Rambow (1993) and Strube and Hahn (1999) suggesting LO should be one of the factors (possibly in conjunction with other factors) when assigning an interpretation to a pronoun.

6 Overall Discussion and Directions for Future Work

The results from Experiments 1 and 2 across different types of NP arguments in the German sentence-initial and sentence-medial position indicate that GF, or, more specifically, subjecthood is a predictor of pronoun resolution. Although referentially fully ambiguous, personal pronouns refer at above-chance levels to the subject of a preceding sentence that offered multiple potential antecedents. This result generalizes for subjects over sentence type, i.e. main (Experiment 2) and embedded clauses (Experiment 1) and over syntactic order, i.e. SO and OS (Experiments 1 & 2). The finding that subjects are chosen as antecedents roughly two-thirds of the time shows that there is a robust resolution preference that nevertheless is not categorical. However, GF turned out not to have a general effect on pronoun resolution for object-object ambiguities in either Experiment 1 or Experiment 2.

Counter to the claims by Strube and Hahn (1999) and Rambow (1993), LO was not found to determine pronoun resolution in either Experiment 1 or 2. Moreover, counter to the claims of the structure-building approach by Gernsbacher (e.g. Gernsbacher and Hargreaves, 1988), FM does not predict pronoun resolution preferences in German (Experiment 2). In sum, LO, whether conceptualized as surface order, first mention or topicalization, was not found to play any role in pronoun interpretation preferences.

Of course, we need to exclude alternative explanations of the null effect of LO and the positive effect of GF in Experiments 1 & 2 that do not attribute the pattern of results to the involvement of grammatical-function-based strategies in

pronoun resolution. To this end, we consider account in terms of parallelism and a frequency explanation, in turn.

One alternative explanation of the robust preference for subject NPs, and the lack of such a clear GF preference in the double object data, might be given in terms of *parallelism*. According to the parallelism account (e.g. Smyth 1994), a pronoun is preferentially interpreted as co-referential with a noun phrase that has the same grammatical role. The ambiguous pronoun in our experiments was invariably a subject. If readers show a preference for an antecedent that has the same grammatical function as the pronoun that is resolved, one would expect a preference for subject antecedents, and one would not expect to see any preference in those cases where the subject is not available. Thus, parallelism would explain both the positive finding for GF and the null finding with respect to LO.

Although stronger conclusions about the plausibility of this alternative hypothesis ultimately have to await a study in which the grammatical function of the pronoun is varied, the results of the two present experiments suggest that parallelism of pronoun and antecedent does not play a significant role in the data. Smyth (1994) argues that there are several aspects to parallelism of which grammatical function is only one. One of the other aspects is structural position of the constituent. The effect of parallelism on pronoun resolution is strongest when more of these different aspects apply. This means that parallelism would predict a linear order effect in Experiment 2. To see how, consider the configuration of the sentence containing the pronoun compared to different word orders in the context sentence. The ambiguous pronoun was immediately preverbal (SV) in all but one of the stimuli. In the preceding context sentence in Experiment 2, the subject is either in preverbal (SVO) or postverbal (OVS) position. This means that there is a higher degree of parallelism between the pronoun sentence and the context sentence when the subject in the latter is preverbal (SVO – SV) compared to when it is postverbal (OVS – SV). According to parallelism, then, preverbal subjects should be selected as antecedents more often than postverbal subjects. As Table 2 shows, this prediction is not borne out: Subjects are preferred, no matter whether they occur preverbally or postverbally. By the same reasoning, parallelism would predict a difference between the SVO cases in Experiment 2, and both of VSO and VOS in Experiment 1. Comparing Tables 1 and 2 shows that this is not borne out either. We therefore conclude that parallelism is not a likely explanation of the results.

A second alternative explanation of the findings might be that *frequency* differences between the word order variants interfere with pronoun interpretation. Non-canonical syntactic orders, such as scrambling and topicalization, are marked and infrequent in German (e.g. Hoberg 1981). Moreover, they are restricted to specific discourse contexts. In particular scrambling of objects across subjects is a marked and infrequent reordering option in German. Since unambi-

guous effects of LO in the present study can surface only if pronouns are resolved to initial objects in scrambled or topicalized position, it could be that a frequency bias against non-canonical word orders, such as scrambling and topicalization, mitigates against or even masks order effects.

However, there is some evidence both across Experiments 1 and 2 and within each experiment that frequency does not affect the pattern of linear order preferences in pronoun resolution. First, topicalization is far more frequent a non-canonical word order than scrambling in German. If relative frequency affected order effects in pronoun resolution, some difference between Experiment 1 and 2 would be expected, contrary to fact.

Second, frequency differences within the experimental conditions in Experiment 1 and 2 would lead one to expect differences in interpretive patterns. Consider scrambling in this respect: In a corpus study on NP order using the NEGRA II corpus that consists of about 20.000 written sentences, Kempen and Harbusch (2003) report that there are large frequency differences between accusative-initial and dative-initial orders compared to nominative-initial orders of full NPs in the German Mittelfeld. Compared to 513 nominative-accusative (i.e. *su* before *do*) orders, there is only one case of an accusative-nominative (*do* before *su*) order, for dative-marked indirect objects, there are 20 cases of dative-nominative (*io* before *su*) orders compared to 43 nominative-dative (*su* before *io*) orders. This corresponds to a ratio of roughly 1 to 500 for *do*-before-*su* orders and roughly 1 to 2 for *io*-before-*su* orders. If frequency differences of scrambling affected linear order effects in pronoun resolution, we would thus expect to see some difference in anaphoric preferences between the *sud* and the *suio* conditions reflecting the frequency divide. Yet, the figures in Figures 1 & 2 demonstrate that there is no such difference between conditions. Moreover, Kempen and Harbusch (2003) note that, for ditransitive verbs, *io*-before-*do* orders by far outnumber *do*-before-*io* orders in the corpus (14 to 3). However, anaphoric preferences do not shift depending on NP ordering in the *do*-*io* condition (see Tables 1 & 2). It thus seems unlikely that frequency effects can account for the null effect of LO in Experiments 1 and 2. Having discussed and dismissed non-grammatical-function accounts of the null effect of LO and the robust subjecthood preference, we conclude that grammatical function indeed underlies pronoun resolution in German. With respect to the role of subjecthood, these results are in line with the findings for personal pronouns in Finnish by Järvikivi et al. (2005) and Kaiser and Trueswell (2007). For German, the grammatical *subject* preference for *personal* pronouns found here complements the grammatical *object* preference for *demonstrative* pronouns elicited by Bosch et al. (2007). In conjunction, these findings document that grammatical function underlies German pronoun resolution; crucially, though, grammatical function interacts with grammatical form (personal versus demonstrative pronouns) in

determining pronoun interpretation preferences (see also Kaiser 2003; Kaiser and Trueswell 2007).

Given the distributional overlap of FM and TOP in German, this study could not dissociate effects of FM and TOP on pronoun resolution. It thus cannot be excluded that the (diverse) information-structural effects associated with topicalization somehow cancel FM effects in Experiment 2. An across-study comparison with the Finnish study by Kaiser and Trueswell (2007), however, suggests that this is unlikely. In Finnish, OVS orders in main clauses are canonically associated with old/given information and are thus obligatorily defocused (e.g. Kaiser and Trueswell 2004). In other words, OVS in Finnish main clauses has uniform information structure. Yet, similarly to topicalized OVS orders in German in Experiment 2, a sentence-completion and an interpretation preference study for Finnish reported in Kaiser and Trueswell (2007) find that personal pronouns preferentially resolve to the subject in Finnish OVS sentences. To the extent the null findings across experiments in different studies allow for comparisons, we speculate, *pace* Hemforth and Konieczny (2002), that whatever the (information-structural) contribution of topicalization to reordering is, it does not seem to affect pronoun resolution preferences.

Notwithstanding this, it would be rewarding to further investigate the effects of Information Structure on pronoun resolution preferences. For instance, scrambling in German is felicitous only in particular discourse contexts, namely those in which the scrambled constituent denotes given information. This requirement on scrambling was met in the present study in that all relevant NPs were given in preceding discourse contexts as in previous studies (Scheepers, Hemforth, and Konieczny, 2000). This way, information-structural differences between these NPs were neutralized, so that the effects of word order could be isolated. The prototypical case of Mittelfeld scrambling, however, is arguably when a given object NP fronts across an information-structurally new (and focused) constituent (Lenerz, 1977; Müller, 1999). In future research, it would be interesting to vary the information-structural contexts for ambiguous pronouns systematically to test for potential interactions between word order and information structure in anaphor resolution. A complicating aspect of such a setup would be, however, that one has to make sure that one measures the result of word order variation on pronoun interpretation, rather than a direct effect of the particular context that is needed to facilitate, e.g., scrambling.

In conclusion, we look to future research that considers how potential effects of information structure and argument structure interact with the strong effect of grammatical function for pronoun resolution attested in the present experiments.

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8 References

- Bosch, P., G. Katz and C. Umbach. (2007). The non-subject bias of German pronouns. To appear in M. Schwarz-Friesel, M. Consten and M. Knees (eds.): *Anaphors in Texts*. Amsterdam: Benjamins.
- Bouma, G. and H. Hopp. (2006). Effects of word order and grammatical function on pronoun resolution in German. In *Ambiguity in Anaphora*. Workshop Proceedings, ESLLI 2006, Málaga, 5–13.
- Brennan, S.E., M.W. Friedman, and C. J. Pollard. (1987). A centering approach to pronouns. In *Proceedings of the 25th Annual Meeting of the ACL*, 155–162.
- Carreiras, M., M.A. Gernsbacher, and V. Villa. (1995). The advantage of first mention in Spanish. *Psychonomic Bulletin & Review* 1, 124–129.
- Crawley R., R. Stevenson and D. Kleinman. (1990). The use of heuristic strategies in the interpretation of pronouns. *Journal of Psycholinguistic Research* 4, 245–264.
- Frederiksen, J. (1981). Understanding anaphora: Rules used by readers in assigning pronominal referents. *Discourse Processes* 4, 323–347.
- Féry, C. (2007). Wide focus object fronting. To appear in S. Ishihara, M. Schmitz, and A. Schwarz (eds.): *Interdisciplinary Studies on Information Structure* 8, Potsdam.
- Gernsbacher, M.A., and D.J. Hargreaves. (1988). Accessing sentence participants: The advantage of first mention. *Journal of Memory and Language* 27, 699–717.
- Gernsbacher, M.A., D.J. Hargreaves, and M. Beeman. (1989). Building and accessing clausal representations: The advantage of first mention versus the advantage of clause recency. *Journal of Memory and Language* 28, 735–755.
- Gordon, P., B. Grosz, and L. Gillom. (1993). Pronouns, names, and the centering of attention in discourse. *Cognitive Science* 17(3), 311–347.
- Grosz, B., A. Joshi, and S. Weinstein. (1995). Centering: A framework for modelling the local coherence of discourse. *Computational Linguistics* 21(2), 203–225.
- Gundel, J. (1988). The Role of Topic and Comment in Linguistic Theory. In G. Hankamer (ed.): *Outstanding Dissertations in Linguistics*. Garland Publishing Co., New York.
- Haider, H. (1993). *Deutsche Syntax, generativ*. Günter Narr, Tübingen.
- Haider, H. and I. Rosengren. (1998). Scrambling. *Sprache und Grammatik*. Volume 49. Lund University.
- Hemforth, B. and L. Konieczny. (2002). Where pronouns and relative clauses differ: Information Structure and binding preferences. Poster presented at CUNY.

- Hoberg, U. (1981). *Die Wortstellung in der geschriebenen deutschen Gegenwartssprache*. München: Hueber.
- Järvikivi, J., R. van Gompel, J. Hyönä, and R. Bertram. (2005). Ambiguous pronoun resolution: Contrasting the first-mention and subject-preference accounts. *Psychological Science* 16(4).
- Kaiser, E. (2003). Word order, grammatical function, and referential form: On the patterns of anaphoric reference in Finnish. *Nordlyd* 31(1), 245–260.
- Kaiser, E. and J.C. Trueswell. (2004). The role of discourse context in the processing of a flexible word-order language. *Cognition* 94, 113–147.
- Kaiser, E. and J.C. Trueswell. (2007). Investigating the interpretation of pronouns and demonstratives in Finnish: Going beyond salience. To appear in E. Gibson and N. Pearlmuter (eds.): *The Processing and Acquisition of Reference*. Cambridge, Mass.: MIT Press.
- Kempen, G. and K. Harbusch. (2003). An artificial opposition between grammaticality and frequency: comment on Bornkessel, Schlesewsky & Friederici (2002). *Cognition* 90, 205–210.
- Lenerz, J. (1977). *Zur Abfolge nominaler Satzglieder im Deutschen*. Günter Narr, Tübingen.
- Müller, G. (1999). Optimality, markedness and word order in German. *Linguistics* 37, 777–818.
- Poesio, M., R. Stevenson, B. di Eugenio, and J. Hitzeman. (2004). Centering: A parametric theory and its instantiations. *Computational Linguistics* 30(3).
- Prince, E. (1981). Toward a taxonomy of given-new information. In P. Cole, (ed.): *Radical Pragmatics*. Academic Press, New York, 223–256.
- Rambow, O. (1993). Pragmatic aspects of scrambling and topicalization in German: A Centering approach. MS University of Pennsylvania.
- Scheepers, C., B. Hemfort and L. Konieczny. (2000). Linking syntactic functions with thematic roles: psych-verbs and the resolution of subject-object ambiguity. In B. Hemfort and L. Konieczny (eds.): *German Sentence Processing*. Kluwer, Dordrecht, 95–135.
- Smyth, R. (1994). Grammatical determinants of ambiguous pronoun resolution. *Journal of Psycholinguistic Research* 23, 197–229.
- Strube, M. and U. Hahn. (1999). Functional Centering. Grounding referential coherence in information structure. *Computational Linguistics* 25(3), 309–344.
- Travis, L. (1984). *Parameters and Effects of Word Order Variation*. Ph.D. thesis, MIT.
- Turan, Ü.D. (1998). Ranking forward-looking center in Turkish: Universal and language-specific properties. In A. Joshi, M. Walker and E. Prince (eds.): *Centering Theory in Discourse*. Clarendon University Press, Oxford, pages 139–161.
- Weber, A. and K. Müller. (2004). Word order variation in German main clauses: A corpus analysis. In *Proceedings of the 20th International Conference on Computational Linguistics*, Geneva, 71–77.
- Weskott, T. (2003). *Information Structure as a Processing Guide: The Left Periphery of German Verb-Second Sentences and its Interpretation in Context*. PhD dissertation. University of Leipzig.
- Wunsch, H. (2006). Anaphora resolution – What helps in German. In *Pre-proceedings of the International Conference on Linguistic Evidence 2006*, Tübingen.

Pronouns in competition: Predicting acquisition delays cross-linguistically¹

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It is well known that English children between the age of 4 and 6 display a so-called Delay of Principle B Effect (DPBE) in that they allow pronouns to refer to a local c-commanding antecedent. Their guessing pattern with pronouns contrasts with their adult-like interpretation of reflexives. The DPBE has been explained as resulting from a lack of pragmatic knowledge or insufficient cognitive resources. However, such extra-grammatical accounts cannot explain why the DPBE only shows up in particular languages and in particular syntactic environments. Moreover, such accounts fail to explain why the DPBE only emerges in comprehension and not in production. This paper hypothesizes that the presence or absence of the DPBE can be explained from the properties of the grammar. Fischer's (2004) optimality-theoretic analysis of binding, explaining cross-linguistic variation, and Hendriks and Spenader's (2005/6) optimality-theoretic account of the acquisition of pronouns and reflexives are combined into a single model. This model yields testable predictions with respect to the presence or absence of the DPBE in particular languages, in particular syntactic environments, and in comprehension and/or production.

1 Introduction

According to standard Binding Theory (cf. Chomsky, 1981), the distribution and interpretation of reflexives is regulated by Principle A, whereas the distribution and interpretation of pronouns is regulated by Principle B.

- (1) Principle A: Reflexives must be bound in their binding domain.
Principle B: Pronouns must be free in their binding domain.

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Assuming that the binding domain is the entire clause, using *himself* in (2) in production to refer to the subject *Bert* satisfies Principle A, whereas using *him* to refer to the subject is ruled out by Principle B, as is illustrated by (3). In comprehension, Principle A explains why the reflexive *himself* in (2) must be interpreted as co-referential with the subject *Bert* and cannot refer to some other individual. Similarly, Principle B accounts for the fact that the pronoun *him* in (3) cannot be co-referential with the subject and must refer to some other individual.

(2) Bert_i washed himself_{i/*j}

(3) Bert_i washed him_{*i/j}

The formulation of Principle A and Principle B in (1) suggests that reflexives and pronouns are always in complementary distribution. However, several exceptions have been observed to the general pattern of complementary distribution:

(4) Bert_i saw a snake near himself_i/him_{i/j}

In (4), both a reflexive and a pronoun are allowed in a locational PP, but such a breakdown of complementarity has also been observed for other constructions, for example picture NPs.

For Reinhart and Reuland (1993), these exceptions motivated replacing the binding principles by syntactic and semantic conditions on reflexivity. Fischer (2004), in contrast, maintains one of the binding principles but argues that this principle must be violable rather than strict, in order to account for cases such as (4). In the next section, Fischer's optimality-theoretic approach to binding will be discussed. This approach allows Fischer to account for the broad range of cross-linguistic variation that is encountered in the field of binding. However, Fischer's optimality-theoretic analysis differs in several respects from Hendriks and Spenader's (2005/6) optimality-theoretic analysis of binding, discussed in section 3, which aims at accounting for the acquisition delay observed with pronouns. In section 4, the two analyses are integrated into one model. Section 5 presents the predictions of the resulting model with respect to cross-linguistic variation in language acquisition. In particular, predictions will be formulated with respect to the occurrence of the so-called Delay of Principle B effect in English, Dutch, German and Italian.

2 Optimal binding

Fischer's (2004) analysis of binding is couched in the framework of Optimality Theory (OT) syntax (cf., e.g., Prince and Smolensky, 2004). In OT syntax, starting from an input meaning, the Generator generates a candidate set consisting of all possible forms for this input meaning. These candidate forms are then evaluated on the basis of a universal set of violable constraints. A crucial property of OT constraints is that they are ordered in a hierarchy of strength: If two constraints are in conflict, it is more important to satisfy the stronger constraint than it is to satisfy the weaker constraint. The candidate that satisfies the total set of constraints best is the optimal candidate. All other candidates are ungrammatical.

2.1 Constraint sub-hierarchies

Constraints in OT can be part of universal constraint sub-hierarchies (cf. Aissen, 1999). According to Fischer (2004), the distribution of pronouns and reflexives across languages can be explained through the interaction between two potentially conflicting constraint sub-hierarchies. The first sub-hierarchy favours binding in local domains and punishes binding in bigger domains. The second sub-hierarchy punishes the occurrence of certain forms in the output.

The first sub-hierarchy favours binding within the smallest domain possible. The smallest domain is the Theta Domain, which is the smallest phrase containing the head that theta-marks the anaphor plus its arguments. An example is the PP *near himself/him* in (4). The somewhat bigger Subject Domain is the smallest phrase containing the anaphor and a subject. Examples are the sentences (2), (3) and (4). The Root Domain is the entire sentence containing the anaphor. The Root Domain allows Fischer to distinguish between an embedded clause (the Subject Domain) and the entire sentence containing the embedded clause (the Root Domain). See Fischer (2004) for definitions of these domains as well as for the additional domains Case Domain, Finite Domain, and Indicative Domain. Note that the smaller domain is always included in the bigger domain. For example, in (4) the Theta Domain *near himself/him* is included in the Subject Domain and the Root Domain, which both comprise the entire sentence.

Principle A is modified by Fischer (2004) to be sensitive to these binding domains of different size, resulting in a family of Principle A constraints with the ranking as given in (5).² The constraints within this sub-hierarchy are or-

² Actually, Fischer (2004) introduces this family of constraints as Principle B constraints, but then goes on to revise them according to the definition given in the text, referring to the resulting constraints as Reflexivity constraints. Because the constraints, as they are formulated, specify the conditions under which a form occurs bound rather than free, they

dered in strength from left to right. In effect, binding within the smallest Theta Domain is preferred to binding within the bigger Subject Domain, which is again preferred to binding within the biggest Root Domain. In general, principles referring to smaller domains are universally higher-ranked than those that refer to bigger domains.

(5) Universal sub-hierarchy 1 (Fischer, partial):

Principle $A_{\text{Theta Domain}}$ >> Principle $A_{\text{Subject Domain}}$ >> Principle $A_{\text{Root Domain}}$

A second modification of the binding principles by Fischer involves their sensitivity to different degrees of anaphoricity. For example, Principle $A_{\text{Subject Domain}}$ is defined as follows (p. 492): “If α is bound in its subject domain, α must be maximally anaphoric”.³ Principle $A_{\text{Subject Domain}}$ and Principle $A_{\text{Root Domain}}$ are defined similarly. In these definitions, α is a reflexive or a pronoun, and reflexives are more anaphoric than pronouns.

The second sub-hierarchy necessary to account for cross-linguistic variation in binding prefers pronouns to reflexives. Furthermore, within the class of reflexives this sub-hierarchy prefers SE anaphors (i.e., morphologically simple reflexives, such as Dutch *zich*) to SELF anaphors (i.e., morphologically complex reflexives, such as English *himself*). This effect is obtained by assuming that *SELF (read: No SELF anaphors) is stronger than *SE, which is again stronger than *Pronoun.

(6) Universal sub-hierarchy 2 (Fischer, partial):

*SELF >> *SE >> *Pronoun

According to Fischer, “the hierarchy can be interpreted as an indication of the decrease in anaphoricity” (2004: 491). That is, if the speaker maximally satisfies this sub-hierarchy, he is as explicit as possible and selects forms that are minimally anaphoric. Thus this sub-hierarchy conflicts with the first sub-hierarchy,

show more resemblance to standard Principle A than to standard Principle B. For this reason, we will refer to them as Principle A constraints.

³ This formulation of Principle $A_{\text{Subject Domain}}$ and Fischer’s other Principle A constraints is somewhat problematic from an OT perspective because the evaluation of a candidate output with respect to this constraint is dependent on the evaluation of other candidate outputs with respect to the same constraint. To determine whether α is the maximally anaphoric element satisfying this constraint, it must be established that there is no candidate output higher in anaphoricity that also satisfies this constraint. For each candidate higher in anaphoricity, one constraint violation is counted. A fundamental assumption of OT, however, is that candidates are compared on the basis of the evaluation function rather than on the basis of the constraints themselves (McCarthy, 2002: 40).

which prefers the output form to be maximally anaphoric. The two universal constraint sub-hierarchies in (5) and (6) are part of the constraint hierarchy that forms the grammar of a language.

2.2 Constraint re-ranking and tied constraints

A fundamental assumption within OT is the assumption that languages share the same set of constraints but differ in the ranking of these constraints. Differences between languages can be explained through a different ranking of the same set of constraints ('typology by re-ranking'). This suggests that the different possibilities for interleaving the two constraint sub-hierarchies introduced in the previous section, giving rise to different grammars, may explain cross-linguistic differences with respect to binding.

Constraints can be stronger or weaker than other constraints. In addition, two constraints can be tied. Fischer includes the option of tied constraints to account for the optionality illustrated by sentence (4), where both a reflexive and a pronoun are possible as prepositional objects. If two constraints X and Y are tied (notation: $X \circ Y$), a violation of X is as serious as a violation of Y. Crucially, a constraint hierarchy with a tie between two constraints is in fact short-hand for two separate hierarchies, one of them containing the dominance relation $X \gg Y$ and the other containing the dominance relation $Y \gg X$. A tie between two constraints often yields more than one optimal candidate.

2.3 Binding in English

As a first example of the interaction between the constraint sub-hierarchies introduced in section 2.1, let us consider the case of English. According to Fischer's (2004) analysis, the constraint ranking in English is as in (7):

(7) English ranking (Fischer):

Principle $A_{TD} \gg *SELF \circ$ Principle $A_{SD} \gg *SE \gg *Pronoun$

For reasons of simplicity, we omit Principle $A_{Root\ Domain}$ (which is stronger than $*Pronoun$ but weaker than Principle $A_{Subject\ Domain}$). Tableau 1 (a production tableau) illustrates the selection of the optimal form in example (2)/(3).

Tableau 1: Selection of the optimal form in “[_{SD} [_{TD} Bert_i washed –_i]]”, where the direct object is co-referential with the subject, according to the analysis of Fischer (2004).

Production	Principle A _{TD}	*SELF	Principle A _{SD}	*SE	*Pronoun
☞ himself		*			
him	*!		*		*

In sentence (2), the Theta Domain is the same as the Subject Domain, namely the entire sentence. All constraints, ranked as in (7), apply to select the optimal candidate. Candidate outputs are the reflexive *himself* and the pronoun *him*. English does not have SE anaphors (but see section 4.3 for a discussion of SE versus SELF anaphors in Dutch and German). Because English does not have SE anaphors, the constraint *SE is never violated. Selection of the pronoun *him* results in a violation of Principle A_{TD} as well as Principle A_{SD} (indicated by an asterisk in the corresponding cell). This is because a pronoun is not the maximally anaphoric element that is bound within these domains. The more anaphoric reflexive is also bound within these domains. Selecting the reflexive *himself* violates the constraint *SELF, whereas selecting a pronoun violates the constraint *Pronoun. However, these two constraint violations do not matter here because violation of the strongest constraint Principle A_{TD} by the pronoun already yields the reflexive as the optimal candidate. Such a fatal violation is indicated by an exclamation mark. Optimal candidates are indicated by the pointing hand (☞).

The proposed constraint ranking is also able to account for the optionality in (4), as illustrated by Tableau 2.

Tableau 2: Selection of the optimal form in “[_{SD} Bert_i saw a snake [_{TD} near –_i]]”, where the prepositional object is co-referential with the subject, according to the analysis of Fischer (2004).

Production	Principle A _{TD}	*SELF	Principle A _{SD}	*SE	*Pronoun
☞ himself		*			
☞ him			*		*

In sentence (4), the Theta Domain is the PP, whereas the Subject Domain is the entire sentence. Both *himself* and *him* satisfy Principle A_{TD} because α is not bound in its Theta Domain. Because *SELF and Principle A_{SD} are tied constraints, both the ranking *SELF >> Principle A_{SD} and the ranking Principle A_{SD} >> *SELF should be considered. If *SELF is ranked higher than Principle A_{SD}, *him* is the optimal candidate because *himself* violates the stronger constraint *SELF. If Principle A_{SD} is ranked higher, *himself* is the optimal candidate be-

cause *him* violates Principle A_{SD} (*himself* is a more anaphoric form bound in the Subject Domain). As a result of *SELF and Principle A_{SD} being tied, both *himself* and *him* come out as optimal and hence are possible forms for expressing the input meaning in the sentence under discussion.

2.4 Explaining differences between English, German, Dutch, Italian, and Icelandic

Different rankings of the constraint sub-hierarchies proposed in section 2.1 give rise to different distributions of pronouns and reflexives.

German has two different types of reflexives: the SE anaphor *sich* and the SELF anaphor *sich selbst*. Fischer (2004) observes that in German a pronoun is not allowed in sentences like (4). In this case, German uses a SE anaphor. The use of a SELF anaphor seems only marginally acceptable. According to Fischer, this pattern can be explained under the assumption that the constraint *SELF is not tied with Principle A_{SD}, as in English, but with the higher ranked constraint Principle A_{TD}.

(8) German ranking (Fischer):

Principle A_{TD} ° *SELF >> Principle A_{SD} >> *SE >> *Pronoun

The German pattern more or less falls out of this constraint ranking, as Tableau 3 shows, although the proposed constraint ranking does not explain why a SELF anaphor seems slightly more acceptable than a pronoun.

Tableau 3: Selection of the optimal form in the German sentence “[_{SD} Bert_i bemerkte eine Schlange [_{TD} neben –_i]]” (Bert saw a snake near –), where the prepositional object is co-referential with the subject, according to the analysis of Fischer (2004).

Production	Principle A _{TD}	*SELF	Principle A _{SD}	*SE	*Pronoun
SELF		*!			
☞ SE			*	*	
pronoun			**!		*

Like German, Dutch also distinguishes a SE anaphor, *zich*, and a SELF anaphor, *zichzelf*. However, in Dutch a pronoun as well as a SE anaphor is allowed in sentences like (4), whereas a SELF anaphor is unacceptable, according to Fischer. The Dutch ranking explaining this pattern is characterized by a tie between Principle A_{SD} and *SE.

(9) Dutch ranking (Fischer):

Principle A_{TD} >> *SELF >> Principle A_{SD} ° *SE >> *Pronoun

Italian also distinguishes between the SE anaphor (which can be realized as a clitic *si* or a full form *sé*) and the SELF anaphor *se stesso*. According to Fischer (fn. 16), whether the elements in Italian occur as clitics or full forms is regulated by different constraints and is not subject to the Binding Theory. In Italian, like German, a SE anaphor is used in sentences like (4). A SELF anaphor is unacceptable in this context, as in Dutch, and a pronoun is almost acceptable. The Italian constraint ranking explaining this pattern is characterized by two ties: a tie between Principle A_{TD} and *SELF and a tie between Principle A_{SD} and *SE.

(10) Italian ranking (Fischer):

Principle A_{TD} ° *SELF >> Principle A_{SD} ° *SE >> *Pronoun

This ranking predicts that in Italian both a pronoun and a SE anaphor are possible in sentences like (4).

All languages discussed above allow a reflexive in a locational PP to be bound by the subject. A language showing even longer distance binding is Icelandic:

(11) Jón_i skipaði Pétri_j PRO_j að raka sig_i/??sjálfan sig_i/hann_i á hverjum degi.

John ordered Peter to shave-Inf SE/himself/him on every day

“John_i ordered Peter to shave him_i every day”

As this example shows, in Icelandic a SE anaphor can be bound outside its Subject Domain. This can be explained by a Principle A constraint referring to the Root Domain. The constraint ranking explaining Long Distance Anaphora is the following:⁴

(12) Icelandic ranking (Fischer, partial):

*SELF >> Principle A_{RD} ° *SE >> *Pronoun

Thus Fischer is able to explain cross-linguistic differences in binding between languages through the different inventory (e.g., English does not have SE anaphors) in combination with a different ranking of the same set of constraints. In the next section, we will look at the acquisition of the binding principles. An

⁴ The reader is referred to Fischer (2004) for a more detailed analysis of Icelandic, as well as an account of differences between e.g. Icelandic, Faroese, and Russian.

important question is whether the constraints introduced in this section are able to explain the acquisition pattern observed with binding.

3 Optimal acquisition of the binding principles

If children learn the grammar of their language, one of the things they must acquire is the correct ranking of the universal set of constraints. On the basis of the constraints discussed in the previous section, it is expected that pronouns are not more difficult to learn than reflexives because pronouns and reflexives are subject to the same set of Principle A constraints. Also, there is no reason to believe that *Pronoun should be more difficult to learn than *SE or *SELF. Furthermore, without any additional assumptions, it is expected that learning to comprehend pronouns is as easy as learning to produce pronouns. The same set of constraints can be used for production and comprehension, in the same way the standard binding principles regulate the distribution and interpretation of pronouns and reflexives. If the child knows the constraints and has established the correct ranking between these constraints, it is expected that (s)he displays the adult pattern of production and comprehension.

However, with respect to the binding principles a remarkable pattern can be observed in language acquisition. Whereas children correctly interpret reflexives from a young age on, they display difficulties correctly interpreting pronouns until the age of 6 or 7 (see, e.g., Chien and Wexler, 1990). This delay between the correct comprehension of reflexives and the correct comprehension of pronouns is known as the Delay of Principle B Effect (DPBE). Children displaying the DPBE allow for a co-referential interpretation for pronouns in simple transitive sentences such as (3) about half of the time, which seems to be the result of chance performance. The DPBE has been explained as resulting from a lack of pragmatic knowledge (Thornton and Wexler, 1999) or insufficient cognitive resources (Reinhart, in press). Another remarkable pattern in the acquisition of pronouns, which has only recently received attention, concerns the difference between production and comprehension. In contrast with their performance in comprehension, children's production of both pronouns and reflexives is adult-like from a young age on (de Villiers, Cahillane, and Altreuter, 2006).

These two asymmetries (the one between reflexives and pronouns, and the other between production and comprehension) are explained by Hendriks and Spenader (2005/6) by assuming that children initially use the grammar in one direction only. Children optimize from meaning to form in production (as in OT syntax), and from meaning to form in comprehension (as in OT semantics). To arrive at the adult pattern of binding, however, Hendriks and Spenader argue that language users also have to learn to take into account the opposite perspective (as in bidirectional OT). As a hearer, they must consider the alternative

forms a speaker could have used. And as a speaker, they must consider the alternative meanings a hearer may assign to the produced form. By taking into account the opposite perspective in communication, one of the meanings can be blocked for potentially ambiguous forms such as pronouns. This yields the adult pattern of production and comprehension. This mechanism of bidirectional optimization will be discussed in section 3.2 below. But first we will look at children’s pattern of production and comprehension, which can be modelled as unidirectional optimization from meaning to form or from form to meaning.

3.1 Unidirectional optimization

To account for children’s pattern as well as the adult pattern, Hendriks and Spenader (2005/6) employ the following constraints under the ranking given.

(13) English ranking (Hendriks and Spenader):

Principle A >> *Pronoun >> *Reflexive

Because they consider only simple transitive sentences such as (2) and (3), a single Principle A constraint (“A reflexive must be bound locally”) suffices. Two differences between Fischer’s (2004) constraint ranking of English and the constraint ranking in (13) are relevant. First, Hendriks and Spenader’s constraint Principle A does not require comparing different anaphoric expressions, which seems to be an improvement on Fischer’s constraint family Principle A (see fn. 3). Second, the ranking of *Pronoun and *Reflexive is the exact opposite of the ranking in Fischer’s account of binding, but is compatible with Burzio’s (1998) constraint sub-hierarchy Referential Economy.

The three constraints in (13) account for the production of reflexives as in Tableau 4, and for the production of pronouns as in Tableau 5. In production, the input is a meaning, and the grammar selects the optimal form for expressing that meaning.

Tableau 4: Selection of the optimal form in “[_{SD} [_{TD} Bert_i washed –_i]]”, where the direct object is co-referential with the subject, according to the analysis of Hendriks and Spenader (2005/6).

Production	Principle A	*Pronoun	*Reflexive
☞ reflexive			*
pronoun		*!	

Tableau 5: Selection of the optimal form in “[_{SD} [_{TD} Bert_i washed –_j]]”, where the direct object is disjoint to the subject, according to the analysis of Hendriks and Spenader (2005/6).

Production	Principle A	*Pronoun	*Reflexive
reflexive	*!		*
☞ pronoun		*	

The resulting pattern is identical to the pattern resulting from Fischer’s constraints. In comprehension, however, the constraints in (13) give rise to a different pattern. Tableau 6 shows the comprehension of reflexives, and Tableau 7 shows the comprehension of pronouns.

Tableau 6: Selection of the optimal meaning for the sentence “[_{SD} [_{TD} Bert washed himself]]”, according to the analysis of Hendriks and Spenader (2005/6).

Comprehension	Principle A	*Pronoun	*Reflexive
☞ co-referential meaning			*
disjoint meaning	*!		*

Tableau 7: Selection of the optimal meaning for the sentence “[_{SD} [_{TD} Bert washed him]]”, according to the analysis of Hendriks and Spenader (2005/6).

Comprehension	Principle A	*Pronoun	*Reflexive
☞ co-referential meaning		*	
☞ disjoint meaning		*	

In comprehension, the form is given as the input. As a result, all candidate meanings for this form violate the constraints *Pronoun and *Reflexive to the same degree. Therefore, Principle A is crucial in deciding on the optimal meaning. Because a disjoint meaning (Bert_i washed himself_j) violates Principle A, a co-referential meaning (Bert_i washed himself_i) is the optimal meaning for the reflexive. Crucially, a pronoun never violates Principle A, irrespective of the selected meaning. Principle A prevents a reflexive form from expressing a disjoint meaning⁵, but does not restrict the interpretation of pronouns. As a result, for a pronoun both a disjoint and a co-referential meaning are optimal. The two meanings will each be chosen half of the time, which corresponds to children’s guessing pattern with pronouns. Thus the pattern resulting from unidirectional

⁵ The constraint Principle A can thus be seen as prohibiting the association between a reflexive form and a disjoint meaning, and could also be formulated as: Avoid reflexive forms with a disjoint meaning.

optimization from meaning to form and from form to meaning is exactly the pattern of production and comprehension displayed by children.

3.2 Bidirectional optimization

According to Hendriks and Spenader (2005/6), adults not only optimize from meaning to form or from form to meaning, but also take into account the opposite perspective in communication, a mechanism known as bidirectional optimization.⁶ According to the constraint ranking in (13), reflexives are preferred to pronouns because *Pronoun is stronger than *Reflexive. The optimal form-meaning pair, satisfying the constraints of the English grammar best, therefore is the pair consisting of a reflexive form and a co-referential meaning (which is the optimal meaning for this form according to Tableau 6). This optimal pair blocks the reflexive as the form for expressing other, less harmonic, meanings, and also blocks the co-referential meaning for other, less harmonic, forms. So although pronouns are potentially ambiguous in comprehension, the co-referential meaning is blocked for the pronoun because this meaning is better expressed using a reflexive. Consequently, for adults, who optimize bidirectionally, pronouns must be disjoint to the subject. This mechanism of bidirectional optimization is illustrated by Tableau 8. Bidirectionally optimal pairs are indicated by the symbol ♯. Blocked pairs are indicated by the X. Note that the grammar (i.e., the constraints and their ranking) is the same as in previous tableaux. Only the mechanism of optimization (bidirectional rather than unidirectional) is different.

Tableau 8: Selection of the optimal form-meaning pair for the sentence “[_{SD} [_{TD} Bert washed –]]”, according to the analysis of Hendriks and Spenader (2005/6).

Bidirectional	Principle A	*Pronoun	*Reflexive
♯ <reflexive, co-referential meaning>			*
X <reflexive, disjoint meaning>	*		*
X <pronoun, co-referential meaning>		*	
♯ <pronoun, disjoint meaning>		*	

⁶ Bidirectional optimization is defined over form-meaning pairs (Blutner, 2000). A form-meaning pair <f,m> is bidirectionally optimal iff:
 a. there is no other pair <f',m> such that <f',m> is more harmonic than <f,m>.
 b. there is no other pair <f,m'> such that <f,m'> is more harmonic than <f,m>.

The more harmonic pair is the pair that satisfies the constraints of the grammar best. A bidirectionally optimal pair is a pair for which there is no pair with the same meaning but a better form (condition a), nor a pair with the same form but a better meaning (condition b), given the constraints of the grammar. A bidirectionally optimal pair blocks other pairs with either the same form or the same meaning.

Acquisition delays arise as a result of a different output for unidirectional versus bidirectional optimization. Under unidirectional optimization, pronouns can be assigned both a disjoint and a co-referential meaning. Under bidirectional optimization, pronouns are only interpreted as disjoint with the subject. As a result, children are expected to interpret pronouns differently than adults and hence display a comprehension delay. Because unidirectional and bidirectional optimization yield the same results in production, no acquisition delay arises in production. Thus Hendriks and Spenader (2005/6) explain why children's correct production of pronouns precedes their comprehension.

Although the binding account of Hendriks and Spenader (2005/6) accounts for children's and adults' pattern of forms and meanings in simple transitive sentences in English, their account does not predict any cross-linguistic differences, nor does it explain the cases where both a pronoun and a reflexive are allowed. To account for the acquisition data as well as cross-linguistic differences, we seem to need a combination of Hendriks and Spenader's analysis and Fischer's analysis. In the next section, we will investigate the possibilities for integrating the two analyses into a single model of optimization.

4 Integrating the two analyses

4.1 Principle A hierarchy

Both Fischer (2004) and Hendriks and Spenader (2005/6) proceed from Principle A and derive the effects of Principle B from the interaction of Principle A and a markedness hierarchy. Accordingly, we will also assume a family of Principle A constraints, sensitive to binding domains of different size. Principle A constraints are formulated as follows: Principle A_{Subject Domain}: "A reflexive must be bound in its Subject Domain"; Principle A_{Theta Domain}: "A reflexive must be bound in its Theta Domain"; etc. This formulation has the advantage that the evaluation of a candidate with respect to these constraints is not dependent on the evaluation of other candidates (cf. fn. 3). Whether a reflexive violates or satisfies this constraint can be determined without looking at whether other candidate outputs violate or satisfy this constraint.

4.2 Markedness hierarchy

According to Fischer's (2004) analysis, pronouns are preferred to reflexives. On the other hand, Hendriks and Spenader's (2005/6) markedness hierarchy on referential forms assumes that reflexives are preferred to pronouns. Fischer motivates her choice by stating (p. 487) that her preference has to counterbalance the effects of Principle A. Hendriks and Spenader's choice for the opposite preference is motivated by the observation that reflexive meanings are somehow easier to learn than pronominal meanings. If pronouns were the preferred forms,

reflexives are incorrectly predicted to be acquired last or even not acquired at all.

However, there is a way to combine these two opposing views on markedness. If reflexives are assumed to be preferred to pronouns (cf. Hendriks and Spenader, 2005/6), while at the same time bigger binding domains are preferred to smaller binding domains (which is the reverse of Fischer's hierarchy), the effects of the markedness hierarchy on referential forms counterbalance the effects of Principle A. So rather than assuming that binding within the smallest Theta Domain is preferred to binding within the bigger Subject Domain, we assume that binding within the bigger Subject Domain is preferred to binding within the smaller Theta Domain. This preference is reflected in the sub-hierarchy in (14):

(14) Universal sub-hierarchy 1 (revised):

Principle A_{Root Domain} >> Principle A_{Subject Domain} >> Principle A_{Theta Domain}

Simultaneously, we assume that reflexives are preferred to pronouns:

(15) Universal sub-hierarchy 2 (Hendriks and Spenader):

*Pronoun >> *Reflexive

In section 4.4 below, we show that the interaction between these two sub-hierarchies yields the correct pattern for English. Moreover, the interaction between these two sub-hierarchies is also able to explain the observed pattern of language acquisition in English.

Thus far, we have only talked about reflexives in general, without distinguishing between SE anaphors and SELF anaphors. In the next section, we take a closer look at the distinction between SE anaphors and SELF anaphors.

4.3 *SE versus SELF*

Fischer (2004) splits up the constraint *Reflexive into the two more fine-grained constraints *SELF and *SE to explain the different distribution of SE anaphors and SELF anaphors in German and Dutch. Fischer notes that in Dutch a SE anaphor is excluded in sentences like (17), whereas in its German counterpart (18) both a SE anaphor and a SELF anaphor are possible.

(16) Bert_i hates himself_i/*him_i

(17) Bert_i haat zichzelf_i/*zich_i/*hem_i

(18) Bert_i hasst sich selbst_i/sich_i/*ihn_i

According to Fischer (2004: fn. 15), the difference between (17) and (18) is an illustration of the general tendency that the German reflexives *sich* and *sich selbst* are more interchangeable than Dutch *zich* and *zichzelf*. She explains this from a different constraint ranking for Dutch and German, which results in partly differing binding domains for *zich/zichzelf* and *sich/sich selbst*. However, Geurts (2004), among others, shows that the choice between *zich* and *zichzelf* in Dutch may be influenced by semantic and pragmatic factors such as habitualness of the action and focus, rather than by syntactic factors such as binding domains. Moreover, the division of labour between Dutch *zich* and *zichzelf* may be explainable in the same terms as the division of labour between German *sich* and *sich selbst*. The German SELF anaphor has been argued to be the result of reanalysis of the string consisting of a SE anaphor and an intensifying particle (Eckardt, 2001), which explains the focus behaviour and the distribution of *sich selbst*. Geurts shows that the focus properties of Dutch *zelf* are like those of German *selbst* in all relevant respects, making a similar analysis of Dutch *zich/zichzelf* and German *sich/sich selbst* plausible.

In addition, Smits, Hendriks, and Spenader (2007) show in their study of the distribution of Dutch *zich* and *zichzelf* in the Clef corpus (a 70 million word large parsed corpus of Dutch) that the choice between *zich* and *zichzelf* is tendential rather than categorical. Many transitive verbs can occur with *zich* as well as *zichzelf* as the direct object; even inherently reflexive verbs sometimes occur with *zichzelf*. The choice of *zich* versus *zichzelf* was found to be strongly correlated with the frequency with which the verb is used with reflexive and non-reflexive events. The ratio with which a verb is used to describe events acted to others correlates with the degree to which the verb prefers *zichzelf*, and the ratio with which a verb is used to describe events acted to oneself correlates with the degree to which the verb prefers *zich*. Since the tendencies are related to the types of real world events the verb describes, the choice between *zich* and *zichzelf* can hardly be ascribed to binding domains.

For these reasons, we hypothesize that the constraint *Reflexive suffices for an adequate account of binding. The distinction between SE anaphors and SELF anaphors must be regulated by semantic or pragmatic constraints unrelated to Binding Theory. An additional advantage of avoiding such a distinction in our binding constraints is that we do not need to make Principle A sensitive to different degrees of anaphoricity (see fn. 3).

4.4 A revised optimality-theoretic model of binding

Taking into account the above considerations, we end up with the following constraint ranking for English:

(19) English ranking (revised):

Principle $A_{\text{Subject Domain}}$ >> *Pronoun ° Principle $A_{\text{Theta Domain}}$ >> *Reflexive

According to the universal sub-hierarchies introduced in section 4.2, Principle $A_{\text{Subject Domain}}$ is stronger than Principle $A_{\text{Theta Domain}}$, and *Pronoun is stronger than *Reflexive. In English, the constraints *Pronoun and Principle $A_{\text{Theta Domain}}$ are tied.

Now let us look at the unidirectional production and comprehension of reflexives and pronouns in simple transitive sentences, according to our revised optimality-theoretic model. A co-referential meaning is best expressed using a reflexive (Tableau 9). A disjoint meaning is best expressed using a pronoun (Tableau 10).

Tableau 9: Selection of the optimal form in “[_{SD} [_{TD} Bert_i washed –_i]]”, where the direct object is co-referential with the subject, according to the revised model.

Production	Pr. A_{SD}	*Pronoun	Pr. A_{TD}	*Reflexive
☞ reflexive				*
pronoun		*!		

Tableau 10: Selection of the optimal form in “[_{SD} [_{TD} Bert_i washed –_j]]”, where the direct object is disjoint to the subject, according to the revised model.

Production	Pr. A_{SD}	*Pronoun	Pr. A_{TD}	*Reflexive
reflexive	*!		*	*
☞ pronoun		*		

This is also the adult pattern of production. In comprehension, on the other hand, the unidirectional model yields a different pattern than the bidirectional model. Under unidirectional optimization, the optimal meaning for a reflexive is a co-referential one (Tableau 11). For pronouns, under unidirectional optimization two optimal meanings emerge: a co-referential meaning and a disjoint meaning (Tableau 12).

Tableau 11: Selection of the optimal meaning for the sentence “[_{SD} [_{TD} Bert washed himself]]”, according to the revised model.

Comprehension	Pr. A_{SD}	*Pronoun	Pr. A_{TD}	*Reflexive
☞ co-referential meaning				*
disjoint meaning	*!		*	*

Tableau 12: Selection of the optimal meaning for the sentence “[_{SD} [_{TD} Bert washed him]]”, according to the revised model.

Comprehension	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ co-referential meaning		*		
☞ disjoint meaning		*		

Adults, however, will not assign a co-referential meaning to a pronoun in comprehension because they also take into account production. In production, a co-referential meaning is best expressed using a reflexive. Hence, the co-referential meaning is blocked for the pronoun. As a result, under bidirectional optimization a pronoun is interpreted as expressing a disjoint meaning only (Tableau 13).

Tableau 13: Selection of the optimal form-meaning pair for the sentence “[_{SD} [_{TD} Bert washed –]]”, according to the revised model.

Bidirectional	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ <reflexive, co-referential meaning>				*
X <reflexive, disjoint meaning>	*		*	*
X <pronoun, co-referential meaning>		*		
☞ <pronoun, disjoint meaning>		*		

So bidirectional optimization yields a different interpretation for pronouns than unidirectional optimization does.

Unidirectional optimization nicely describes children’s pattern of production and comprehension. In contrast, the adult pattern of production and comprehension is best described by the mechanism of bidirectional optimization. So let us proceed from the assumption that children optimize unidirectionally whereas adults optimize bidirectionally. On the basis of the revised constraints and their ranking we thus predict a DPBE in simple transitive sentences in English. Consequently, our revised model yields the same predictions with respect to the acquisition of reflexives and pronouns as Hendriks and Spender’s (2005/6) model. In the next section, we will see whether the revised model is also able to generate new predictions with respect to the acquisition of pronouns in other syntactic environments than simple transitive sentences and in other languages than English.

5 Predicting acquisition delays

In this section, we will look at the predictions of our revised model. Recall that a Delay of Principle B Effect arises if, under the same constraints and their ranking, bidirectional optimization and unidirectional optimization yield different

outputs. Section 5.1 considers locational PPs in English. Section 5.2 focuses on embedded clauses in English and the other languages under discussion. In section 5.3, the predictions of our model are discussed for Dutch transitive sentences, and in section 5.4 for Dutch locational PPs. In sections 5.5 and 5.6 we present the predictions for German locational PPs and German transitive sentences, respectively. Section 5.7, finally, discusses transitive sentences in Italian. Because there is some disagreement with respect to the relevant acceptability judgments for Icelandic pronouns (see Fischer, 2004: fn. 21), we will omit Icelandic from the present discussion.

5.1 No DPBE in English locational PPs

Unidirectional optimization from meaning to form predicts that co-reference between the subject and the argument of a locational preposition can be expressed by a reflexive as well as a pronoun (Tableau 14).

Tableau 14: Selection of the optimal form in “[_{SD} Bert_i saw a snake [_{TD} near $-_i$]]”, where the prepositional object is co-referential with the subject, according to the revised model.

Production	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ reflexive			*	*
☞ pronoun		*		

A disjoint meaning must be expressed using a pronoun (Tableau 15):

Tableau 15: Selection of the optimal form in “[_{SD} Bert_i saw a snake [_{TD} near $-_j$]]”, where the prepositional object is disjoint to the subject, according to the revised model.

Production	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
reflexive	*!		*	*
☞ pronoun		*		

In comprehension, a pronoun is predicted to be interpreted as co-referential with the subject as well as disjoint to the subject (Tableau 16). As the reader can check for himself, a reflexive is predicted to be co-referential with the subject (no tableau is given here).

Tableau 16: Selection of the optimal meaning for the sentence “[_{SD} Bert saw a snake [_{TD} near him]]”, according to the revised model.

Comprehension	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ co-referential meaning		*		
☞ disjoint meaning		*		

Bidirectional optimization yields three optimal form-meaning pairs (Tableau 17):

Tableau 17: Selection of the optimal form-meaning pair for the sentence “[_{SD} Bert saw a snake [_{TD} near –]]”, according to the revised model.

Bidirectional	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ <reflexive, co-referential meaning>			*	*
X <reflexive, disjoint meaning>	*		*	*
☞ <pronoun, co-referential meaning>		*		
☞ <pronoun, disjoint meaning>		*		

Because children’s unidirectional interpretation of pronouns is identical to adults’ bidirectional interpretation of pronouns (compare Tableau 16 and Tableau 17; in both cases, pronouns are ambiguous), no DPBE is predicted for pronouns in locational PPs in English. This prediction may be generalized to all other cases in English where the Theta Domain is smaller than the Subject Domain (e.g. in picture NPs). Because, both under unidirectional production and under bidirectional production, co-reference between the subject and the argument of a locational preposition can be optionally expressed by a reflexive or a pronoun, no production delay is predicted either.

5.2 *No DPBE in English embedded clauses*

Consider the following example, where a reflexive cannot be bound by the subject of the matrix clause, and a pronoun should be used instead to express co-reference with the matrix subject. The same pattern can be observed in German, Dutch and Italian.

(20) *Bert_i knows that Mary washed himself_i

Because the local subject *Mary* differs from the reflexive in gender, the reflexive cannot be bound by the local subject. Strictly speaking, we would require a higher-ranked constraint on agreement of gender features between the anaphor and the antecedent to block the local binding relation. However, for reasons of

clarity, we omit this constraint from the tableaux below. A bidirectional tableau gives the correct results:

Tableau 18: Selection of the optimal form-meaning pair for the sentence “[_{RD} Bert knows that [_{SD} [_{TD} Mary washed –]]]”, according to the revised model.

Bidirectional	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
X <reflexive, co-referential meaning>	*		*	*
X <reflexive, disjoint meaning>	*		*	*
☝ <pronoun, co-referential meaning>		*		
☝ <pronoun, disjoint meaning>		*		

As Tableau 18 shows, a pronoun is the preferred form in (20). This pronoun can be co-referential with the matrix subject, but can also be disjoint to the matrix subject, provided that pronoun and antecedent agree in gender features.

As the reader can check for himself, children’s pattern of production of pronouns and reflexives is adult-like. However, an interesting pattern emerges from children’s unidirectional comprehension of sentence (20). Although this sentence is ungrammatical, the sentence can nevertheless be assigned a meaning, as is the case for all ungrammatical input in Optimality Theory:

Tableau 19: Selection of the optimal meaning for the sentence “[_{RD} Bert knows that [_{SD} [_{TD} Mary washed himself]]]”, according to the revised model.

Comprehension	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ co-referential meaning	*		*	*
☞ disjoint meaning	*		*	*

According to Tableau 19, children will be able to assign both a co-referential meaning and a disjoint meaning to the reflexive in (20).

Does this mean that children’s comprehension of (20) differs from the adult comprehension of this sentence? Do we predict a DPBE in this case? As Tableau 18 shows, for adults reflexives are never the optimal form in (20). However, if adults would hear a reflexive in the syntactic environment in (20), the constraints of their grammar would not be able to distinguish between a co-referential meaning and a disjoint meaning. According to Tableau 18, a co-referential meaning for a reflexive (the first candidate) and a disjoint meaning for a reflexive (the second candidate) violate and satisfy the same constraints. This is in fact the same constraint profile as in the unidirectional comprehension Tableau 19. Hence, the grammar predicts no DPBE for reflexive objects in embedded clauses in English. Because Principle A_{Subject Domain} is high-ranked in all

languages under consideration, as we will see below, the same prediction holds for German, Dutch and Italian.

5.3 *A DPBE in Dutch transitive sentences*

If the division of labour between SE anaphors and SELF anaphors is not determined by the markedness sub-hierarchy of referential forms, as was argued in section 4.3, the same constraints that play a role in binding in English should also play a role in Dutch. Consequently, the pattern of acquisition of binding in Dutch is predicted to be the same as in English. That is, a DPBE is also predicted for transitive sentences in Dutch. For Dutch, this prediction has been experimentally confirmed (Koster, 1993; Philip and Coopmans, 1996). The comprehension delay in Dutch has been observed for pronouns versus the SELF anaphor *zichzelf*, as well as for pronouns versus the SE anaphor *zich*.

5.4 *No DPBE in Dutch locational PPs*

Assuming that the same constraint ranking is responsible for binding in English and Dutch, our model also predicts the same pattern of acquisition for locational PPs in these languages. That is, for Dutch, as for English (cf. section 5.1), no DPBE is predicted for pronominal objects in locational PPs. As yet, however, we are not aware of any study investigating the acquisition of pronominal reference in locational PPs.

5.5 *A DPBE in German locational PPs*

Fischer (2004: 494) observes that German differs from English and Dutch in that it does not allow pronouns in locational PPs to be co-referential with the subject:

- (21) Bert_i bemerkte eine Schlange neben sich_i/??sich selbst_i/*ihm_i
Bert_i noticed a snake next.to SE_i/SELF_i/him_i
 ‘Bert_i saw a snake near himself_i/him_i.’

This can be modelled by assuming that in German the constraint *Pronoun must be stronger than the constraint Principle A_{TD}.

Tableau 20: Selection of the optimal form in the German sentence “[_{SD} Bert_i bemerkte eine Schlange [_{TD} neben -_i]]” (Bert saw a snake near -), where the prepositional object is co-referential with the subject, according to the revised model.

Production	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ reflexive			*	*
pronoun		*		

Under this ranking, a reflexive (*sich* or *sich selbst*) is the optimal form in production (Tableau 20). In comprehension, a pronoun will be ambiguous between a co-referential and a disjoint meaning (Tableau 21). Tableaux 20 and 21 illustrate unidirectional optimization, which models the pattern of production and comprehension for children.

Tableau 21: Selection of the optimal meaning for the German sentence “[_{SD} Bert bemerkte eine Schlange [_{TD} neben ihn]]” (Bert saw a snake near him), according to the revised model.

Comprehension	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ co-referential meaning		*		
☞ disjoint meaning		*		

The pattern of production and comprehension for adults is modelled by bidirectional optimization. Because the co-referential meaning is blocked under bidirectional optimization (Tableau 22), a DPBE is predicted in locational PPs in German.

Tableau 22: Selection of the optimal form-meaning pair for the German sentence “[_{SD} Bert bemerkte eine Schlange [_{TD} neben –]]” (Bert saw a snake near –), according to the revised model.

Bidirectional	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ <reflexive, co-referential meaning>			*	*
X <reflexive, disjoint meaning>	*		*	*
X <pronoun, co-referential meaning>		*		
☞ <pronoun, disjoint meaning>		*		

Note that this analysis, and the prediction of a comprehension delay, hinges on the unacceptability of the pronoun in the syntactic environment in (21). If pronouns turn out to be acceptable in this syntactic environment after all, the German adult pattern can be explained in the same way as the Dutch pattern, and no DPBE is predicted.

5.6 A DPBE in German transitive sentences

Adopting the constraint ranking in the previous section for German, object pronouns in transitive sentences are predicted to be ambiguous between a co-referential and a disjoint meaning:

Tableau 23: Selection of the optimal meaning for the German sentence “[_{SD} [_{TD} Bert hasst ihn]]” (Bert hates him), according to the revised model.

Comprehension	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ co-referential meaning		*		
☞ disjoint meaning		*		

Because the co-referential meaning for the pronoun is blocked by bidirectional optimization (Tableau 24), and hence children’s unidirectional interpretation of pronouns is different from adults’ bidirectional interpretation, a DPBE is predicted for pronouns in German transitive sentences.

Tableau 24: Selection of the optimal form-meaning pair for the German sentence “[_{SD} [_{TD} Bert hasst –]]” (Bert hates –), according to the revised model.

Bidirectional	Pr. A _{SD}	*Pronoun	Pr. A _{TD}	*Reflexive
☞ <reflexive, co-referential meaning>				*
X <reflexive, disjoint meaning>	*		*	*
X <pronoun, co-referential meaning>		*		
☞ <pronoun, disjoint meaning>		*		

As far as we know, no study has yet investigated the DPBE in German. However, our model predicts such comprehension delays to be present both for object pronouns in simple transitive sentences and for object pronouns in locational PPs.

5.7 A DPBE in Italian transitive sentences?

Fischer (2004) argues that the pattern of binding in Italian can be obtained using the same constraints as for English, German and Dutch, but under a different ranking. For German and Dutch, we suggested (section 4.3) that in many cases a SE anaphor and a SELF anaphor are both possible, and that the choice between the two may be influenced by factors such as focus. Italian, however, differs from German and Dutch in one crucial aspect: In Italian, SE anaphors can be realized as clitics preceding the finite verb, whereas SELF anaphors must be realized in a position following the finite verb:

- (22) Bert_i si_i odia/odia se stesso_i/*lo_i odia
Bert_i SE_i hates/hates SELF_i/him_i hates
 “Bert hates himself”

This difference is ignored by Fischer but may be highly relevant for the present discussion. In fact, it suggests that an additional constraint is at work in Italian, which syntactically distinguishes between SE and SELF anaphors.

Another well-known observation is that Italian and other Romance languages do not exhibit a DPBE (e.g., McKee, 1992). In her study, McKee focuses on SE anaphors and pronouns in pre-verbal clitic position in Italian and finds that, compared to English, Italian speaking children do not exhibit a DPBE with respect to the pre-verbally occurring pronoun. A pre-verbally occurring pronoun can only refer to some other individual than the local subject, also for children. From the perspective of our optimality-theoretic model, this is surprising because our model assumes that pronouns are underspecified with respect to their interpretation. Only in bidirectional competition with reflexives is one of the potential meanings blocked. So why are pre-verbally occurring pronouns in Italian not ambiguous for children?

Here, we wish to speculate on a possible explanation for the absence of a DPBE in Italian. Spenader, Smits and Hendriks (2006), in their study with Dutch speaking children, found that altering the information structure of the context had a significant effect on the presence of a DPBE in Dutch. In the standard task used by, e.g., Chien and Wexler (1990), the two referents introduced in the context are equally salient (“This is Mama Bear. This is Goldilocks”). This gives rise to a pronoun interpretation problem, also in Dutch. However, if the context is modified in such a way that there is only one salient referent, which is not the subject of the sentence (e.g., “This is Mama Bear”), children interpret the subsequent pronoun correctly as disjoint to the subject. So discourse cues in the form of a clear discourse topic dissolve the DPBE in Dutch.

Now suppose that the pre-verbal position in Italian is a topic position, i.e., a position in which only elements can appear which refer to the topic of the discourse. In this case, syntax would provide the necessary cues with respect to topic-hood to render the pronoun unambiguous. According to Spenader et al., integrating cues with respect to topic-hood into the model can be done by adding a constraint on comprehension which requires pronouns to refer to the discourse topic. Because of this relatively strong constraint ProTop (“Pronouns refer to topics”), the pronoun is interpreted as the discourse topic under unidirectional optimization (Tableau 25).

Tableau 25: Selection of the optimal meaning for the Italian sentence “[_{SD} [_{TD} Bert lo odia]]” (Bert hates him) in a single-topic context where Bert ≠ topic), according to the revised model.

Comprehension	Pr. A _{SD}	ProTop	*Pronoun Pr. A _{TD}	*Reflexive
co-referential meaning		*!	*	
☞ disjoint meaning			*	

If the local subject is not the discourse topic, the co-referential meaning violates the constraint ProTop. As a result, the pronoun is correctly interpreted as disjoint to the local subject. Because the output of unidirectional comprehension of pre-verbal pronouns in a single-topic context and the adult pattern of comprehension are the same, no DPBE arises for a pronoun in pre-verbal position.

If this explanation is correct, we predict that pronouns in post-verbal position in Italian do give rise to a DPBE because the post-verbal position is not a topic position. In the absence of a single-topic context, no cues are provided as to the topic-hood of potential referents. Consequently, pronouns in post-verbal position remain ambiguous until one of their meanings is blocked through bidirectional optimization. Baauw and Delfitto (1999) mention an unpublished pilot study by Berger (1997), who finds that Italian children appear to incorrectly allow co-reference with the subject much more often in constructions containing pronouns in post-verbal position than in constructions containing pronouns in pre-verbal position.⁷ This is in line with the predictions of our model, although further study is needed to corroborate this initial finding. Another prediction that requires further investigation is that adding a single-topic context will have an effect on the correct interpretation of pronouns occurring post-verbally but not on pronouns occurring pre-verbally (since syntax already provides the relevant cues here).

6 Conclusions

In this paper, we combined Fischer’s (2004) optimality-theoretic analysis of binding, which explains the observed cross-linguistic variation in binding, and Hendriks and Spender’s (2005/6) optimality-theoretic account of the acquisition of pronouns and reflexives. The resulting optimality-theoretic model al-

⁷ The relevant contrast is between sentence (i) and sentence (ii) (attributed by Baauw and Delfitto (1999) to Berger (1997)):

- (i) Il ragazzo sta indicando lui
- (ii) Il ragazzo lo sta indicando
“The boy is pointing at him”

The post-verbally occurring form is the full pronoun *lui*, whereas the pre-verbally occurring form is the clitic pronoun *lo*.

lowed us to generate predictions with respect to the presence or absence of a DPBE cross-linguistically. Acquisition delays are predicted to arise as a result of a different output for unidirectional versus bidirectional optimization. Our optimality-theoretic model predicts a DPBE to be present with respect to the comprehension of pronouns in transitive sentences in English, Dutch, and German, and in locational PPs in German. In contrast, the model predicts an absence of DPBE with respect to the comprehension of pronouns in locational PPs in English and Dutch, but not in German. Also no DPBE is predicted with respect to the comprehension of pronouns in embedded clauses in English, German, Dutch and Italian. Finally, under the additional assumption that the preverbal position in Italian is a topic position, pre-verbally occurring pronouns in Italian are predicted not to give rise to a DPBE in comprehension, whereas post-verbally occurring pronouns are expected to exhibit a DPBE.

7 References

- Aissen, J. (1999). Markedness and subject choice in Optimality Theory. *Natural Language & Linguistic Theory*, 17: 673-711.
- Baauw, S. & D. Delfitto (1999). Coreference and language acquisition. In: D. Delfitto, J. Schroten & H. de Swart (eds.): *Recherches de Linguistique Française et Romane d'Utrecht* (Utrecht Studies in Romance Linguistics) XVIII, Utrecht University.
- Berger, C. (1997). Research paper 'Acquisition of Syntax', Utrecht University.
- Blutner, R. (2000). Some Aspects of Optimality in Natural Language Interpretation. *Journal of Semantics*, 17: 189-216.
- Burzio, L. (1998). Anaphora and soft constraints. In: P. Barbosa et al. (eds.): *Is the best good enough? Optimality and competition in syntax*. Cambridge, MA: MIT Press.
- Chien, Y.-C. & K. Wexler (1990). Children's knowledge of locality conditions on binding as evidence for the modularity of syntax and pragmatics. *Language Acquisition*, 13: 225-295.
- Chomsky, N. (1981). *Lectures on Government and Binding*. Dordrecht: Foris.
- De Villiers, J., J. Cahillane, & E. Altreuter (2006). What can Production Reveal about Principle B? In: K.U. Deen, J. Nomura, B. Schulz & B.D. Schwartz (eds.): *The Proceedings of the Inaugural Conference on Generative Approaches to Language Acquisition - North America*. Honolulu, HI: University of Connecticut Occasional Papers in Linguistics 4: 89-100.
- Eckardt, R. (2001). Reanalysing *selbst*. *Natural Language Semantics*, 9: 371-412.
- Fischer, S. (2004). Optimal binding. *Natural Language & Linguistic Theory*, 22: 481-526.
- Geurts, B. (2004). Weak and strong reflexives in Dutch. In: E. Keenan & P. Schlenker (eds.): *Proceedings of the ESSLLI'04 workshop on Semantic Approaches to Binding Theory*. Nancy, France.
- Hendriks, P. & J. Spenader (2005/2006). When production precedes comprehension: An optimization approach to the acquisition of pronouns. *Language Acquisition*, 13: 319-348.
- Koster, C. (1993). *Errors in Anaphora Acquisition*. Doctoral dissertation, Utrecht University.

- McCarthy, J.J. (2002). *A thematic guide to Optimality Theory* (Research Surveys in Linguistics). Cambridge: Cambridge University Press.
- McKee, C. (1992). A comparison of pronouns and anaphors in Italian and English Acquisition. *Language Acquisition*, 2: 21-54.
- Philip, W. & P. Coopmans (1996). The Double Dutch Delay of Principle B Effect. In: A. Stringfellow, D. Cahana-Amitay, E. Hughes & A. Zukowski (eds.): *Proceedings of the 20th Boston University Conference on Language Development*. Somerville, MA: Cascadilla Press, 576-587.
- Prince, A. & P. Smolensky (2004). *Optimality Theory: Constraint interaction in generative Grammar*. Blackwell. Also appeared as Technical Report CU-CS-696-4993, Department of Computer Science, University of Colorado at Boulder, and Technical Report TR-2, Rutgers Center for Cognitive Science, Rutgers University, New Brunswick, NJ, April 1993.
- Reinhart, T. (in press). Processing or pragmatics? Explaining the coreference delay. In: T. Gibson & N. Pearlmuter (eds.): *The processing and acquisition of reference*. MIT Press.
- Reinhart, T. & E. Reuland (1993). Reflexivity. *Linguistic Inquiry*, 24: 657-720.
- Smits, E.-J., Hendriks, P. & J. Spenader (2007). Using very large parsed corpora and judgment data to classify verb reflexivity. In: A. Branco (ed.): *Anaphora: Analysis, Algorithms and Applications. 6th Discourse Anaphora and Anaphor Resolution Colloquium, DAARC 2007*. LNAI (Lecture Notes in Artificial Intelligence) #4410, Berlin Heidelberg: Springer-Verlag, 77-93.
- Spenader, J., E.-J. Smits & P. Hendriks (2006). Coherent discourse solves the Pronoun Interpretation Problem. Ms, U. of Groningen (<http://www.let.rug.nl/~hendriks/pip06.pdf>).
- Thornton, R. & K. Wexler (1999). *Principle B, VP Ellipsis and Interpretation in Child Grammar*. Cambridge, MA: MIT Press.

Influence of animacy and grammatical role on production and comprehension of intersentential pronouns in German L1-acquisition¹

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In anaphora resolution theory, it has been assumed that anaphora resolution is based on a reversed mapping of antecedent salience and anaphora complexity: minimal complex anaphora refer to maximal salient antecedents. In order to examine whether and by which developmental steps German children gain command of this mapping maxim we conducted an experiment on production and comprehension of intersentential pronouns including the three pronoun types zero, personal, and demonstrative pronoun. With respect to antecedent salience, the experiment varied syntactic role (subject/object) and in/animacy. Six age groups of children (age range from 2;0 to 6;0) and an adult control group has been tested. The hypothesis arising from the mapping maxim is that zero pronoun correlates with more salient antecedents than personal and demonstrative pronoun, the latter correlating with the least salient antecedents. The results are: In production, children first establish the opposition of zero pronoun with animate antecedents vs. demonstrative pronoun with inanimate antecedents. In a next step, syntactic role comes into play and a more complex system opposing the three presented pronoun types is established. In comprehension, however, the effect of pronoun type remains weak and antecedent features remain a strong factor in reference choice. However, also adults employ pronoun type and antecedent features. The oldest children and the adults show variation in personal pronoun resolution according to the animacy pattern of the potential antecedents. In case of identical animacy features, the subject is the preferred candidate; in case of distinct animacy features, there is a tendency to choose the object antecedent.

¹ The presented study was worked out in close cooperation with Natalia Gagarina and Milena Kuehnast who conducted parallel experiments on Russian and Bulgarian (see Gagarina this volume; Kuehnast this volume), and with Insa Gülzow who did a great deal of the experiments on German. Further, I would like to thank our students Franziska Bewer, Britta Grabherr, Robert Hoffmann, and Jenny Ewert. Elena Andonova provided first statistical analyses on a preliminary version of the data for which I am very thankful, although these statistics will not appear in this paper.

1 Questions and Hypotheses

The numerous and diverse approaches on anaphora resolution currently proposed converge on the assumption that one of the core criteria in the disambiguation of anaphoric reference is the salience of referents in the mental representation of a situation (e.g., Gundel et al 1993; Ariel 2004; Grosz et al. 1995). Restricting the scope of possible referents to linguistically prementioned referents, salience can be determined by linguistic structural features, e.g., grammatical role, word order, definiteness, agreement etc., or by semantic features, i.e., properties of the antecedent, such as semantic inference relations, semantic role, topicality, animacy, etc. Very likely, salience is determined by interaction of a bunch of such criteria. Some of them have been proposed to be especially relevant or, at least, sufficient in order to appropriately generate the resolution of certain types of anaphora. With respect to pronominal anaphora the following criteria are discussed: syntactic role, syntactic or semantic parallelism, old-new information (theme-rheme-/topic-focus-structure). Distinct solutions are proposed on what is the decisive hierarchy of these criteria in salience determination.

A further topic is the classification of anaphoric capacities of the diverse pronoun types. Does each pronoun type have distinct and stable features of ‘anaphoricity’? Or is there rather a pragmatic resolution process including variation in the anaphoric relations of an anaphora in dependence on actual feature constellations? The widely accepted assumption of a reversed mapping of antecedent salience and anaphora complexity, i.e., maximal salient antecedents are referred to by minimal complex anaphora and minimal salient antecedents by maximal complex anaphora (see Givón 1983; Levinson 2000), hints at a pragmatically based solution of anaphoric reference. A prerequisite to more detailed elaboration of this ‘reversed-mapping hypothesis’ is the determination of the range of features relevant for antecedent salience and their hierarchical ranking(s).

For the time being, there are more questions than answers in the field of (pronominal) anaphora resolution. Given this situation, it might be helpful to have a look at language acquisition which provides the opportunity to go back to, very likely, less complex stages of language processing. We suppose that basic structures of linguistic domains are acquired before internal differentiation takes place by incorporation of further specifications. Thus, early phases of language acquisition might provide insights, for instance, in what are primary and what are merely secondary features in salience determination or in what are primary anaphoric capacities of the different types of anaphora.

The experimental investigation reported in this paper aims at answering the following question or, at least, at providing insights in what are possible

methods and relevant problems in answering the question: Does the antecedent features syntactic role and animacy provide cues for production and/or comprehension of zero, personal, and demonstrative pronouns? It is worth noting, that zero pronoun is ungrammatical in German. However, it has been chosen for two reasons: Firstly, the experiment has been conducted on German, Russian, and Bulgarian in order to investigate across-language and language-specific aspects of intersentential pronoun use. In Russian and Bulgarian, zero pronoun is a grammatical type of anaphora. Secondly, even children acquiring non-pro-drop languages as German tend to omit the subject phrase in the early phases. The question arises how children deal with this gap in anaphoric reference. Do they treat it in line with the reversed-mapping hypothesis?

Syntactic role, i.e., the opposition between subject and object role, has been chosen because certain approaches (e.g., classical Centering Theory; Grosz 1995, Beaver 2004) propose a subject preference in pronoun resolution (especially for the personal pronoun). Other approaches propose a preference for either old (Strube & Hahn 1999) or new information (Haijcova et al. 1993) including the possibility of object preference. The animacy feature has been chosen because for instance Mandler (1992) suggests a high preference for animacy distinctions in early cognitive development of children.

Starting from the reversed-mapping hypothesis, the three pronoun types zero, personal, and demonstrative pronoun are proposed to show the following anaphoric capacities:

- (1) *Hypothesis on anaphoric capacities*
 - (a) If there occurs any relevant pattern for the ungrammatical *zero pronoun*, it correlates with the most salient antecedent.
 - (b) The *demonstrative pronoun* correlates with the least salient antecedent.
 - (c) The anaphoric capacity of the *personal pronoun*, theoretically, lies somewhere in the middle. Taking into account the ungrammaticality of the zero pronoun in German, the personal pronoun should correlate with higher salient antecedents.

With respect to salience ranking, the following questions will be examined:

- (2)
 - (a) Are subject antecedents more salient than object antecedents or vice versa?
 - (b) Are animate antecedents more salient than inanimate antecedents or vice versa?
 - (c) Is there an interaction of syntactic role and animacy in salience ranking?

Special emphasis will be given on the course of development over age and the comparison of the children's behaviour with that of the adult control group. The general hypothesis is that we will find age-related changes in the correlation of pronoun type and antecedent features. On the base of what has been said above on increasing complexity by consequent differentiation of linguistic domains in

the course of acquisition, we will investigate the following hypotheses on developmental steps in the correlation of pronoun types and antecedent features:

- (3) *Hypotheses on developmental steps*
- (a) Younger children (about up to age 4;0) exhibit a bipolar opposition in the anaphoric capacities of the three pronoun types unifying the anaphoric capacity of two pronoun types, either zero/personal vs. demonstrative or zero vs. personal/demonstrative pronoun. Older children (of about age 4;0 to 5;6) and adults exhibit a more complex pattern of oppositions containing specific anaphoric capacities for each pronoun type.
 - (b) Younger children's opposition of the anaphoric capacities of the pronoun types relies on only one of the two antecedent features (syntactic role or animacy) whereas older children and adults use both of them.

In section 2, we will introduce the experimental method and materials. After that, the results on pronoun production will be presented (section 3) and discussed (section 4). Section 5 and 6, respectively, present and discuss the results on pronoun comprehension. Section 7 gives a short summary on results and open questions.

2 Experimental method and material

The experiment was performed as a combined production and comprehension experiment. In a playing situation with two experimenters, the child was presented with 12 short stories representing 12 experimental conditions (see below). The stories were presented to the child by the first experimenter using toy puppets. Each story included two protagonists and ended with an 'antecedent sentence' expressing an interaction of these two protagonists. The 'antecedent sentence' was immediately followed by an 'anaphoric sentence' containing the pronoun and an information which was true for both protagonists (e.g., being blue or being happy). Thus, an ambiguous situation occurred with respect to the reference of the pronoun. No semantic cues, gender cues, or other cues for pronoun reference were given. Pronoun production was elicited by asking the child to repeat the last, i.e., the anaphoric sentence to a distracted puppet (played by the second experimenter) who was introduced to the child as absent-minded and hard of hearing. Pronoun comprehension was evaluated by a clarification question asked by the distracted puppet (*who*-question) immediately following the child's sentence repetition.

(4) *Example of the experimental settings:*

Exp 1: Das ist der Bär und hier ist der Ball.		That's the bear and that's the ball.
Der Bär spielt gern Fussball.		The bear likes to play football.
Jetzt liegt der Ball vor dem Bären.		Now, the ball is in front of the bear.
antecedent sentence: Der Bär tritt den Ball.		The bear is kicking the ball.
anaphoric sentence: Er ist weiss.		He is white. (notice: both are white!)
Exp 2 (distracted puppet): Oh, wie bitte?		Pardon?
	Ich hab nicht verstanden.	I did not get it.
Child: <u>PRODUCTION</u>	Er ist weiss.	He is white.
Exp 2:	Wer ist weiss?	Who is white?
Child: <u>COMPREHENS.</u>	Der Bär.	The bear.

The correlation of the antecedent properties in/animacy and syntactic role, i.e., subject/object, in the application of zero, personal, and demonstrative pronouns results in a 2x2x3 category setting. The 2x2 correlation of the antecedent properties required four types of antecedent sentences (table 1).

Table 1. Types of antecedent sentences

	antecedent features	example	
A	+anim sbj : +anim obj	der affe umarmt den hund	'the monkey is hugging the dog'
B	-anim sbj : +anim obj	der ball berührt den bären	'the ball is touching the bear'
C	-anim sbj : -anim obj	der traktor schiebt den bus	'the tractor is pushing the bus'
D	+anim sbj : -anim obj	der elefant fährt den traktor	'the elephant is driving the tractor'

Each of these four sentence types occurred in combination with all three types of pronouns (table 2).

Table 2. Types of anaphoric sentences

pronoun type	example	example	example	example
zero	ist weiss	'is white'	lacht laut	'is loughing loud'
personal	er ist weiss	'he is white'	er lacht laut	'he is loughing loud'
demonstrative	der ist weiss	'this is white'	der lacht laut	'this is loughing loud'

Two sets (cohorts) of 12 test items were constructed, one half of the children of each age group were tested with the one and the other half with the other set. The children are grouped into 6 age groups covering the age of 2;0 to 6;0.

Table 3. Age groups and number of subjects in the production task

age group	2;6 - 2;11	3;0 - 3;5	3;6 - 3;11	4;0 - 4;5	4;6 - 4;11	5;6 - 5;11	adults
number of tested subjects	27	25	25	21	22	25	38
number of analysed subjects	16	18	20	20	19	21	32

Excluded from the analyses of pronoun production are all subjects showing the following types of behaviour in more than 80% of the repetitions, i.e., in 11 or 12 stimuli:

- (a) giving no answer,
- (b) producing one and the same pronoun type,
- (c) producing a complete noun phrase instead of a pronoun (e.g. *der bär ist blau* ‘the bear is blue’),
- (d) the combination of (a) + (b) or of (a) + (c),
- (e) giving other types of answers.²

Table 4. Age groups and number of subjects in the comprehension task

age group	2;6 - 2;11	3;0 - 3;5	3;6 - 3;11	4;0 - 4;5	4;6 - 4;11	5;6 - 5;11	adults
number of tested subjects	27	24	25	21	22	25	38
number of analysed subjects	22	21	20	19	18	18	28

Excluded from the analyses of pronoun comprehension are all subjects who:

- (a) showed a subject or object bias,
- (b) a bias to answer that the situation is true for both participants,
- (c) gave less than 4 subject/object answers on the *who*-question.³

² **Table 3a.** Numbers of excluded subjects per age and criterion (production task)

	2;6	3;0	3;6	4;0	4;6	5;6	adults
a)	2	1					
b)	8x zero	5x zero	3x zero 1x personal 1x demonstr.		1x zero 2x personal	1x personal	
c)						2	5
d)				1			1
e)	1					1	

³ **Table 4a.** Numbers of excluded subjects per age and criterion (comprehension task)

	2;6	3;0	3;6	4;0	4;6	5;6	adults
a)	4x SBJ		1x SBJ 2x OBJ	2x SBJ	4x SBJ	6x SBJ 1x OBJ	4x SBJ 4x OBJ
b)	1	1					1
c)		1	2				1

As emphasized above, the main goal of this paper lies in detecting developmental steps and relevant tendencies in the correlation of syntactic role and animacy with anaphoric use of the three pronoun types. Because of the complexity of the involved parameters and the fact that development does not exclusively proceed in statistically significant steps, we concentrate here on observable tendencies and lines of development over the investigated age groups. All analyses are based on calculation of percentages.

3 Results of the production experiment

3.1 General repetition scores

The most intriguing results in pronoun production are expected from deviations of the presented and the repeated pronoun. Such deviations are numerous in the younger children, they decrease in the older ones, and adults, finally, only exceptionally deviate from the presented pronoun. Therefore, before analysing the mismatching repetitions (section 3.3), the general repetition scores (section 3.1) and the general distribution of the repeated pronouns over the four sentence types (section 3.2) shall be highlighted.

Taking all repetitions as 100%, correct repetition of all anaphoric sentences would result at 33,3% for each of the three pronoun types. However, besides pronominal deviation from the presented pattern, children produced DPs like *der bär* ‘the bear’, *der ball* ‘the ball’. Bare nouns did not occur. Sometimes children gave no answer or produced something different. In figure 1, all productions of the required pronouns and of DPs are calculated as 100%. All other types of productions are excluded from the analysis.

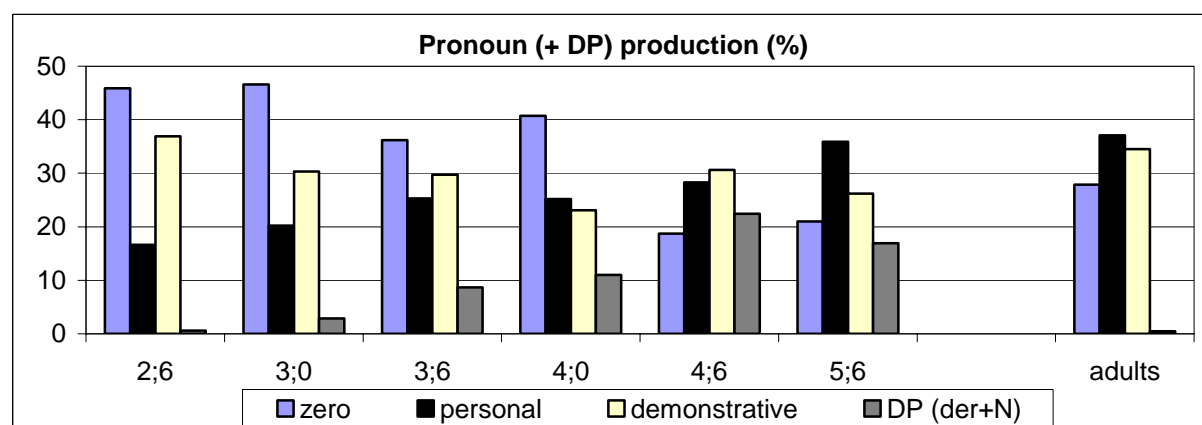


Figure 1. Production of pronoun types and DPs in the repetition task

Up to age 4;0, children produce more zero than personal and demonstrative pronouns, that means they tend to omit the subject pronoun in the repetition of the anaphoric sentence.

- (5) Exp.: der elefant fährt den traktor the elephant is driving the traktor
 er ist blau he/it is blue
 EXP 2: wie bitte? was war los? pardon? what happened?
 CHI: (ist) blau⁴ (is) blue

The youngest children (age 2;6) prefer to produce zero and demonstrative pronouns over personal pronouns. In contrast, the oldest children (age 5;6) preferably produce the personal pronoun. In that, they behave similar to the adults who show a tendency to replace zero by personal pronouns although they, in general, only minimally deviate from the presented pattern.

An unexpected or at least unwanted feature is the production of DPs which increases with age. The structure of the experiment, i.e., the immediately following comprehension part induced by the *who*-question, caused the anticipation of this question and led the children to insert the answer to the *who*-question in the production task producing for instance *der bär ist weiss* ‘the bear is white’ instead of \emptyset /*der/er ist weiss* ‘ \emptyset /he/this is white’ or *der schal ist lang* ‘the scarf is long’ instead of \emptyset /*er/der ist lang* ‘ \emptyset /it/this is long’.

3.2 Pronoun repetition in relation to sentence types

The influence of syntactic role and in/animacy on pronoun production will be evaluated first by comparing the distribution of each pronoun type over the four sentence types (see table 1). Starting with the zero pronoun, figures 2, 3, and 4 present the results for each pronoun type.

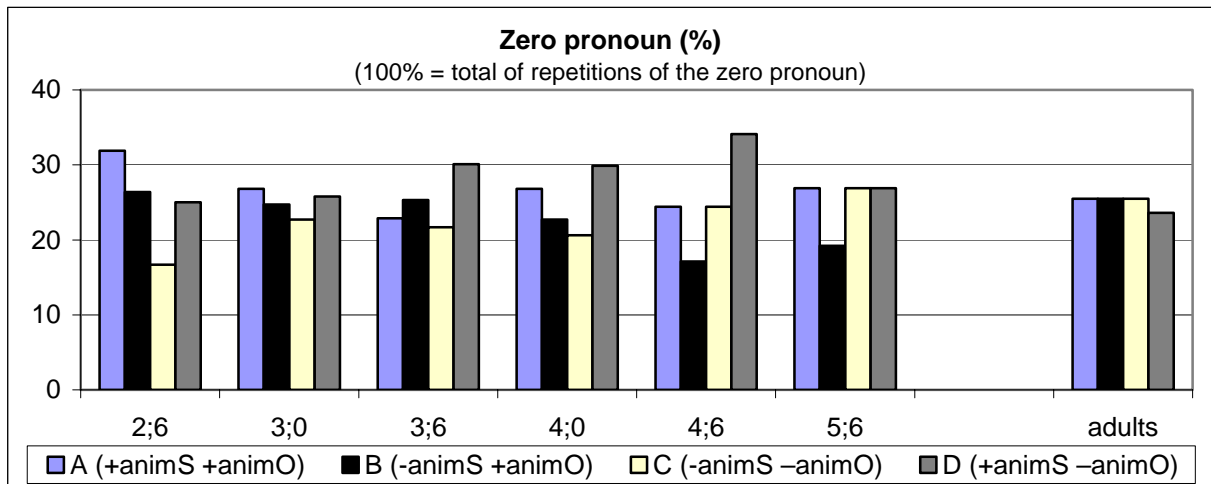


Figure 2. Distribution of the zero pronoun over sentence types per age group

At a first glance, no sentence type seems to especially attract the zero pronoun. However, there is a clear contrast between children’s and adults’ behaviour.

⁴ Sometimes also the copula was omitted, especially by the younger children.

Adults show a well-balanced distribution. In comparison, children show preference and even avoidance tendencies which change with age. From age 2;6 to 4;6, preference tendencies change from sentence type A to D. Only the 5;6-year-olds do not show any preference tendency. Tendencies to avoid the zero pronoun change from sentence type C to B between age 2;6 and 5;6. Table 5 extracts the maximal contrasts in distribution of the zero pronoun and presents the included feature oppositions. Further, it allows to infer developmental steps in the production of the zero pronoun.

Table 5. Oppositions and developmental steps in the production of the zero pronoun

most frequent in:	A		D			∅	
	2;6	3;0	3;6	4;0	4;6	5;6	adults
least frequent in:	C			B			∅
opposition of:	A vs. C		D vs. C		D vs. B	avoid. in B	∅
(antecedent properties)	animate vs inanimate		animate S vs. inanimate		animate S vs. inanimate S	no prefer. but avoidance with inanimate S	
developmental steps:	step 1		step 2		step 3	step 4	target stage

The zero pronoun tends to be related first to the in/animacy opposition and later on to the combination of in/animacy and syntactic role.

In step 1, animacy is the only decisive distribution cue: Zero pronoun tends to be preferred when (one of) the potential antecedents is/are animate and tends to be avoided (low frequent) when (one of) the potential antecedents is/are inanimate. In step 2, syntactic role becomes relevant in preferred use by focusing on animate subjects in the presence of inanimate objects (D). Relevance of syntactic role increases further in step 3: In addition to the preference for animate subjects, zero pronouns tend to be avoided with inanimate subjects in the presence of animate objects (B). Step 4, performed by the oldest age group, exhibits the disappearance of any preference. However, there is a tendency to avoid zero pronouns in the condition ‘inanimate subject – animate object’ (B).

In the production of personal pronouns, again, adults do not exhibit different frequencies in the four sentence types, whereas children do.

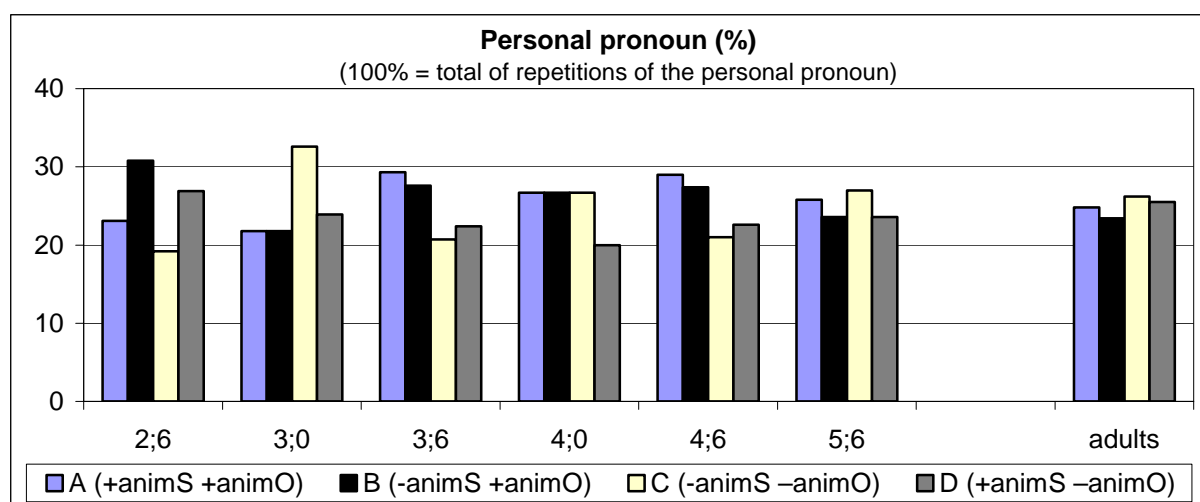


Figure 3. Distribution of the personal pronoun over sentence types per age group

However, even with the children the differences in the distribution over sentence types are comparably small. Only weak oppositions and developmental changes can be stated.

Table 6. Oppositions and developmental steps in the production of the personal pronoun

most frequent in:	B	C	A/(B)	∅	A/(B)	∅
	2;6	3;0	3;6	4;0	4;6	5;6 adults
least frequent in:	C	A/B	C/(D)	D	C/(D)	∅
opposition of: (antecedent prop- erties)	unclear (reversed pattern)	A/B vs. C/D animate (O) vs. inanimate (O)				∅
developmental steps:	step 1		step 2		target stage	

The two youngest age groups produce only a small number of personal pronouns (see figure 1). Avoidance of the personal pronoun is the most pronounced tendency in step 1. In step 2, production tends to correlate with animacy and syntactic role. It is slightly preferred when the potential antecedent is animate, especially when the object referent is animate (A/B). In contrast, the personal pronoun tends to be avoided when the potential antecedent is inanimate, especially when the object referent is inanimate (C/D). In the oldest age group, preference and avoidance tendencies have disappeared and children display adult behaviour.

In the distribution of the demonstrative pronoun, again, adults do not show any tendency of preference or avoidance whereas children do.

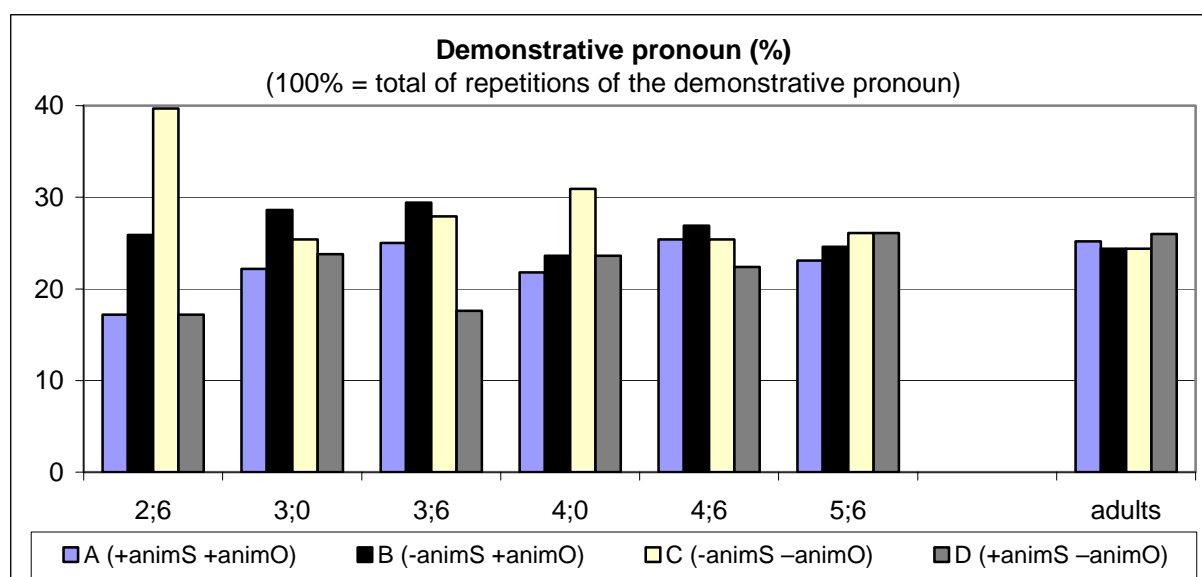


Figure 4. Distribution of the demonstrative pronoun over sentence types per age group

The youngest age group shows an exceptionally high preference to produce the demonstrative pronoun in sentence type C, i.e., when both antecedents are inanimate. Up to age 3;6, the demonstrative pronoun is more frequent in sentence types B and C than in sentence types A and D, i.e., when the subject antecedent is inanimate. Later on, this opposition becomes weaker. However, up to age 4;6, frequency remains most high either in B or in C.

Table 7. Oppositions and developmental steps in the production of the demonstrative pronoun

most frequent in:	C	B		C	B	∅
	2;6	3;0	3;6	4;0	4;6	5;6 adults
least frequent in:	A/D	A	D	A	D	∅
opposition of:	C vs. A/D	B/C vs. A/D				∅
(antecedent properties)	inanimate vs. animate (S)	inanimate (S) vs. animate (S)				
developmental steps:	step 1	step 2				target stage

As it was the case with the zero pronoun, production of the demonstrative pronoun tends to be based on the animacy feature in the youngest children. However, it is the opposite distribution. Production tends to be preferred when the potential antecedents are inanimate and to be avoided when they are animate. Further, syntactic role appears to be relevant earlier than with the zero pronoun. In step 1, production of the demonstrative pronoun is most frequent when the potential antecedents are both inanimate, but it is least frequent when the poten-

tial antecedent, and especially the subject, is animate. In step 2, syntactic role becomes relevant also for preferred production: the demonstrative pronoun is most frequent when the potential antecedent, and especially the subject, is inanimate. At age 5;6 – but starting already at age 4;6 – sentence type oppositions have disappeared and children behave similarly to adults.

In the next section, the observed tendencies will be further elaborated by an analysis of the incorrectly repeated pronouns and their distribution over sentence types.

3.3 *Incorrect pronoun repetition*

Figure 5 presents the total amount of incorrectly repeated pronouns, as well as the rate of incorrect zero, personal and demonstrative pronouns.

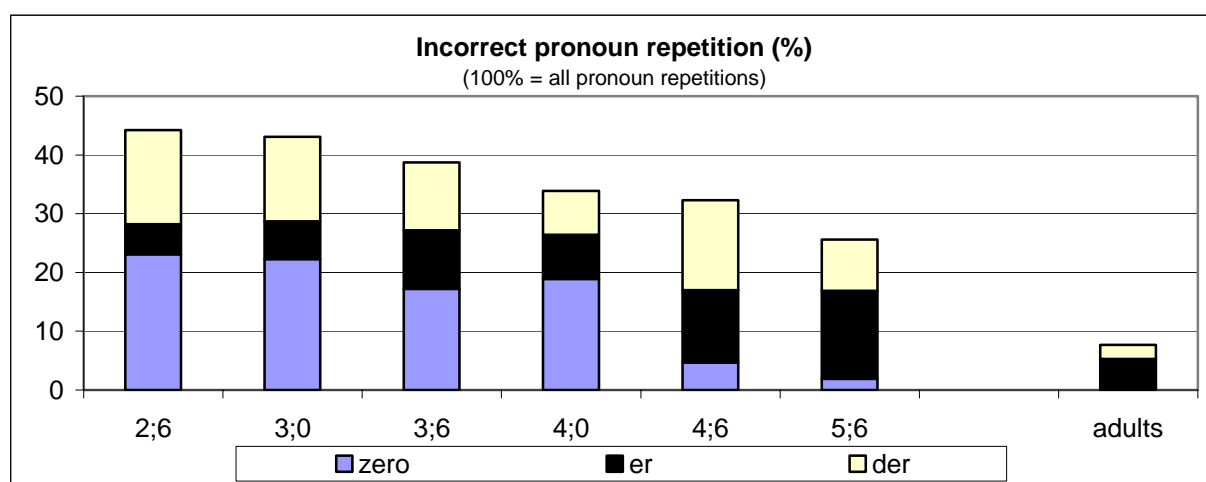


Figure 5. Incorrect repetitions of the zero, personal, and demonstrative pronoun per age group

Incorrect repetitions are most frequent with the youngest children (69 out of 156 repetitions) and decrease over time. The 5;6-year-olds produce significantly fewer incorrect repetitions than the 2;6-year-olds. However, even with the 5;6-year-olds one third of all repetitions are incorrect (53 of 206). In opposition, adults only exceptionally replace the presented pronoun (29 of 378).

The zero pronoun is the most frequent type among incorrect repetitions up to age 4;0. In the beginning (age 2;6 and 3;0), demonstrative pronouns are more frequently incorrect than personal pronouns. From age 3;6 to age 4;6, the portion of these two types is balanced. With the oldest age group and the adults, incorrect personal pronouns become more frequent than incorrect demonstrative pronouns. It is worth noting that the seemingly low frequency of incorrect personal pronouns in the younger children is related to its infrequent use in general. Figure 6 presents the rate of incorrect repetitions for each pronoun type.

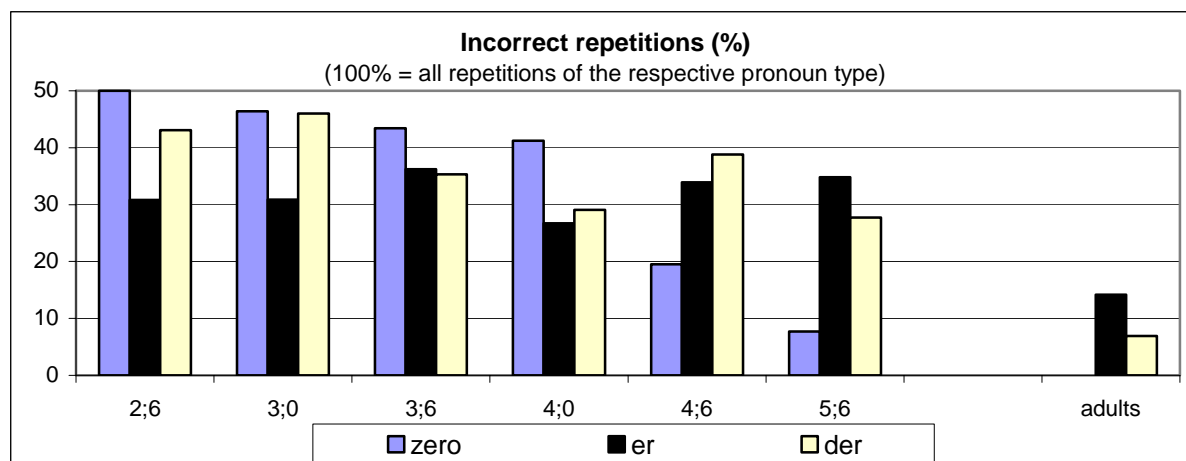


Figure 6. Incorrect repetitions in relation to the total of repetitions of each pronoun

Incorrect productions of the ungrammatical zero pronoun decrease drastically after age 4;0. The portion of incorrect personal pronouns, in contrast, remains stable and that of demonstrative pronouns decreases slightly. Figure 5 and 6 suggest that the patterns of incorrect repetitions are similar within age group 2;6 and 3;0 and within age group 3;6 and 4;0. Since this has been confirmed by separate analyses of each group, we will put these groups together in the following analyses.

Figures 7 to 9 present the distribution of incorrect repetitions over sentence types for each age group separately. It is worth noting that the calculation for age group 4;6 is based on a low amount of data (55 incorrect repetitions spread over 12 conditions).

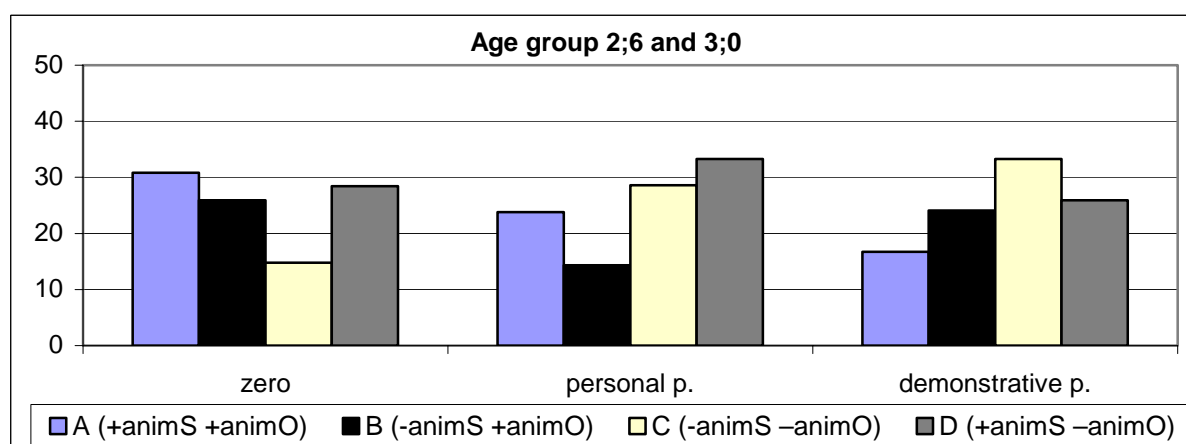


Figure 7. Distribution of incorrect repetitions of zero, personal, and demonstrative pronouns over sentence types at age 2;6-3;0

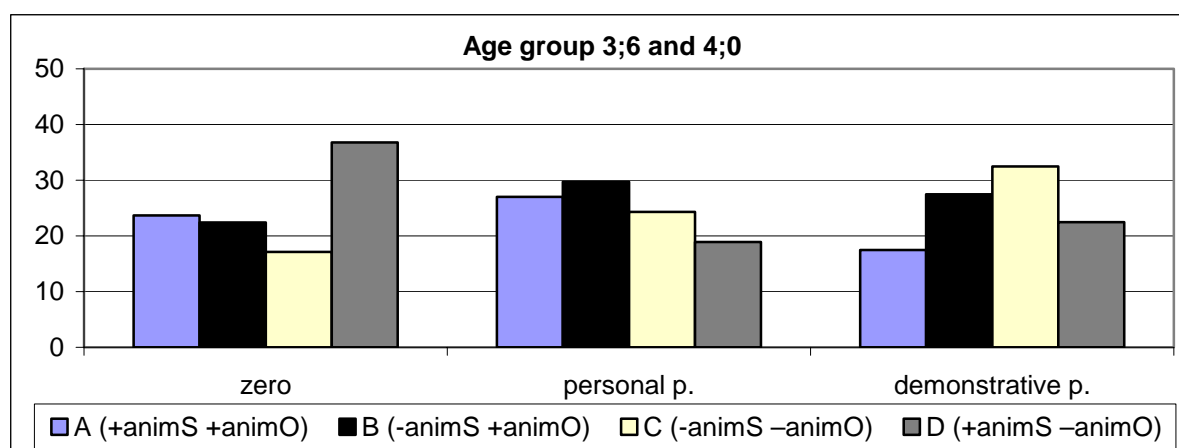


Figure 8. Distribution of incorrect repetitions of zero, personal, and demonstrative pronouns over sentence types at age 3;6-4;0

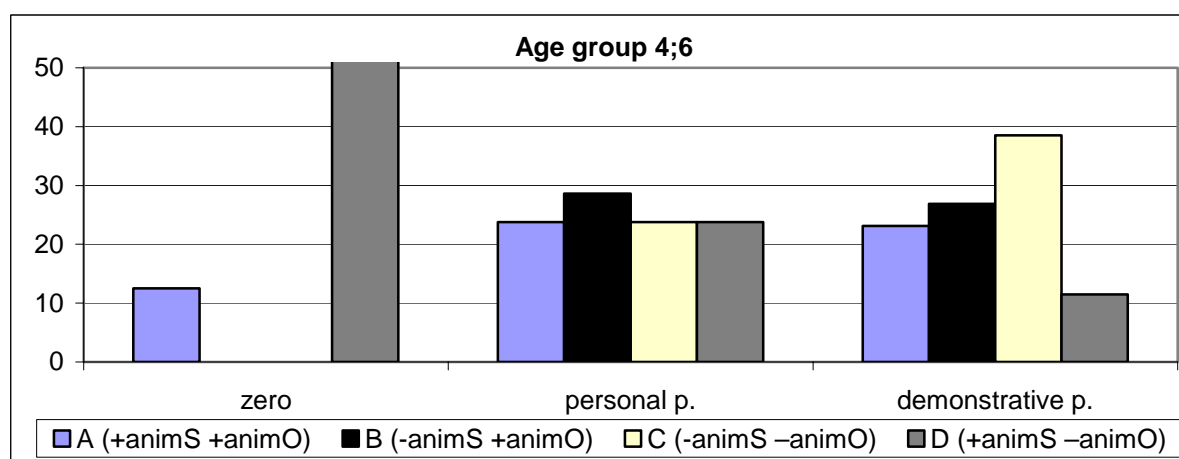


Figure 9. Distribution of incorrect repetitions of zero, personal, and demonstrative pronouns over sentence types at age 4;6

Table 8 summarizes the emerging tendencies and their development over age.

Table 8. Frequency of incorrect repetitions over age groups and sentence types

	zero		personal		demonstrative	
	most frequent	least frequent	most frequent	least frequent	most frequent	least frequent
2;6-3;0	A	C +B	D	B	C	A
3;6-4;0	D		B	D		D
4;6			(B)	∅		

Incorrect zero and demonstrative pronouns are used in direct opposition. With the youngest children, their distribution tends to be exclusively based on the animacy cue (A vs. C and vice versa). At age 3;6-4;0, animacy becomes correlated with subject role in the preferred production of the zero pronoun (D in the second row). And vice versa, at age 4;6, animacy becomes correlated with sub-

ject role in the avoidance of the demonstrative pronoun (D in the last row). Exclusive correlation of incorrect pronoun production with animacy (A vs. C) lasts longer with the demonstrative than with the zero pronoun.

In direct opposition, incorrect production of the personal pronoun seems to be related to syntactic role from age 3;6 on.⁵ There is no indication of a mere animacy contrast in any of the age groups whereas such tendency occurred in the analysis of the total of personal pronoun productions (cf. A vs. C at age 3;6 and 4;6 in table 6). At age 3;6-4;0, in/animacy and object role appear to be decisive. Incorrect personal pronouns tend to be preferably produced when an animate object occurs in the presence of an inanimate subject (B) and avoided when an inanimate object occurs in the presence of an animate subject (D). The relevance of the in/animacy opposition is underlined by the closer similarities of the frequencies in A and B (animate objects) vs. in C and D (inanimate objects) (cf. figure 8). The opposition is not long-lasting, it nearly disappeared at age 4;6.

Finally, in order to track down a possibly new step in development, the distribution of incorrect productions of the 5;6-year-olds (figure 10) and the adults (figure 11) shall be presented, although the number of incorrect repetitions is low (especially with the adults). Note that the zero pronoun values at age 5;6 result from a total of four and the demonstrative pronoun values in the adult group from a total of nine incorrect productions.

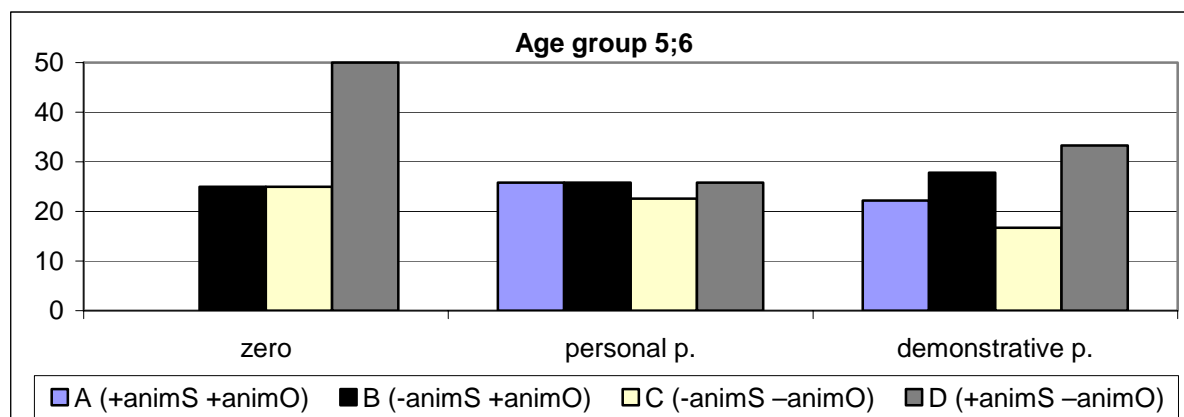


Figure 10. Distribution of incorrect repetitions of zero, personal, and demonstrative pronouns over sentence types at age 5;6

⁵ Due to the late onset of productive use of the personal pronoun, incorrect personal pronouns are infrequent at age 2;6-3;0. Thus, the opposition in question in table 8 is not completely reliable.

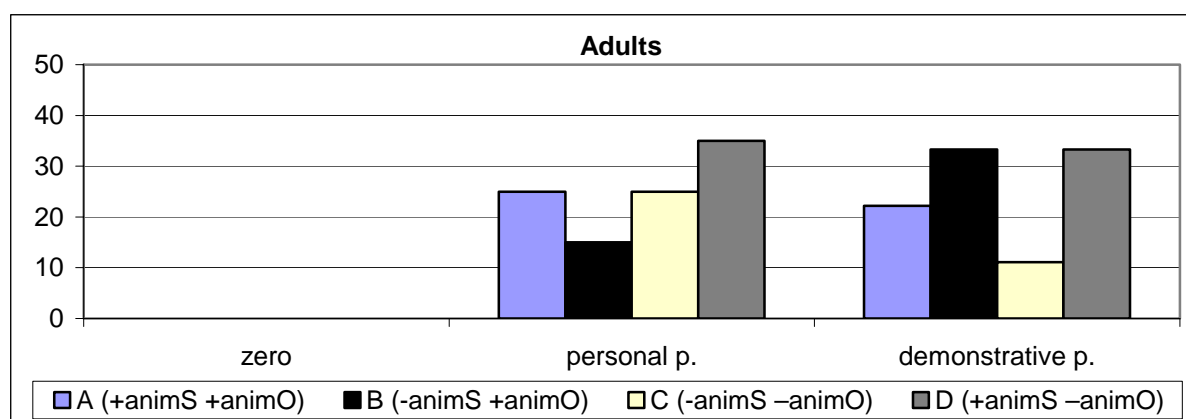


Figure 11. Distribution of incorrect repetitions of zero, personal, and demonstrative pronouns over sentence types in the adult group

The two figures reveal that incorrect productions tend to show a completely different distribution than up to age 4;6. The zero pronoun (nearly) disappeared from incorrect production; personal pronouns constitute the absolute majority (cf. figure 5). The point to hint at is that in both groups sentence type D, which represents the canonical sentence structure (animate subject – inanimate object), attracts the most incorrect productions with all pronoun types; i.e., even with demonstrative pronouns. This might indicate, that both antecedents the animate subject and the inanimate object are good topic candidates for the continuation of the story.

4 Discussion of the results on pronoun production

The analysis of the general repetition scores of the presented pronouns (section 3.1) revealed changes in the general preference ranking of the three pronoun types. The main change takes place between the zero pronoun, which is most preferred up to age 4;0 but infrequent afterwards, and the personal pronoun which is infrequent up to age 3;6 but most frequent at age 5;6 and with the adults (cf. figure 1). These changes can be used to identify three stages in the production preferences of zero, personal, and demonstrative pronouns:

Table 9. Preferences in the production of zero, personal, and demonstrative pronouns

stage	age range	preference hierarchy
stage 1	2;6 – 3;0	zero > demonstrative > personal pronoun
stage 2	3;6 - 4;0	zero > demonstrative/personal pronoun
stage 3	4;6 – 5;6	personal > demonstrative > zero pronoun

The initial preference for the zero pronoun is to be interpreted as subject drop, which is a well-known phenomenon in spontaneous productions up to about age 2;6 in German. Overt subjects become regularly produced when children gain

command of finite verb forms (e.g., Weissenborn 1990, 1992). The extension of zero pronoun production up to age 4;0 in the experiment is presumably caused by two facts: a) that this ungrammatical structure is offered by the experimenter and b) that all involved participants, the experimenter, the puppet, and the child, share attention of the situations and their protagonists supporting elliptic structures, especially when the child is uncertain whether the presented pronoun type is appropriate or not. The personal pronoun is more affected by subject drop than the demonstrative pronoun before age 4;0. The data allow for the hypothesis that the personal pronoun is not a fully productive anaphor up to age 3;11. It has to be checked at which age and in which contexts the personal pronoun becomes productive in spontaneous productions.

Considering the three pronoun types presented in the experiment, children tend to oppose subject omission (zero pronoun) and demonstrative pronoun and to ignore the personal pronoun in stage 1. Stage 2 seems to cover a phase of reorganisation of pronoun use, presumably caused by the increasing use of the personal pronoun and the necessity to reorganise the oppositions between the single pronoun types. Stage 3 presents the target stage, with the personal pronoun as most frequent (and presumably least restricted), the demonstrative pronoun as less frequent (and presumably more restricted), and the ungrammatical zero pronoun as least frequent (i.e., avoided).

The developmental steps in pronoun use are remarkable in that the pronoun type which is most unspecified in its anaphoric use in adult language, the personal pronoun, becomes productive after the pronoun type which is more restricted in adult language, the demonstrative pronoun (Bosch & Umbach this volume). This is the opposite order as found in a range of other acquisition domains where it is the less restricted or default form of the adult language which becomes productive prior to more restricted forms in child language (e.g., the infinitive of the verb, the nominative of the noun, the indefinite in opposition to the definite article). A first hypothesis on how this could be explained is that the demonstrative pronoun is more general and thus more available to the child than the personal pronoun due to the syncretism of deictic and anaphoric features in this form and the importance of deictic reference in early child language. As mentioned above, the conducted experiment includes shared attention of situations and protagonists among all participants; very likely, this constellation additionally contributes to an initial preference for demonstrative (i.e., verbal pointing) over personal pronouns.




The analyses of all pronoun productions (section 3.2) and of the incorrect productions (section 3.3) revealed that the distribution of the three pronoun types over the four sentence types is not arbitrary, but shows relevant tendencies with respect to the antecedent properties in/animacy and syntactic role. In the case of the zero pronoun, the results on the distribution of incorrect productions

equal the findings on all zero pronoun productions: up to age 3;0, zero pronoun production exclusively correlates with animacy, afterwards subject role becomes a further cue resulting in a preference for sentences with animate subjects. With the demonstrative pronoun, incorrect productions exhibit a pronounced tendency to correlate with inanimacy up to age 4;0, whereas the analysis of all demonstrative pronoun productions suggests an early correlation with both inanimacy and subject role. When the personal pronoun becomes regularly produced (age 3;6), it correlates with both animacy and object role in both types of analyses, however, animacy appears as a slightly stronger cue considering all productions.

In the youngest age group, demonstrative pronouns are the most frequent incorrect type in sentence type C, although zero pronouns are generally most preferred at this age and prevail in incorrect production in all of the other sentence types. Both preference (demonstrative pronouns) and avoidance (zero pronoun) in C is stronger and lasts longer with incorrect repetitions than regarding all pronoun repetitions.

Altogether, these results lead to the assumption that, at the onset of pronoun production, animacy is a more decisive cue than is grammatical role. By generalizing the findings of the last sections, three stages of pronoun production in dependence of antecedent in/animacy and syntactic role come into view:

Table 10. Developmental stages in the correlation of pronoun production with the antecedent properties in/animacy and syntactic role

stage 1	2;6 - 3;0	ZERO PRONOUN +animate 	DEMONSTRATIVE PRONOUN -animate
stage 2	3;6 - 4;6	+animate S   +animate O PERSONAL PRONOUN	-animate S
stage 3	5;6	adult-like behaviour: no preferences elicited by the experiment	

These developmental stages roughly correspond with the three stages inferred from the general pronoun type preference (cf. table 9). Moreover, they provide evidence for the *hypothesis on developmental steps* (section 1, (3)): Children up to about age 3;0 exhibit a bipolar opposition in anaphoric pronoun use. The demonstrative pronoun is opposed to pronoun omission (zero pronoun). In difference to the hypothesis, the personal pronoun is not unified with one of the other two types, but is simply less frequent in production. In accordance with the hypothesis, the opposition of pronoun omission and demonstrative pronoun is simply based on the animacy feature, i.e., on only one of the two investigated ante-

cedent features: pronoun omission is preferred when the antecedent(s) is/are animate and the demonstrative pronoun is preferred when the antecedent(s) is/are inanimate (A vs. C). Further, as it was assumed, the system of pronominal anaphora becomes more complex in stage 2 in both respects the number of opposed pronoun types and the features involved in the determination of their anaphoric capacity. Very likely, productive use of the third pronoun type, the personal pronoun, leads to a specification of the features opposing the anaphoric capacities. In stage 2, syntactic role is used in addition to in/animacy. The opposition of pronoun omission and demonstrative pronoun becomes specified as animate subject vs. inanimate subject. The personal pronoun is set in opposition to the other two pronoun types: a syntactic role opposition with the zero pronoun, (animate) subject vs. (animate) object related, and a more complex or stronger opposition of animate object vs. inanimate subject with the demonstrative pronoun.

According to the reversed-mapping hypothesis (section 1), the anaphoric preferences of the three pronoun types reveal the relation of antecedent features to antecedent salience. The formally least complex zero pronoun correlates with animate subjects, whereas the more complex personal pronoun correlates with object role and the even more complex demonstrative pronoun with inanimacy. The results provide evidence for positive answers to the questions on the salience hierarchy of these features (see (2) in section 1): animacy > inanimacy and subject > object. Further, there is an interaction of both features with respect to salience hierarchy: animate subjects > animate objects > inanimate subjects > inanimate objects.

The 5;6-year-olds and the adults did not show relevant differences in the repetition of the three pronoun types. Because of the low amount of incorrect repetitions especially with the adults, it is impossible to decide whether the 5-year-olds utilize the same oppositions in the anaphoric capacities of the three pronoun types as the adults do. Nevertheless, the distribution of incorrect repetitions deviates from that of the younger children. Recall that sentence type D attracts the most incorrect repetitions with all three pronoun types. As has been concluded above, the features [+animate] and [+subject] accumulate to the highest antecedent salience in the given experiment. In sentence type D, the salience of the animate subject is strengthened to a maximum by the fact that the object exhibits the opposite and, thus, least salient feature combination. Hypothetically, the 5;6-year-olds and the adults oppose the pronominal types in order to continue either the subject (zero and personal pronoun) or the object (demonstrative pronoun) antecedent, i.e., to continue the discourse topic or to change it (Bosch & Umbach this volume). In line with this assumption, it can be assumed that these groups prefer to continue the topic (subject) in sentence type C (very low amount of demonstrative pronouns) and to change the topic to the object antece-

dent in sentence type B (high amount of demonstrative pronouns despite overall preference for personal pronouns), cf. figures 10 and 11, but recall the low amount of incorrect repetitions. We will see whether these hypothetical correlations are confirmed by the results of the comprehension task.

5 Results on pronoun comprehension

5.1 General remarks

Recall that pronoun comprehension was tested by asking the children a clarification question after the repetition task. The situation presented in the antecedent sentence is ambiguous with respect to pronoun reference (*der affe umarmt den hund* ‘the monkey is hugging the dog’ – *er lacht laut* ‘he is laughing loudly’). The clarification question (*who*-question) aims at identifying the referent of the pronoun in the child’s representation of the situation. Each antecedent sentence provides one subject and one object antecedent in SVO order. The subject antecedent is at the same time the first and the object antecedent the last mentioned antecedent. The results of the experiment show that children do not use a simple position cue, neither in production nor in comprehension. However, correlations with other features can not be excluded. In a follow-up experiment (not analysed yet) word order is varied in order to investigate this factor. In the following, we will speak of subject vs. object choice having in mind that this, for the time being, is synonymous with first vs. last mention.

Section 5.2 presents an overall analysis of antecedent choice irrespective of correlations with pronoun type or antecedent features. Antecedent choice in relation to the pronoun type produced in the repetition task is analysed in section 5.3. Section 5.4 considers relations of antecedent choice and sentence type (i.e., antecedent features). Finally, potential correlations of all three components antecedent choice, sentence type, and pronoun type are examined in section 5.5.

5.2 Overall analysis of antecedent choice

Figure 12 presents the total rate of subject-object choice in each age group.

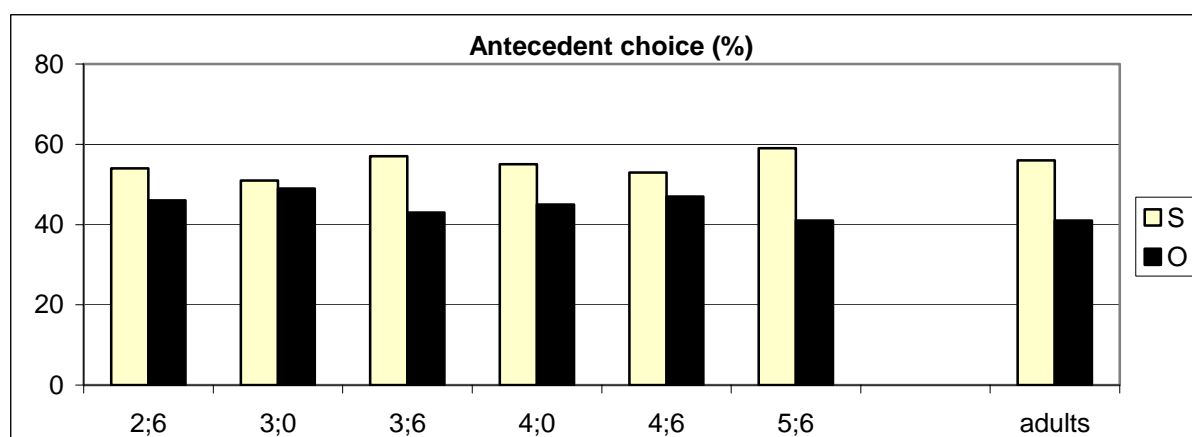


Figure 12. Total rate of subject-object choice per age group

There is no overall tendency to prefer the subject over the object antecedent. Even at age 5;6 and with the adults, the tendency to chose the subject antecedent remains at chance level.

5.3 *Antecedent choice in relation to the produced pronoun*⁶

According to the *hypothesis on anaphoric capacities* (section 1, (1)), the different pronoun types should indicate differences in anaphoric reference, i.e., in the internal representation of the pronoun referent. Figures 13 to 15 present antecedent choice in relation to the pronoun type produced in the repetition task.

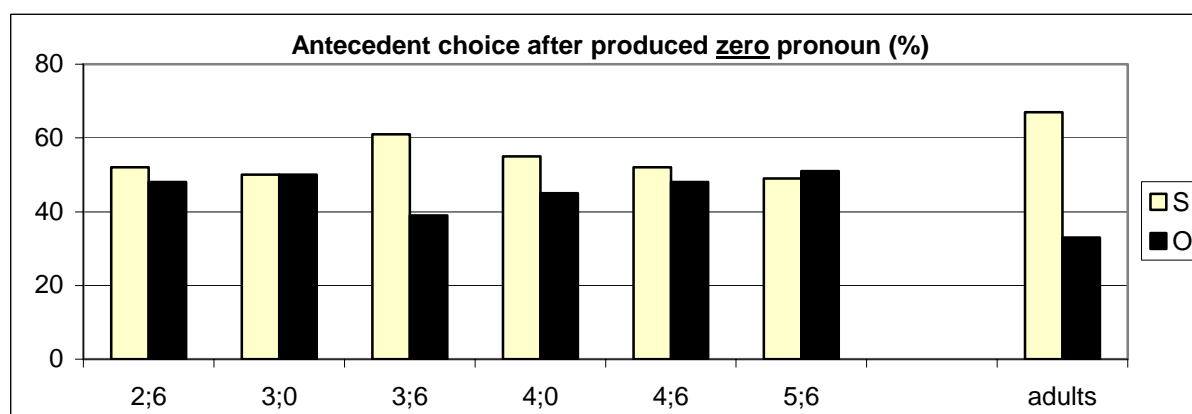


Figure 13. Subject-object choice in relation to zero pronoun per age group

⁶ Note that there is a difference in the data-base for the calculation of the overall antecedent choice based on all answers to the clarification question (section 5.2) and the antecedent choice in relation to the produced pronoun based on only those answers that follow the production of one of the three pronoun types (section 5.3). Therefore, the bars in figure 12 do not present the average value of the correspondent bars in figures 13 to 15.

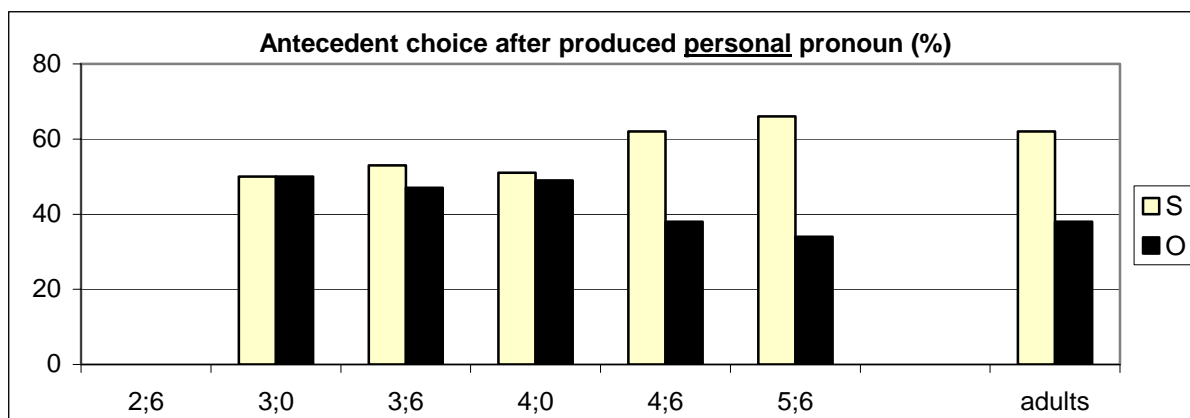


Figure 14. Subject-object choice in relation to personal pronoun per age group⁷

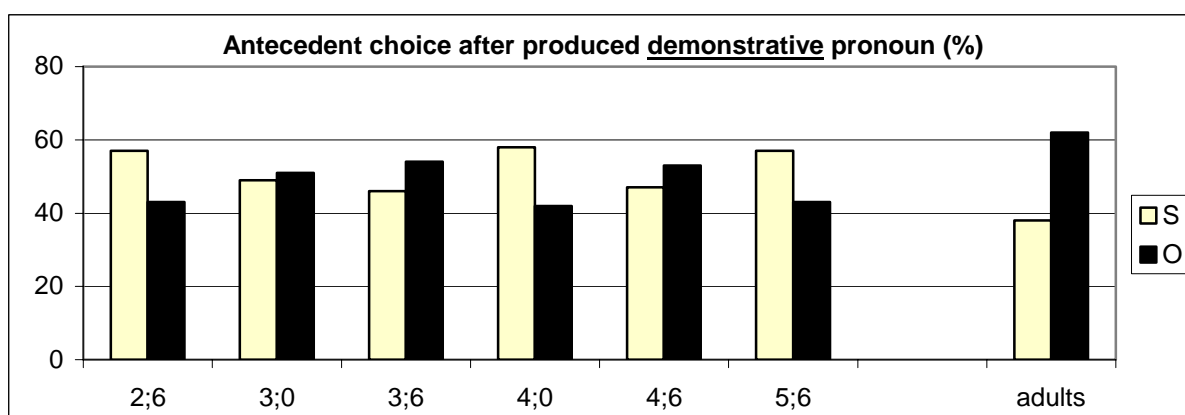


Figure 15. Subject-object choice in relation to demonstrative pronoun per age group

Whereas the adults show an opposition of subject choice with zero and personal pronoun vs. object choice with demonstrative pronoun, no such opposition occurs in the children's data. Moreover, no overall tendency to prefer the object with either pronoun type is observed in the children. Up to age 4;0, performance is at chance level with all three pronoun types. With the older children (age 4;6 and 5;6), a tendency to prefer the subject antecedent occurs when the personal pronoun has been produced. Only in case of this pronoun, the older children perform in accordance with the adults. In case of the demonstrative pronoun, rather they tend to do the opposite, i.e., prefer the subject over the object antecedent. Even with the zero pronoun, children do not show adult-like behaviour but perform at chance level in all investigated age groups (except, for age 3;6; however, there is no developmental continuity with neighbouring age groups).

The expectation of an overall dependence of antecedent choice (comprehension task) on pronoun choice (production task) is confirmed for the adults but not for the children. In the next section, we will examine whether antecedent

⁷ There is no calculation of personal pronouns for the youngest age group (2;6) because of the low amount of data for this form.

choice is (more) constrained by the antecedent features syntactic role and in/animacy.

5.4 Antecedent choice in relation to sentence type

Figure 16 demonstrates that there are indeed differences in antecedent choice across the four sentence categories. In the following we will primarily focus on subject choice. Object choice is inherently included in that the opposite of what is said on subject choice is true for object choice. Note that object choice can be inferred from figure 16 by the difference of each bar to 100%.

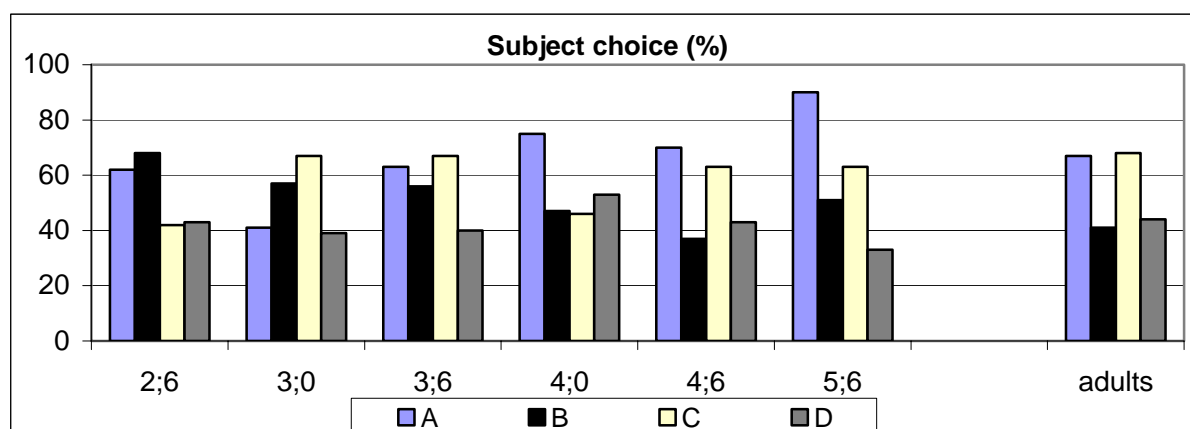


Figure 16. Subject choice per sentence type and age group

Comparing the youngest children with the adults and the oldest children, there appears a complete change in the preferences for subject choice. The youngest children tend to prefer the subject antecedent if the antecedent sentence contains an animate object (A/B), but they tend to prefer the object antecedent if there is an inanimate object (C/D). In other words, animate objects are the least appropriate antecedents for the youngest children. In contrast, the adults and the oldest children tend to prefer the subject if both antecedents bear the same animacy feature, i.e., if both are animate (A) or inanimate (C). If the two antecedents differ in animacy (B/D), there appears a tendency towards object choice. Figure 16 depicts this pattern of developmental change. After the initial stage at age 2;6, a remarkable increase of subject choice is observed in sentence type C at age 3;0 and 3;6. At age 4;0 and 4;6, subject choice decreases in sentence type B and increases in sentence type A. Finally, at age 5;6, but already observable at age 4;6, both processes combine to the opposition of subject preference in A/C vs. subject avoidance in B/D. Table 11 summarizes the described stages.

Table 11. Stages of reorganization of subject choice in relation to antecedent features

stage	age range	developmental processes
stage 1	2;6	frequent subject choice in A/B; infrequent subject choice in C/D
stage 2	3;0 – 3;6	increase of subject choice in C
stage 3	4;0 (- 4;6)	decrease of subject choice in B, increase of subject choice in A
stage 4	4;6 – 5;6	frequent subject choice in A/C; infrequent subject choice in B/D

In sentence type D, subject choice is comparably at a low level in all age groups. This is remarkable considering the findings that zero is the most preferred incorrect pronoun type in D from 3;6 to 5;6 (figures 8 - 10) and that D attracts the most incorrect repetitions with all pronoun types in the 5;6-year-olds and the adults (figures 10 and 11).

5.5 Antecedent choice in relation to sentence type and pronoun type

Finally, it has been checked whether antecedent choice varies in the single sentence types in dependence of the produced pronoun type. Table 12 presents the summary of the observable results. ‘SBJ’ indicates that there is a tendency to prefer the subject with each of the three pronoun types (more than 62,5%). Expressions including an arrow indicate that there is a tendency to prefer (more than 62,5%) subject (S) or object (O) with the pronoun type listed in front of the arrow. ‘Chance’ indicates that subject-object choice lies between 37,5% - 62,5% with each pronoun type. ‘Zp’ means zero pronoun, ‘pp’ personal pronoun and ‘dp’ demonstrative pronoun. Performance with pronoun types lacking in a cell lies at chance level.

Table 12. Preferences in antecedent choice per sentence type and produced pronoun

	2;6 excl. pp	3;0	3;6	4;0	4;6	5;6	adults
A	SBJ	zp → O	zp/pp → S	SBJ	SBJ	SBJ	zp/pp → S dp → O
B	SBJ	chance	zp → S dp → O	zp → S pp → O	zp/dp → O	chance	dp → O
C	zp → O	SBJ	zp → S	pp → O	pp → S	pp → S	zp/pp → S
D	chance	pp/dp → O	pp → O	pp/dp → S zp → O	zp/pp → S dp → O	zp → O	chance

Let us start with a closer look at the adults. It turns out that there is an interaction of sentence type (antecedent features) and produced pronoun type differen-

tiating the results of section 5.3 and 5.4. The preference for subject with zero and personal pronoun opposed to object with demonstrative pronoun (figures 13 – 15) is most pronounced in sentence type A. In sentence type C, the same opposition occurs, but it is weaker due to chance performance with demonstrative pronoun. In sentence types B and D, however, performance is at chance level except for the demonstrative pronoun in B (object preference). It turns out that the opposition of A/C vs. B/D (section 5.4) is based on variation of antecedent choice with zero and personal pronoun. The preference for object choice with demonstrative pronoun (figure 15) is restricted to antecedent sentences containing an animate object (A/B), whereas performance is at chance level if there is an inanimate object (C/D).

Table 13: Anaphora resolution in the adults depicted by the rate of subject choice (%)

	A	B	C	D
repeated	animate S	inanimate S	inanimate S	animate S
pronoun	animate O	animate O	inanimate O	inanimate O
zero	76	55	80	50
personal	76	38	88	42
demonstrative	35	22	48	45

Table 13 reveals that the difference in antecedent choice with zero and personal pronoun (figures 13 and 14) is restricted to sentence type B, in which object choice is more likely with the personal than with the zero pronoun. The hypothesis that the comparably high rate of irregular repetitions in sentence type D is caused by oppositions of subject vs. object preferences with the three pronoun types (end of section 4) is not confirmed. Of all sentence types, antecedent choice is only with D at chance level for all pronoun types. Does this indicate that, with canonical sentence structure, both types of discourse continuation (topic continuation or topic change) are equally likely and disambiguation is a function of context?

With respect to the data of the children, table 12 highlights that there are instances of different antecedent preferences of the pronoun types within sentence types. However, at a first glance it is hard to detect oppositions fitting in a developmental pattern over age. Considering the distribution of antecedent preferences per pronoun type in more detail, there appears two stages in the development of pronoun comprehension with respect to sentence types B, C, and D. In sentence type A, i.e., if both potential antecedents are animate, the subject is the preferred antecedent irrespective of the produced pronoun type in all age groups. This indicates the strong impact of antecedent features on antecedent choice up to age 5;6. Considering the other sentence types, stage 1 reaches up to

age 4;0 and stage 2 covers age 4;6 and 5;6. At stage 1, children exhibit a tendency towards subject reference with zero, object reference with personal,⁸ and at first subject reference followed by chance performance with demonstrative pronoun in sentence types B and C (inanimate subject). With the canonical sentence type D, there seems to exist an overall tendency towards object reference indicated by the lack of subject preferences (except age 4;0) and the four instances of object preference which include all three pronoun types. Comparing sentence types A and D, it seems that, in stage 1, the in/animacy of the object leads to opposite tendencies in antecedent choice. In the presence of an animate object (A), the animate subject is the preferred antecedent, i.e., given positive neutralization of the animacy feature, the (animate) subject wins over the (animate) object. In contrast, in the presence of an inanimate object (D), the animate subject is not the preferred antecedent anymore, but object choice becomes equal or more likely. At stage 2, antecedent choice in sentence types B and C (inanimate subject) develops differently. In sentence type C (inanimate object), performance is at chance level with zero and demonstrative pronoun, whereas the personal pronoun tends to be correlated with subject reference. In sentence type B (animate object), zero and demonstrative pronoun tend to correlate with object reference, whereas performance is at chance level with the personal pronoun. In sentence type D, varying preferences with zero pronoun appear, whereas the personal and demonstrative pronoun seem to develop the functional opposition of subject vs. object preference. In sum, at stage 2, there emerges an opposition between the personal pronoun used for subject reference and the demonstrative pronoun with which subject preference tends to be at least avoided (cf. tables 15 and 16 below).

One further outcome of the present analysis is a more detailed insight into the differences in the results of the adults and the two oldest age groups of the children found in section 5.3. The difference in the result for the zero pronoun (figure 13) originates from different preferences in sentence types B and C, i.e., in the presence of inanimate subjects. The lack of an overall object preference with demonstrative pronoun in the children in contrast to clear object preference in the adults (figure 15) is caused by the strength of subject preference in sentence type A. In all other sentence types children do show the tendency towards object preference.

6 Discussion of the results on pronoun comprehension

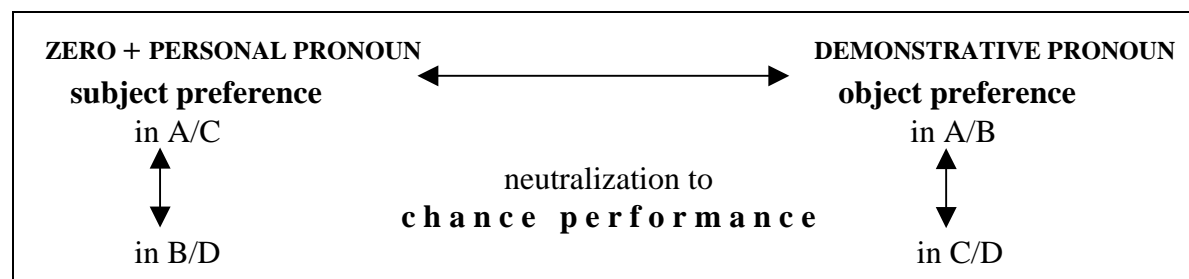
The first result is that the target pattern of pronoun resolution - as found in the adults in this experiment - was observed in children only from age 4;6 on and

⁸ Recall that personal pronouns are productively produced from age 3;6, at the earliest.

only with respect to the personal pronoun. With zero and demonstrative pronoun, children and adults display distinct behaviour. The second result is that, even in the adults, anaphoric specification of the pronoun types does not hold irrespective of the distribution of the in/animacy feature among the two protagonists. This means that the anaphoric function of a pronominal type is not absolutely fixed; rather each type covers a certain anaphoric domain in which anaphoric reference can vary in dependence of the given feature constellation. The third result is that the hypotheses proposed in section 1 are confirmed in general, but some specifications and modifications are required. Finally, differences between production and comprehension were observed in the results on salience ranking of the investigated antecedent features. In the following, these results will be discussed in more detail.

The adults oppose the anaphoric capacities of zero and personal with demonstrative pronoun. The resolution preferences can be neutralized by the distribution of animacy feature. Subject preference with zero and personal pronouns is neutralized by distinctivity of the animacy feature (B/D). Object preference with demonstrative pronoun is neutralized by occurrence of inanimate objects (C/D). The adult pattern of pronoun resolution can be schematized as follows:

Table 14. Oppositions in antecedent choice in the target stage (adults)



These results can be further strengthened by noticing that figures 13 and 14 indicate a stronger subject preference with the zero pronoun than with the personal pronoun. Leaving aside for the moment the question why the observed preferences can be neutralized in certain sentence types (see below), the overall pattern of preferences confirms the reversed-mapping hypothesis. Most importantly, the ungrammatical zero pronoun is treated by the adults in line with this hypothesis. This provides evidence for the existence and strength of a ‘reversed-mapping principle’ determining the reference domain even for ‘new’ types of anaphora.

In the children’s data, pronoun type is completely ignored in sentence type A. This underlines the stronger impact of antecedent features on children’s resolution behaviour up to the end of the investigated period. Pronoun-type-

related oppositions remain weak and unstable up to age 5;6. However, on the base of the results for sentence types B, C, and D, the two stages in the emergence of anaphoric preferences described in section 5.5 allow for hypothesizing the functional oppositions presented in tables 15 and 16.

Table 15. Oppositions in antecedent choice emerging up to age 4;0 (stage 1)

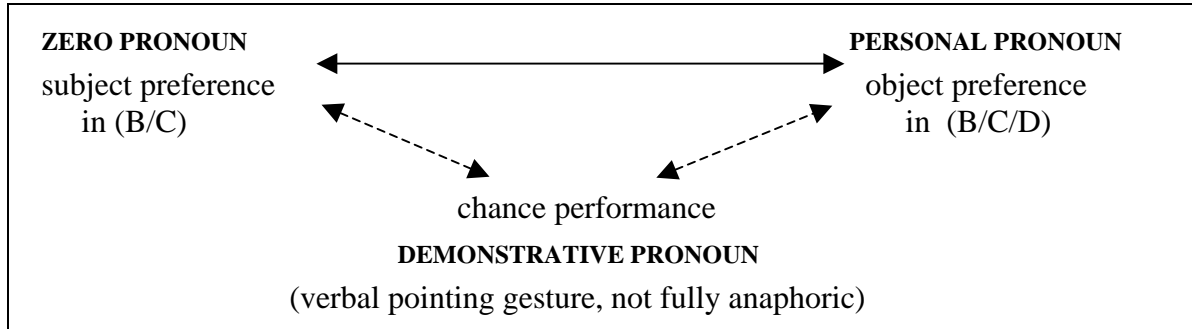
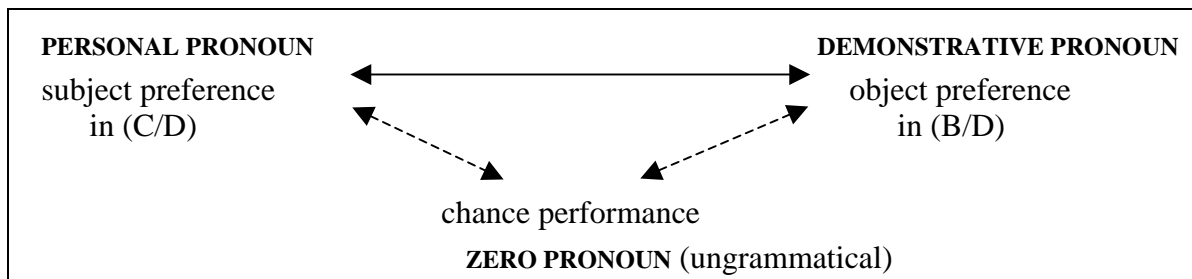


Table 16. Oppositions in antecedent choice emerging at age 4;6 and 5;6 (stage 2)



It can be argued that the difference between the three stages (including the target stage) is mainly caused by different functional specification of the demonstrative pronoun. Recall, it has been argued in section 4 that the deictic capacities of the demonstrative pronoun cause earlier emergence of productive use with the demonstrative than with the personal pronoun. The demonstrative pronoun can be used as a (verbal) pointing gesture. In Bittner (2007), however, it has been shown that German-learning children younger than 2;6 are aware of the anaphoric character of the demonstrative pronoun in spontaneous language production (dialogs). It is predominantly used if the referent in question is pre-mentioned in the linguistic context. In contrast, a full DP is used if the referent is newly introduced or reactivated after a longer time in linguistic context. Anaphoric and deictic use converge in the function of symbolizing that the referent in question is in the ‘shared focus of attention’. Even in the experiment reported here, the younger children seem to treat the demonstrative pronoun exclusively in this ‘shared-focus-of-attention’-function. With this function it can refer/point to the subject, as well as to the object antecedent. No further specifications of its anaphoric capacity is acquired in stage 1. Provided that these considerations are correct, the anaphoric (core) system in stage 1 consists of zero and personal pro-

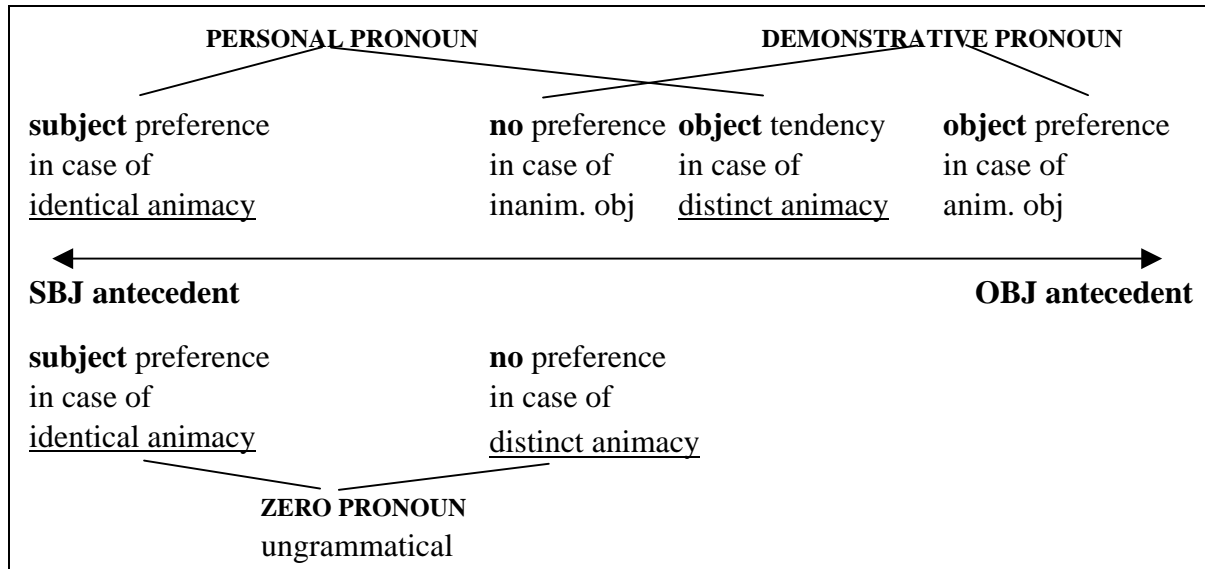
noun which tend to be opposed as predicted by the reversed-mapping hypothesis (table 15).

Following this line of explanation, the changes in the anaphoric oppositions from stage 1 to stage 2 are caused by incorporation of the demonstrative pronoun in the anaphoric (core) system. At stage 2, children seem to have specified the anaphoric function of the demonstrative pronoun in accordance with the reversed-mapping hypothesis. Being the most complex anaphor it refers to less salient antecedents (animate objects). This developmental step is accompanied by another one. Children seem to become aware of the ungrammaticality of the zero pronoun, i.e., of subject omission. Figures 1 and 5 highlight the rapid decrease of zero pronoun production from age 4;0 to 4;6. The resulting uncertainty on how to cope with the zero pronoun in the experiment comes to light by variation and chance performance in anaphora resolution. Moreover, this development leads to the loss of an anaphoric mean specified for reference to high salient antecedents. The change from stage 1 to stage 2 caused by the two developmental steps can be viewed as a move against the clockwise direction (cf. figures 15 and 16): The zero pronoun loses the status of a (grammatical) anaphoric means and moves towards chance performance. At the same time, the demonstrative pronoun gains the anaphoric capacity to refer to object antecedents and moves towards the position taken by the personal pronoun so far. In accordance with the reversed-mapping hypothesis (or due to it) and supported by the disappearance of the zero pronoun as appropriate means for subject reference, the personal pronoun moves from object towards subject preference. Needless to say that the emerging anaphoric opposition of personal and demonstrative pronoun is in accordance with the reversed-mapping hypothesis.

It can be stated that children enter the path to the target stage at about age 4;6. However, the anaphoric oppositions displayed by the children deviate from those of the adults in quantity and quality even at age 5;6. The difference in quantity appears in the number of pronouns incorporated in the system of anaphoric oppositions. Whereas the adults relate all three of the tested pronoun types, children relate only two of them. This means only two of them are assigned with explicit anaphoric specifications and underlie the 'reversed-mapping-principle'. The difference in quality (entailing a difference in quantity) appears in the stronger specification of the anaphoric capacities including the appearance of chance performance and resulting in the specification of certain domains of anaphoric reference for each pronoun type. Table 17 aims at schematising these domains and specifications of anaphoric capacities in the adults. The main criterion of salience determination is syntactic role, the animacy feature causes internal specifications and determines the anaphoric domain of each pronoun type. Note that the presence of the ungrammatical zero pronoun in the experiment might influence the 'normal' target oppositions between personal

and demonstrative pronoun. Note further that the experimental conditions include only a small part of the criteria relevant for salience determination and anaphoric reference even for personal and demonstrative pronouns. In this view, the results present principled ways of interaction of salience determining criteria in the target language rather than the complete adult system.

Table 17. Specification of the anaphoric capacities of the three pronoun types in the adults



The findings for the adults are interesting with respect to the current discussion on the anaphoric capacity of the personal pronoun in German (cf. Bosch & Umbach this volume, Bouma & Hopp this volume). Bouma & Hopp provided experimental evidence for the assumption that the personal pronoun refers to the subject antecedent which is in line with e.g. classical Centering Theory (a.o. Grosz et al. 1995). Bosch & Umbach, however, discuss results from a corpus study showing that the personal pronoun can refer to other antecedents as well. Additionally, they present experimental data indicating that reading time is not significantly delayed if the personal pronoun follows stimuli including an object bias or even unbiased stimuli, whereas reading time is significantly delayed if a demonstrative pronoun follows stimuli containing a subject bias. These results suggest that the anaphoric capacity of the personal pronoun is less restricted (by grammatical role) than that of the demonstrative pronoun.⁹ This fits in very well with our findings for the older children and the adults (tables 12, 13, and 17). Furthermore, recall that, in the adults and the oldest children, the correlation of personal pronoun with subject reference did not occur in the conditions with distinct animacy of antecedents (B and D), but it did occur in the conditions with

⁹ In fact, Bosch & Umbach argue that grammatical role is not decisive at all. Instead, the anaphoric capacity of the personal and the demonstrative pronoun is seen as related to information structure, especially the discourse-topic status of the potential referent.

identity of the animacy features (A and C; figure 16 and table 12). The examples of the stimuli presented in Bouma & Hopp and even of the experiment reported in Bosch & Umbach contain exclusively antecedents with identical animacy features. Seemingly, the animacy pattern of the potential antecedents influence the resolution of the personal pronoun. An overall and exclusive correlation of the personal pronoun with subject role has to be rejected on the base of the findings of Bosch & Umbach and of our experiment.

The findings for the personal pronoun, but even for the demonstrative and the zero pronoun, suggest the interaction of different features in the determination of anaphoric relations. With all three pronoun types, subject (zero and personal pronoun) or object choice (demonstrative pronoun) becomes more or less likely in dependence of the distribution of the animacy feature. Although the interaction of grammatical role and in/animacy is not as systematic in the children as in the adults, it is yet present (table 12). Moreover, animacy has a stronger overall impact on the children's resolution strategies than on that of the adults. This is evident, most impressively, by the dominating role of the animacy pattern in sentence type A. When both antecedents are animate, subject preference occurs with all pronoun types. This is not just a result of the neutralization of the animacy criterion; instead, it also matters whether both participants are animate or inanimate. Inanimacy of both antecedents (C) makes subject choice less likely at stage 1. At stage 2, it remains preferred with the personal pronoun, but becomes less likely with the other two pronoun types. Only at the target stage is the resolution pattern nearly the same in sentence types A and C (weaker object preference with demonstrative pronouns in C is caused by inanimacy of the object). In case of distinct animacy features (B and D), object choice becomes more likely in general and, especially, with the demonstrative pronoun. This holds irrespective of the distribution of in/animacy over subject and object. The results for sentence type D provide the strongest evidence that the personal pronoun is not restricted to subject reference in German: The most maximal contrast in antecedent salience, animate subject vs. inanimate object, does not lead to subject preference, neither in the adults nor in the children. However, we do not have a consistent explanation for the lack of subject preference in this condition.¹⁰ It is worth noting that sentence type D caused unexpected or at least special results in both the production and the comprehension part of the experiment. One can speculate whether the maximal salience contrast and the closer familiarity of personal and demonstrative pronoun in German cause some specific resolution conditions.

¹⁰ It can be ruled out that this is an artefact of the stimuli construction by comparison with the results on Russian and Bulgarian (Gagarina this volume, Kuehnast this volume). In these languages, the subject is the preferred referent of zero and personal pronoun.

Finally, we will consider the results with respect to the questions and hypotheses formulated in section 1 and in relation to the results on pronoun production. By summarizing the results on pronoun production (section 4), we proposed the following salience ranking of the discussed antecedent features for the children at age 3;6 to 4;6 (tables 8 and 10):¹¹ animate subject > animate object > inanimate subject > inanimate object. As already shown, this finding is confirmed with respect to syntactic role by the resolution patterns: subject > object. However, with respect to animacy, which is the more dominant feature from the production perspective, this ranking does not occur. Neither animate antecedents predominantly attract less complex anaphors nor inanimate antecedents more complex anaphors. Taking into account that the pronouns always occurred in subject and as such in topic position in the experiment, it follows that there is no overall tendency to consider animate antecedents to be the better topics of a subsequent utterance in children and adults. However, this is not true in general. It has been found that the object preference with demonstrative pronoun is strong with animate objects but neutralized with inanimate objects in the adults. Taking into account that, according to e.g. Bosch & Umbach (this volume), demonstrative pronouns symbolize a change of the discourse topic, our results suggest that topic change is more expected with animate antecedents by the adults. Children, however, do not show the same preference for animate objects. Considering the subject preference with (zero and) personal pronoun, no such internal specification occurs. Inanimate subjects are as good candidates to continue the discourse topic as are animate subjects. In sum, in pronoun resolution, syntactic role appeared to be a stronger salience criterion than in/animacy. The reversed-mapping hypothesis, thus, is confirmed with respect to the correlation of syntactic role and pronoun type. Animacy occurs as an additional mapping factor in the domain of the demonstrative pronoun: Animacy wins over inanimacy in the expected way, i.e., animate objects are the more preferred antecedents of the demonstrative pronoun. Special confirmation for the reversed-mapping hypothesis results from the fact that the adults tend to integrate the ungrammatical zero pronoun in the anaphoric system in the expected way. This also holds even for the children at stage 1 who also prefer subject reference with this form (table 14). Furthermore, children at that stage oppose zero and personal pronoun in accordance with the reversed-mapping hypothesis.

Part (a) of the hypothesis on developmental steps (section 1) has to be refined in that also the older children exhibit a bipolar opposition of two pronoun types. Only the adults integrate all three pronoun types in the anaphoric system in that each pronoun type – despite of overlaps – occupies a different part of the

¹¹ Recall that the oldest children and the adults repeated the presented pronoun mostly correct. Thus, no salience ranking could be inferred for these groups.

scale from subject to object preference (table 16). Further, the ungrammatical zero pronoun does not cause complete alignment of zero/personal or personal/demonstrative pronoun. All three pronoun types are treated distinctively in all stages. This suggests that children operate on the base of the one-form-one-meaning principle trying to find out a specific functional content for each grammatical sign. The developmental steps confirm that a maximal bipolar opposition – embodied in this experiment by subject vs. object preference of distinct pronoun types – is at the onset of the development of anaphoric contrasts. Due to weak and changing preferences in antecedent choice during stage 1, it is hardly to decide whether part (b) of the hypothesis on developmental steps is confirmed in the sense of a true interaction of syntactic role and in/animacy at this stage. Syntactic role is clearly the main criterion for antecedent choice. In/animacy seems to function as a minor but separate criterion influencing the impact of the syntactic role criterion as described above. However, no internal specification of subject or object preference on the base of in/animacy can be detected. At stage 2, the differences in the preferences of the personal pronoun emerge: Subject preference with identical vs. chance performance with distinct animacy features of the antecedents. But it is only at the target stage, that the in/animacy-dependent internal specification of object preference with the demonstrative pronoun occurs. In sum, there are only weak evidences for part (b) of the hypothesis on developmental steps but at the same time no counterevidence turned up.

The questions on salience ranking (see (2) (a-c) of section 1) are positively answered on the base of the production data in section 4. On the base of the comprehension data, answers to questions (2b) and (2c) would be slightly different or more preliminary, at least with respect to the children. The differences in the results concerning the question on interaction of the two investigated criteria lead to the hypothesis that interaction has not to be understood as convergence of all relevant criteria to one unified salience hierarchy. Instead, each feature creates its own salience hierarchy, the interaction – and the relevance – of which varies across the different types of anaphoric means. These findings correlate with the suggestion of Kaiser (2005) that there is no unified notion of salience in anaphora resolution. In our case, the syntactic role hierarchy appears to be relevant with all pronoun types and from the very beginning. In contrast, the animacy hierarchy appears to be of different relevance for the single pronoun types and true interaction with syntactic role emerges late.

7 Conclusion

The reported experiment tested a complex pattern of factors (potentially) relevant in the production and comprehension of intersentential pronouns. The re-

sults allow first insights into developmental steps in the acquisition of anaphoric specification of pronominal reference. It is worth noting that although a huge group of subjects has been tested, the data base is small with respect to each of the 12 conditions investigated in the experiment. The results are therefore preliminary and have to be controlled and deepened by further investigations.

The main goal was to examine whether syntactic role and in/animacy of potential antecedents influence the production and comprehension of zero, personal, and demonstrative pronouns in 2;6 to 5;11-year-old children and adults. Further, it should be investigated whether the patterns of pronoun production and comprehension support the ‘reversed-mapping hypothesis’ proposed in several theories on anaphora resolution. The main results are as follows:

- (A) Children tend to distinguish the anaphoric capacities of the three pronoun types from the very onset of production.
- (B) The personal pronoun becomes productive later than the demonstrative pronoun, which can be explained by the impact of deictic capacities of the demonstrative pronoun and the children’s frequent use of deictic reference; the zero pronoun, which is ungrammatical in German, is treated by the younger children as subject drop, the older children become aware of the ungrammaticality of this form and tend to avoid it.
- (C) Using the scale of formal complexity of the three pronoun types, zero > personal > demonstrative, to infer possible salience hierarchies of the investigated antecedent features, the following hierarchies turned up: (a) in the production task: animate > inanimate; subject > object; both combining to animate subject > animate object > inanimate subject > inanimate object, (b) in the comprehension task: subject > object is the primary scale, interacting for demonstrative pronouns with animate > inanimate as the secondary scale; for the other two pronoun types, the animacy pattern represented by both potential antecedents is decisive.
- (D) The correlations of pronoun type and antecedent features provide evidence for the reversed-mapping hypothesis: Children and adults tend to oppose the three pronoun types in production and comprehension such that less complex anaphors correlate with high salient antecedents and vice versa; strong support for the existence of a reversed-mapping principle results from the correlation of the ungrammatical zero pronoun with (animate) subject in the children up to age 4;0 and the adults.
- (E) The system of anaphoric oppositions develops over age from simple maximal contrasts of two pronoun types (zero vs. personal up to age 4;0 and personal vs. demonstrative up to age 5;6) to the complex anaphoric distinctions in the target stage; in production, the distinctions are exclusively based on the animacy feature in the younger children, syntactic role becomes relevant as a further criterion only at about age 3;6; in comprehension, syntactic role is most decisive but the animacy feature or even the animacy pattern influences the strength of the correlation of pronoun type and syntactic role.
- (F) The data suggest a reorganisation of the initial anaphoric oppositions from age 3;6 to 4;5. In pronoun comprehension, children do not attain the adult pattern of anaphoric oppositions before their sixth birthday. With respect to production, the experiment does not allow any statement on the properties of the target stage and on when children reach that stage because the oldest children and the adults performed mainly correctly in the repetition task.

- (G) There is no evidence for use of merely positional, i.e., first-last-mention cues, with any of the three pronoun types at any age bracket. The subject and object preferences, interpretable as positional preferences, vary under the influence of the in/animacy feature.
- (H) There is strong evidence from the adults' and the older children's data that the personal pronoun is not exclusively resolved to subjects. Subject preference turned up only in case of the neutralization of the animacy feature (identity in in/animacy of both antecedents), otherwise object reference becomes equally likely. The anaphoric properties of the personal pronoun turned out to be less specified than those of the demonstrative pronoun which does not show tendencies towards subject reference in the adults' data.
- (I) The anaphoric capacity of a single pronoun type is not determined by (a) absolute and stable features; instead, different features are active and interact in different contexts; this leads to variation in the anaphoric reference of one and the same pronoun type; there appears a certain anaphoric domain in which a pronoun type can be used. Further, and consequently, anaphoric capacity is not even determined by (b) a unified salience hierarchy; instead each feature creates its individual salience hierarchy and the actual anaphoric reference results from the interaction of relevant hierarchies.

To finalize, there is a range of open questions to be addressed in future research. In addition to the necessity to strengthen the presented results by further data and the use of other experimental methods, the relevance of other criteria such as topicality, information status, positional cues, semantic and syntactic parallelism and their interaction with syntactic role and in/animacy has to be investigated. Questions resulting from the analysis of the present data concern the unexpected and yet unexplained findings for sentence type D in nearly all analyses. Are they an experimental artefact or are they caused by the feature constellation presenting the maximal salience contrast of the investigated antecedent features? Another question arises from the results of Bosch & Umbach (this volume): What is the impact of topic continuation and topic change on our results? Even in the adults, production of the demonstrative pronoun does not regularly lead to object choice, which would indicate comprehension of a topic change in the presented stimuli. Finally, differences between results of the production and the comprehension part of the experiment appeared which cannot be explained on the base of the conducted experiment.

8 References

- Ariel, M. (2004). Accessibility marking: Discourse functions, discourse profiles, and processing cues. *Discourse processes* 37 (2): 91-116.
- Beaver, D. (2004). The optimization of discourse anaphora. *Linguistics and Philosophy* 27, 3-56.
- Bittner, D. (2007). Early functions of definite determiners and DPs in German first language acquisition. In: Stark, E., E. Leiss & W. Abraham (eds.), *Nominal determination. Typology, context constraints and historical emergence*. Amsterdam/Philadelphia: Benjamins (Studies in Language Companion Series 89), 213-238.

- Bosch, P. & C. Umbach (this volume). Reference determination for demonstrative pronouns.
- Bouma, G. & H. Hopp (this volume). Coreference preferences for personal pronouns in German.
- Gagarina, N. (this volume). The hare hugs the rabbit. It is white ... Who is white? Anaphoric reference in Russian.
- Givón, T. (1983). Topic continuity in discourse: A quantitative cross-language study. Amsterdam: Benjamins.
- Grosz, B., A. Joshi & S. Weinstein (1995). Centering: A framework for modelling the local coherence of discourse. *Computational Linguistics* 21 (2): 203-226.
- Gundel, J., Hedberg, N. & R. Zacharski (1993). Cognitive status and the form of referring Expressions in Discourse. *Language* 69: 274-307.
- Hajcova, E., B. Partee, & P. Sgall (1993). *Topic-Focus articulation, tripartite structure and semantic content*. Dordrecht: Kluwer.
- Kaiser, E. (2005). Different forms have different referential properties: implications for the notion of salience. In: Branco, A., T. McEnery & R. Mitkov (eds.), *Anaphora processing: linguistic, cognitive and computational modelling*. Amsterdam: Benjamins, 261-282.
- Kuehnast, M. (this volume). Production and comprehension of intersentential pronominal reference in early child Bulgarian – an experimental study.
- Levinson, S. C. (2000). *Presumptive meanings. The theory of generalized conversational implicature*. Cambridge, MA., London: MIT Press.
- Mandler, J. M. (1992). How to build a baby: II. Conceptual primitives. *Psychological Review* 99 (4): 587-604.
- Strube, M. & U. Hahn (1999). Functional Centering. *Computational Linguistics* 25 (3): 309-344.
- Weissenborn, J. (1990). Subjektlose Sätze in der frühen Kindersprache. Ein theoretisches und empirisches Problem der Spracherwerbsforschung. *Der Deutschunterricht* 42, 35-47.
- Weissenborn, J. (1992). Null subjects in early grammars: Implications for parameter setting theories. In: Weissenborn, J., H. Goodluck & T. Roeper (eds.), *Theoretical issues in language acquisition*. Hillsdale, N.J.: Lawrence Erlbaum, 269-299.

The hare hugs the rabbit. He is white ... Who is white? **Pronominal anaphora in Russian¹**

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This paper investigates the production and comprehension of intrasentential anaphoric pronominal reference in Russian. In particular, it examines the elicited imitation and comprehension of three anaphoric pronouns in subject position – personal 3rd singular masculine, demonstrative and zero – in one hundred and eighty monolingual Russian-speaking children and twenty adults. The three types of pronouns were designed to have an antecedent in the preceding sentence containing a verb and two arguments. These antecedents differ in their syntactical role and animacy. The sentence position, agentivity and topicality remained constant. The sentences with (in)animate subjects and objects constituted the following four ‘conditions’: two sentences with a subject and an object being either animate or inanimate and two sentences with a subject and an object exhibiting a diverse (in)animacy. Regarding the resolution of the anaphoric pronouns the *similarity principle* (or *feature-concord rule*) and its possible violations were tested. This principle suggests that an anaphoric pronoun is most likely resolved to the antecedent with a maximum of similar characteristics or features and it primarily governs the assignment of an antecedent to anaphoric pronouns in subject position in the absence of the violating conditions. Results show the influence of this rule on the anaphora resolution process increasing with age, on the one hand, and the development of the impact of animacy, syntactic role and the type of anaphoric pronouns that violate the feature-concord rule, on the other.

¹ This study was performed in the tight cooperation with Dagmar Bittner, Milena Kuehnast and Insa Gülzow (see the respective papers in this volume). The design, material and conception of the experiments is the result of the joint work of all the project participants and their long-lasting and heated debates. My special thanks go to Elena Limbach for the transcription and coding of the data from Russian and to Inna Gridina for her assistance in the experiments.

1 Introduction

Strangely, the studies on anaphoric pronominal reference and on verbal aspect show a notable resemblance.

The large body of literature on verbal aspect is full of dissimilarities in the terminology. Researchers struggle with the outsized variation that defines the notions of lexical, grammatical, situational aspect and so forth in diverse ways, and note that “[w]hile a detailed systematization of approaches is still lacking, the theoretical literature in this field is still growing ... there is no land in sight ...” (Sasse 2001: 2).

The large body of literature on anaphoric reference seems to accept the definition of anaphora (henceforth, I will speak about the pronominal anaphora only) and shows no general confusion in the concept of pronominal reference. Researchers agree that generally, the term anaphora embraces the co-referential relationship between text (discourse) items (cf. Bussmann 1996), and that anaphora resolution mechanisms disambiguate the pronominal reference, i.e. seek for the best-fitting and most proper antecedent of the anaphoric pronouns. The studies scrutinise this within- and cross-sentential relationship in the different types of discourses and different types of languages, e.g. artificial and natural. Yet, ‘there is no land in sight’ as far as the understanding of the rules and mechanisms governing the assignment of an antecedent to the pronominal anaphora, the factors governing these rules and their overall hierarchy and correlation is concerned. The overview of the most recent and the most prominent theories that differ in their salience ranking of the antecedents of the pronominal anaphora (modified ZAS-P2 proposal 2007) below seems to support the ‘no land in sight’ claim:

- i. Classical Centering theory (Brennan et al. 1987; Walker et al. 1989; Grosz et al. 1995):
subject < parallelism < [semantic inferences]²
- ii. Functional Centering theory (Strube & Hahn 1999):
discourse-old < [semantic inferences] < discourse-new < parallelis
- iii. Functional Sentence Perspective or Topic Focus Articulation (Adamec 1966, Daneš 1974, Hajičova 1974, Hajicova et al. 1993):
[semantic inferences] < parallelism < focus (new) < topic (old)
- iv. Integrated Model of anaphora resolution (Mitkov 2002):
[semantic parallelism] < syntactic parallelism < subject
- v. Pragmatic Accounts (cf. Burzio 1996; Levinson 2000; Huang 2000):
topic (old) < subject < object

² The understanding of the notion of semantic inferences may be different in the mentioned accounts.

Thus, the Classical Centering Theory and the Integrated Model make contradictory predictions for the referent of *her* in sentences like (1) for Russian. Classical Centering goes for the subject preference, thus *her* refers to Maria, while the Integrated Model ranks syntactic parallelism as the highest resolution mechanism, thus *her* should be resolved into the direct object of the previous sentence, the daughter:

- (1) Mama kormila doch'. Papa nezhno pogladil jejo
mother feed-ipf:past:sg:fem daughter-acc. father affectionately stroke-pf:past:sg:fem her
'The mother was feeding the daughter. The father affectionately stroke her'

So, bearing in mind these considerations and applying Sasse's (2001) statement to the scope of anaphora research, that "a detailed systematization of approaches is still lacking, the theoretical literature in this field is still growing", I aim at scrutinizing in this article only one particular issue regarding Russian-speaking children and adults. This very issue concerns the production and comprehension of intrasentential anaphoric 3rd singular personal, proximate demonstrative masculine and zero pronouns in subject position (parallel SVO structures in the *antecedent* and *anaphoric* sentences) in sentences like (2a) to (2c), and will be highlighted in part 1.2. below:

- (2) a Lev i zajac–horoshije staryje druz'ja. Lev obnimajet zajca. **On** smejotsja.
lion and hare good old friends. lion hug-ipf:pres:3s hare-acc. he laugh-ipf:pres:3s
'The lion and the hare are good old friends. The lion is hugging the hare. He is laughing.'
- b Tigr i medved' – horoshije staryje druz'ja. Tigr obnimajet medved'a. **Etot** smejotsja.³
tiger and bear good old friends. tiger hug-ipf:pres:3s bear-acc. this laugh-ipf:pres:3s
'The tiger and the bear are good old friends. The tiger is hugging the bear. This is laughing.'
- c Kot i lis – horoshije staryje druz'ja. Kot obnimajet lisa. **Ø** smejotsja.
cat and fox good old friends. cat hug-ipf:pres:3s fox-acc. Ø laugh-ipf:pres:3s
'The cat and the fox are good old friends. The cat is hugging the fox. Ø is laughing.'

1.1 Anaphoric reference in language acquisition

The process of anaphora resolution requires inferences in order to determine an appropriate antecedent. The development of rules governing this process as well as the acquisition of the pronominal reference in children was one of the acquisitionists' main interests in the middle of the seventies and eighties. Experimental studies on production and comprehension as well as longitudinal studies showed

³ The sentences in 2b and 2c are somewhat grammatically odd.

controversies with respect to the age at which children acquire/use pronominal reference, and with respect to its functions and form (cf. Kail 1976, Wykes 1981, for more references see ZAS-P2 proposal, 2007). Furthermore these studies provide rather diverse evidence of the anaphora resolution mechanisms children employ and the interaction of regularities within these mechanisms. I will mainly address these studies, the overwhelming majority of which investigate the English-speaking populations; studies on Russian will be discussed at the end of this section.

The early experimental studies on the resolution of anaphora in children that children at the age of five use gender and number information in the anaphora resolution process (see ZAS-P2 proposal 2007). Wykes (1981) in his act-out comprehension experiments corroborated these results for sentences containing one anaphoric pronoun. Contradictory evidence was obtained in comprehension experiments with four year-old French-speaking children by Kail (1976), who found that children prefer the subject or agent as the antecedent, even despite the clear parallelism in gender between the object and pronominal anaphora. This preference for the antecedent with a similar syntactic role as the anaphoric pronoun and for the subject/topic as the most likely antecedent (Wykes 1981) had been shown to have much more influence on children than on adults and was explained as a child-specific resolution strategy. However, the same type of favourisation had been shown to be used by adults and was called *parallelism* in the ‘adult’ resolution theories. It is ranked as the highest resolution mechanism, at least in some resolution theories (Mitkov 2002), thus the child-specific resolution strategy may be called into question. In the experiments with the additional conditions, children were shown to exhibit difficulties in the selection of a proper antecedent (Wykes 1981). Two accounts for the problems with anaphora resolution discussed in the study deal with children’s limited processing and inferential capacities and with resolution strategies different from those adults use.

Longitudinal and narrative data also provide miscellaneous evidence on the use of anaphoric reference in Russian as compared with English, German, French. On the one hand, Karmiloff-Smith’s (1981) and Hickmann’s (2003) investigations of narratives in English and French have shown that children use definite NPs and pronouns in primarily deictic function up to the age of approx. 6;0. On the other hand, recent analyses of the narratives of the Russian- and German-speaking monolingual children showed that already at age 3;6, they are able to use pronouns anaphorically and not only deictically, and that by this age children produce coherent and cohesive discourse (Gülzow and Gagarina, this volume). Additionally, longitudinal studies on German, e.g. Bittner (2002, 2007), provide evidence that already at the age of 2;2, German-speaking children show a functional division between the demonstrative pronouns *das*, *der*, *die* and *den*: *das* is used primary deictically while *der*, *die* and *den* are primarily

anaphoric. Anaphoric demonstrative pronouns and full DP are used functionally distinct from the onset of their production. The former are used to maintain the conversation/topic and the latter are used to signal a topic shift or a contrast (cf. Bamberg 1987 for German, Hickmann et al. 1995 for French). Longitudinal studies on Russian reveal anaphoric uses of demonstrative, personal, and zero pronouns by the age of 2;6 and 3;0 by at least four children (e.g. Dobrova 2003, Gagarina 2006). Considering the successful every-day communication between children and their caretakers and the results of the previous observations, one may predict that core anaphora resolution mechanisms should have been acquired by the age of three, the age by which children acquire the basic morphological rules of their mother tongue, have the competence of a perspective-shifting skill (Ricard et al. 1999) and make no errors in the reverse pronoun use (Dale and Crain-Toreson 1993).

As far as the salience hierarchy of the antecedents is concerned, longitudinal and experimental studies on pronominal reference acquisition as well as narrative studies rank antecedents differently and offer multiple scenarios of acquisition sequences of the salience criteria. On the one hand, Karmiloff-Smith (1981), Bamberg (1987) argue that children use *thematic subject strategy* in the production of narrative texts favouring subject or topic as the antecedents of pronouns. On the other hand, it is proposed that *animacy* plays a crucial role in young children's pronoun understanding. Early sensitivity to *animacy* is found in studies that show early perceptive and categorical differentiation between animate and inanimate entities (Poulin-Dubois et al. 1996, Golinkoff-Smith et al. 1984). Generally, although postulating the high rank of the *subject* feature of an antecedent, researchers also include *animacy* and *agentivity* into the set of substantial/competing criteria defining the salience of the antecedent of the pronominal anaphora. These features define the syntactic and semantic roles, this distinction is not necessarily acquired or present in early children's grammars.

To summarise, a contradictory picture emerges from the overview of the research on anaphoric pronominal reference in children. On the one hand, studies report early abilities to resolve anaphoric pronouns onto the prominent subjects. On the other hand, the acquisitionists point to the children's early sensitivity to animateness. Furthermore, although children seem to have problems with anaphoric uses in discourse as late as the age of six, and seem to have problems with anaphora disambiguation when they have to draw additional inference and have more than one anaphoric pronoun to be disambiguated, the children develop their own strategies in order to manage anaphora resolution.

In view of the results of both theories on anaphora resolution in natural languages and from acquisition studies of anaphoric reference, the present study aims at establishing regularities which children follow in the resolution of intra-sentential anaphora in 'simple' settings – the first sentence: two competing ante-

cedents, subject and object, varying only in animacy; the following sentence – anaphoric pronominal reference in subject position.

The structure of the article is as follows: the following part gives a very brief and schematised overview of the pronominal (anaphoric) reference in Russian. The next part describes and explains the chosen methods and procedures in detail. The two subsequent parts present hypotheses and results on comprehension and elicited imitation respectively. The conclusion finishes the paper.

1.2 *The system of pronominal reference in target Russian*

Russian is a morphologically rich language with the word order governed by the *thema/rhema* reasoning, i.e. old-new information sequence. The pronominal system includes 9 groups of pronouns (as specified in Švedova et al. 1980, Rosenthal et al. 1991, cf. Isačenko 1968, only 5 groups). For the purpose of the present study which explores the disambiguation strategies of personal, demonstrative and zero pronouns, I will concentrate in what follows on the description of these three types only. Personal pronouns are distributed between two numbers and three persons and are marked for six cases as shown in Table 1.

Table 1: 3rd person pronouns in Russian

Person	Singular	Plural	Cases
3	He <i>On</i>	They <i>Oni</i>	1. nominative
	She <i>Ona</i>		2. genitive
	It <i>Ono</i>		3. dative
			4. accusative
			5. instrumental
			6. locativ

As far as anaphoric use is concerned, masculine, feminine, and neuter 3rd person singular pronouns may refer to both animate and inanimate antecedents, and the anaphoric uses may be said not to be constrained as it is the case with demonstratives. Generally, personal pronouns are considered to be the most ‘neutral means of indicating continuity of reference across a sentence boundary’ (Kresin 1998: 424).

Demonstrative pronouns form two groups, proximate and distal, which in turn contain pronouns in three genders in the singular: masculine, feminine, and neutral, as well as plural forms marked for six cases, table 2:

Table 2: Masculine demonstrative pronouns in Russian

Person	Proximate	Distal	Cases
Masculine	This <i>etot</i>	That <i>tot</i>	1. nominative 2. genitive 3. dative 4. accusative 5. instrumental 6. locative

The anaphoric use of these types of pronouns is strongly connected with the deictic function and is restricted to specific, contrastive contexts (Paducheva 1985, Krasavina 2004) with two or more antecedents, where the speakers ‘wishes to distinguish between two potential referents’ (Kresin 1998: 424 about distal *tot*, but this is also true for the proximate *etot*). In adult Russian the proximate forms are treated as unmarked and dominant in comparison with the distal forms; in the children’s longitudinal naturalistic data these forms occur earlier than their distal counterparts. Considering all the above-mentioned reasons, it is the proximate forms that have been chosen for the experiment.

Russian is arguably considered a weak pro-drop language. Franks (1995) considers Russian pro-drop features to be of the Chinese “non-local” specification type (:303) and argues that ‘Russian really is not morphologically uniform, hence not pro-drop in the sense that null subjects are not licensed’ (1995:301, cf. Geist 2006 – on the non pro-drop character of Russian). Traditional Russian grammars point to the six categories of sentences, the so-called *one-component* sentences that don’t have an overt grammatical subject (Rosental’ et al. 1991). These sentences are given in (3):

- (3) a. (I) Pishu knigu
 write-ipf:pres:1s book-acc:sg
 ‘I’m writing a/the book’
- b. (They) Mame dali (dadut) knigu.
 mother-dat:sg:book give-pf:past:sg:fem (give-pf:pres:3sg) book-acc:sg
 ‘The mother will get the book’
- c. (You) Pishesh’ knigu, a mysli putajustja.
 Write-ipf:pres:2s book-acc:sg, and the thoughts confuse-ipf:pres:3g
 ‘When one writes the book, the thoughts are confused’
- d. (It) Temneet.
 Impersonal becoming-dark-ipf:pres:3s
 ‘It’s becoming dark’

- e. Prinjat' knigu k pechati.
Accept-inf book:acc:sg to print-dat:sg
'Accept the book for printing!'
- f. Noch'. Ulica. Fonar'. Apteka (A. Blok's poem)
Night. Street. Lantern. Pharmacy.'

So, zero (pro)nominal subjects are more frequently used in sentences in which the predicates are marked for person-number; these predicates are imperfective verbs in the present and perfectives in the future (for the regularity of subject omissions in Russian see Geldbach 1999, Švedova et al. 1980, Franks 1995). Animacy is manifested in the accusative case marking of the masculine nouns of the second declension. Accusative of inanimate nouns is equal to nominative, like *stol* 'table-acc=nom', whereas accusative of animate nouns is equal to genitive, like *tigra* 'tiger-gen=nom'.

2 Method

2.1 Participants

180 monolingual children from middle-class families of St. Petersburg took part in the experiment. As a control group, 21 adults were tested. The distribution of subjects across groups is given in Table 3.

Table 3: Participants and database.

Group ID	Age	N. of subjects per group	N. of subjects per year
9	18-23, 40, 65	21 (adults)	
1	2;0-2;11	20	20
2	3;0-3;5	25	52
3	3;6-3;11	27	
4	4;0-4;5	26	66
5	4;6-4;11	42	
6	5;0-5;5	26	40 (with 3 children at 6;0)
7	5;6-5;11	14	
		180 (children)	

Subjects were excluded from the calculations if they didn't react to at least half of the stimuli sentences and didn't also participate in the comprehension task at least half of the time.

2.2 Design of the study

The data were collected in the experimental procedure that can be called “four-in-one”; the four combined parts representing the elicited imitation (sentence repetition) task, with each repeated-sentence followed by a comprehension question and two elicited narratives. Narratives were obtained on the basis of two picture stories, one of which is Hickman’s (2003) cat-story. The other is a fox-story, designed specifically for the project (painter J. Mühling), in which all three protagonists belong to the same gender and differ only in animacy (see appendix 2)⁴. This very design of the experiment was chosen since it doesn’t interfere with the three experimental techniques used in the experiment, because it provides us with comprehension data and two types of production data simultaneously, and because it allows the combined comparison of different data modes. The goal of the elicited imitation experiment was to check whether and in what conditions do children correct/change grammatically odd sentences, containing an anaphor with an antecedent in the previous sentence.

In particular, the elicited imitation task and the comprehension task were performed in the following way: children had to listen to 6 situations (an act out design), repeat 6 stimuli sentences terminating each of these situations, and disambiguate the pronominal reference by answering the who-question, then tell two stories on the basis of six pictures each and deal again with the remaining 6 situations. In the experiment, children hear one of the two fellows with different types of (in)animate subjects and objects to avoid the influence of the specific types of protagonists (the list of protagonists is given in appendix 1). Furthermore, the verbs were controlled in order to avoid a too direct semantic inference on the resolution process. The fellow’s sentences were randomised and presented to children basically in two orders. As warming up and pausing, the language comprehension test, checking the level of understanding of verbs and prepositions was presented to the children (Siegmüller and Kautchke 2006). An example of one situation from fellow one type is given below:

⁴ The analyses of narratives is beyond the scope of this paper, but since they were incorporated into the experiment, I found it necessary to give a short note on them.

A narrator – the first experimenter – holds a white bear and a white ball in his hands and acts out the story she pronounces:

Look, here is a bear and here is a ball. The bear likes to play football. The ball is in front of the bear. The bear is kicking the ball.

He is white. (The last, stimuli sentence that the child has to repeat; was whispered)

A distracted puppet – second experimenter – asks:

Oh, what did she say? Repeat.

Child: *He is white.* [child’s production: sentence imitation]

A distracted puppet – second experimenter – asks:

Who is white?

Child: *The ball.* [child’s comprehension: answer to the *wh*-question]

In total, twelve situations result from *four*×*three* conditions. The four conditions represent the combination of (in)animacy of subjects and objects, and the group of the three conditions corresponds to the type of the pronominal reference in the stimuli sentence, i.e. zero, personal or demonstrative pronouns (see Table 4 below).

Table 4: Design of twelve situations: types of sentences and pronouns

Type of sentence	Type of subject	Type of object	Type of pronoun
A	Animate Subject	Animate Object	1. Personal 2. Demonstrative 3. Zero
B	Inanimate Subject	Animate Object	1. Personal 2. Demonstrative 3. Zero
C	Inanimate Subject	Inanimate Object	1. Personal 2. Demonstrative 3. Zero
D	Animate Subject	Inanimate Object	1. Personal 2. Demonstrative 3. Zero

The four types of potential antecedents form a linear continuum with the salience decreasing towards the right edge: animate S > inanimate S > animate O > inanimate O. These four types of sentences may build a somewhat different continuum of hierarchal salience if one treats the object and subject in tandem. This continuum may have two possible orders, depending on the underlying condition which defines salience. If one assumes the absolute prominence of subjects

irrespective of animacy (in our case, all subjects are agents⁵, topics, and are first-positioned in the sentence) and presupposes that the subject/agent rule is the basic rule children obey in their resolution strategy from age 2;6, the following continuum with the salience decreasing top-down may be proposed (the most prominent antecedents within a sentence type are marked in bold):

- (4) **+animate S** // –animate O → D
+animate S // +animate O → A
–animate S // –animate O → C
–animate S // +animate O → B

Assuming the interaction of salience of the two main verb arguments, the salience of first-positioned subject is highest in condition D, in which the object is inanimate, and it is lowest (but still higher than the object) in condition B, in which the object is animate.

If one considers animacy as a feature that is able to violate or even override the subject's prominence, then the continuum exhibits the following order with the salience decreasing top-down (the most prominent antecedents within a sentence type are marked in bold):

- (5) **+animate S** // –animate O → D
–animate S // **+animate O** → B
+animate S // +animate O → A
–animate S // –animate O → C

Again the subject is the most preferred candidate in condition D, followed by the animate object as the next prominent antecedent since it occurs in a sentence with an inanimate subject, so we expect the smaller children to prefer the object in condition B, since the animacy should play a more important role in their choice.

2.3 The choice of experimental technique and age

The elicited imitation (sentence imitation) task as an experimental technique to control pronoun production was chosen due to several reasons. Firstly, we started from the assumption that “when children are asked to imitate a sentence, they often make changes ... the way THEY think it should be” (O’Grady 2005), so by presenting non-target sentences to children, we expected them to correct these sentences in a systematic way. Secondly, other researchers had already

⁵ Note, that in sentences with a null copula (and s-predicates), like *On sinij* ‘He (is) blue’ the subject are not the ‘real’ agents.

successfully used this technique; e.g. Lust (1981), who asked 2;6 to 3;6 year olds to repeat sentences like: *Because Sam was thirsty, Sam drank some soda* and *Because he was thirsty, Sam drank some soda*. Children corrected the first and the second sentences in the following way: *Because Sam was thirsty, he drank some soda* and *Because Sam was thirsty, he drank some soda*, respectively. More recently, Ambridge and Pine (2006) effectively used elicited imitation to examine the agreement/tense omission model “for precise control of the target utterance with respect to the pronoun subject” (Ambridge and Pine 2006:884). Thirdly, this technique seemed to us the most successful way to make young children produce the three types of pronouns we intended to investigate.

We started testing children from the age of two and a half. The reasons for starting with this age-group were the following. Two and a half is the lowest border allowing the performance of such a type of experiments: our longitudinal data and results of previous research showed that children by this age can be said to have acquired pronouns basically that means that no reverse use like,

‘I’ll carry you for ‘YOU carry ME’

Lift you up and you can see the window for ‘Lift ME up and I can see the window’”
(cited after O’Grady 2005:76)

is found (cf. at the age of 18 months approx. 50% of pronominal reference is reverse: Dale and Crain-Toreson (1993)). Furthermore, by this age children have acquired the so-called the perspective-shifting skill (Ricard et al. 1999) and they reach the cognitive ability to follow the (linguistic) task and *change* its linguistic components if necessary.

3 Study one – comprehension

3.1 Assignment of antecedents - predictions

If the interpretation of the results in the previously reviewed studies is true, the following hypotheses stemming from the theories discussed and from the results of the previous studies, can be proposed:

1. The *similarity principle* primarily governs the assignment of a antecedent to anaphoric pronouns in subject position in the absence of the violating conditions. The violating conditions, like, for example, speakers’ age and language-/pronoun-specific factors, may weaken the controlling supremacy of this principle.

The *similarity principle* or *feature-concord rule* postulates that an anaphoric pronoun is most likely resolved to the antecedent with the maximum of similar characteristics or features. In our case these features include (but generally may not be restricted to) the syntactic role, agentivity, sentence position and topicality.⁶ The *similarity principle* strongly resembles parallelism assumed in anaphora resolution theories (cf. Mitkov 2002); it differs from the latter in the number of features that co-refer an antecedent and a anaphor. Parallelism postulates the anaphora resolution into the antecedent with the same syntactical role and sentence position, similarity rule extends the number of features to topicality, agentivity, semantic parallelism, etc. In the present study the sentence position is fused with syntactic role and agentivity, since subjects are predominantly agents and always have the sentence initial position. In contrast, the objects are recipients and occupy the sentence final position. The separation of these features is the matter of the future experiment.

The three violating conditions and their essentials: first, under speakers' age influence I understand constrains in young children on processing and referential capacities, e.g. the *recency of mentioning effect* (cf. Wykes 1981), and incompleteness in the acquisition of notions of the syntactic role. Second, language-universal constrains include the feature *animacy*, the addition of which to the antecedent can make it the most attractive candidate for the resolution despite the *similarity principle*. Third, language-specific factors which may include functional restriction on or language-specific preference of the antecedents for certain pronouns, like for example *der* in German, have been shown to be more likely resolved to the object NP of the previous clause or sentence (Bosch, Katz, and Umbach 2007).

Prediction one (without violating factors) would mean that, in our case, children at all ages would tend to resolve all pronominal anaphora of the experiment onto subjects irrespectively of their animacy. The following factors (with the degree of influence decreasing top down) are anticipated to violate this rule:

2. The *similarity rule* is *age-sensitive*, i.e. the effect of this rule is weaker in the youngest children who may not yet recognize all similar features of the anaphora and the antecedent and may show higher sensitivity to another features, in our case – animacy. Hence, in condition B the most probable antecedent would be an animate object in youngest children (also due to the *recency of mentioning*)

⁶ According to the topic-similarity the anaphoric pronouns *he* and *zero* should refer to the first protagonist, which is a topic.

3. The *similarity rule* is *animacy-sensitive*, i.e. the effect of the rule may be violated in the non-prototypical combination ‘inanimate subject – animate object’ (condition B) and this is especially true for young children, who may rank animacy higher as the feature-similarity rule
4. The *similarity rule* is *pronoun-sensitive*, i.e. demonstrative pronouns as structurally more complex anaphora may be resolved into the least salient referents – inanimate objects (and this is especially true for condition B), since in the resolution process these referents take priority over the antecedents displaying features maximally similar to the anaphora features. Moreover, language-specific constraints on the antecedent references of demonstratives are at play here – demonstratives are said to refer most typically to subordinate antecedents in non-subject syntactical role and to mark the topic-shift in discourse.⁷

The interaction of the *similarity rule* with the three violating conditions given above manifests in the fact that the number of choices of subjects as the antecedents of anaphoric pronouns will be lower in cases where these conditions are manifested most prominently, like young age and animacy of objects in tandem with inanimacy of subject (condition B). Since the target sentences always contain two possible antecedents with changing animacy features, the subject and the object, the effect of the subject rule is expected to be stronger in the D-condition, where the antecedent subject is the most prominent, since it contains the features [+animate], [+agent], [combined with -animate object]. And consequently this effect is expected to be the weakest in B-condition, where the antecedent subject has the features [-animate], [+agent], [combined with +animate object]. The animacy influence on subject/agent effect is expected to be the most strong with the youngest children, who are more sensitive to animacy than their older siblings.

⁷ As noted above, the stimuli sentences contain three types of pronouns – personal, demonstrative and zero, with the two latter types of stimuli being not fully grammatical in Russian. The influence of a *reversed mapping* is expected to be stronger in these grammatically odd sentences. A reversed mapping constrains the relationship between anaphora and their antecedents in the way that structurally more complex anaphora are related to less salient referents and vice versa (Gundel et al. 1993; Ariel 2001), e.g. demonstrative pronouns should be more often resolved into objects, especially in condition B which contrasts an animate object and inanimate subject. However, the language-specific constraints on their referential functions violate this rule.

3.2 Assignment of antecedents – result

The results are presented in three steps: I start with the general distributional picture of subject and object choices (Figure 1), move towards the choices of subjects and object within the sentence types (Figure 2), and finish with by adding the three pronoun types to the distribution picture (Figures 3, 4 and 4a-4c).

The general choices of subjects given in Figure 1 is scrutinised in the next two figures which basically repeat figure one but with the columns divided horizontally into four parts according to the A, B, C, and D sentence types and then vertically – into three parts according to the three pronoun types: personal, demonstrative and zero. The purpose of this three-step delineable schema is to provide a smooth transition from a general into a detailed insight of the anaphora resolution in all twelve conditions and thus to facilitate the comprehension of the last graph in this part.

Figure 1 shows the distribution of S vs. O choices out of all choices of subjects and objects, given in percentages.

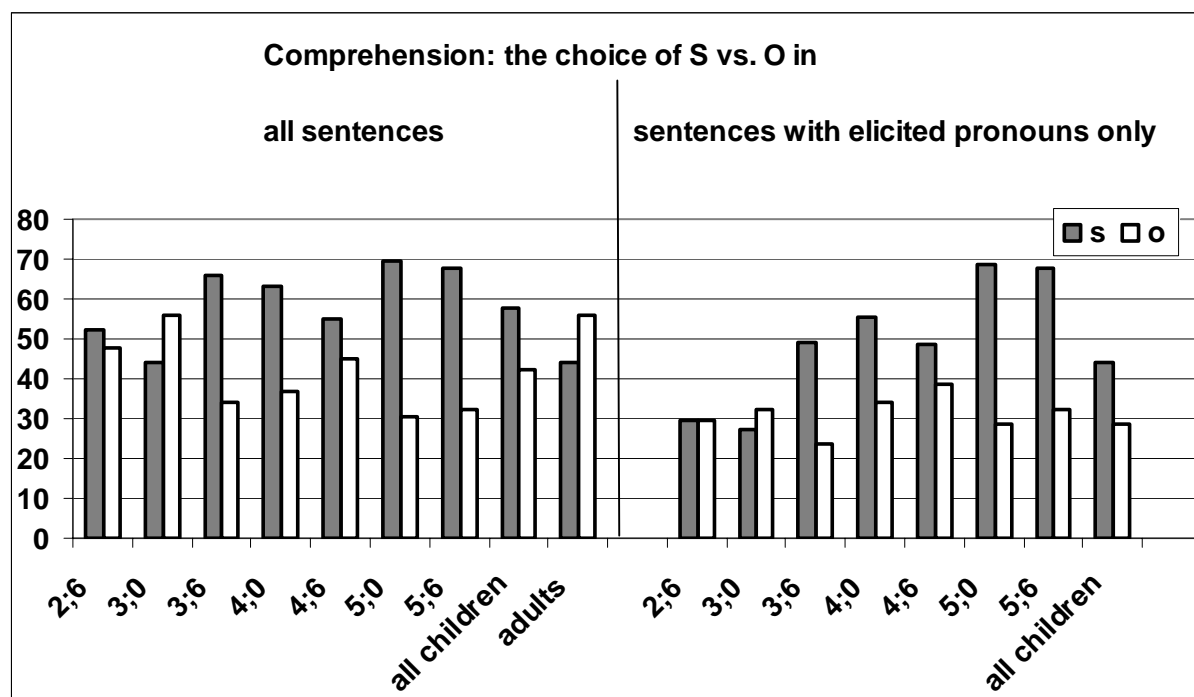


Figure 1: Resolution of anaphoric pronouns into subjects vs. objects in all data from Russian⁸

The two parts of the figure mirror each other with one distinction: the left part includes all choices irrespectively of the successfulness of the participation in the sentence repetition task, while the right part is restricted only to the ‘full participation in the experiment’, i.e. children repeated pronouns in the first, elicited

⁸ All figures present percentages on the vertical axe, except for cases notified extra.

imitation task, and have chosen either subject or object in the second, comprehension task. Since adults were not introduced to the elicited imitation task (in the pilot study all were imitating stimuli sentences without any changes) the respective columns in the left part are empty. There is no significant variation the correlation of subject vs. object choices between the two parts of this figure. The minor proportional dissimilarity between the corresponding values in the left and right part of this figure is obvious in the groups of 2;6 year old children, who equally choose subjects and objects when they repeated pronouns in comparison with the slight preference for subjects if choices in all sentences are counted. The clearly observable difference in the general amount of responses, which is lower in the right part, since not all children had successfully imitated pronoun sentences diminishes with age. All analyses of this section below are based on the right part, dealing with the data of children who fully participated in the experiment, i.e. successfully fulfilled the two tasks. The data of adults, which show a different bias in choices will be analysed separately. At this point one cannot help noting that adults seem to generally use the *opposition/confrontation strategy*, resisting to the anaphora resolution rules that rank the subject as the most probable and the most salient antecedent, and seeking a forgery in the anaphoric reference they have to resolve, thus naming on purpose the ‘wrong’ antecedent (see more detailed analyses below). The second possible explanation of the object preference is given when referring to the type of anaphora and their role in the continuity of reference representation in discourse.

The two younger groups differ from all older groups in that they do not prefer subjects over objects. The preference for subjects increases with age and reaches a significant difference at the two oldest groups (significantly higher when objects are inanimate).⁹

The next Figure 2 shows the distribution of subject vs. object choice divided into four sentence types. Such division provides an outlook onto the distribution of subject/object preferences within animacy and subjecthood combinations, which shows the most clear development in three age groups: three-, four-s, and five-year olds. These three age groups are marked in bold and by an oval and will be described in detail below. The ‘intermediate’ groups resemble the developmental curve within the three ‘main’ groups taken for the detailed description.

⁹ The statistical analyses for this study were mainly done by E. Andonova from the University of Bremen. The Chi-square results I obtained by myself.

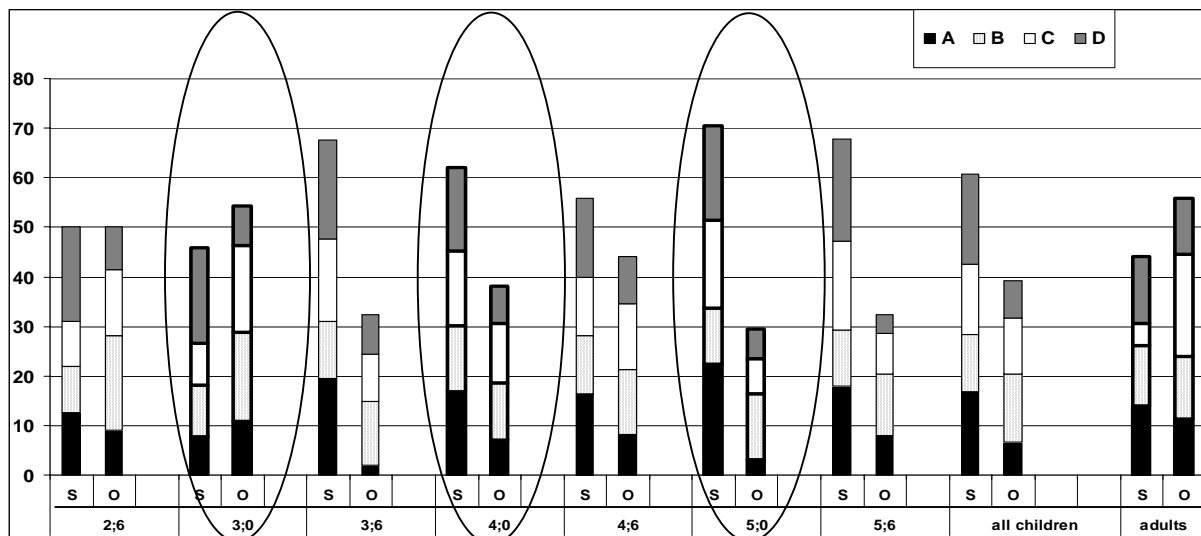


Figure 2: Resolution of anaphoric pronouns into subjects vs. objects across sentence types

First, consider condition D, the highest part of columns marked in dotted black, which shows constant increase of subject vs. decrease of object choices in this category – children learn to recognize the similarity rule and resolve anaphora into subject in the most prototypical constellation of verb arguments: animate subject/inanimate object. This bias towards subjects is even stronger if we summarize conditions A and D, the two black parts of the columns, which exhibit the animate subjects. A significant main effect of animacy ($p < 0,0067$) occurs at 4;00 and becomes even more significant with five year old children. Interestingly, these two conditions are the only conditions where adults slightly prefer subjects over objects (14% vs. 11% in condition D and the same proportion in condition A), however the rate of their choices differ across the three pronoun types. But this small adults' subject preference is generally overridden by the highly significant preference for objects in condition C ($p < 0,0017$). It is this condition that 'compiles' the general object preference in adults data.

In condition C, the youngest children behave similarly to the adults in that they prefer objects. Four and five year-olds exhibit a subject bias in this condition, and the degree of subject preference in the oldest group is highly significant ($p < 0,0002$). The same bias for subject is clearly seen in condition A in the two older groups: it is also significant for these groups ($p < 0,0125$). An inferential summary thus shows that in conditions where both a subject and an object are either animate or inanimate, children increasingly choose subjects, thus learning to differentiate syntactical roles in the anaphora resolution process and learning to obey the *similarity rule* (the ranking of animacy is lower as the ranking of a syntactic role).

Second, consider condition B, the dotted white part of the column, where I predict the strongest violation of the similarity rule. In this condition no subject bias is found at all. However, the slight preponderance of objects is not significant thus, the distribution of choices between subjects and objects can be said to be at a chance level.

The split of subject vs. object preference which provides a more differentiated view regarding the types of imitated pronouns is given in Figures 3 and 4 below. For a better comprehension of the figures below recall explanation in 3.2. and imagine that each column of Figure 2 is vertically divided into three parts, representing the types of pronouns children repeated and adults heard (remember adults did not have the elicited imitation task).

Adults' data that are given separately in Figure 3 show the slight preference for subjects with personal pronouns and no preference for either subjects or objects with zero pronouns. With regard to demonstratives, adult resolve these into objects significantly more often across all conditions ($p < 0,001$).¹⁰

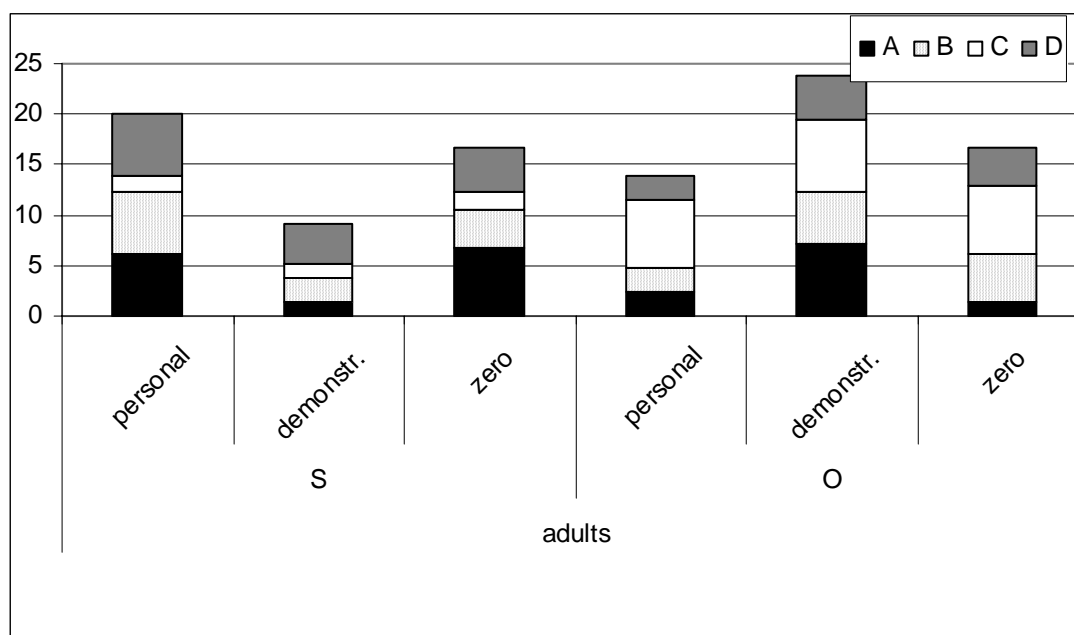


Figure 3: Resolution of anaphoric pronouns into subjects vs. objects in adult data from Russian

The more diverse representation of choices occurs across the sentence conditions A, B, C, and D (vertical division of the columns in Figure 2). Here, the preference <subjects--personal pronouns> is especially evident in conditions A

¹⁰ This corroborates the data for the distal pronouns: ‘when there are two potential referents with the same gender and number, *tot* is said to corefer to the most recent potential antecedent (Revzin 1973:123) or to a previous non-subject antecedent (Adamec 1988:170, Koktova 1992)’ Kresin 1998:421, cf. Krasavina et al. 2007

and D where the subjects are animate. The preference <subjects--zero pronouns> is especially strong in condition A and less evident in condition D where the subjects are animate. No preference for subjects with demonstrative pronouns is observed.

The overall preference for objects with demonstratives is highly significant, $p < 0,001$. In condition C, this preference seems to be ‘pronoun-resistant’, since it does not change at all neither for personal, nor for demonstrative or zero pronouns. In condition A, the same preference for objects is registered only for demonstratives, thus, probably evidencing the specific anaphoric functions of demonstratives in discourse.

Figure 4 below presents the same structure as Figure 3, yet for children. The same three most representative groups of children marked with an oval will be described. I first compare the first and the second columns in three age groups: these columns reflect the choices of subjects in sentences with personal and demonstrative pronouns and they both increase likewise towards the oldest group. If we contrast them to the third column which does not change across ages significantly, we will see that all three columns draw nearer to each other, thus showing only a slight impact of the pronoun types on the choice of the antecedents. The minor tendency for a subject preference in sentences with zero pronouns is not significant.

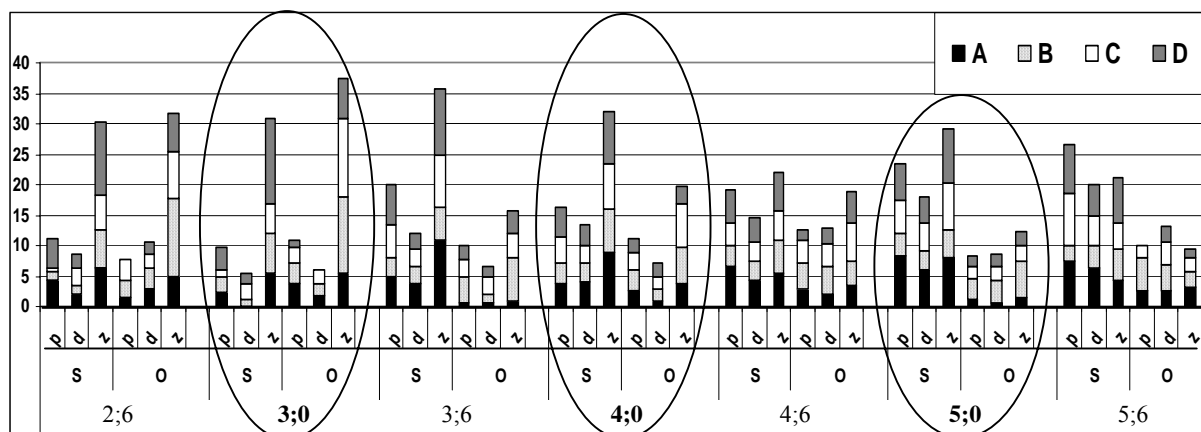


Figure 4: Resolution of anaphoric pronouns into subjects vs. objects in all data from Russian

The same tendency (of narrowing the scope of choices across three types of pronouns) in the selection of objects is observed in the last three columns in each age group. While the choice of objects does not change across ages in sentences with personal and demonstrative pronouns, it significantly decreases towards the older group in the zero pronoun sentences, $p < 0.0399$.

Figures 4a to 4c are a somewhat more scrupulous representation of the relevant parts of Figure 4 and show in details the selection of subjects vs. objects across the three types of pronouns and the four conditions.

Figure 4a provides the overview of the subject vs. object choices after the elicited personal pronouns. In condition A, the preference of subjects over objects is at chance level by younger children and develops towards the significant difference towards the oldest children. In condition B, no significant developmental effects are attested and the choices of subject vs. objects stay at a chance level, yet the slight tendency for the animate objects is seen with the youngest children. Condition C replicates the developmental picture of condition A as far as subjects is concerned and shows no changes across ages in the choice of objects: they remain at the level below 5%. In condition D, the preponderance for subjects in all age groups is seen, this preponderance increases towards the older children.

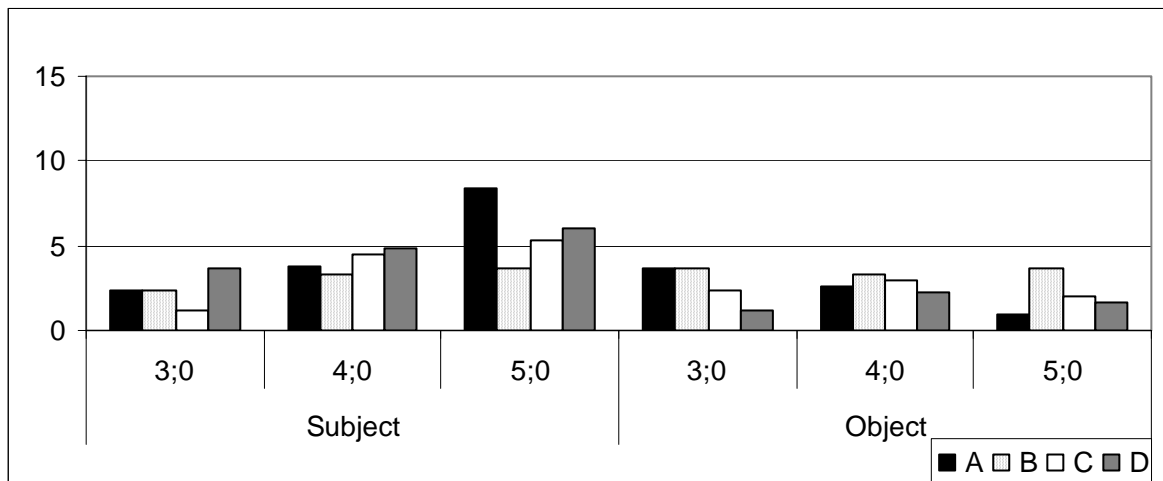


Figure 4a: Resolution of anaphoric pronouns into subjects vs. objects in all data from Russian: elicited *personal* pronouns

Figure 4b provides the overview of the subject vs. object choices after the elicited demonstrative pronouns. This pronominal type that exhibits very specific anaphoric functions is underrepresented. Children frequently omit or substitute the demonstrative pronouns in the elicited imitation task. The most clear effect with this lower number of demonstratives' uses is the increase of the subjects preference towards the older children in all conditions except for condition B. This effect is most strongly manifested in condition A.

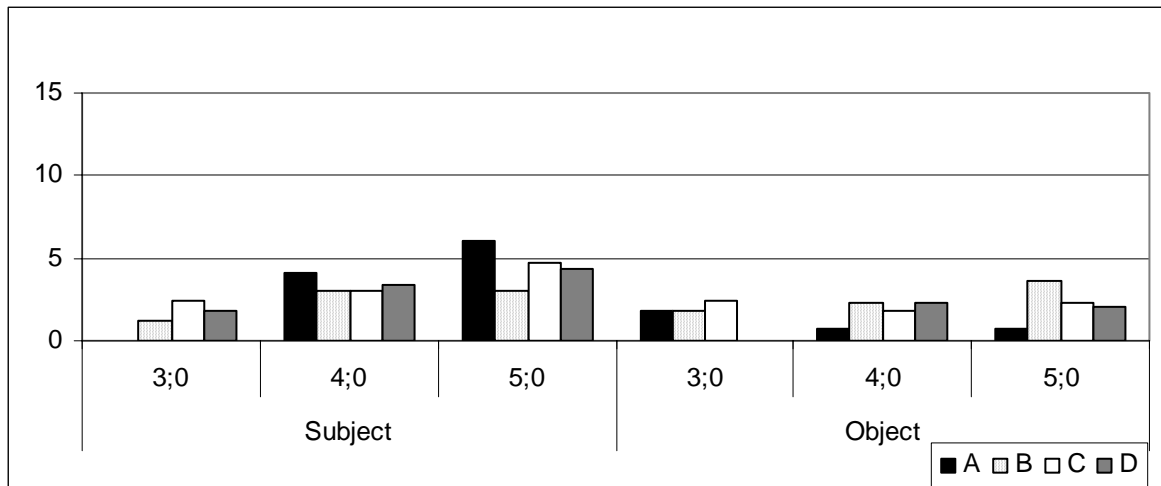


Figure 4b: Resolution of anaphoric pronouns into subjects vs. objects in all data from Russian: elicited *demonstrative* pronouns

Figure 4c provides the overview of the subject vs. object choices after the elicited zero pronouns. This type of the pronouns, i.e. omissions, is the most frequent in comparison with the two previous types. In condition A, the slight increase of subject choices vs. the strong decrease of object choices towards the older group is observed. In condition B, no changes in the subject choices is observed vs. strong decrease of object choices towards the four-year-old children is seen (the number of object choices remains the same within the two oldest groups). Condition C remains condition A although the tendencies are manifested weaker. Finally, condition D show the decreasing tendencies in both subjects and objects choices, with the preference for subjects across all children.

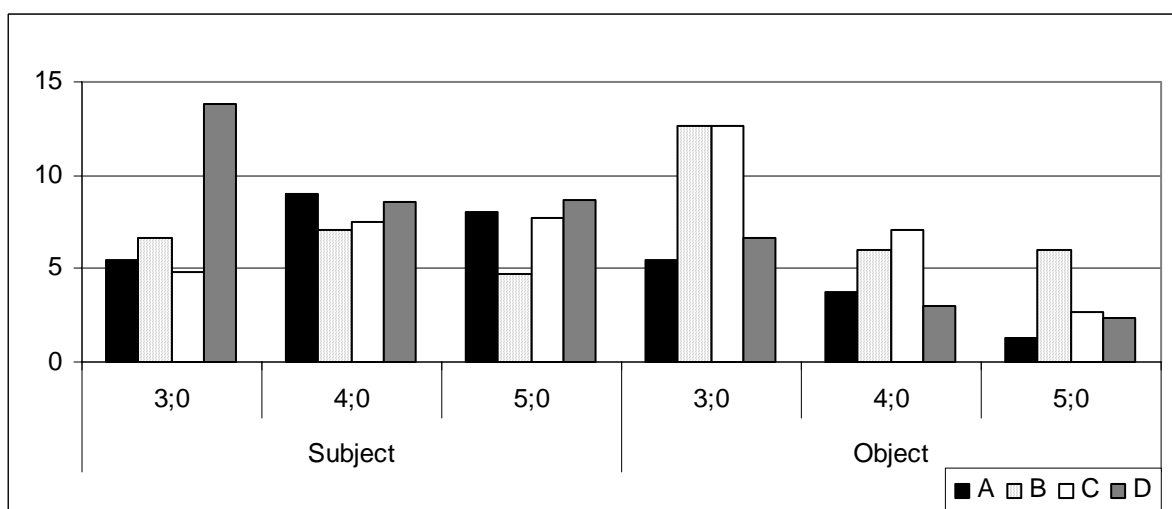


Figure 4c: Resolution of anaphoric pronouns into subjects vs. objects in all data from Russian: elicited *zero* pronouns

4 Study two – elicited imitation

4.1 Elicited imitation strategies – predictions

To recapitulate briefly, children were asked to repeat stimuli sentences containing personal, demonstrative and zero anaphoric pronouns following the antecedent sentences which contained subjects and objects having the two variables +/-animacy in crossed variations (see table 4). The predictions are the following:

1. Children will imitate the grammatically correct stimuli sentences with personal pronoun without any deviation from the stimuli. In case of any errors in these stimuli sentences – omissions and/or substitutions – they should occur in the prototypical condition B (the animate subjects and inanimate objects) where children will subjects as the anaphora referent. Omissions are expected to be generally more frequent with the younger children as with the older children (it is ‘cognitively easier’ to omit an item as to substitute an item and young children often omit pronominal subjects, see Gerken 1991 and Valian et al. 1996); no substitutions of personal pronouns with the demonstrative *etot* are expected
2. Systematic divergence to the stimuli is expected in the grammatically odd sentences with demonstrative and zero pronouns. This divergence can be divided into two categories:
 - (a) <omission> and (b) <replacement>, the latter can be in its turn divided into (b₁) <*non-target to target replacement*> and (b₂) <*non-target to non-target replacement*>.

Taking into consideration that all situations were acted out in front of the children, sentences with the zero pronoun can be said to be less grammatically odd as sentences with the demonstrative *etot*. The type (a) substitutions are expected to be the most frequent in younger children and with demonstratives and to disappear subsequently towards the older children. The type (b) substitutions are expected to be higher in younger children and in *non-prototypical* sentences, like, for example, condition B with inanimate subject and animate object. This type (b) is expected to be governed by the reverse mapping principle and by the fact that personal pronouns are the most neutral ‘means of indicating continuity of reference across a sentence boundary’ (Kresin 1998: 424) that do not switch the topic. I argue that the reverse mapping principle should be considered only for pronouns the anaphoric functions of which are not referentially restricted or contextually constraint; thus only a slight effect, if any at all, is expected with the demonstrative pronoun, the resolution of which undergoes the specific, con-

textually dependent rules. Furthermore, this principle can be applied only in a limited degree to zero vs. personal pronouns and only with the older children.¹¹ These two types of pronouns allow the broader referential choice, i.e. their anaphoric functions are ‘under-specified’, in the target Russian. It is expected that animacy in the youngest children and a syntactic role in the oldest children will govern the referential choice of the erroneously repeated zero and personal pronouns. Thus, the following continua of preferences are predicted: with younger children [animate (subjects, objects) < inanimate (subjects, objects)] and with older children [subjects (animate, inanimate) < objects (animate, inanimate)].

4.2 Elicited imitation strategies – results

Results will be presented in four sections. The first two sections give an overview of all children’s responses to the stimuli sentences and all responses, containing pronouns (these latter responses will be the matter of analyses). The two concluding sections deal with errors in elicited imitation.

Figure 5 below shows that already the youngest children successfully participated in the experiment: almost 60% of them produced the results that were possible to evaluate for the purpose of the study.

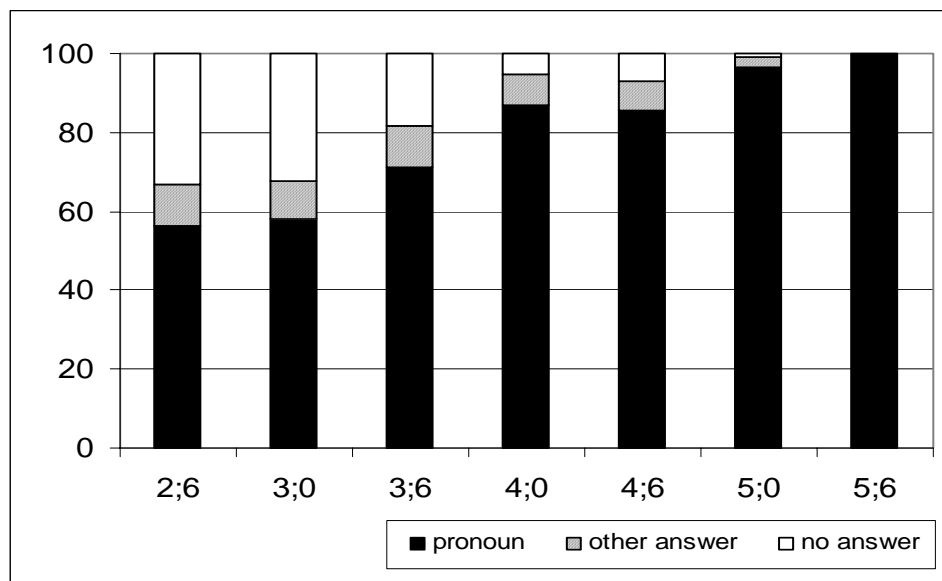


Figure 5: Overview of the elicited repetition

The next Figure 6, gives an overview of all sentences with personal, demonstrative or zero pronoun irrespectively of their correctness, i.e. whether they re-

¹¹ Only the older children may show the establishment of the different anaphoric functions between the zero and personal pronoun.

peated the target pronoun or substituted it. Figure 6 shows that children did not repeat automatically all stimuli (if they would have repeated everything without any changes, the distribution would have been similar for each type – 33,33%), but changed them in the way that the proportion of zero pronouns decreases with age and the proportion of personal pronouns increases.

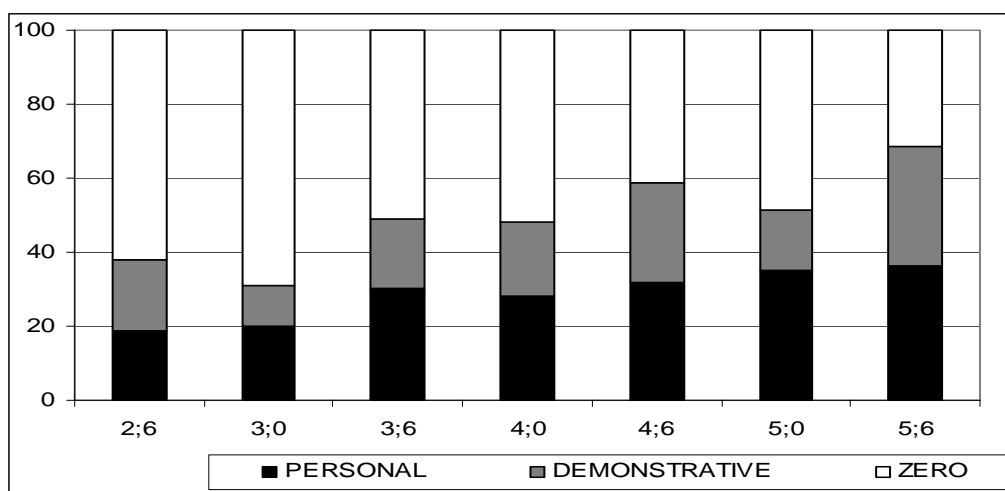


Figure 6: Overview of the repeated pronouns

The extraction of the erroneous uses of pronouns from all responses is the most important part of the elicited imitation experiment, see Figure 7 below.

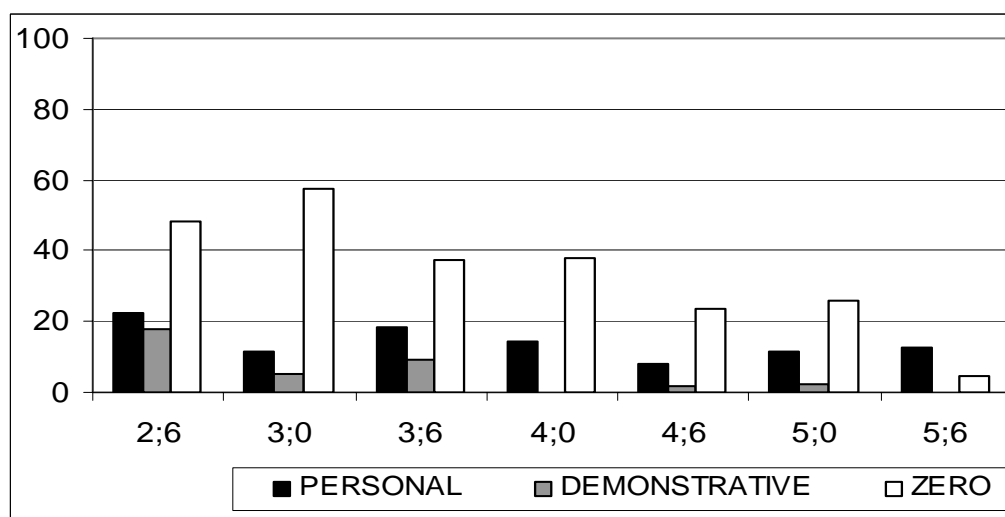


Figure 7: Erroneous repetitions of the pronouns

This figure demonstrates the steady decrease of the zero and demonstrative errors and the permanence (with a slight diminishment) of the personal pronouns. Thus, our prediction that children would more or less stably use personal pronouns as the substitution for the grammatically odd demonstratives and zeros holds. Further, as expected, the number of zero pronouns decreases with age (cf.

Gerken 1991 and Valian et al. 1996 on the subject omission), i.e. children show a reduce in the omission of pronominal subjects.

Compare the conditions in which these substitutions occur, Figures 8a and 8b, which illustrates the numbers and the proportional distribution of pronouns. Note, that since the absolute numbers of the substitutions are relatively low and that only three groups are compared, the numbers of the two subgroups of each full year are summarised, e.g. three-year-olds are compiled from 3;0 and 3;6, etc.

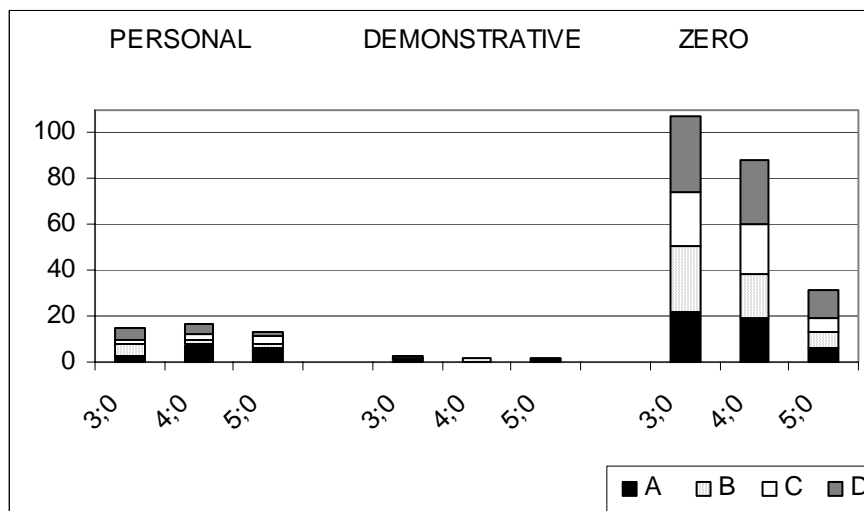


Figure 8a: Distribution of the erroneous repetitions of the pronouns: numbers

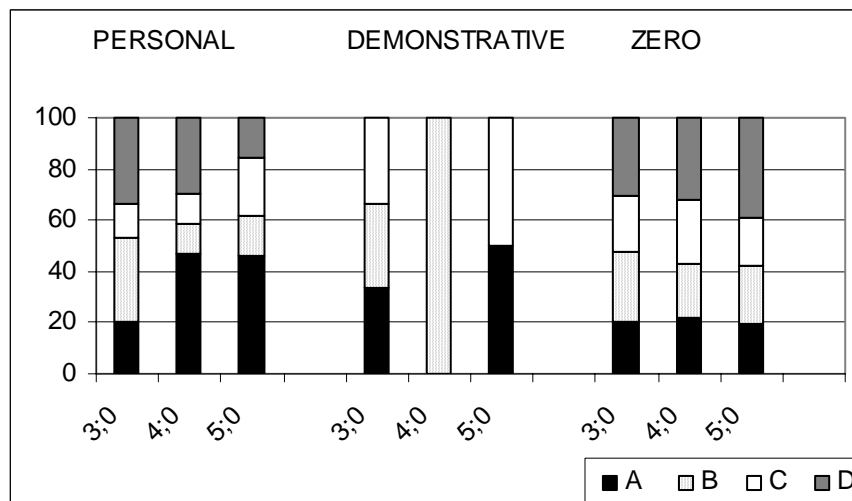


Figure 8b: Distribution of the erroneous repetitions of the pronouns: percentages

With personal pronouns two general tendencies are observed: the first tendency is the increase of substitutions in condition A towards the older children (remember the steady growth of subject choices in condition A towards older children). Thus, the most remarkable result at this point is the children's increasing

substitution of demonstrative and zero pronouns with personal pronouns (in conditions A and C, but not B and D) parallel to the increasing choice of subjects. Do we have to interpret these two analogous tendencies as the acquisition of the syntactical role and establishment of the resolution rules of the anaphoric 3rd person pronoun in discourse? Or as the establishment of pure resolution rules, in our case, the similarity rule?

The second tendency, is the modest but steady increase of substitutions in condition C towards the oldest group (remember the constant increases of subject choices and very slight decreases of object choices towards the older children in C). Again, is there any connection between the erroneous production of personal pronouns and subject choices? There is one more drop of substitutions in condition B after the age of 3;0 (no significant changes in the choice of subjects vs. objects in this condition across pronouns and groups). There is one more, modest but steady, increase of substitutions in condition B (remember no changes in subject vs. object preferences in B).

Demonstrative pronouns hardly are erroneously used to substitute the other pronouns in the target stimuli, hence they will not be treated.

Finally, zero pronouns absolutely dominate in all conditions at 3;0 and show a significant regression by 5;0. Across all conditions where zeros are only seldom used, condition D dominates.

The erroneous uses of zero and personal pronouns are compared with their antecedent's choices in the last figure, Figure 9.

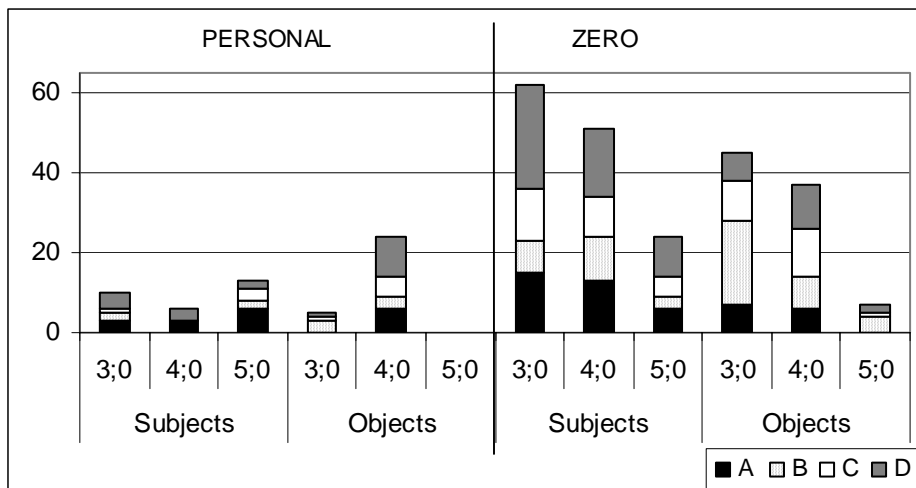


Figure 9: Resolution of the erroneously repeated personal and zero pronouns into subjects and objects (numbers)

Figure 9 aims at showing the deliberately erroneous repetitions of anaphoric pronouns together with the resolution of these pronouns. It thus crowns the previous analyses in that it most strongly shows the interaction between (elicited) production and resolution of the anaphoric pronouns in Russian.

The production of personal pronouns with the subsequent choice of subjects or objects does not show an age-consistent picture for neither subjects nor objects. However, the choices of subjects preponderate in the youngest children, and these choices remain the only ones in the older children. The middle group seems to be at crossroad and restructuring its resolution strategy: the children of this group suddenly assign objects to the personal pronouns; and this effect is mostly seen in condition D. As far as the distribution of resolution strategies across the four conditions is concerned, condition A seems to be the most constant with the youngest and the oldest groups – it is in this condition that the children choose subjects, especially the oldest group.

To recapitulate, zero pronouns are used most often by the youngest children and their number decreases towards the oldest group. This is as expected, since the older children omit pronouns less frequently than the younger children (see Freundenthal et al. 2007). Furthermore, although zero pronominal subjects are admitted in the tested contexts/situations, they still sound odd despite the extralinguistic situations acted out. So, with zero pronouns children of all ages show a strong preference for subjects, this preference is mostly clear in the oldest children. This tendency is particularly evident in prototypical condition D, in which the tandem of animacy and the syntactic role of subject promotes the resolution of zero pronouns onto subjects. Does this mean that already young children are sensitive to the syntactic role? The partial answer to this question can be found in the results for conditions A with the two animate antecedents and C with the two inanimate antecedents: the two verb arguments differ only in their syntactic role. Hence, if younger children are able to recognise the syntactic role (and rank it higher than the other antecedent's features) and the anaphoric 'force' of the zero pronouns, they should resolve them into subjects. This is what we observed in A, but not in C. Finally, in condition B, children predominantly choose animate objects.

5 Discussion and conclusion

The discussion and conclusion will be given in turn, corresponding to the parts 3.2. and 4.2.. To sum up part 3.2., the resolution of anaphoric pronouns in subject position is governed by the similarity rule: an overwhelming number of children choose subjects as antecedents. A closer look into the animacy and subjecthood of the antecedents and the type of anaphoric pronouns reveals various violations of this rule however.

First, as was predicted, younger children, especially the two younger groups, prefer objects in sentences with inanimate subjects and animate objects (condition B), thus, they rank the animacy of a protagonist higher than the syntactic rule and they also place it over the similarity rule. Second, as it was also predicted, the preference for subjects as resolution candidates is much higher in the ‘prototypical’ sentences with animate subject and inanimate objects (condition D) since the contrast of the syntactic roles is strengthened by animacy. Third, in sentences with animate subjects and objects (A condition), children with age increasingly prefer subjects, i.e. the establishment of the dominance of a syntactic role is becoming more certain and definite. The same tendency, although a bit weaker, is seen in sentences with inanimate subjects and objects (C condition). Thus, in these two conditions, where the animacy of the protagonists does not differ, one may indirectly observe the establishment of the syntactic role. This establishment is manifested in that children are learning the prominence of subjects and choose them as the most probable antecedents of the subject anaphora.

Furthermore, the similarity rule is consequently overridden by adults in condition C across all pronouns and in all four conditions with demonstratives. As it has been mentioned in section 1.2., demonstratives constitute a pronominal class with specific anaphoric functions which are realised in a restricted set of contexts which were not the subject of this study. In the contexts that were used in the study, adults display the *controversial contrive or ‘against’* strategy which may be strengthened by the recency of mentioning and/or topic shift effect. This strategy means that potentially considering subjects as the correct antecedents of the anaphora, they deliberately choose objects, assuming a counterfeit in the experiment. The topic shift effect may serve as an additional explanation for the strong preference for objects across all conditions with demonstratives – since this type of pronoun guides the topic shift (the ‘marked’ anaphoric reference), adults resolve it to objects even in the non-target conditions. That fact that adults resolve the anaphoric demonstrative *etot* into object speaks for the last, fourth prediction of section 3.1., namely that the similarity rule is pronoun-sensitive, since it maybe violated by restrictions in its anaphoric functions of some pronouns (see *Russkaja Grammatika-80*). Finally, while the domination of the similarity rule is generally corroborated by the results across four types of sentence conditions taken together with the older children, it overridden by a set of factors.

To sum up part 4.2., the children substitute the anaphoric pronouns in the elicited imitation task in the following manner: zero pronouns are used most frequently, followed by the personal pronouns; demonstrative are hardly ever produced and hence will not be treated below. When the children produce zero pronouns, they generally prefer subjects and not objects. The situation differs

across conditions: the preference for subject is most clear in condition D – even the youngest group of children favour animate subjects. The preference for subjects is less clear in condition A, and most vague in condition C. All children preferably resolve the zero anaphora into the animate subjects, thus showing sensitivity to animacy. Remarkably, if the subject is used together with the inanimate object, then the preference rate is higher than with an animate object. However, in condition B, the youngest children definitely go for objects ($p < 0,0157$), and the older groups show a performance at chance level. The youngest children prefer animate antecedents – the summary of all conditions, except for C, shows that irrespectively of the syntactic role they choose animate antecedents. Since the rate of the erroneous uses of personal pronouns is low, only restricted conclusions can be drawn.

The anaphoric system of the youngest group of Russian-speaking children can be said to consist of zero and personal pronouns without the clear division of functions within these two types of anaphora. This diffusion can be interpreted in terms of the structural peculiarities of the target system children acquire. In this target system, the personal pronouns are underspecified, and there is no clear <one form -- one function> relationship. Moreover, the zero pronouns also do not exhibit a clearly restricted and transparent (contextually deciphered) relationship to their antecedents. This situation is complicated by the processing work children have to perform in the anaphora resolution process.

The attempt to build the schema of the resolution rules depending on (a) the salience status of an antecedent and (b) the type of pronouns is presented in (6). This schema is a linear continuum – for the older children (four types of potential antecedents) – with the salience decreasing towards the right edge:

(6) animate S > inanimate S > animate O > inanimate O

These four types of sentences build a somewhat different continuum of hierarchical salience if looking at younger children and if one treats the object and subject in tandem. Since younger children rely more strongly on animacy, this continuum will have the following order, with the salience decreasing left-right:

(7) animate (S,O) > inanimate (S,O)

In (7), the notions of subject and object are not yet clearly ‘governed’ by the anaphoric functions of pronouns and are not yet established in the system of anaphoric reference. This establishment develops towards the group of the older children, which rank subjects higher and thus choose them as antecedents in conditions where the subject and objects exhibit a similar level of animacy.

More research needs to be done in order to examine the establishment of the system of the anaphoric pronominal reference in children. This will be the subject task of the next set of experiments.

6 References

- Adamec, P. (1988). K vyjadřování a rozpoznávání koreference c ruštiny a češtině. *Československá 1988*: 167-177.
- Ambridge, B. & J. Pine (2007). Testing the Agreement/Tense Omission model using an elicited imitation paradigm. *Journal of Child Language*, 33: 879-898.
- Ariel, M. (2001). Accessibility Theory: An Overview. In: T. Sanders, J. Schilperoord & W. Spooren (eds.), *Text Representation*. Amsterdam, Philadelphia: Benjamins, 29-88.
- Bamberg, M.G. (1987). *The Acquisition of Narratives*. Berlin, New York, Amsterdam: De Gruyter.
- Bittner, D. (2002). Emergence of grammatical complexity and markedness in the acquisition of verb and noun phrases in German. In: K. Dziubalska-Kolaczyk & J. Weckwerth (eds.), *Future Challenges for Natural Linguistics*. Wien: Lincom, 25-56.
- Bittner, D. (2007). Early functions of definite determiners and DPs in German first language acquisition. In: Stark, Elisabeth, Elisabeth Leiss & Werner Abraham (eds.), *Nominal determination. Typology, context constraints and historical emergence*. Amsterdam/Philadelphia: Benjamins (Studies in Language Companion Series 89), 213-238.
- Bosch, P., G. Katz & C. Umbach. (to appear). The Non-Subject Bias of German Demonstrative Pronouns. In M. Schwarz-Friesel, M. Consten, M. Knees (eds), *Anaphors in Texts Cognitive, formal and applied approaches to anaphoric reference*, 145–164.
- Brennan, S., M.W. Friedman & C.J. Pollard (1987). A Centering Approach to Pronouns. *Proceedings of the 25th Annual Meeting of Association for Computational Linguistics*, Stanford, 155-162.
- Burzio, L. (1996). The Role of the Antecedent in Anaphoric Relations. In: R. Freidin (ed.), *Current Issues in Comparative Grammar*. Dordrecht: Kluwer.
- Bussmann, H. (1996). *Routledge Dictionary of Language and Linguistics*. London, New York: Routledge.
- Dale, P. & C. Crain-Thompson (1993). Pronouns reveals: Who, when, and why? *Journal of Child Language*, 20:573-589.
- Dobrova, G.R. (2003). *Ontogeny of the Personal Dexis (personal pronouns and kinship terms)*. [Ontogenez personal'nogo deiksisa (lichnyje mestoimtnija i terminy rodstva)]. St. Peterburg: RGPU-Press.
- Franks, S. (1995). *Parameters of Slavic Morphosyntax*. Oxford: Oxford University Press.
- Gagarina, N. (2006). Pervyje mestoimenija v detskoj rechi (na materiale dannyh ruskoy rechi dvuh detej: bilingva I monolingva). [Early pronouns in child speech: A comparison of two children: a Russian monolingual and a German-Russian bilingual]. *Proceedings of the Conference on Language Development and Linguistic Education of Children*, Orjol (Russia): Kartusch, 126–129.
- Gagarina, N. & I. Guelzow (2007). Anaphoric elements in discourse. *Talk presented at the Workshop on the Information Structure in Adult and Child Language*. 29-31 March 2007, MPI Nijmegen.

- Golinkoff, R.M., C.G. Harding, V. Carlson-Luden & M.E. Sexton (1984). The infant's perception of causal events: The distinction between animate and inanimate objects. In L.P. Lipsitt (ed.), *Advances in infancy research*, 3. Norwood (NJ): Ablex, 145-151.
- Grosz, B., S. Weinstein & A. Joshi (1995). Centering a framework for modeling the local coherence of discourse. *Computational linguistics*, 21.2.
- Gundel, J., N. Hedberg & R. Zacharski (1993). Cognitive status and the form of referring expressions in discourse. *Language*, 69.2.
- Haijčova, E., B. Partee & P. Sgall (1993). *Topic-Focus Articulation, Tripartite Structure and Semantic Content*. Dordrech: Kluwer.
- Hickmann, M. (2003). Children's discourse: Person, space and time across languages. *Cambridge Studies in Linguistics*, 98. Cambridge: Cambridge University Press.
- Hickmann, M., M. Kail, & F. Roland (1995). Cohesive anaphoric relations in French children's narratives as a function of mutual knowledge. *First Language*, 15: 277-300.
- Huang, Y. (2000). *Anaphora: A cross-linguistic study*. Oxford: Oxford University Press.
- Isacenko, A.V. (1968). *Die Russische Sprache der Gegenwart*. VEB Max Niemeyer Verlag.
- Kail, M. (1976). Stratégie de compréhension des pronoms personnels chez le jeune enfant. *Enfance*, 3-4: 447-466.
- Karmiloff-Smith, A. (1981). The grammatical marking of thematic structure in the development of language production. In: W. Deutsch (ed.), *The child's construction of language*. London: Academic Press, 121-147.
- Karmiloff-Smith, A. (1980). Psychological process underlying pronominalization and non-pronominalization in children's connected discourse. In J. Kreiman & A.E. Ojega (eds.) *Papers from the parasession on pronouns and anaphora*. Chicago: Chicago Linguistic Society.
- Koktová, E. (1992). Anaphoric expressions across clause boundary in pro-drop languages. *Prague Bulletin of Mathematical Linguistics*, 58: 39-63.
- Krasavina, O. (2004). Upotrebljenje ukazatel'noj imennoj gruppy v ruskom pis'mennom narativnom diskurse. [The use of a demonstrative NP in Russian written narrative discourse. *Issues in Linguistics*] *Voprosy jazykoznanija* 3: 51-68.
- Krasavina, O., C. Chiarcos & D. Zalmanov (2007). Aspects of topicality in the use of demonstrative expressions in German, English and Russian. *Proceedings of the 6th Discourse Anaphora and Anaphor Resolution Colloquium (DAARC-2007)*, Lagos (Portugal), March 29-30.
- Kresin, S.C. (1998). Deixis and thematic hierarchies in Russian narrative prose. *Journal of Pragmatics*, 30: 421-435.
- Levinson, S.C. (2000). *Presumptive Meanings: The theory of generalized conversational implicature*. Cambridge (MA), London: MIT Press.
- Lust, B. (1981). Constraint on anaphora in child language: A prediction for a universal. In: S. Tavakolian (ed.), *Language acquisition and linguistic theory*. MA, MIT Press, 74-96.
- MacWhinney, B. (2000). *The CHILDES project: tools for analyzing talk. Vol. I: Transcription, format and programs*. Mahwah (NJ): Lawrence Erlbaum Associates.
- Nicolova, R. (1986). *Bulgarskite mestoimenija*. [Bulgarian Pronouns] Sofia: Nauka i izkustvo.
- O'Grady, W. (2005). *How Children Learn Language*. Cambridge: Cambridge University Press.
- Paducheva, E. V. (1985). Vyskazyvanije i ego sootnesjonnost' s deistvitel'nost'ju (Referencial'nyje aspekty semantiki mestoimenij). Moskva, Nauka.

- Poulin-Dubois, D., A. Lepage & Ferland, D. (1996). Infants' concept of animacy: Conceptual foundations for verb learning 38. *Cognitive Development*, 11: 19-36.
- Reinhart, T. (1983). *Anaphora and semantic interpretation*. London: Croom Helm.
- Revzin, I. (1973). Transformacionnoe issledovanie konstrukcij s sub'ektnym i ob'ektnym priimennym dopolneniem: Genitivus subjectivus i Genitivus objectivus". In A.A. Zaliznjak (ed.), *Problemy grammatičeskogo modelirovania*. Moscow: Nauka, 88–95
- Richard, M., P. Girouard & T.G. Décarie (1999). Personal pronouns and perspective talking in tofflers. *Journal of Child Language*, 26: 681-697.
- Rosental, D.E., I.B. Golub & M.A. Telenkova (1991). *Sovremennyj russkij jazyk*. Moskva: Vysshaja Shkola.
- Sasse, J. (2001). Recent Activity in the Theory of Aspect: Accomplishments, Achievements, or just Non-progressive State?. *KLANN, Arbeitspapiere*, 40. Köln.
- Švedova et al. (1980). *Russkaja Grammatika-80*. Moskva.
- Siegmüller, J. and C. Kautchke (2006). *Patholinguistische Therapie bei Sprachentwicklungsstörungen*. München: Urban & Fischer.
- Strube, M. & U. Hahn (1999). Functional Centering: Grounding referential coherence in information structure. *Computational Linguistics*, 25.3: 309-344.
- Voelikova, M. (2000). *Existential Sentences*. München: Lincom.
- Wykes, T. (1981). Inference and children's comprehension of pronouns. *Journal of Experimental Child Psychology*, 32: 264-278.

7 Appendix 1

Fellow 1

Fellow 2

Šenten.		
type	Type of subject	Type of object
A	Animate Subject <i>Hare</i>	Animate Objec <i>Lion</i>
B	Inanimate Subject <i>Ball</i>	Animate Objec <i>Bear</i>
C	Inanimate Subject <i>Bus</i> <i>Tractor</i>	Inanimate Objec <i>Tractor</i> <i>Bus</i>
D	Animate Subject <i>Elephant</i>	Inanimate Objec <i>Tractor</i>

enten.		
type	Type of subject	Type of object
A	Animate Subject <i>Lion</i>	Animate Object <i>Hare</i>
B	Inanimate Subject <i>Tractor</i>	Animate Object <i>Elephant</i>
C	Inanimate Subject <i>Scarf</i>	Inanimate Objec <i>Pencil</i>
D	Animate Subject <i>Bear</i>	Inanimate Objec <i>Ball</i>

Production and comprehension of intersentential pronominal reference in early child Bulgarian - an experimental study^{*}

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The paper presents results from a combined production and comprehension study addressing some of the factors which guide the establishment of intersentential pronominal reference in child and adult Bulgarian. We investigate the time course and different stages in the acquisition of null, personal and demonstrative pronouns and their specific anaphoric functions. We target possible age-induced changes in the salience hierarchy of referent features such as animacy and grammatical role. Following the general consent in the field of anaphora research, we assume a division of labour between different pronominal forms with respect to the salience of their referents. Based on the data of Bulgarian preschool children we investigate the validity of this form-function relation, its language-specific shape and its developmentally induced variation. The results reveal an initial prominence of animate referents which later on develops into preference for animate subjects. Although the investigated 3 to 5 year old Bulgarian children do not stick to the adult anaphora resolution strategy, they comply with the principle of the reversed mapping within the range of tested pronouns and react according to their salience criteria which promote animate subjects as the most prominent co-reference candidates.

1 Introduction

In every communicative situation a speaker needs to choose such referring expressions that the addressee could reasonably establish a co-reference relation to the entity meant by the speaker. The success of such interactive communication processes depends on the evaluation of the referents' accessibility status by the

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This study is part of a cross-linguistic investigation conducted together with D. Bittner and N. Gagarina and I. Gülzow. I am grateful to N. Tchenkova for transcribing and coding the data. I'm indebted to E. Andonova for her support in the statistic analysis.

communication participants and on their ability to encode the accessibility status by means of appropriate referring expressions.

Theories dealing with the mapping between the accessibility status of the referent and the type of referring means (Ariel 2001 & 2004; Givón 1983; Gundel, Hedberg & Zacharski 1993; Levinson 2000, *inter alia*) have established a reversed correlation between the complexity of referring expressions and the activation status of a referent in the working memory. Referents which are in the focus of attention need the simplest referring expression and vice versa.¹ Such a reversed mapping presupposes two ordered sets. The first set reflects a ranking of referents according to their accessibility score. The second set concerns the number and the ordering of available referring expressions according their complexity.

From a developmental perspective, the time course and possible stages in the acquisition of intersentential pronominal reference have to be investigated in order to provide language specific and cross-linguistically valid evidence for the following questions: Do children rely on a unique salience hierarchy of referent features as diverse as animacy, agency, syntactic role, linear distance or discourse status and are there age induced changes in the feature ranking? When and in which contexts do children use structural contrasts between pronominal classes to uniquely identify ambiguous referents? Are there general developmental patterns and do they diverge or converge in a cross-linguistic comparison?

While it is possible to assume the universal validity of the reversed mapping between the salience rank of referents and the complexity of referring expressions, both sets taken separately are subject to language dependent variation. In order to set up the conditions of successful co-reference establishment in a given language, both sets are to be considered in more detail.

1.1 The set of referring expressions in Bulgarian

Bulgarian is a South-Slavic language with a relatively free word order, but SVO is perceived as the basic variety. As a member of the Balkan linguistic union, Bulgarian exhibits some nominal properties which set it apart from the other Slavic languages. Bulgarian is an analytic language and has no nominal case system. The only preserved case differentiation amounts to the accusative and dative forms of the short personal pronouns. Bulgarian nouns are organised in a 3-gender system. Nominal definiteness is expressed by means of gender/number specific enclitic definite articles attached to the first member of the nominal

¹ See Kaiser (2005) for a different approach to anaphora resolution and argumentation against a unified notion of salience.

phrase. Additionally, nominal definiteness may also be marked by a demonstrative pronoun heading the nominal group like in all other Slavic languages.

A special feature of Bulgarian is its double pronominal system: the classes of the personal, the reflexive and the possessive pronouns exhibit a system of full (long) and enclitic (short) pronominal forms. The use of the short pronoun together with its full form or with a noun is a phenomenon known in the literature as 'clitic doubling' and is subject to pragmatic restrictions such as topic marking. The pronouns of the 3rd person singular exhibit gender distinctive forms in nominative and the oblique cases.

Bulgarian speakers may alternate between an overt and a covert realisation of the subject position. Morphologically distinct agreement markers on the verb assure the person/number identification. Bulgarian is a typical subject-drop (or pro-drop) language (see Bojadzhiev et al. 1999:596f. for the application of defining typological criteria to Bulgarian). Personal pronouns for first and second person singular and plural are obligatorily left out if not emphatically stressed.

Sentences with a non-overt realisation of a 3rd person subject may be formally divided with respect to the grammatical person and number of the pronoun (see definitions and functions in Andreicin 1978). Subjectless sentences with 3rd person plural predicates function similarly to passive sentences. They highlight the action without naming the performer. Such constructions are called unspecified personal sentences. The dropped subject is understood as referring to a human performer. The distinction between singular and plural is neutralised, in the sense that the construction is felicitous even if a single person carries out the action (Rå Hauge 1999:134). The main characteristic of the unspecified personal constructions is the requirement that the dropped subject has to be a person.

Compared to the clear interpretation of the unspecified personal constructions, the non-overt realisation of the subject in clauses with 3rd person singular predicates is a phenomenon whose felicity conditions still lack a precise description. There is a general consent that the subject of a clause may be dropped if its referent is apparent to the participants of a given communicative situation. This general rule surfaces differently in spoken and written language. While in a spoken discourse a highly accessible referent may be referred to by a null pronoun without a preceding explicit introduction, in written discourse the referent has to be introduced explicitly. In written discourse a null pronoun needs an antecedent, in spoken discourse not necessarily. Consider a situation in which a father sees the mother coming out of their son's room. The subject drop in both dialog utterances (1a) and (1b) is not only grammatical and acceptable but actually the preferred option.

- (1) a. Spi li?
 sleep 3SG PRES IMPF question particle
 Is (he) sleeping?
- b. Da, naj-nakraja zaspā.
 Yes last end sleep 3SG AOR PF
 Yes, in the end (he) fell asleep.

The picture becomes more complicated if there is more than one available referent. In such cases morphological markers play a disambiguating role. Apart from the general consent that the overt subject expression may be left out if its referent is accessible from the context (by virtue of its salience or semantic inference), Bulgarian grammarians (Nicolova 1986:43; Ilieva 1985:31) concede that the establishment of co-reference relations by means of non-overt 3rd person singular pronouns still awaits a profound analysis. The use of overt 3rd person personal pronouns in contexts with several probable antecedents seems problematic, too. The gender distinction expressed in the overt 3rd singular personal pronouns, which is the only difference between the overt and non-overt pronominal realisations,² is an important but often not a sufficient disambiguation cue. In a context with a high ambiguity potential, substitution of a subject-drop by an overt personal pronoun often cannot resolve the referential vagueness, because of the tiny functional difference.

The distribution of demonstrative pronouns in Bulgarian deviates considerably from the function of demonstratives in the anaphoric systems of the other Slavic languages. Definite demonstrative pronouns are divided into the classes of proximal *tozi/toja* 'this' and distal pronouns *onzi/onja* 'that'. More important than the proximal / distal difference is the functional differentiation between the neutral demonstrative form *tova*, on the one hand, and the feminine and masculine forms, on the other. The neutral proximal pronoun *tova* 'this' is the basic deictic marker similar to a pointing gesture (and often accompanied by such). It is the standard means used for the selection and identification of a particular referent in choice situations.

Utterances containing bare masculine or feminine demonstratives are very infrequent and are treated by the speakers as not really well-formed. Ivančev (1978:225) argues that utterances like (2a) if accepted are actually understood as elliptic nominal phrases as in (2b). A personal pronoun seems to be the most felicitous expression (2c).

² The formal difference between overt and null subjects with respect to the expression of gender is obviated in cases of complex predicates containing past participles which exhibit gender agreement.

- (2) a. ? Tazi e pevica.
this_{proximal} DEM 3SG FEM be_{3SG PRES IMPF} singer_{FEM SG INDEF}
This is a singer.
- b. Tazi zhena e pevica.
this_{proximal} DEM 3SG FEM woman_{FEM SG} be_{3SG PRES IMPF} singer_{FEM SG INDEF}
This woman is a singer.
- c. Tja e pevica.
She_{3SG FEM} be_{3SG PRES IMPF} singer_{FEM SG INDEF}
She is a singer.

In Bulgarian, anaphoric uses of bare demonstratives are considered old-fashioned and bad style. (Ivančev 1978:185f.; Rå Hauge 1999:53). Opposite to Czech and to some extent to Russian, Bulgarian does not employ bare demonstrative pronouns to signal that an antecedent from the focus part of the preceding sentence has become the topic in the current sentence. Bulgarian demonstratives are able to function properly as anaphoric devices only in complex nominal phrases in which they appear as specificity markers. In such cases the demonstrative pronoun as a part of a synonymous nominal phrase (3c) signals a topic shift and enters into an opposition to the definite article (compare also Ginina 1980). The demonstrative nominal phrase contrasts also with the personal pronoun which tends to preserve the established topic referent (3b). Consider the possible continuations of a discourse segment introduced as in (3a).

- (3) a. Dirigentät_i srestna tenora_k.
The conductor met the tenor.
- b. Toj_{i/k} ne beshe dovolen ot izpālnenieto.
He was not happy with the performance
- c. Tozi ambizosen pevez_k ne beshe dovolen ot izpālnenieto.
This ambitious singer was not happy with the performance

While the personal pronoun in (3b) tends to be resolved to the conductor, the very explicit demonstrative phrase shifts attention to the singer (3c).

The rank of demonstrative pronouns within the means establishing discourse co-reference in Bulgarian is perhaps best understood through its cataphoric function. Prototypically, the bare demonstrative pronoun appears as head of a defining relative clause (4). This complex syntactic construction illustrates the fact that demonstratives appear in expressions promoting referents which are not in the focus of attention and actually still have to be identified more pre-

cisely (cf. Charalossova 1995 for an extended discussion of the deictic and anaphoric functions of Bulgarian demonstrative phrases).

- (4) Tozi, kojto e vzel knigite, trajva da gi varne.
 This _{3SG MASC} who take _{3SG PERF PF} must to bring _{3SG PRES PF} them back
 The one who has taken the books must bring them back.

Figure 1 presents a (non-exhaustive) list of referring expressions in Bulgarian which are ordered relatively according to their increasing formal complexity. Obviously, in the set of anaphoric referring expressions the pronouns appear to be the minimally complex forms. The difference between null pronouns and personal pronouns in subject position amounts to a morphological gender expression in the 3rd person singular. There is more pronounced increase of formal complexity with respect to the oblique cases of the personal pronouns which is based on the double system comprising full/short forms. The definite demonstrative pronouns have left their position in the row of anaphoric pronouns and have acquired a new one in the row of nominal phrases.

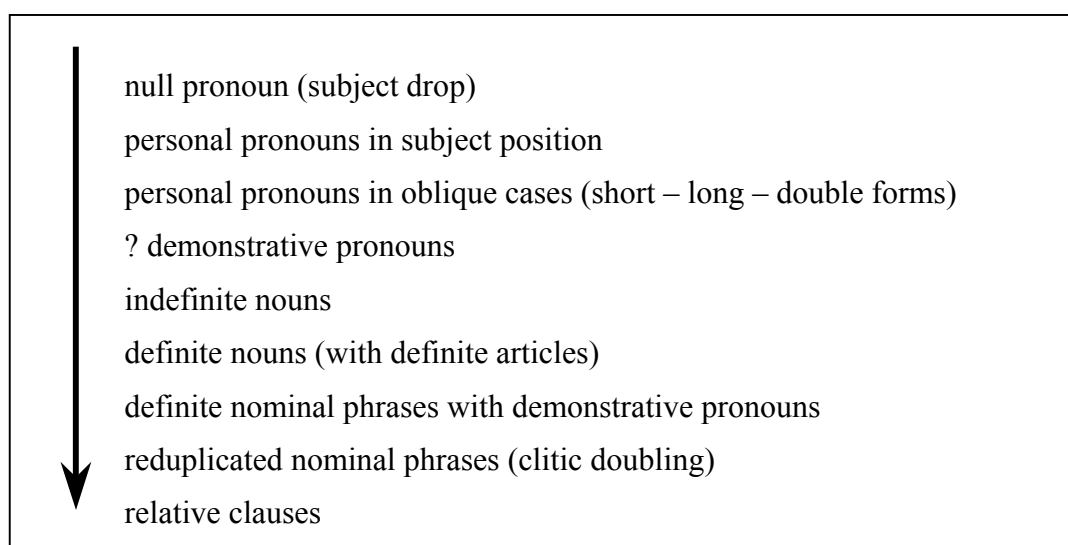


Figure 1: Types of anaphoric expressions

The complexity-based opposition between personal and demonstrative pronouns as anaphoric pronouns known from other Slavic (e.g. Czech) or Germanic languages (e.g. German) appears in Bulgarian on the level of definite noun phrases as a functional opposition between the definite article and the demonstrative pronoun in their functions as determiners.

1.2 The concept of salience and salience determining factors

The literature on discourse organisation in Bulgarian and in particular on the establishment of intersentential co-reference relations reveals a clear influence of the Prague linguistics school and its theory of the functional sentence perspective. As far as the function and distribution of different pronominal types are treated in discourse context, this happens according to their appearance in the theme (topic) or in the rheme (focus) part of the sentence. Theme and rheme are understood as pieces of information structure differentiated by their degree of communicative dynamism (cf. Sgall, Hajicova & Panevova 1986). Grammatical role and word order are some of the basic notions determining the dynamism degree. Subject status and preverbal position are associated with the theme, the part with the lowest dynamism status. The subject is the pivot of the predication and therefore the most static piece of information. The subject referent is thus easily accessible, representing an entity of the knowledge shared by the communicative partners. According to Hajicova, Partee & Sgall (1993) this property of topic subjects makes them highly accessible for pronominalisation.

To start with the use of null pronoun in Bulgarian, let us consider the felicity condition of subject drop in the formulation of Maslov (1981:356) "*The obligatory semantic-syntactic condition for implicitness of the subject is its identity with the theme.*" (translation M.K.). An implicit prerequisite for the application of the definition is the need to determine which one of the antecedents is best candidate to become the theme of the anaphoric sentence. Only then the antecedent will be accessible for a non-overt reference. Some Bulgarian scholars (e.g. Ivančev 1978) favour "the march of ideas", stating that rhematic referents are in the focus of attention, and therefore they are the preferred candidates to become the topic in subsequent sentences.

In a comparison between Czech and Bulgarian use of pronominal reference Uhliřova (1990:281) also points out that in Bulgarian, anaphoric subject drop is often used to take up a referent associated with the rheme (non-subject antecedent) of the preceding sentence. Further she notes that the use of personal pronoun is always possible, while subject drop is correlated with an informationally non-actualised referent (theme continuation). In this sense Ivančev (1978:175) says that subjects expressed by personal and null pronouns represent transition elements in the information load of an utterance. In a further development of this idea, Leafgren (2001) shows that in Bulgarian, personal pronouns and subject-drop keep track to one referent entity. The use of these minimal pronominal types marks the establishment of a discourse theme.

Whether the antecedent subject or object will be pronominalised in the subsequent utterance and by which pronoun type depends partly also on the animacy of the referent. Traditionally, animacy is not treated as a morphologi-

cally expressed nominal category,³ mainly because Bulgarian has lost its case system which in the remaining Slavic languages helps to mark animacy differences. Nevertheless, the semantic notion plays a significant role as discourse-relevant factor. It is utilised as an important disambiguation factor in models of natural language processing. In her algorithm of pronominal resolution, Ilieva (1985) applies animacy as the primary disambiguation criterion and only afterwards morphological filters for gender and number. Animacy is assigned a comparable rank also in advanced automatic models of anaphora resolution as a part of the semantic module (see Mitkov 1994).

Recalling the brief discussion of sentence types with null-subjects in section 1.1, animacy and especially humanness turn out as features which make a referent even more accessible to null anaphors in Bulgarian. These types of subject-drop constructions provide a piece of evidence supporting Comrie's generalisation "*...the most natural kind of transitive construction is one where the A is high in animacy and definiteness, and the P is lower in animacy and definiteness; and any deviation from this pattern leads to a more marked construction.*" (Comrie 1989:128).

2 Empirical investigation

In order to gather more empirical facts about the assumed relationship between the activation status of the referent and its linguistic encoding, we designed an experiment which was conducted with Bulgarian adults and children.⁴ The activation status of a referent depends on a quite inhomogeneous array of factors functioning on the sentence level and on the discourse level.

In the present study we investigate the factors animacy and grammatical role in terms of their relative weight for the activation status of an available referent. The chosen experimental method guarantees that other important factors such as differences in givenness (cf. Gundel, Hedberg, and Zacharski 1993) were controlled by the perceptual availability of both referents. On the level of linguistic expression, the equality of givenness values was upheld by using only definite nouns for the constitution of the context.

With respect to the types of referring expressions, only pronominal anaphors in subject position were tested. We selected three types of pronouns which differ from each other by the degree of formal complexity, the distance between them in the set of anaphoric expression and their acceptability as anaphoric means both in terms of grammatical well-formedness and pragmatic appropriateness.

³ See literature overview and extended discussion on animacy as nominal category in Bulgarian in (Kostadinova 1995).

⁴ Parallel experimental investigations were conducted with German and Russian children. See extended discussions by D. Bittner and N. Gagarina in the present volume.

Assuming a universal application of the reversed mapping between anaphoric complexity and the accessibility of referents, we expect that Bulgarian adults comply with this principle within the functional distribution of anaphoric expressions in Bulgarian, and in particular within the pronominal system. Looking at the co-reference understanding of the adult speakers, we seek empirical evidence supporting or rejecting the hypothesis that the investigated salience properties are hierarchically ordered in Bulgarian.

The investigation of child language aims at determining whether formal complexity (understood as length of the sound string) is the criterion children choose as a starting point in the acquisition of co-reference establishment by means of anaphoric pronouns. The pro-drop property of Bulgarian allows an insight into the development of a referential technique in which the referring expression does not exhibit a physical form, and into the mechanism promoting its differentiation from techniques working with overt anaphoric means. Given the high frequency of subject drop in Bulgarian, we investigate how young children assign an interpretation to the null pronoun and which factors they initially rely on for co-reference establishment.

A basic aim of the study is to find out whether children start with the same interpretation of null pronouns as adults. If they do so, what is the most important referent feature which guides their interpretation? In case the subject-drop interpretations of young children and of adults deviate, two issues are of interest. Is the interpretation difference based on a different ranking of the investigated salience cues? At which age does this difference disappear and what developmental pattern leads to the adult way of understanding null anaphors?

As a next step, the study aims at possible differences between the interpretation of null, personal and demonstrative pronouns based on their different perceptual salience (sound length). The analysis of the production sample of the three pronouns in terms of quantity and distribution will provide additional information about the assumed influence of the investigated referential properties – animacy and syntactic role – on the use of pronominal anaphors. Taken together all these information sources allow inferences concerning the primary research question: Do children acquiring Bulgarian as a first language comply with the reversed mapping principle when they produce and comprehend anaphoric pronouns?

2.1 *Experimental method*

We conducted a combined production and comprehension experiment comparing the performance of children and adult groups. The intention behind the experimental design is to find out how Bulgarian children of different age groups

interpret salience cues like animacy and syntactic role when producing and resolving pronominal anaphora of varying complexity in ambiguous situations.

2.1.1 Subjects

A total of 151 monolingual Bulgarian children participated in the experiment. As indicated in Table 1, the children were divided in 5 homogeneous age groups in age brackets set 6 months apart.

The children were tested in a separate room in their kindergarten. Additionally, 20 adult Bulgarians (16 to 54 years old, mean age 34) were tested as a control group. The experiment was conducted in Vidin, and therefore all subjects speak the North-Western variety of Bulgarian.

Table 1: Age groups

Group	Mean age	Age bracket	Number
1	3;0	2;10 - 3;03	30
2	3;6	3;04 - 3;09	30
3	4;0	3;10 - 4,03	32
4	4;6	4;04 - 4,09	28
5	5;0	4,10 - 5,03	31

2.1.2 Materials and design

We conducted a combined production and comprehension experiment in the form of a playing situation. The subjects were presented with short stories (mean length 5 clauses) about two protagonists, acted out with puppets by the experimenter, who tells the story. A second experimenter played a distracted penguin using a hand puppet. In the production part of the experiment, the penguin named Toto asked the children to repeat an anaphoric utterance. In the comprehension part, the penguin prompted the children to resolve the pronoun by asking them to choose one of the referents.

The stories represent 4 constellations of referent properties lined up according to the factors ANIMACY (\pm animate) and SYNTACTIC ROLE (subject/object). We constructed 4 antecedent sentence types (see Table 2) and combined each of them with 3 different anaphoric utterances – one with subject drop, one containing a personal pronoun and one with containing a demonstrative pronoun.

Table 2: Combination of referent features in the antecedent sentences

Sentence	Subject & object animacy	Example
A	animate SUB & animate OBJ	The lion is biting the tiger.
B	inanimate SUB & animate OBJ	The ball is touching the bear.
C	inanimate SUB & inanimate OBJ	The bus is pushing the tractor.
D	animate SUB & inanimate OBJ	The elephant is driving the tractor.

In order to control gender cues, the nominal antecedents were always of the same gender, either masculine or feminine. In Bulgarian, ball and bear are feminine nouns. For subsequent reference by means of a 3rd person singular personal pronoun, the feminine form *tja* – "she" has to be used. We tested the disambiguation power of 3 pronominal types with increasing complexity: null pronouns (subject-drop), personal pronouns and proximal demonstrative pronouns.

We prepared 2 sets of stimuli for the resulting 12 conditions. The children were randomly assigned to one of the two stimuli sets. The stimuli were randomised by means of the Latin square. The experiment was conducted in two sessions of 6 stimuli each, with a break between them in which the children did a story telling task.

2.1.3 Procedure

The children were tested in a quiet room in the kindergarten. The child and the two experimenters sat together at a table. The first experimenter introduced to the child the second experimenter as Toto the penguin, who came to Bulgaria for a holiday. Then she explained that she is going to show some toys and to tell stories about them. The children were told that Toto is a little distracted and does not understand Bulgarian properly because he comes from the South Pole. The children were asked to listen carefully to the stories and to help Toto if he misses the point.

In each stimulus unit, the penguin asked the child to repeat the target utterance which was the last one in the story. Usually the child repeated the anaphoric sentence more or less correctly. The anaphoric sentence makes a statement about a visual property which is true for both referents. In this situation of ambiguous reference, the penguin asked the child a clarification question in order to find out which referent is meant by the child. Usually the child named the referent and pointed at it. Some children responded only by pointing. A stimulus example and the course of the procedure are illustrated in Figure 2. Each subject received a training session. The child received only positive feedback, independent of repetition accuracy and referent choice. The children were videotaped in such a way that their faces were not visible.

Exp. 1:	Look! This is a ball and this is a bear. (Both toys are white.) The ball is falling on the table. The ball is springing on the table.
Antecedent clause:	Now the ball is touching the bear.
Anaphoric clause:	It / this / Ø is white.
Exp. 2 (Toto):	I didn't understand. Repeat this for me, please.
Child: (production)	It is white.
Exp. 2 (Toto):	Who is white?

Figure 2: Experimental procedure

2.2 *Transcription and coding*

The videotapes were transcribed by a native speaker. A 10% sample of randomly chosen transcripts was checked for accuracy by a second person. No deviations were found.

The answers the children gave in the production part of the experiment were coded in the following 6 categories: null pronoun (NULL), personal pronoun (PP), demonstrative pronoun (DEM), noun (N), ellipsis (E) and no answer. Personal and demonstrative pronouns were coded respectively, independent from their status as (in)correct repetition with respect to the given pronoun type. The responses were assigned to the noun category when children used a bare noun, a definite noun (with a post-posed definite article), a definite nominal phrase consisting of a noun and a demonstrative pronoun, or a proper name. If a child responded with an utterance of the type "*This bear is white*", the answer was assigned to the noun category, although the child also produced a demonstrative pronoun. Cases in which the children produced only the adjective "*White.*" without the copula verb were coded separately as ellipsis. As null pronouns were coded only the cases in which children produced verbs (full verbs/copula) whose agreement markers signal the presence of a null pronoun. Note that in Bulgarian utterances with subject drop like "*Is white*" or more literary "*Ø white is.*" are completely well-formed even in copula constructions. Cases in which children remained silent were coded as no response.

For the comprehension part of the test we coded the responses to the "Who?" question in the following way: The syntactic role of the chosen referent was coded as subject or object according to the syntactic role of the antecedent in the preceding sentence. The same word order (SVO) was preserved in all antecedent sentences – the subject was always the first noun and the object the second one. All animal puppets were coded as animate, the remaining toys as inanimate. No dolls resembling humans were used.

Some children did not resolve the ambiguity by stating that both referents exhibit the property in question. Such responses were coded as unclear and were not taken into consideration later on. Also as unclear were coded responses in which the child named one referent but pointed to the other, or used a different ambiguous noun such as "the vehicle" in a situation containing a bus and a tractor as referents. The last two response types appeared very seldom, under 1%. As no response were coded the cases in which the child did not react to the comprehension question either by naming or pointing.

3 Production data

In the experiment a total number of 151 children participated. For the evaluation of the production part 11 children had to be excluded, because they did not repeat anything. 9 of the children were in age group 1 (mean age 3;0) and 2 children were in the second group (mean age 3;6). The remaining 140 children achieved a high task compliance rate, producing pronouns in 92% of the time. Figure 3 presents the distribution of valid answer types. A full compliance with the repetition task would amount to an average distribution of 33,33 % for each given pronominal type and no elliptic or nominal responses.

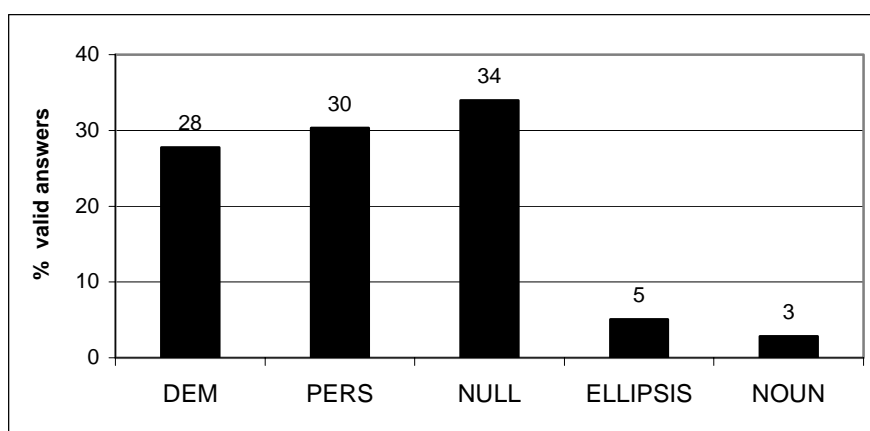


Figure 3: Distribution of valid response types

The slight preference for null pronouns – sentences with subject drop - decreases with age (compare Figure 3 and Figure 4). The same is true for the elliptical answers, in which the children repeated only the adjective and left out the copula. The use of nouns shows a slight increase with age, but is hampered by the better task compliance of the older children.

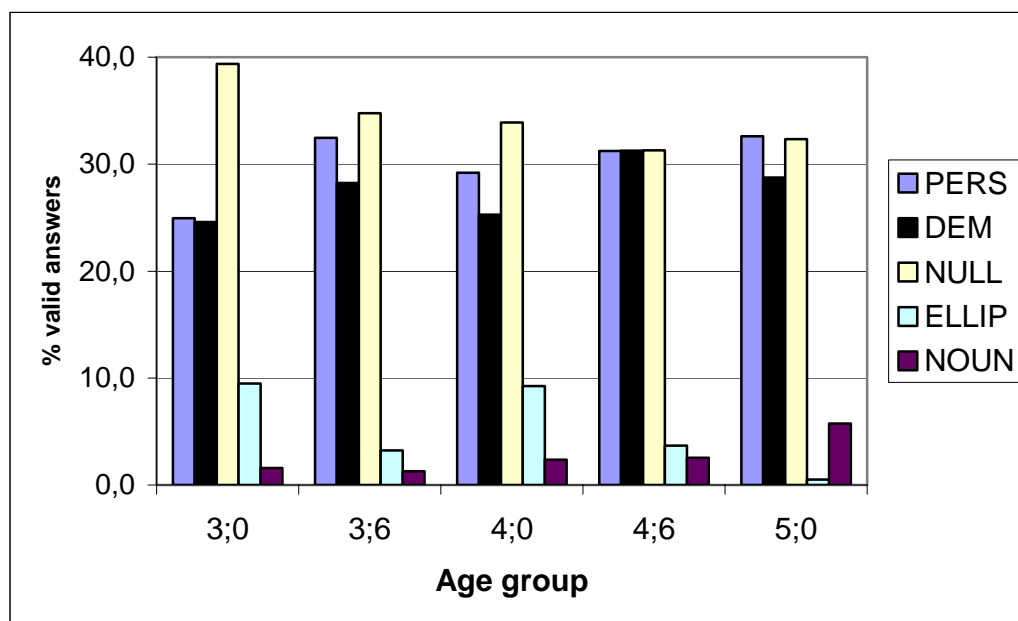


Figure 4: Repetition pattern per age group

The pattern of production errors excludes substitution of a null pronoun by a demonstrative pronoun. The most frequent deviation from the given pronoun is substitution of demonstrative and personal pronouns by subject drop. This production pattern is most characteristic for the youngest tested children and becomes levelled by the increase of personal pronouns already at the next age bracket (mean age 3;6). Apparently, younger children tend to produce elliptical answers, repeating only the adjective. This behaviour disappears with age. Apart from formal considerations (presence/absence of a predicate bearing agreement markers), the differentiation between utterances with subject drop and elliptic utterances is discussed from a comprehension point of view in section 4.2.2.

The age development of pronominal production was traced by a one-way ANOVA with the factor AGE GROUP on the proportion of produced pronouns per sentence type. We found a significant developmental change for each of the tested pronouns in sentence A (e.g. for the rate of personal pronouns $F_{(4;139)}=2,614$ $p>.044$). Tuckey's post-hock comparison between group 1 and group 4 ($p<.068$) reveals an increase of personal pronouns which reaches significance in group 5 ($p<.033$). The high rate of null pronouns produced by the youngest group decreases significantly already at the next age bracket ($p<.045$). The age effect on the production rate of demonstratives ($F_{(4;139)}=2,386$ $p>.054$) reflects an overall increase of produced demonstratives. Tuckey-HSD reveals no significant differences between the single age groups.

A significant age induced change was also found for the production rates of null pronouns in sentence D ($F_{(4;139)}=4.601$ $p>.002$). Similar to the developmental pattern of subject-drop in sentence A, we see a decrease of null pronouns

with age. However, the significant change ($p < .001$) appears later, namely between the production score of group 1 (3-year-olds) compared to group 3 (4-years-olds). This difference remains valid also between group 1 and all remaining older children in the groups 4 and 5. All other comparisons did not reach significance. In the following, we present a descriptive analysis of the production behaviour according to the 4 sentence types per age group.

Group 1 (mean age of 3;0) produces a significantly higher number of utterances with subject drop than with personal pronouns (Wilcoxon $(2,21) z = -2.54$; $p < .011$), or with demonstrative pronouns (Wilcoxon $(2,21) z = -2.414$; $p < .016$) in sentence A, and similarly in conditions C and D (see Figure 5).

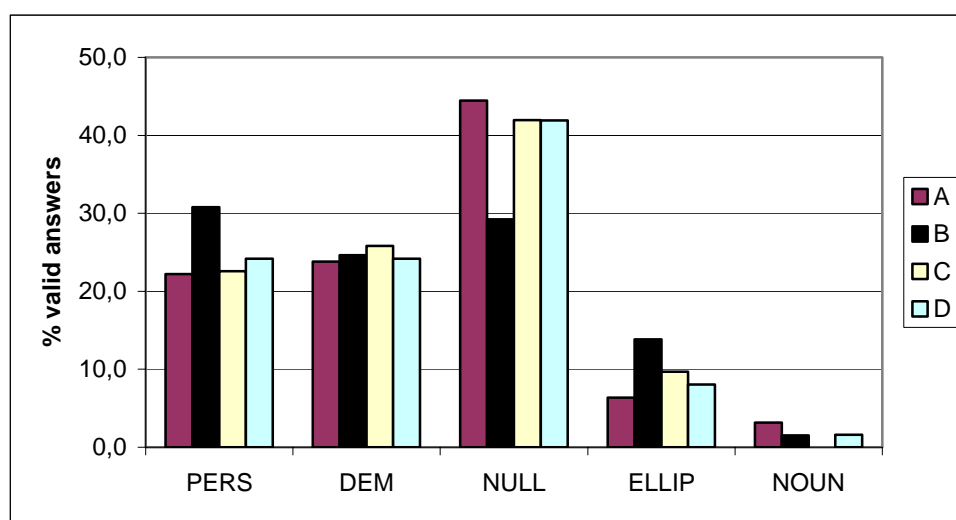


Figure 5: Production pattern of group 1 (mean age of 3;0)

The production of null pronouns in sentence B differs significantly from this pattern, which means that their rate is equal to the production rates of personal and demonstrative pronouns. The non-canonical combination of inanimate subject and an animate object in B seems to influence the production behaviour of the youngest children, prompting them to repeat the pronoun they heard or to leave out the pronoun completely, often producing minimal elliptic sentences.

The repetition pattern of group 2 (mean age of 3;6) shows no significant influence of sentence type and no preference for a pronominal type in the production pattern (see Figure 6). The repetition rates of all pronouns approach similar levels.

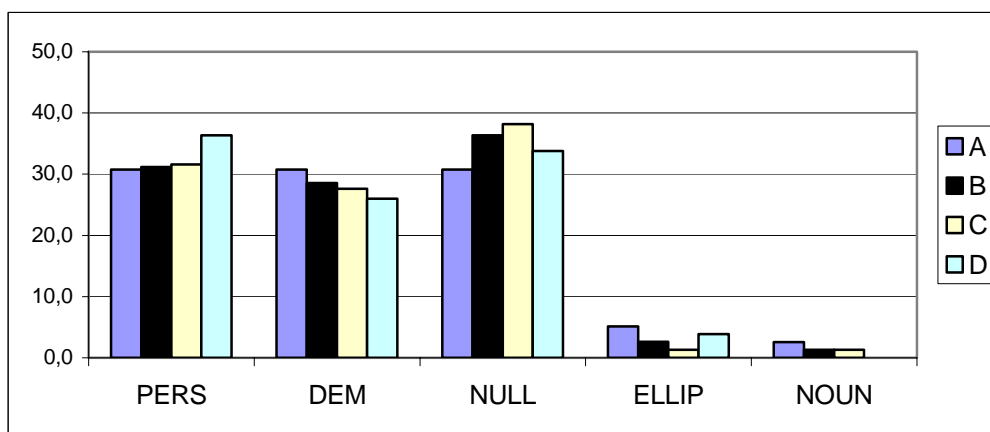


Figure 6: Production pattern of group 2 (mean age of 3;6)

In sentence A, group 3 (mean age 4;0) shows rates of subject drop (Wilcoxon $(2,32)$ $z=-2.862$; $p<.004$) and of personal pronouns (Wilcoxon $(2,32)$ $z=-2.598$; $p<.009$) which are significantly higher than the rate of demonstrative pronouns. The rates of the 3 pronominal types are levelled in condition D, while the rate of elliptic productions in it increased.

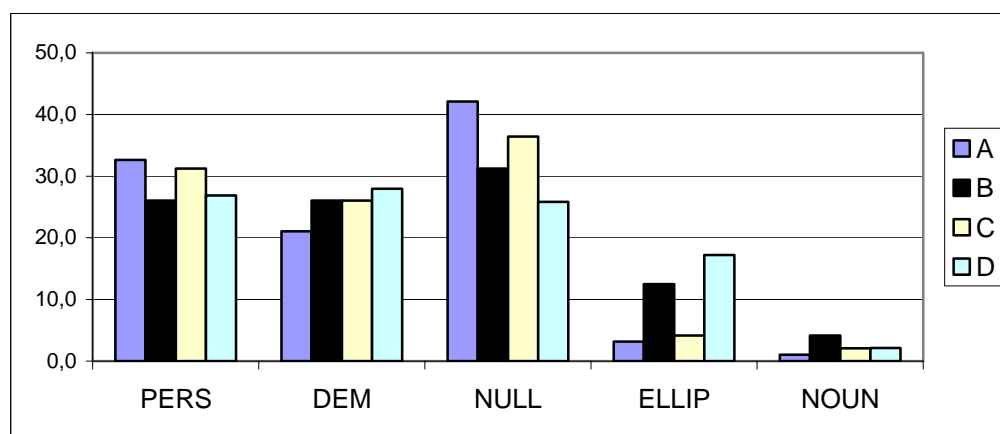


Figure 7: Production pattern of group 3 (mean age of 4;0)

The production pattern in group 4 (mean age of 4;6) shows high scores of correct repetitions for each given pronoun type. There are no differences in the production rates of the pronoun types in the four sentence categories.

In the last age group, the 5-year-old children exhibit a different production behaviour for sentence A when compared to all other sentences. In a context featuring two animate referents, the 5-year-olds preferably produce personal (Wilcoxon $(2,31)$ $z=-2.271$; $p<.023$) and null pronouns (Wilcoxon $(2,31)$ $z=-2.333$; $p<.020$) and avoid demonstratives. The increase of noun production is also related to the overall tendency for demonstratives to become substituted by nouns.

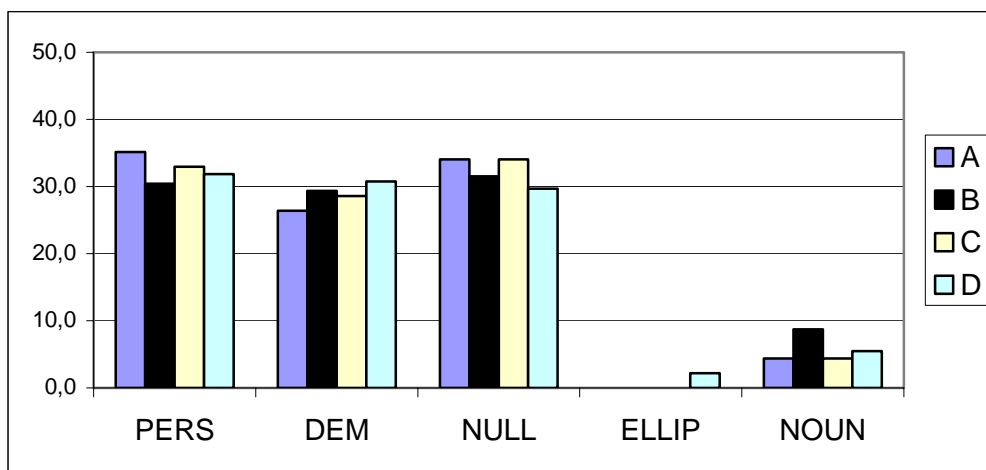


Figure 8: Production pattern of group 5 (mean age of 5;0)

To sum up, we found a developmental change in the use of the three tested pronominal types. The initial phase is characterised by an overuse of subject-drop. Later on the children gradually adjust their use of null pronouns to contexts in which there are animate subjects as antecedents. The same is true for the personal pronouns. The production pattern found in sentence A confirms the hypothesis that Bulgarian children rely on the animacy of referents to select an appropriate pronominal form. While personal and null pronouns are the preferred choice, the children start avoiding demonstrative pronouns when both referents are animate, at an age of approximately 4 years.

The production of elliptic utterances seems characteristic for sentence D, in which the animacy cue is supported by the grammatical role. With respect to their repetition behaviour, 4-year-old children tend to produce elliptic utterances as substitutes for utterances with subject-drop. A second relevant observation concerns the distribution of elliptic utterances and the substitution of the anaphoric pronouns by a nominal phrase. The rates of these answer types stand in a reciprocal relation to each other. With increasing age, the children learn that minimising the utterance is not the appropriate behaviour in ambiguous contexts, and that the use of more explicit expressions (nouns and nominal phrases) guarantees the communication success.

4 Sentence comprehension

In order to establish a comparison base against which the comprehension of the children can be evaluated, we will first discuss the way Bulgarian adults perceive the situations presented in the 4 sentence types and the role of anaphoric pronouns as disambiguation cues. Afterwards we will present analyses and a discussion of child comprehension targeting the investigated referential features, pronominal resolution and age effects.

4.1 Analysis and discussion of adult anaphora resolution

In the production part, the adult participants achieved a correct repetition score of 99.7 %. The failure quote is due to one participant who did not produce two stimuli clauses. Given the complete correspondence between given stimuli and produced pronouns, the main goal will be the evaluation of disambiguation strategies according to the pronouns given in the 4 types of stimuli sentences.

The first analysis concerns the comprehension pattern in the four sentence types. The results of 4 x 3 ANOVA with the factors SENTENCE TYPE (A, B, C, D) and PRONOUN TYPE (PERS, DEM & NULL) reveal a significant effect of sentence type ($F_{(3,467)}=20.082$; $p<.000$), but no effect of the pronoun type and no interactions.

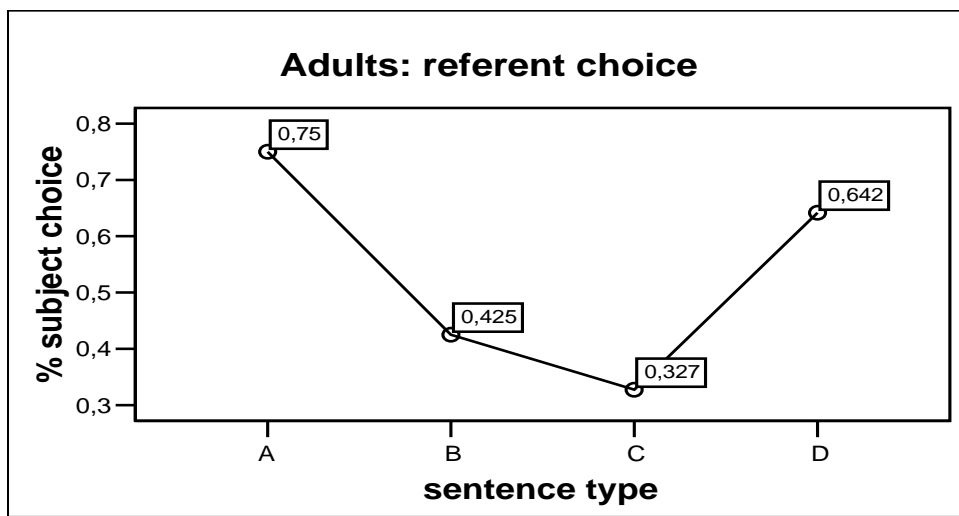


Figure 9: Adults - comprehension pattern in the sentences

In a fine-grained ANOVA with the factors SUBJECT ANIMACY, OBJECT ANIMACY and PRONOUN TYPE, we see a main effect of SUBJECT ANIMACY ($F_{(1,467)}=54.629$, $p<.000$) and OBJECT ANIMACY ($F_{(1,467)}=5.671$ $p<.018$), but no effect of the given PRONOUN TYPE and no interactions. From Figure 9 we see that a referent is likely to be chosen if it is animate and the more so if it is a subject at the same time. For all stimuli taken together, we do not find an effect of the given pronoun, but a strong effect of the referential properties in their 4 possible combinations. In what follows we analyse the disambiguation power of the given pronoun types within the four sentence types separately (see relevant numbers in Table 3).

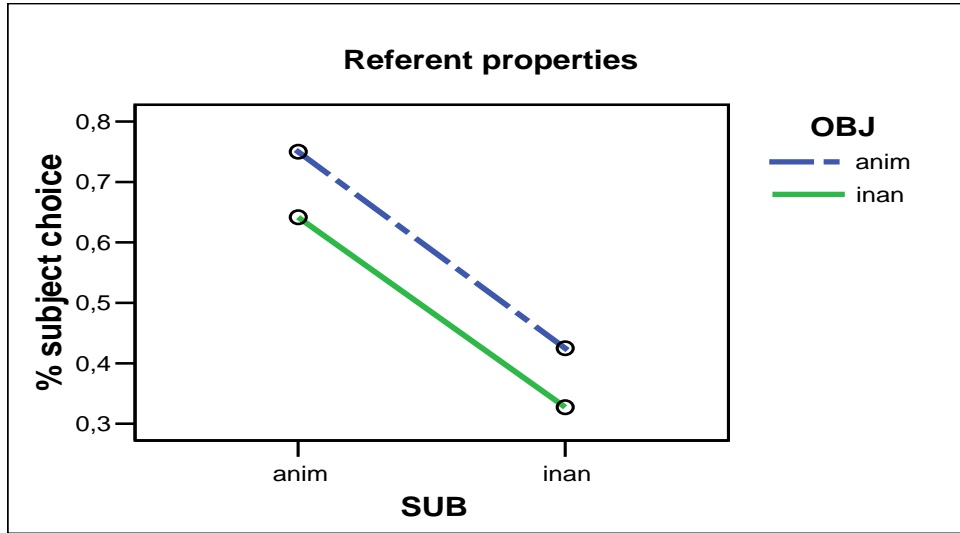


Figure 10: Main effects of subject and object animacy

Sentence A is not comprehended as an ambiguous one by the adult speakers of Bulgarian. In a one-sample t-test (2-sided, df 19) comparing the choice behaviour against the chance level (50%), all three pronouns were reliably (PERS: $p < .000$; DEM: $p < .017$; NULL: $p < .002$) disambiguated to the animate subject. In setting B we observe that the choice between subject and object as antecedents of the used anaphora remains at chance level.

Table 3: Anaphora resolution depicted by the rate of chosen antecedent subjects

	A	B	C	D
given pronoun	animate SUB animate OBJ	inanimate SUB animate OBJ	inanimate SUB inanimate OBJ	animate SUB inanimate OBJ
PP	78%	45%	30%	70%
DP	70%	40%	40%	55%
NULL	78%	43%	28%	68%

For sentence C featuring two inanimate referents, we expected the factor grammatical role to be decisive for pronominal disambiguation in the same way as in sentence A. However, in the sentences with anaphoric subject-drop ($p < .009$) or with a personal pronoun ($p < .017$), the referent choice clearly goes to the object. Sentences containing a demonstrative pronoun lead to a random referent choice. In setting D, depicting the prototypical constellation of an animate subject and inanimate object, the disambiguation function of the used pronominal anaphora is slightly less pronounced than expected. The personal pronoun and the null pronoun refer to the animate subject. The demonstrative pronoun remained at chance level as in sentences B and C.

To sum up, the 4 settings differ with respect to the referent choice, the main factor being the presence of an animate subject. The participants understand personal pronouns and null pronouns as referring to animate subjects if there are any, as in settings A and D. In settings lacking an animate subject, personal and null pronouns show sensitivity to the animacy of the object. If both referents are inanimate, personal and especially null pronouns are resolved to the object of the antecedent clause. The presence of an animate object in sentence B results in a chance level referent choice. Sentence B represents a constellation of conflicting cues, animacy and grammatical role guiding the choice in different directions. As there is no interaction between the animacy of subject and objects, we conclude that grammatical role and animacy are perceived by the adult speakers as equally strong cues.

Stimulus sentences with demonstrative pronouns seem to be ambiguous for Bulgarian adults. In sentences B, C and D, the test persons remain at chance level. Sentence A is the only condition in which the preference for the animate subject overrides the unusual use of a demonstrative pronoun. This fact may be accounted for by the alignment of two prerequisites. The first one is that both referents are masculine, thus fulfilling the felicity requirement for the use of a masculine demonstrative pronoun. The second one is the absence of an animacy difference between the referents. In a situation like in D, in which there is a possible inanimate referent, the use of a demonstrative as an expression referring to the animate referent becomes less felicitous.

A demonstrative pronoun always retains its identification function selecting a single referent out of a set whose members exhibit the same features. The use of a demonstrative presupposes the existence of such a set. Given those considerations, the acceptability of demonstrative pronouns in sentence A can be explained by the possibility to perceive the quite similar animate referents (e.g. tiger and lion) as building a set. In contrast, the animacy difference in D prevents the constitution of a set, needed for the felicitous use of a demonstrative pronoun.

4.2 Analysis and discussion of child comprehension

In this section we investigate the influence of the antecedents' animacy and syntactic role on the way children understand pronouns as anaphoric expressions. The first analysis concerns the referential choice of all age groups together. It targets the assumed ranking of referent features which are possibly used by the children for co-reference establishment.

We computed a 3 x 4 ANOVA on the percent choice of subjects (or first mentioned referents) with the factors GIVEN PRONOUN TYPE (PERS, DEM & NULL) and SENTENCE TYPE (A, B, C, D). We found a main effect of the factor sentence

type ($F_{(1,1744)}=56,47$; $p<.0000$), but no effect of the factor pronoun type given in the anaphoric sentence. In Figure 11 we see that children alter their referential choice according to the different combinations of referent properties. Tukey's post hoc comparison reveals significant differences between all sentence type pairings except for the sentences B and C.

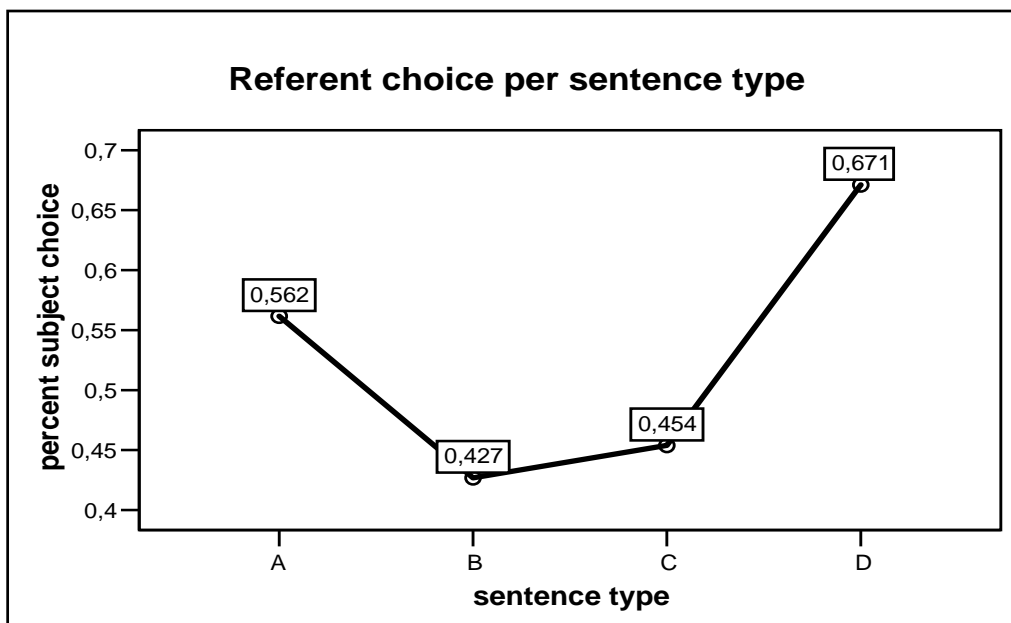


Figure 11: Children - comprehension pattern

In the following, we present a more detailed ANOVA analysis of children's comprehension with the factors ANIMACY and GRAMMATICAL ROLE of the antecedents. We see a main effect of SUBJECT ANIMACY ($F_{(1,1744)}=56.47$; $p<.000$). OBJECT ANIMACY plays a significant role for the co-reference establishment as well ($F_{(1,1744)}=8.49$; $p<.004$). The possible combinations of SUBJECT and OBJECT ANIMACY have different impact on the referent choice as revealed by their interaction just approaching significance ($F_{(1,1696)}=3.34$; $p<0.067$). In sentences of the A type in which both antecedents are animate, the referent choice goes to the subject. If both antecedents are inanimate as in the mirror condition C, the children tend to choose the object, but remain at chance.

In sentences B and D representing mixed conditions of subject and object animacy, we see the effect of conflicting (sentence B) or aligned (sentence D) disambiguation cues. The combination of an animate subject and an inanimate object (D) presents the children with a prototypical feature distribution, and thus with a less ambiguous situation. Accordingly, the children opt for the animate subject in almost 70% of the time. In the opposite feature combination (B), the animate antecedent, being an object this time, wins over the inanimate subject.

In sum, the presence of an animate subject is a decisive cue for the resolution of ambiguous pronominal reference, and it is more powerful if there is an animacy difference between the referents.

4.2.1 Developmental pattern

The comprehension data comprising the referent choice of all children in the age bracket from 2;10 to 5;03 is not homogeneous. The comprehension pattern changes with age as the significant three-way interaction: SUBJECT ANIMACY x OBJECT ANIMACY x AGE GROUP ($F_{(4,1696)}=5.59$; $p<.000$) of the computed ANOVA reveals. Figure 12 shows the different effects of the selected factors on the reference establishment in each of the 5 tested age groups.

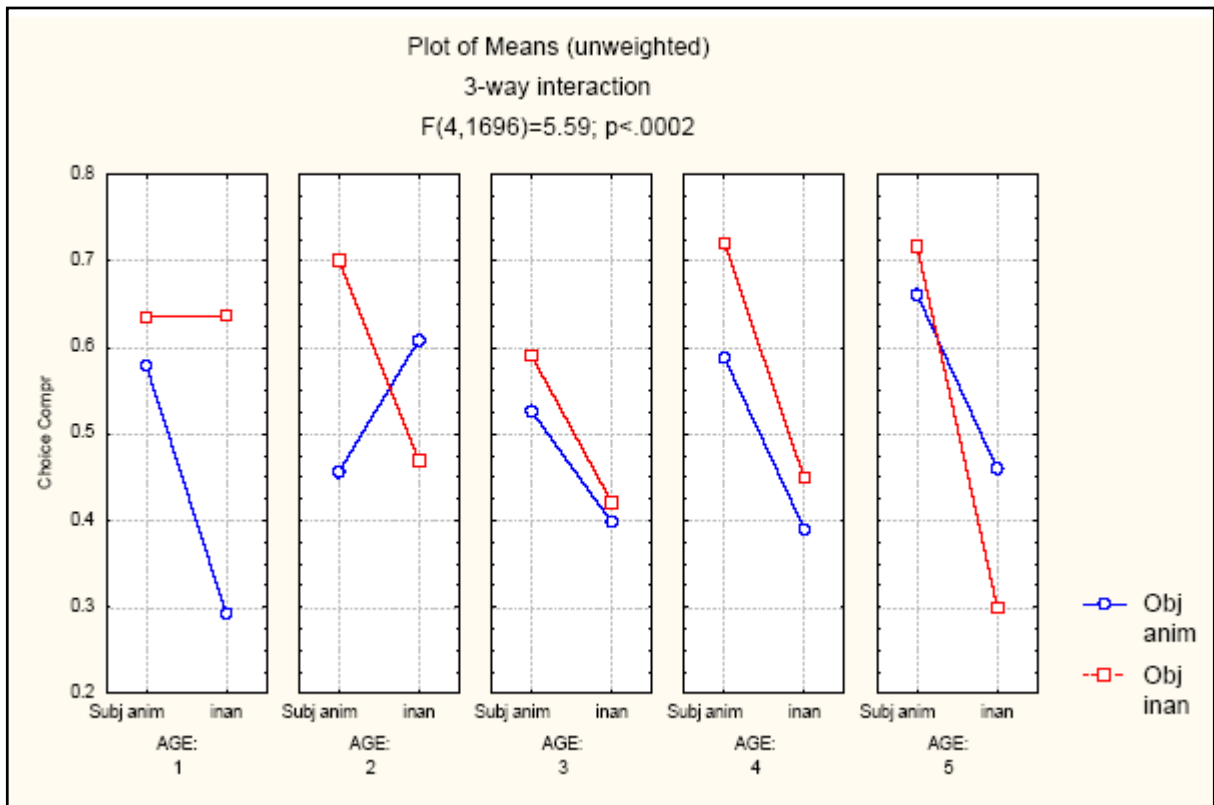


Figure 12: Threefold interaction of age group, subject and object animacy

In the following, we present separate analyses for each of the 5 age groups targeting the effects of the factors SUBJECT ANIMACY, OBJECT ANIMACY and PRONOUN on the referential choice measured again as percentage of chosen subject antecedents.

For the youngest age group (mean age 3;0), we found main effects of both SUBJECT ANIMACY ($F_{(1,341)}=7.73$; $p<.0057$) and OBJECT ANIMACY ($F_{(1,341)}=15.11$; $p<.0001$), and a significant interaction between them ($F_{(1,431)}=5.59$; $p<.005$), but no effect of the given pronoun type. When the subject is animate, the animacy of

the object noun does not influence the referent choice. When the subject is inanimate, then there is a significant difference between choices in conditions with animate object as in B and inanimate objects as in C. The youngest tested children show a clear animacy effect in sentence B in which the animate object wins. Sentence B differs from all other conditions as it presents a situation which is resolved easily by the children – triggering an above chance performance (71% object choices). In condition C, the children opt for the subject antecedent, the proportion of chosen inanimate subjects being the same as of the animate subjects in sentence D. The youngest children seem to rely on a hierarchy of referential features which is headed by animacy and followed by subject as syntactic role.

Separate χ^2 tests targeted the disambiguation functions of the three pronominal types given in each of the four sentences. In sentences A and C, the children remain at chance level independent of the given pronoun type. In sentence B demonstrative ($\chi^2_{(1,30)}=6.5$; $p<.01$) and null pronouns are resolved to the animate object ($\chi^2_{(1,30)}=5.8$ $p<.016$). The personal pronoun narrowly misses significance ($p<.068$).

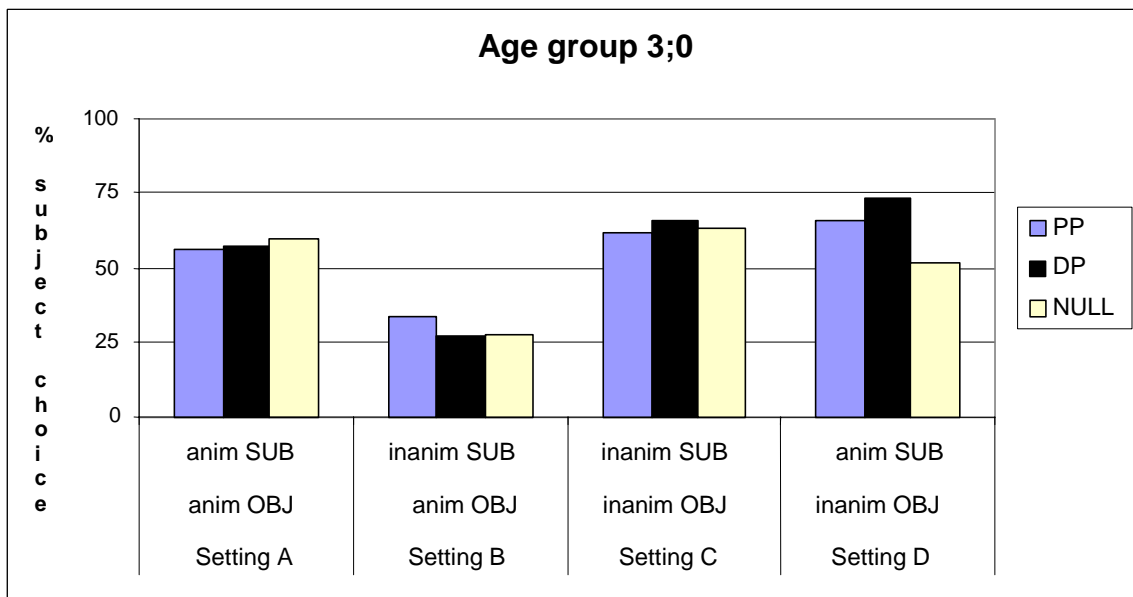


Figure 13: Pronominal co-reference at the age of 3;6

In setting D presenting the opposite cue combination only the demonstratives clearly pattern with the animate subject ($p<.01$). The direct comparison between B and D shows a significant preference for the animate referent, particularly clearly when children are presented with a demonstrative pronoun.

Taken together the results suggest that children initially rely on the factor animacy when resolving a pronoun. The behaviour of the demonstrative pro-

noun suggests that the children interpret it more deictically, as pointing to the most salient referent.

The children in group 2 (mean age 3;6) do not use the same disambiguation strategy as the 3-year-olds. There are no main effects of SUBJECT and OBJECT ANIMACY, but a significant interaction between them. When the subject is animate, the co-reference establishment depends on the animacy feature of the object.

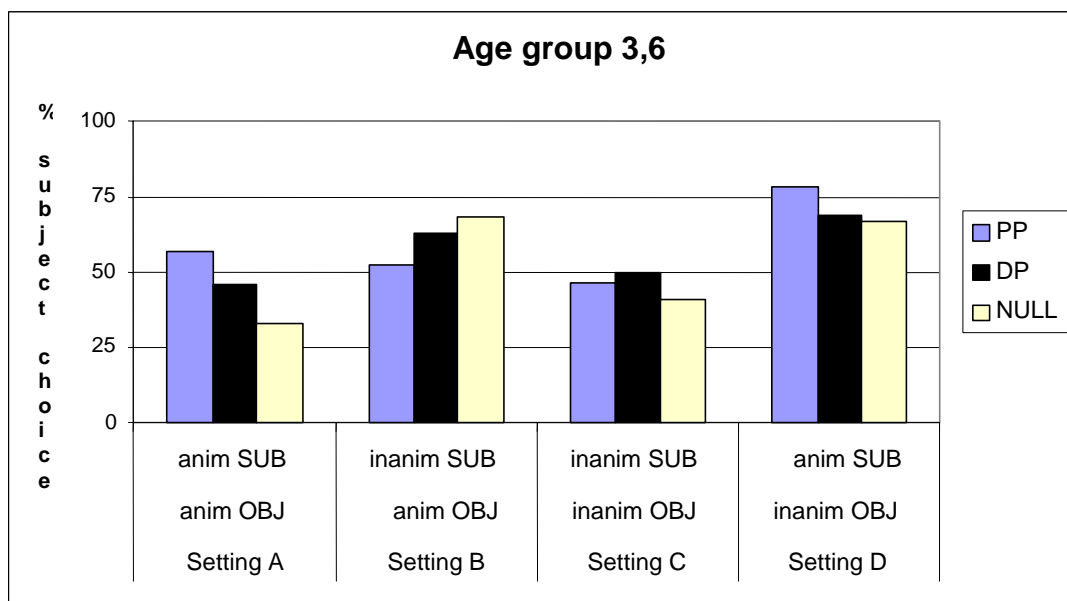


Figure 14: Pronominal co-reference at the age of 3;6

If the animate subject has a distinct animacy value from the object (the object is inanimate), then the animate subject wins as pronominal antecedent. If there is no animacy cline, the referent choice remains at chance level. The children perform best in the less ambiguous sentence D. In the opposite cue configuration of sentence B, they are at chance, no longer preferring the animate object. The children also show a chance behaviour in sentence A and C, in which the animacy cue is neutralised and the syntactic role does not suffice as referent indicator. The weakening of the subject position as a disambiguation cue results in an overall chance performance, apart from sentence D which still preserves the subject preference due to the animacy factor.

For age group 2, the personal pronoun does not influence the referent choice except for condition D in which it unambiguously refers to the animate subject ($\chi^2_{(1,28)}=8.33$; $p<.004$). The same is true for the demonstrative pronoun which points to the subject in D ($p<.050$). Null pronouns tend to be associated with animate objects in sentences A, B and with animate subjects in D, but miss significance ($p<.08$ in A and D and $p<.059$ in B).

The situation of transition becomes more pronounced in age group 3 (mean age of 4;0). The only relevant factor is SUBJECT ANIMACY ($F_{(1,364)}=8.35$; $p<.0041$), no other effects or interactions hold significance here. While in sentence A the children are clearly at chance level – 53% subject choice - in sentence C a shift towards an object choice becomes apparent. Although the rate of chosen subject in D is not very high (59%), there is still a significant difference to sentence B, in which the preference for the object aligns with the animacy cue.

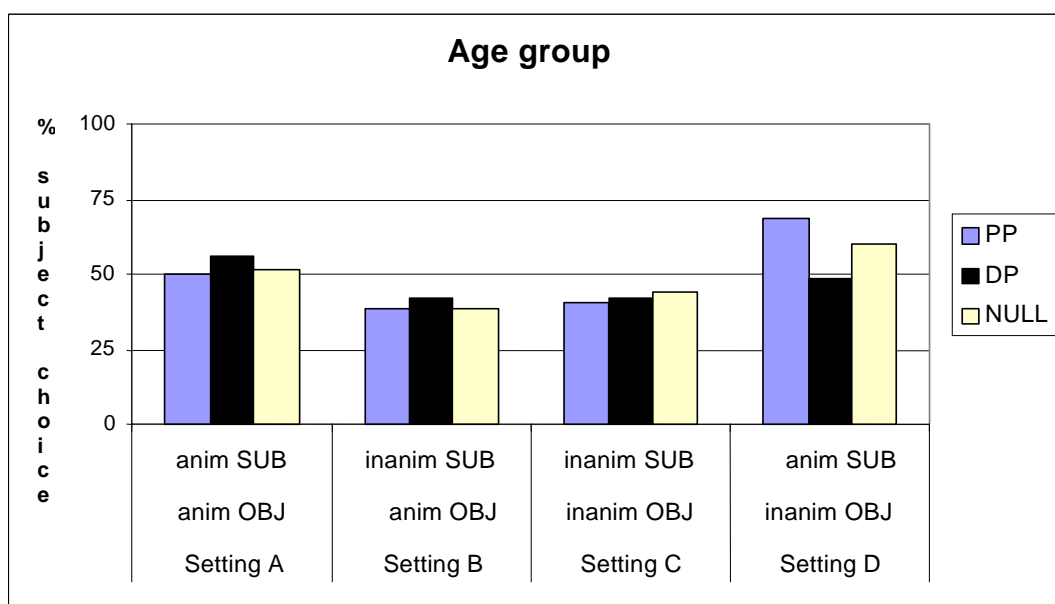


Figure 15: Pronominal resolution at the age of 4;0

The single pronoun conditions reflect the overall difficulties of the 4-year-olds to establish co-reference between the given anaphoric pronoun and a possible antecedent. Only the personal pronoun is associated with the animate subject in condition D ($\chi^2_{(1,32)}=4.5$; $p<.034$) in all other conditions the children remain at chance independently of the given pronoun.

In group 4 (mean age 4;6) we find a main effect of SUBJECT ANIMACY ($F_{(1,335)}=20.06$; $p<.0000$) and a marginal effect of OBJECT ANIMACY ($p<.07$), but no interaction between them. Sentence D is recognized as the most unambiguous situation, the pronoun is assigned to the animate subject antecedent. The influence of the factor syntactic role is shifted back to the subject, as it becomes more strongly associated with the prototype of an animate agent – the proportion of subject choices in sentence A increases again. In the cases lacking animate subjects (B and C), objects are gaining attention but their proportions are still not significantly higher than the rates of subject choices. The animate objects are slightly preferred over the inanimate ones.

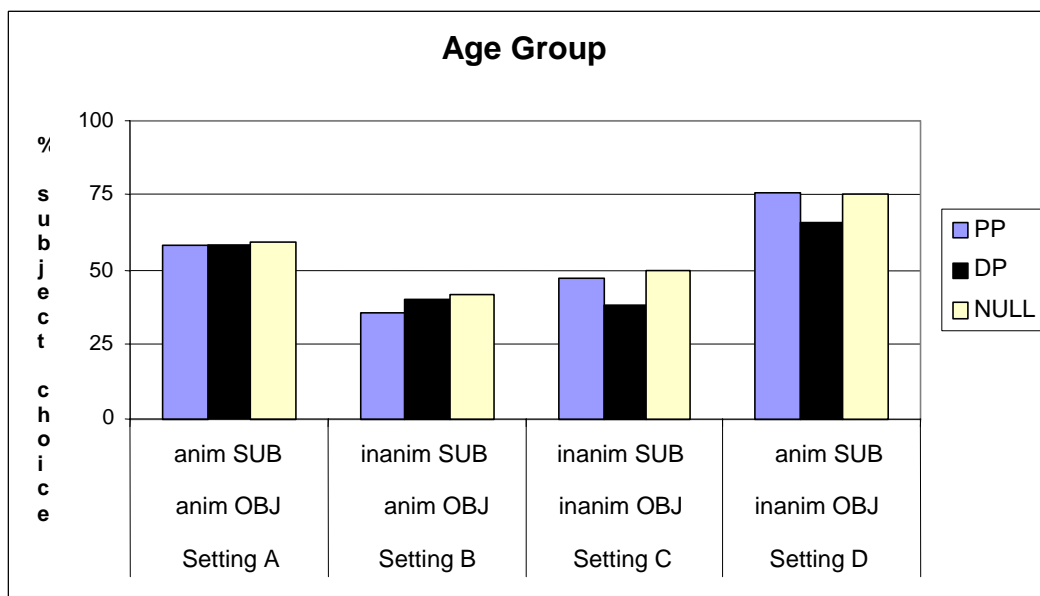


Figure 16: Pronominal resolution at the age of 4;6

The children still don't rely on the different types of pronouns as a disambiguation signal. No significant differences between the understandings of the three pronouns are found in sentences A, B and C. In sentence D, the null pronoun ($\chi^2_{(1,28)}=7.0$; $p<.008$) becomes established as referring to the animate subject in the same way as the personal pronoun ($\chi^2_{(1,29)}=7.7$; $p<.005$), the demonstrative pronoun doesn't reach significance ($p<.095$).

Group 5 (mean age of 5;0) exhibits a comprehension pattern which resembles the adult's behaviour. We find a main effect of SUBJECT ANIMACY ($F_{(1,340)}=37.35$; $p<.000$) and a significant two-way interaction with OBJECT ANIMACY ($F_{(1,340)}=4.54$; $p<.034$). In the conditions with animate subjects (A and D), the pronoun co-reference is established unambiguously to the animate subject. In sentence C, the five-year-olds clearly choose the object. The object preference in B does not reach significance. When no prototypical animate subject is available, the children resolve the pronoun to the prototypical object, the inanimate one. Now, sentence B becomes the most ambiguous one, as it is deficient in terms of prototypical referents, containing an inanimate subject and an animate object.

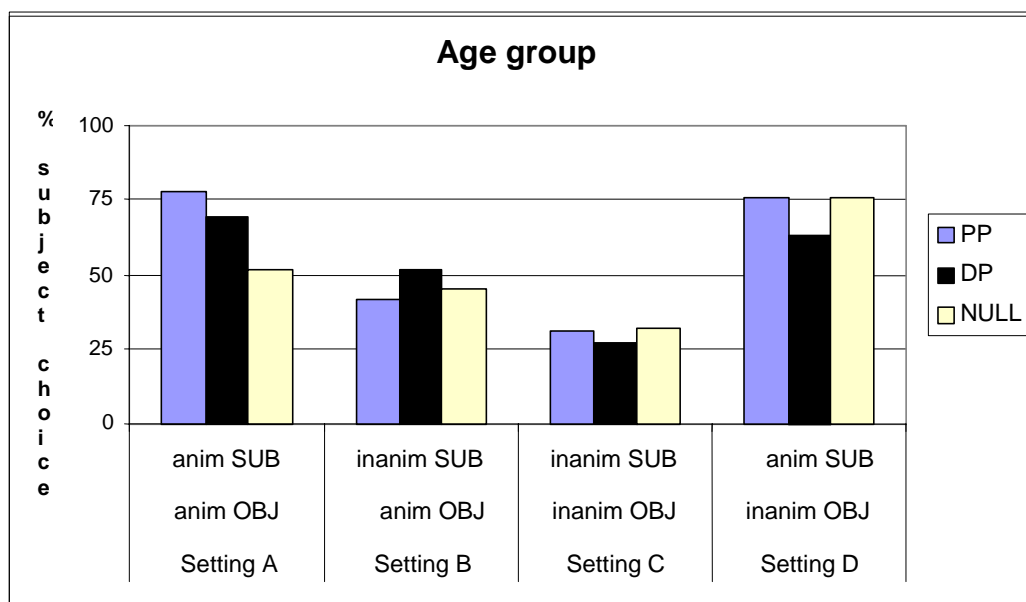


Figure 17: Pronominal resolution at the age of 5;0

For the 5-year-old children, a match between a personal pronouns and an animate subject can be observed, as it becomes clear from the significant disambiguation effect of the personal pronoun in sentence A ($\chi^2_{(1,27)}=8,3$; $p<.004$), as well as in sentence D ($\chi^2_{(1,29)}=7.6$; $p<.005$). The demonstrative pronouns are understood as referring to the more salient referent, if the children are able to establish such a connection through the antecedent context. The deictic behaviour of the demonstrative pronoun ($\chi^2_{(1,31)}=6.5$; $p<.011$) is particularly clear in sentence C in which the inanimate object seems to be the more accessible antecedent. This referent choice is quite opposite to the animate subjects in sentence D preferred from the age earliest tested. The 5-year-olds start to understand that the null pronoun is used when the referent is not ambiguous. In condition C the preference moves to the prototypical inanimate object ($\chi^2_{(1,31)}=3.9$; $p<.048$). The other factors which may influence the salience of the object in C will be discussed below.

4.2.2 Analysis of referent choice according to the produced pronoun

The next analysis is based on the pronouns which the children actually produced in the repetition task. The results of an ANOVA with the factors SENTENCE TYPE, PRODUCED PRONOUN and AGE GROUP revealed an overall pattern which was not different from the analysis based on the given pronoun types. We found a significant main effect of the SENTENCE TYPE ($F_{(3, 1562)}= 23.815$; $p<.000$), and a significant interaction between SENTENCE TYPE and AGE GROUP, but no effects of PRODUCED PRONOUN (see Figure 18) or AGE GROUP, and no other interactions.

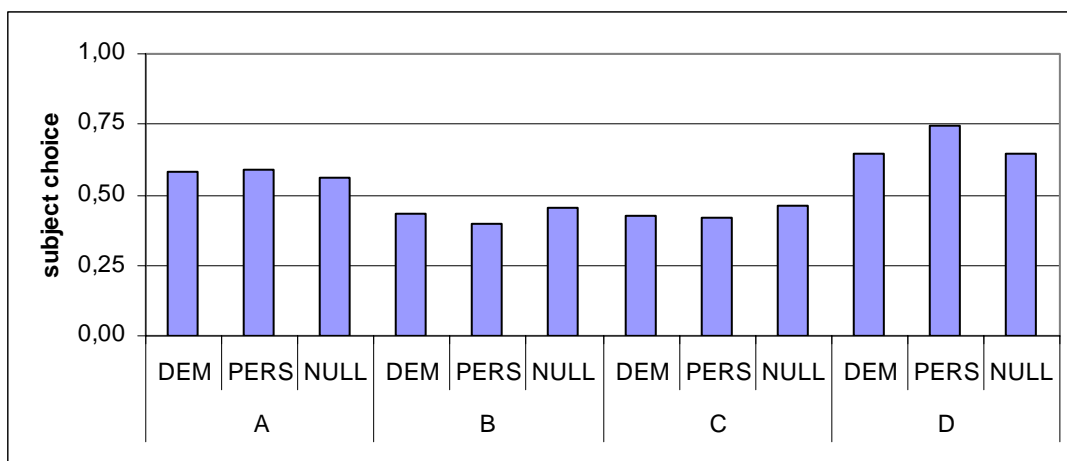


Figure 18: Resolution of produced pronouns

The overall impression is that children have difficulties in understanding null pronouns in the given experimental conditions. The interpretation of elliptic utterances also exhibits an inhomogeneous pattern. The comparison between the resolution preferences of elliptic utterances and such containing subject-drop shows that they often deviate, as for instance in sentence C.

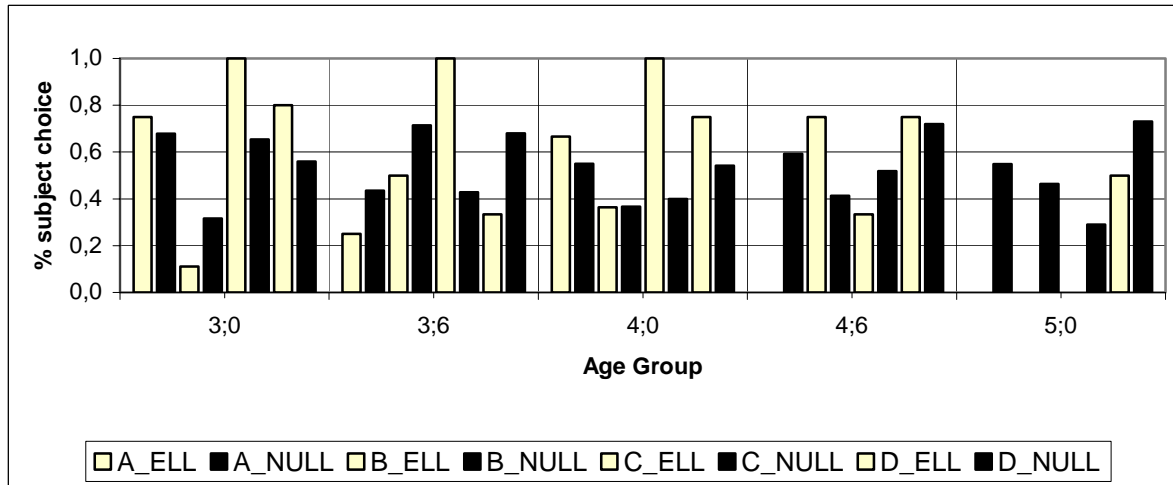


Figure 19: Understanding of ellipses and null pronouns

Up to the age of 4;6, all elliptic utterances in C are resolved to the subject, while the null pronouns don't show a clear co-reference establishment (see Figure 19).

The difficulties which the children experience when interpreting utterances with subject-drop are especially relevant in sentence A. This antecedent sentence combines two animate referents and seems not to be ambiguous for the adult Bulgarians (see Table 3). Except for the youngest group in which children profit from the joint preference for animate referents and for subjects, all other

children, even the oldest tested group, remain at chance level in sentence A. Utterances exhibiting subject-drop are reliably resolved to the animate subject only when the children reach the age of 4;6 and in situations presenting at least two aligned cues as in sentence D.

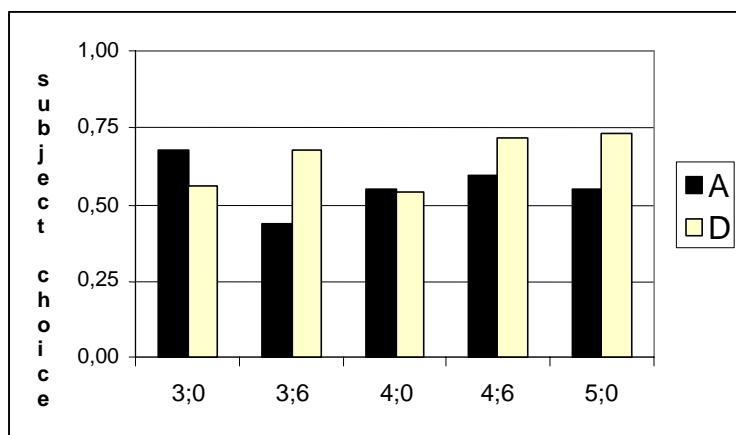


Figure 20: Comprehension of produced null pronouns

In contrast to the difficulties with null pronouns, the children arrive at a stable interpretation of personal pronouns much faster. Their orientation point is the distribution of salience features as represented by the referent in the antecedent context of sentence D.

5 Conclusion

The comparison of children's comprehension data and that of the adults reveals a difference with respect to ambiguity perception. The experimental design presents the subjects with stimuli contexts which exhibit a high degree of ambiguity. In order to access the influence of only two salience factors - animacy and grammatical role - the stimuli were deprived of almost all other cues which are jointly at the disposal of the speaker/hearer in every day communication.

Adult Bulgarian speakers navigate in such impoverished contexts using prototypical combinations of referent features. This means that there is no real ranking between the single features animacy and grammatical role. The chance behaviour in sentence B in which the investigated antecedent properties support different referent choices is a clear indicator for this conclusion. A second indicator is found in the unambiguous but reversed referent choice in sentences A and C, in which animacy is neutralised. Adult speakers look for a prototypical referent, and if there is one, they are able to establish a co-reference relation. In sentence A, the best candidate is the animate subject, in sentence C it is the inanimate object. As a result, null pronouns are reliably resolved to these referents which are highlighted through their conventionalised feature combination. Con-

sequently, the referential choice in sentence D is somehow less clear. The percentage of null pronouns resolved to the animate subject decreases slightly, which adds additional support to the common grammar rule that null pronouns are applied only in clear reference relations. In sentence D, the inanimate object increases the ambiguity potential, but still its property of prototypical object cannot override the salience of the animate subject. Although adult Bulgarians do not use demonstrative pronouns as disambiguation cue, the difference between the rates of reference choice achieved for null and personal pronouns on the one hand, and for demonstrative pronouns, on the other is taken as evidence that demonstrative pronouns pattern with the disfavoured referent.

The evaluation of the language acquisition data shows that Bulgarian children do not apply the same disambiguation strategy as adult speakers. The youngest children tested (mean age of 3;0) use a hierarchy of referent features headed by animacy and followed by subject as the preferred grammatical role. This result is in line with the good animacy discrimination abilities of young children found by Mandler (1992) in general, and the prominent role of animate referents at the early stages of co-reference establishment reported in Kuehnast et al. (2007), Bittner and Gagarina, (this volume). However, the pattern of pronominal resolution, particularly with respect to the best disambiguation effect of demonstrative pronouns, provides evidence that the 3-year-old Bulgarian children understand the presented pronominal forms as deictic markers, pointing to one of the perceptually available referents.

In the next age brackets the children perceive the given antecedent sentences A, B and C as highly ambiguous. Their inability to establish a clear co-reference relation with the null pronoun reflects the fact that the given salience cues are not sufficient for the promotion of one referent. The presence of a highly salient and thus unambiguous referent as precondition for the use of a non-overt anaphor is given (from a Bulgarian child's perspective) only in sentence D. In sentence D the investigated salience factors endorse the same referent – the animate subject – and at the same time downgrade the second referent – the inanimate object. The double animacy/grammatical role cline is the background against which the children are able to establish a salience contrast and thus to sanction an appropriate referent for the investigated minimally complex anaphors. When children decide on the animate subject as the most salient antecedent, they start to acquire the appropriate distribution of anaphoric pronouns both in terms of production and comprehension. Within the system of anaphoric expressions in Bulgarian, this process translates to higher production rates of personal and null pronouns and to decreased rates of demonstratives. The pattern of anaphora interpretation is based on the co-reference establishment between personal pronouns and animate subjects in contexts of cue alignment. The adult-like understanding of utterances with subject-drop develops afterwards.

At this point we want to underline that the discussed comprehension pattern of null pronouns applies to highly ambiguous contexts which are unusual in every day communication. Ultimately, the resolution behaviour of the young Bulgarian children exhibits the expected compliance with the principle of reversed mapping between complexity of anaphoric expressions and salience of referents. Bearing in mind that none of the given referents appears to be very salient according to the criteria currently applied by the child, the use of the non-overt pronouns is not appropriate. The use of the personal pronoun as a more complex form appears to be a more suitable anaphoric counterpart for a referent whose activation status is not backed by salience factors of the usual amount and strength.

6 References

- Andrejčin, L. (1978). *Osnovna bālgarska gramatika*. Sofia: Nauka i izkustvo.
- Ariel, M. (2001). Accessibility theory: An overview. In: T. J. Sanders, T. J. Schilperoord & W. Spooren (eds.): *Text representation: Linguistic and psycholinguistic aspects*. Amsterdam: John Benjamins Publishing Company, 29-87.
- Ariel, M. (2004). Accessibility marking: Discourse functions, discourse profiles, and processing cues. *Discourse processes* 37 (2), 91-116.
- Bittner, D. (2007). Influence of animacy and grammatical role on production and comprehension of intersentential pronouns in German L1-acquisition. This volume
- Bojadzhiev, T., I. Kucarov & J. Penchev (1999). *Sāvremenēn bālgarski ezik*. Sofia: Indatelstvo "Petār Beron".
- Charalossova, K. (1995). Pokazatlnite mestoimenija v sāvremennija bālgarski knizhoven ezik. In: V. Stankov (ed.): *Problemi na gramatichnata sistema na bālgarskija ezik*. Sofia: Akademichno izdatelstvo "Marin Drinov", 179-221.
- Comrie, B. (1989). *Language universals and linguistic typology*. Chicago: University Press.
- Gagarina, N. (2007): The hare hug the rabbit. He is white... Who is white? Pronominal anaphora in Russian. This volume
- Ginina, S. (1980). Anafora, pokasatelno mestoimēnie i opredelenost na imenata v bālgarskija i sārbohārvatskija ezik. *Sāpostavitelno ezikoznanie* 5 (4): 24-32.
- Givón, T. (1983). *Topic continuity in discourse: A quantitative cross-language study*. Amsterdam: John Benjamins Publishing Company.
- Grosz, B., A. Joshi & S. Weinstein (1995). Centering: A framework for modeling the local coherence of discourse. *Computational Linguistics*, 21 (2): 203-226.
- Grūning, A. & A. Kibrik (2005). Modelling Referential Choice in Discourse: A Cognitive and Calculative Approach and a Neural Network approach. In: A. Branco, T. McEnery & R. Mitkov (eds.): *Anaphora Processing: linguistic, cognitive and computational modelling*. Amsterdam: John Benjamins Publishing Company, 163-198.
- Gundel, J., N. Hedberg & R. Zacharski (1993). Cognitive status and the form of referring Expressions in Discourse. *Language*, 69: 274-307.
- Haijcovā, E., B. Partee & P. Sgall (1993). *Topic-Focus Articulation, Tripartite Structure and Semantic Content*. Dordrech: Kluwer Academic Publishers.
- Ilieva, K. (1985). *Mestoimenija i tekst*. Sofia: Izdatelstvo na bālgarskata akademija na naukite.

- Ivančev, S (1978). *Prinosi v bälgarskoto i slavjanskoto ezikoznanie*. Sofia: Nauka i izkustvo.
- Kaiser, E. (2005). Different forms have different referential properties: Implications for the notion of 'salience'. In: A. Branco, T. McEnery & R. Mitkov (eds.): *Anaphora Processing: linguistic, cognitive and computational modelling*. Amsterdam: John Benjamins Publishing House, 261-282.
- Kostadinova, P. (1995). Odushevenostta v sävremennija bälgraski knizhoven ezik. In: V. Stankov (ed.): *Problemi na gramatichnata sistema na bälgarskija ezik*. Sofia: Akademichno izdatelstvo "Marin Drinov", 51-85.
- Kuehnast, M., Bittner, D., Gagarina, N. & I. Gülzow (2007). Acquisition of anaphoric pronouns by German, Russian and Bulgarian speaking children. In: A. Branco, T. McEnery, R. Mitkov & F. Silva (eds.): *Proceedings of the 6th Discourse Anaphora and Anaphor Resolution Colloquium (DAARC 2007)*. Porto: Centro de Linguistica da Universidade to Porto, 65-70.
- Leafgren, J. (2002). *Degrees of Explicitness. Information structure and the packaging of Bulgarian subjects and objects*. Amsterdam: John Benjamins Publishing Company.
- Levinson, S. C. (2000). *Presumptive Meanings. The theory of generalized conversational Implicature*. Cambridge, MA., London: MIT Press.
- Mandler, J. M. (1992). How to build a baby: II. Conceptual primitives. *Psychological Review*, 99 (4): 587-604.
- Maslov, J. S. (1981). Grammatika bolgarskogo jazyka. Moskva: "Vysshaja shkola".
- Mitkov, R. (1994). An integrated model for anaphora resolution. *Proceedings of the 15th International Conference on Computational Linguistics (COLING'94), Kyoto, Japan*.
- Nicolova, R. (1986). *Bälgarskite mestoimenija*. Sofia: Nauka i izkustvo.
- Rå Hauge, K. (1999). *A Short Grammar of Contemporary Bulgarian*. Bloomington: Slavica.
- Sgall, P., E. Hajicova & J. Panevova (1986). *The Meaning of the Sentence and its Semantic and Pragmatic Aspects*. Dordrecht: Reidel.
- Strube, M. & U. Hahn (1999). Functional Centering. *Computational Linguistics*, 25 (3): 309-344.
- Uhlirova, L. (1990). Za anaforata v bälgarskija ezik v sravnenie s cheshkija ezik. *Säpostavitelno ezikiznanie*, 15 (4-5):278-285.

Noun phrases, pronouns and anaphoric reference in young children narratives¹

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This paper deals with the development of discourse competence in German-, Russian- and Bulgarian-speaking children. In particular, it examines the use of anaphoric pronominal reference in elicited narrations of children between the ages of 2;6 and 6;0. As the pronominal (and nominal) systems of target German, Russian and Bulgarian differ in the repertoire and functions of anaphoric elements we will examine which kind of noun phrases children use to make reference to story participants. In a second step of the analysis, we will investigate how pronominal expressions relate to antecedents. In this respect the pronominal form of the anaphor, the syntactic function of the antecedent and the distance between antecedent and anaphor will be analyzed. The findings will be discussed with regard to predictions made by proposals such as the *Complementary Hypothesis* (Bosch, Rozario, and Zhao 2003) which assumes an asymmetry between the use of personal pronouns and demonstrative pronouns when referring back to subject or object antecedents.

1 Introduction

It has been argued that the resolution of anaphoric expressions is dependent on criteria such as the salience of referents. Taking different perspectives on which criteria are constitutive for the notion of salience, proposals made by the *Centering Theory* (Grosz, Joshi, and Weinstein 1995; Strube and Hahn 1999), *Accessi-*

¹ This study was conducted in cooperation with Dagmar Bittner and Milena Kuehnast (see the respective papers in this volume). The narratives for German were collected by Insa Gülzow and Dagmar Bittner, for Bulgarian – by Milena Kuehnast, and for Russian – by Natalia Gagarina with the help of their assistants.

bility Hierarchies (Ariel 2001, 2004; Gundel, Hedberg, and Zacharski 1993), and the *Complementary Hypothesis* (Bosch, Rozario, and Zhao 2003) agree on the relation that is assumed to hold between a relatively high salience of the referent and a relatively low formal complexity of the anaphor. For instance, German personal pronouns which are regarded to be relatively low in complexity show a slight preference for grammatical subjects as their antecedents. Demonstrative pronouns on the other hand which display a higher degree of formal complexity display a strong bias for non-subject antecedents (Bosch, Katz, and Umbach 2007).

According to the general consent of the theories mentioned above, the categorization of possible referents into those which are contextually salient is signaled by the speaker with the use of an expression which allows the listener to identify the intended referent. The identification of referents with personal pronouns represents the minimum degree of wording unless a language allows null subjects such as Russian and Bulgarian. The more verbal demonstrative pronouns signal a lesser degree of salience but supplement the use of personal pronouns by coding different degrees of proximity. While personal pronouns are generally not used deictically although it is possible in certain contexts (e.g. Huang 2007), the different pragmatic functions of demonstratives such as the exocentric situational use and the endocentric discourse deictic, tracking and recognitional use (e.g. Himmelmann 1996) all allow for different degrees of spatial, temporal or discursal deixis (Chafe 1996). This is an important point to note as it has been claimed that it is in the context of the exophoric or situational use of demonstratives involving the coding of relative distance in relation to a deictic centre which is central for the acquisition of demonstrative expressions (Clark 1978).

Anaphoric personal pronouns and demonstrative pronouns are coreferential with a noun or a noun phrase in the previous discourse. There are contexts in which their use appears to be synonomous, see (1).

- (1) Heute war unser Nachbar hier. *Er* /*Der* wollte den Rasenmäher leihen.
 ‘Our neighbor was here today. *He*/DEM² wanted to borrow the mower.’

In (1) the difference between *Er* referring to the subject noun phrase and *Der* referring to the subject noun phrase seems marginal. However, as for instance argued by Bosch, Katz, and Umbach (2007) or Diessel (1999) there are contexts in

² Pronominal demonstratives will be glossed with DEM. Note that in German *dieser* is the proximal demonstrative pronoun (proxDEM) and *jener* the distal demonstrative pronoun (disDEM). Apart from a few contexts, the demonstrative *der* is formally identical with the German definite article (DEF).

which the use of a personal pronoun or a demonstrative pronoun may disambiguate reference, see (2).

- (2) Der Direktor brüllte den Angestellten an. *Er/Der* war sehr wütend.
'The director shouted at the employee. *He/DEM* was very angry.'

The preferred referent of the personal pronoun *Er* in (2) is the director while the preferred referent of the demonstrative pronoun *Der* is the employee. Although it is claimed that demonstratives do not relate to non-topicality (Krasavina and Chiarcos 2007), anaphoric demonstratives are often associated with a shift of topic or a tendency to relate to grammatical non-subjects. Anaphoric personal pronouns track continuing topics, a function that may also be served by definite noun phrases (Diessel 1999, Bosch, Katz, and Umbach 2007).

As languages differ with regard to their pronominal inventories which may be different both in size and with regard to the functions covered. The distribution and the form-function pairings of pronominal expressions within a particular language may differ, too. For demonstratives in Iberoromance languages for instance it has been demonstrated that the opposition between a two-term and a three-term system results in a different partition of the functional domain (Jungbluth 2005). The languages investigated in the present study all feature personal pronouns and (proximal and distal) demonstratives, but only German includes the use of a more neutral demonstrative pronoun which is formally almost identical with the definite article.

Depending on a given expressions' relation to other anaphors in the inventory of a language, their adnominal and pronominal usages, and the presence versus absence of definite and indefinite noun phrases, the linguistic data available to the partners in a communicative situation may lead to different assumptions about which entities are at the focus of the other person's attention. Gundel, Hedberg, and Zacharski (1993) for instance could show that in a language like Russian which lacks both definite and indefinite articles bare noun phrases are used in a majority of cases in which the cognitive status of a discourse referent is low. In Russian, distinctions between different levels of higher cognitive statuses emerge with regard to the use of personal versus adnominal and pronominal demonstratives. For English which has both definite and indefinite articles, a corresponding segmentation could also be observed for discourse referents with a relatively low cognitive status. With regard to the languages analyzed, only German and Bulgarian feature a definite article/definite suffix which results in the presence of noun phrases the use of which is in competition with pronominal noun phrases when relating to different cognitive statuses.

In the present study we will pursue two questions related to the acquisition of mechanisms dealing with anaphor resolution. In a first step we will examine

the general distribution of noun phrases used for reference by the children in the study across different age groups. We assume that these will on the one hand be influenced by the different kind of referring expressions that are available in the three languages investigated and on the other hand on more general developmental processes such as an early tendency to engage in the naming of referents (e.g. Hickmann 2003). The second step of the analysis will be concerned with the relation between pronominal expressions and their antecedents. The pronominal form of the anaphor, such as whether the children used personal pronouns or demonstrative pronouns, will be assessed. Following the general consent of the major approaches to anaphor resolution, the syntactic function of the antecedent will then be analyzed with regard to the distinction between grammatical subjects and grammatical non-subjects. Finally the distance between antecedent and anaphor will be analyzed, as it is assumed that personal pronouns can cover a wider stretch of discourse when finding their antecedent while demonstratives seem to operate on a more local level when referring to antecedents or when introducing a topic shift. The findings will be discussed with regard to predictions made by proposals such as the *Complementary Hypothesis* (Bosch, Rozario, and Zhao 2003) which assumes an asymmetry between the use of personal pronouns and demonstrative pronouns when referring back to subject or object antecedents.

2 The target systems

The pronominal systems of target Russian, Bulgarian and German differ in the repertoire and the functions of anaphoric elements. While German exhibits the full range of personal pronouns and adnominal and pronominal articles and demonstratives, Russian and Bulgarian have no one-to-one equivalent to pronominal *der* which is formally almost identical with the German definite article *der*. The only formal difference between adnominal and pronominal *der* can be observed in the genitive and the dative plural, see (3).

- (3) a. Der Hund gehört den Nachbarn/denen.
 DEF dog belongs DEF neighbors/DEM
 ‚The dog belongs to the neighbors/to them.’
- b. Des Mannes Hund/Dessen Hund hat mich gebissen.
 DEF man’s dog/DEM dog has me bitten
 ‚The man’s dog/His dog has bitten me.’

In contrast to Russian which does not have articles, Bulgarian has a definite suffix. Russian (a weak-prodrop language, cf. Franks 1995) and Bulgarian allow null subjects in certain contexts which is not a target option in German.

In German, *der* can be used both adnominally and pronominally, see (4), the same is true for the German proximal demonstrative *dieser*, see (5), which contrasts with distal *jener* see (6).

- (4) Der Hund/der hat gebellt.
DEF dog/DEM has barked
'The dog/DEM has barked.'
- (5) Dieser Hund/dieser hat gebellt.
proxDEM dog/proxDEM has barked
'This dog/this has barked.'
- (6) Jener Hund/jener hat gebellt.
disDEM dog/disDEM has barked
'That dog/that has barked.'

In the Russian anaphoric system proximal *etot* and distal *tot* can be used pronominally and adnominally, see (7) and (8), but no article system with a similar function exists.

- (7) Eta sobaka/Eta lajala.
proxDEM dog/proxDEM bark-IMPERF.PAST.FEM.SG
'This dog/this was barking.'
- (8) Ta sobaka/Ta lajala.
disDEM dog/disDEM bark-IMPERF.PAST.FEM.SG
,That dog/that was barking.'

The respective examples for Bulgarian proximal *tozi* and distal *onzi* are given in (9) and (10).³ Definite noun phrases are marked with a suffix, see (11).

- (9) Tozi tigar/Tozi laeshe.
proxDEM tiger/proxDEM barked
'This tiger/this barked.'
- (10) Onzi tigar/Onzi laeshe.
disDEM tiger/disDEM barked
,That tiger/that barked.'
- (11) Tigarat laeshe.
tigerDEF barked
'The tiger barked.'

³ Note that in Bulgarian *kuche* 'dog' has neutral gender; *tigar* 'tiger' is masculine.

From a typological point of view, most if not all languages have at least two demonstratives which can locate a referent either near the deictic centre or relatively distant from the deictic center. German belongs to an infrequent type of language which features a three-term system in which one member is distance-neutral (Himmelman 1997). This leads to a situation in which the Russian and the Bulgarian system of demonstrative pronouns feature terms which are distance-marked as either proximal or distal while German has an additional unmarked term. Hence, the contexts in which German *der* and Russian *etot/tot* and Bulgarian *tozi/onzi* can be used deictically and anaphorically differ substantially, with Russian *etot/tot* and Bulgarian *tozi/onzi* being more limited in contexts for the expression's deictic use as in many cases the use of the demonstrative implies a contrast and thus another potential referent.

All three languages exhibit personal pronouns, see (12)-(14).

- | | | |
|------|--|-----------|
| (12) | Er hat gebellt.
he hasbarked
'He has barked.' | German |
| (13) | On lajal.
he barking-IMPERF.PAST.MASC.SG
'He was barking.' | Russian |
| (14) | To laeshe.
he barked
'He barked.' | Bulgarian |

It is generally possible to use personal pronouns deictically, see (15), in which case they are usually accompanied by a pointing-gesture (cf. Huang 2007). Similar to definite articles, personal pronouns are not distance-marked.

- (15) *pointing to two different students in a class*
 SIE hält heute ein Referat, aber SIE erst nächste Woche
 SHE gives today a presentation but SHE only next week
 'SHE gives a presentation today, but SHE will give one next week.'

Given the typological differences of German in comparison with Russian and Bulgarian, a question to be addressed in the study is how these differences influence children's early use and acquisition of cohesive devices in order to produce connected discourse. Which anaphoric devices do Russian and German children use initially and how do they expand and develop these devices towards a target representation?

3 Data and method

The data consist of elicited picture stories from more than one hundred Russian-, Bulgarian- and German-speaking monolingual children and adults. With a scenario somewhat similar to the *Cat Story* which was introduced by Hickmann (2003) and features a mother bird, her chicken, a cat and a dog, a *Fox Story* was developed by the project participants (painter J. Mühling) in which the gender of the protagonists was controlled. The protagonists of the *Fox Story* are a bird, a fish and a fox who exhibit identical gender within the two languages, male in German and female in Russian and Bulgarian. The rationale behind this procedure was to test the effect of protagonists of identical gender on the productions of the children and the adults. In the *Fox Story* the different characters cannot be distinguished by the gender marking of identical types of noun phrases which may encourage the use of different kinds of noun phrases such as demonstrative pronouns and personal pronouns to disambiguate between the individual referents.

The children in the study were shown the individual pictures of the two stories which were then presented one by one when the children were asked to narrate the story. Note that this procedure does not discourage the children from using pronominals deictically (Hickmann 2003). The experimenter refrained from asking questions like *What's this?* in order not to provoke namings, but encouraged the children to continue by asking questions like *What's happening now?* and *How does the story continue?*

The experiment was conducted in Germany (Berlin), Russia (St. Petersburg) and Bulgaria (Vieden), testing about 120 children per language. The subjects were divided into age groups of approximately 30 children. In the Bulgarian data, the age group of two-year-olds is absent as children at this age are not accepted at a Kindergarten.

4 Results

First we will examine which kind of noun phrase the German, Russian and Bulgarian children use to make reference to story participants. Second, we will investigate how pronominal expressions relate to their antecedents. In this step of the analysis, the pronominal form of the anaphor (personal pronoun or demonstrative pronoun), the syntactic function of the antecedent (subject or non-subject) and the distance between antecedent and anaphor will be analyzed.

4.1 Overall distribution of reference types

In a first step of the analysis, the overall distribution of different types of noun phrases was examined. The noun phrases that occurred in the narrations were categorized into seven types: definite noun phrases, indefinite noun phrases,

pronominal demonstrative pronouns, adnominal demonstrative pronouns, personal pronouns, bare noun phrases and zero subjects. Table 1 gives the abbreviations used in the figures and the constructions which are realized in the target systems. Note that DEM refers to distance-marked demonstratives in Russian and Bulgarian. The respective terms German proximal *dieser* and distal *jener* did not occur in the data; DEM in the German data refers to pronominal *der*.

Table 1: NP construction types in German, Russian and Bulgarian

construction	abbr.	German	Russian	Bulgarian
definite NP	defNP	√		√
indefinite NP	indefNP	√		√
pronominal dem. pr.	DEM	√	√	√
adnominal dem. pr.	DEM NP	√	√	√
personal pronoun	PRO	√	√	√
bare NP	bare NP		√	√
zero subject	zero NP		√	√

4.1.1 The German children

For the German children there is an obvious change in distribution of noun phrases between the age groups of 2;0 and 3;0, see Figure 1. While the majority of noun phrases used by two-year-olds are indefinite noun phrases, their proportion dramatically decreases in the age group of three-year-olds.

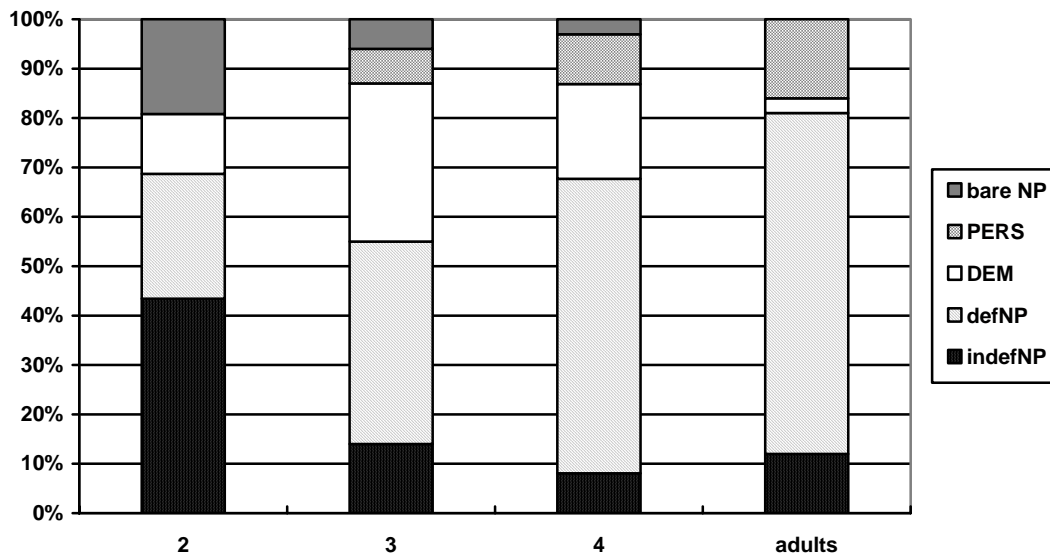


Figure 1: German children's distribution of noun phrases

A close look at the utterances revealed that most instances of indefinite noun phrases at age 2;0 are namings, see (16).

- (16) a. EX1: und was passiert als nächstes?
 and what happens next?
 child: ein Fuchs.
 a fox
- b. EX1: was ist denn da los?
 what is happening there?
 child: ein Vogel.
 a bird
- c. EX1: und schau mal hier.
 and, look here.
 child: ein Fisch.
 a fish

Paul, 2;07,17

At age 3;0 the use of indefinite noun phrases drops almost to the level of the adults. This change correlates with an increase of definite noun phrases and an increase of both demonstrative pronouns and personal pronouns. The three-year-olds make intensive use of demonstrative pronouns which decreases at age 4;0 towards the adult level. The use of personal pronouns steadily increases. For bare noun phrases which are not an option in target German, a steady decrease is documented with bare noun phrases representing 20% of all noun phrases in the group of two-year-olds.

4.1.2 *The Russian children*

In comparison to the German children, the Russian children are much closer to the adult distribution of types of noun phrases even in the youngest age group.

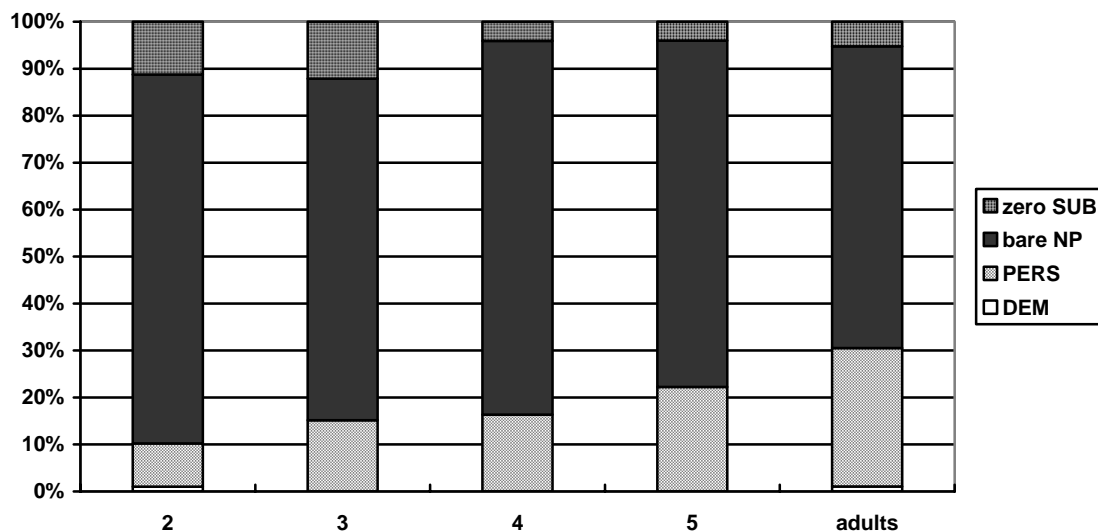


Figure 2: Russian children's distribution of noun phrases

There are no dramatic increases or decreases, but a steady approximation of the adult proportions. Similar to the German children the use of personal pronouns

steadily increases. There is a constant high number of bare noun phrases and presence of zero subjects which both structures being a target option in Russian. Contrary to the results of the German children, demonstrative pronouns are not used in higher proportions than by the adults but they remain at a very low level.⁴ Zero subjects are overrepresented in the youngest age group but their use decreases to the adult level in the four-year-olds.

4.1.3 The Bulgarian children

The types of reference used by the Bulgarian children is somewhat similar to the German children in that the proportions of the adult's use are steadily approximated and different from the Russian children in that they are not distributed similarly from the beginning, see Figure 3.

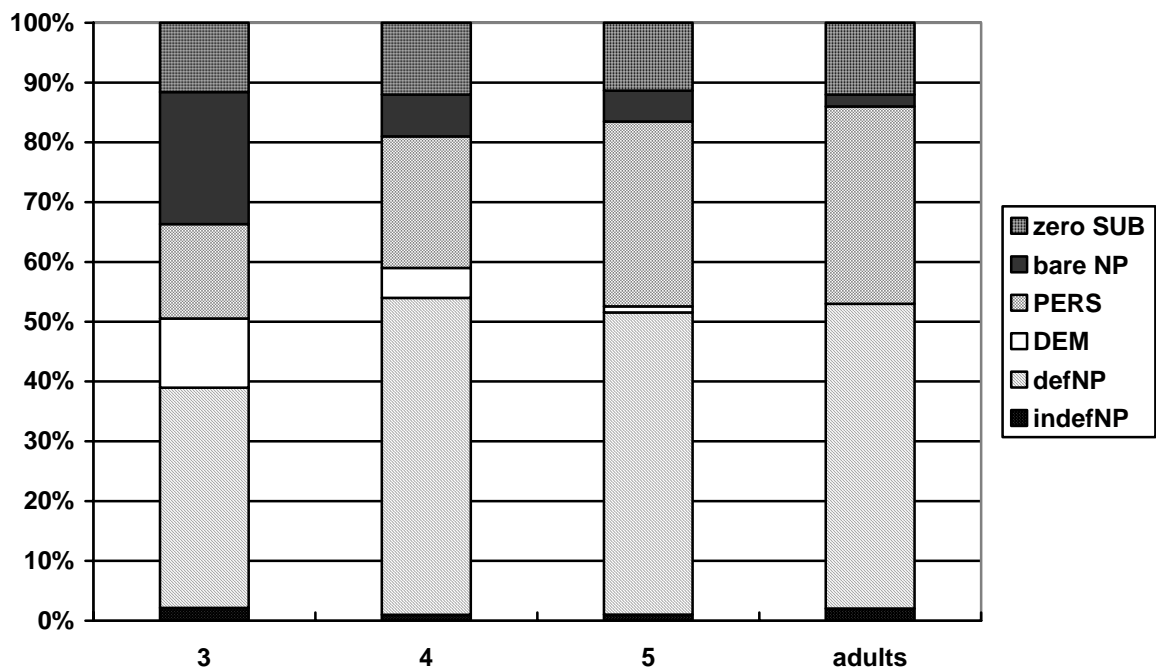


Figure 3: Bulgarian children's distribution of noun phrases

Similar to the German children the use of definite noun phrases slowly increases. This is also true for the Bulgarian children's use of personal pronouns. Demonstrative pronouns are almost absent from the adult's data, but are used at a 10% level by the two-year-olds and in about 5% of the cases by the three-year-olds. Indefinite noun phrases are almost absent from both the adult and the children's data. Zero subjects are at a constant target like level while bare noun phrases which are an option in Bulgarian decrease from a 20% level in the youngest age group to the adult value in the group of the five-year-olds.

⁴ Already the youngest children produce DEM NPs; this production increases towards the four-year old children and drops in the oldest group. Adults actively produce DEM NPs.

4.2 *Relation between pronominal expressions and their antecedents*

Analyzing the NEGRA corpus of written German, Bosch, Rozario, and Zhao (2003) compared the occurrences of pronominal demonstratives and personal pronouns. Results show that there is an asymmetry between the distribution of demonstratives and personal pronouns with regarding their antecedents, see Table 2.

Table 2: Demonstratives and personal pronouns in written German (adapted from Bosch, Rozario, and Zhao 2003)

	earlier	preceding sentence		same sentence
		nominative	non-nominative	
DEM	8.9%	14.5%	46.7%	30%
PERS	17.7%	48%	7.3%	27.2%

While a majority of demonstrative pronouns refers back to non-nominative antecedents in the preceding sentence, a majority of personal pronouns refers back to nominative antecedents. Within the same sentence the distribution of demonstratives and personal pronouns is about equal. When antecedents are located in the earlier discourse the anaphor tends to be a personal pronoun rather than a demonstrative pronoun.

4.2.1 *The German data*

The same kind of analysis was done with the data of the German adults, who were tested in the same setting, see Table 3.

Table 3: Demonstratives and personal pronouns in the data of the German adults

	earlier	preceding sentence		same sentence
		nominative	non-nominative	
DEM	0%	36%	18%	45%
PERS	0%	36%	11%	53%

The results are somewhat different from the findings of Bosch, Rozario, and Zhao (2003). This may be due to the differences in written and spoken corpora regarding the distribution of demonstratives and personal pronouns (Bosch et al. 2007). There are, however, similar tendencies to be observed. Comparing the use of personal pronouns finding their antecedents in the preceding sentence, Table 3 shows that personal pronouns have a majority of nominative antecedents. While this is also the result for the use of demonstrative pronouns, a comparison between the kind of anaphor that refers back to non-nominative

antecedents shows that there is a larger proportion of demonstrative pronouns (18%) that finds non-nominative antecedents than personal pronouns (11%).

For the German children an increase in demonstrative pronouns referring to non-nominatives in the preceding sentence can be observed between the age group of two-year-olds and the older age groups, see Figure 4. While the use of demonstrative pronouns in the same sentence is almost absent from the data, the distribution of demonstrative pronouns referring to nominal and non-nominal referents in the preceding sentence and in the earlier discourse is similar in the age groups of the three-year-olds, the four-year-olds and the five-year-olds.

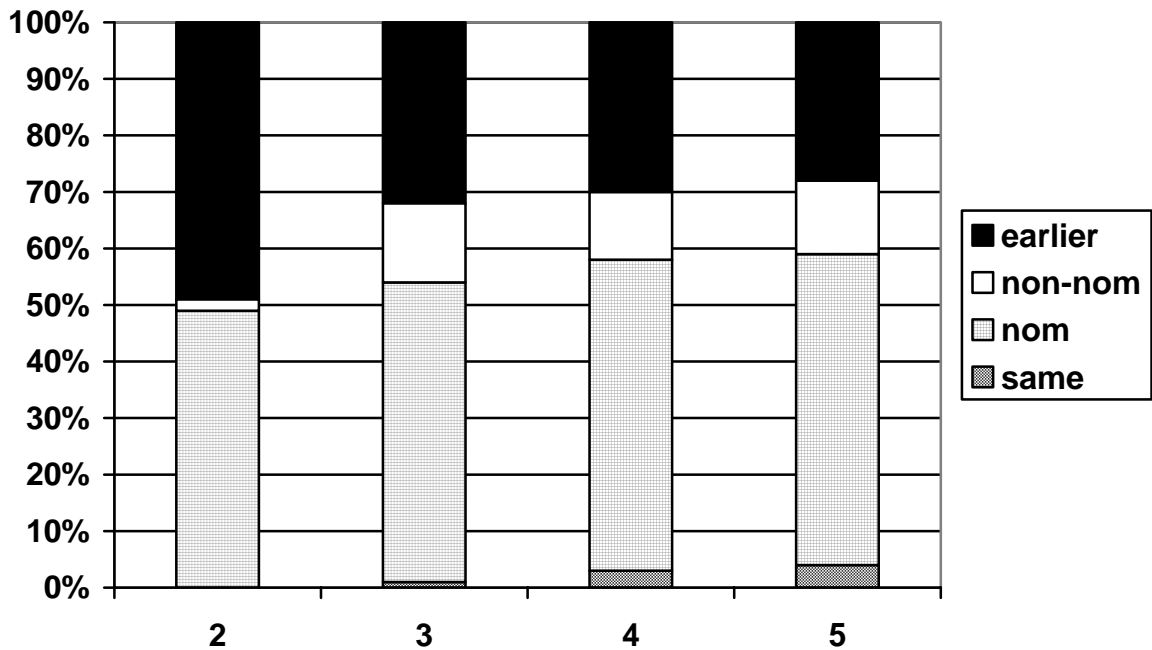


Figure 4: German children's use of demonstrative pronouns

The German children's use of personal pronouns is subject to a greater amount of change within the different age groups, see Figure 5.

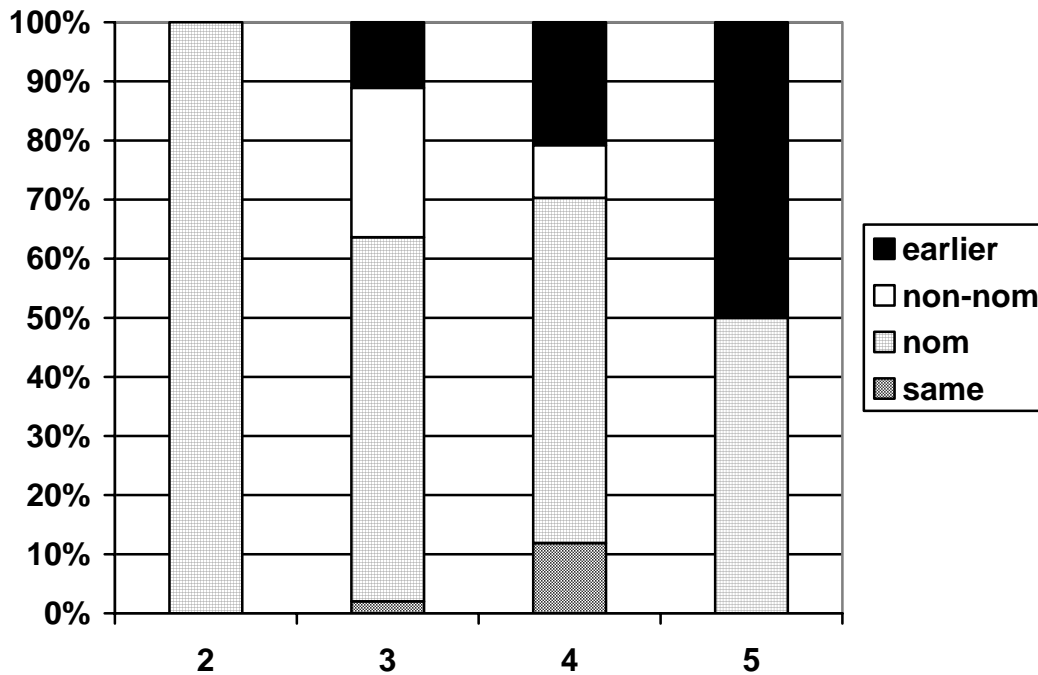


Figure 5: German children's use of personal pronouns

In the youngest age group, personal pronouns always refer back to grammatical subject in the preceding sentence. While this kind of use decreases to about 60% in the following three age groups, in the data of the three-year-olds use of personal pronouns referring to non-subject antecedents in the preceding sentence and use of personal pronouns referring back to discourse participants who were mentioned earlier is documented. While the use of personal pronouns to refer to non-nominative antecedents decreases in the age group of four-year-olds and is then given up by the five-year olds, the use of personal pronouns that have antecedents in the earlier discourse increases.

4.2.2 *The Russian children*

As the previous analysis of the overall distribution of noun phrases in the Russian data revealed, neither the adults nor the children used pronominal demonstrative pronouns in relevant numbers. Therefore it is impossible to compare the data following the analysis of Bosch, Rozario, and Zhao (2003). However, the syntactical status of the antecedents of personal pronouns could also be assessed, see Figure 6.

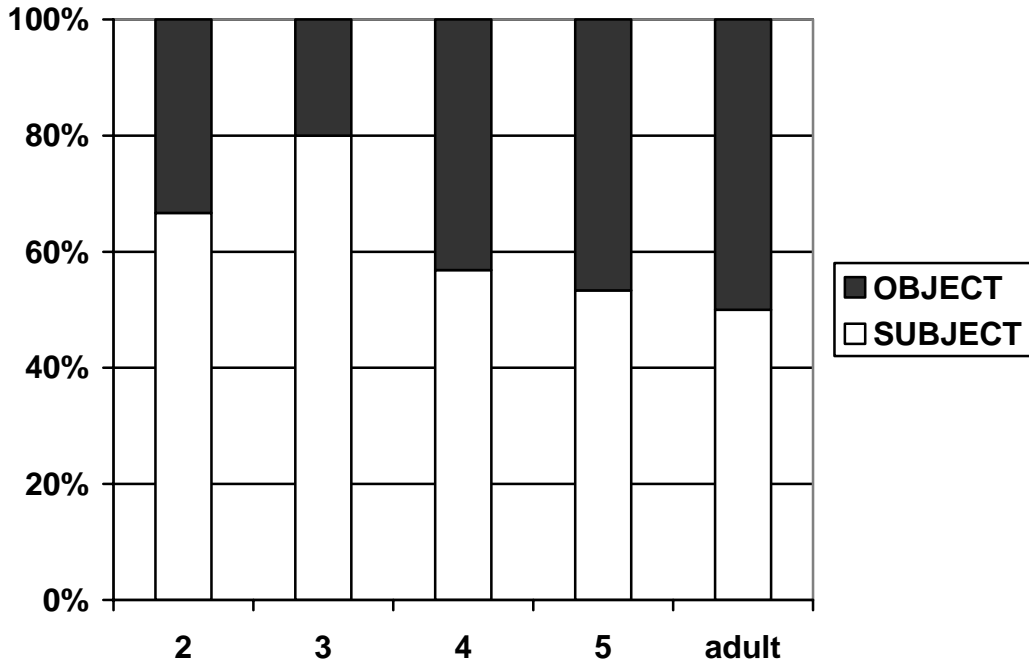


Figure 6: Antecedents of personal pronoun in the Russian data

Similar to previous analyses in this study, Russian children show an early awareness of distributions in their target languages (for the use of verbal inflection see also Gülzow and Gagarina 2006). An interesting fact to note is that an asymmetry of the kind observed in German corpora is not evident in the data of the children and the adults. The antecedents of personal pronouns are evenly distributed between grammatical subjects and grammatical non-subjects.

As this result seems to contradict much of what is generally assumed by theories of anaphor resolution, we performed a second analysis of this kind in which the individual referents were separated, see Figures 7-9.

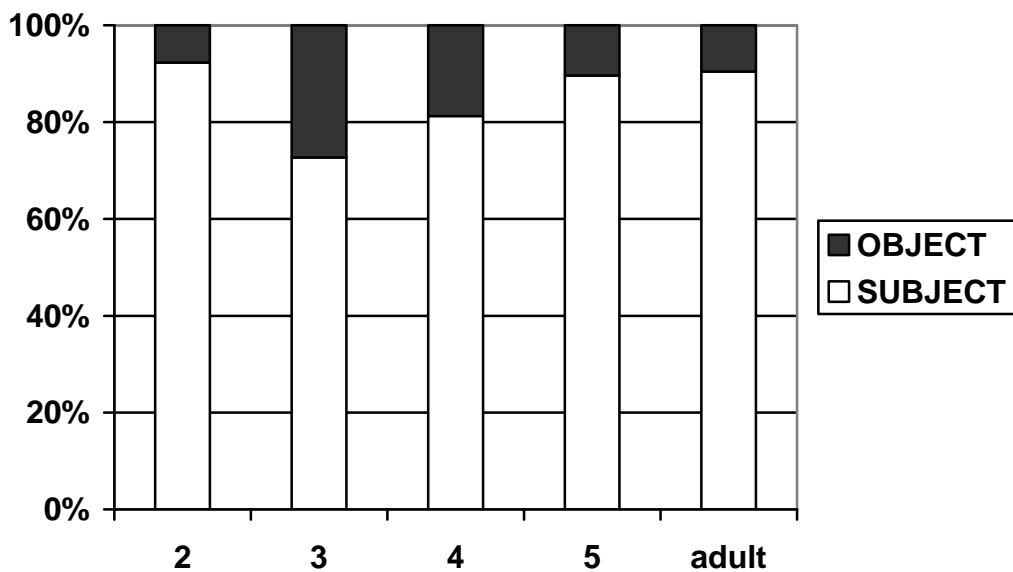


Figure 7: Bird as antecedent of personal pronouns in the Russian data

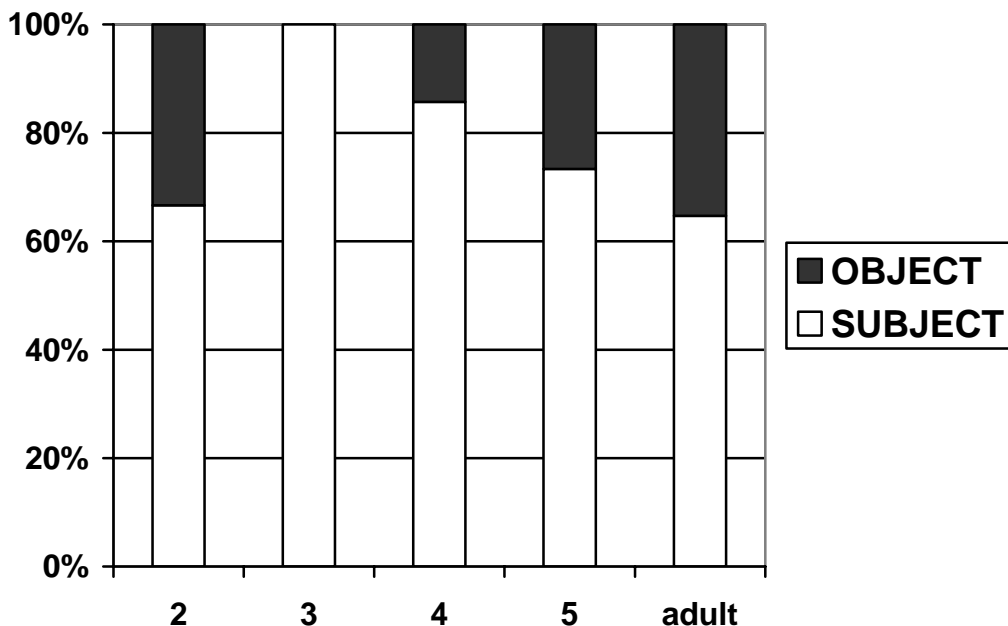


Figure 8: Fox as antecedent of personal pronouns in the Russian data

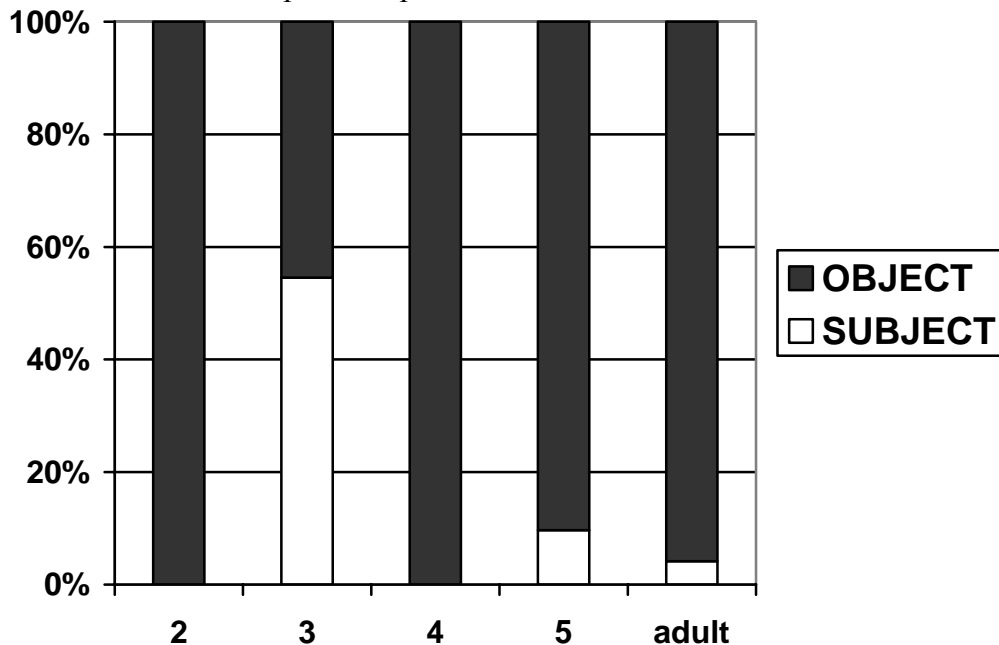


Figure 9: Fish as antecedent of personal pronouns in the Russian data

As Figures 7-9 clearly illustrate, the even distribution of the antecedents of Russian personal pronouns between subject and non-subject antecedents is in large parts influenced by a tendency of both the bird and the fox to be referents of a subject noun phrase and of the fish to be the referent of object noun phrases.

4.2.3 The Bulgarian children

The first step in the analysis of the Bulgarian data revealed that Bulgarian children are similar to the German children while the adult data more closely reflects the findings in the Russian data. On their way to a target like distribution of noun phrases, Bulgarian children pass through a phase in which they rely on demonstrative pronouns in a much higher proportion than is documented in the adult data. In fact the Bulgarian adults hardly used the demonstrative pronoun to refer to discourse antecedents. With regard to the Bulgarian children's choice of antecedents with regard to their syntactic status, no asymmetry could be observed, see Figure 10 and Figure 11. In Figure 10 raw numbers are given to illustrate that at age five, demonstratives have almost vanished from the children's data.

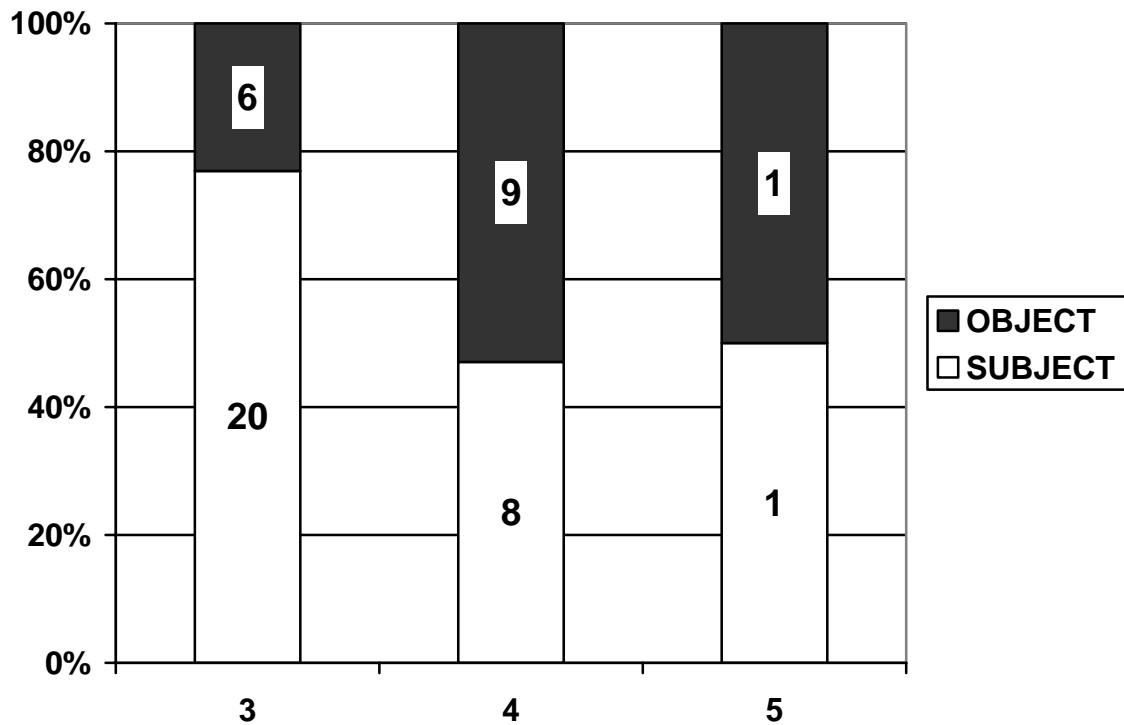


Figure 10: Demonstrative pronouns in the Bulgarian data

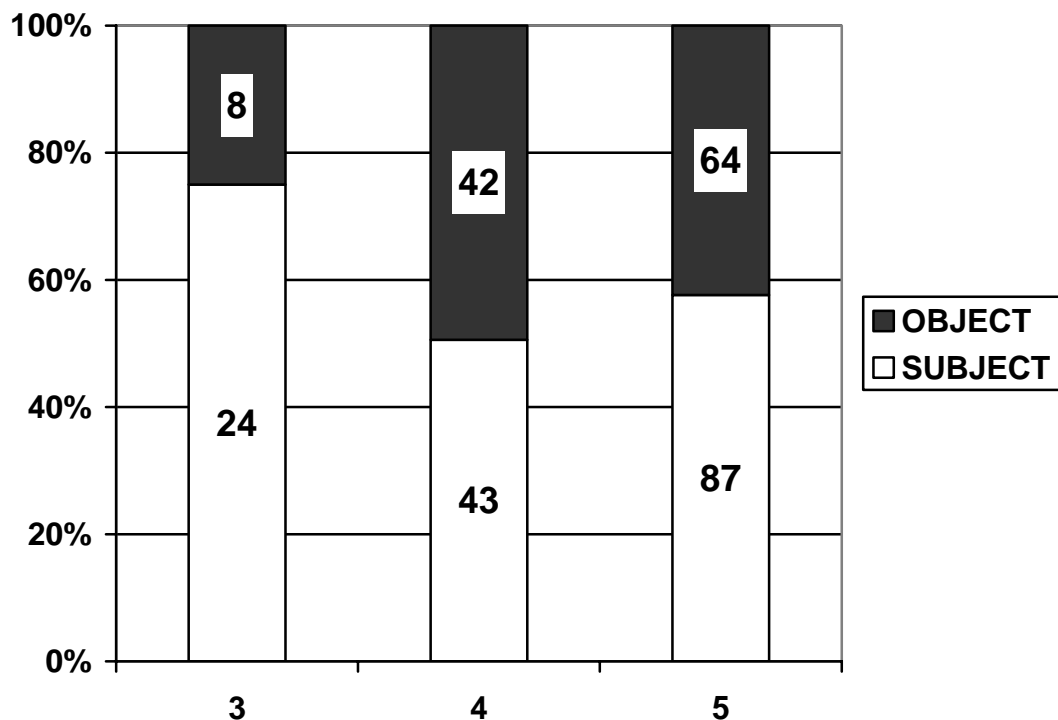


Figure 11: Personal pronouns in the Bulgarian data

5 Conclusion

In *Centering Theory* it is assumed that the relation between antecedent and anaphor is determined by factors such as the saliency of the referent and the complexity of the anaphor (Grosz, Joshi, and Weinstein 1995). High saliency of a discourse referent is believed to correlate with an anaphor that is low in complexity while low saliency of a discourse referent correlates with a formally more complex anaphor. For the German system this would imply a hierarchy such as illustrated in (17).

- (17) $\emptyset < er < der < dieser < der\ Hund$
 PERS DEM ‘this’ ‘the dog’
 high saliency.....low saliency
 low complexity.....high complexity

This leads to an asymmetry such as illustrated in (18).

- (18) a. Fritz_i will Hans_j morgen besuchen.

Fritz wants Hans tomorrow visit
 ‘Fritz wants to visit Hans tomorrow.’

- b. Er_i/Der_j war lange verreist.
PERS/DEM was a.long.time on.vacation
'He/DEM was on vacation for a long time.'

Bosch, Katz, and Umbach (2007) argue that there are referential preferences of German personal pronouns and demonstrative pronouns with regard to the properties of their discourse antecedents. In the written corpora which they analyzed, some tendency of personal pronouns to prefer grammatical subjects and a strong bias of demonstrative pronouns to choose grammatical non-subjects as their antecedents was displayed. In the data analyzed in the present study, similar tendencies could be observed in the German data but the findings could not be replicated in a one-to-one fashion. This is not surprising as there are substantial differences to be expected between corpora of written and spoken language. With regard to cross-linguistic differences, an analysis following Bosch, Katz, and Umbach (2007) was not possible for the Russian and the Bulgarian data as demonstrative pronouns are only represented by small numbers in the Bulgarian children's data and are absent from the Russian children's data and both from the Russian and the Bulgarian adult's data. In the Russian data the degree of animacy of the referents is reflected in the syntactic status of the noun phrases in which the referents occupy and clearly overrides subsequent grammatical coding of saliency in terms of the relation between anaphor and antecedent.

These results are valuable in themselves with regard to previous debates on the question which of the uses of demonstrative pronouns is the most basic. Himmelmann (1996) has argued against positions as formulated by Bühler (1934) and Lyons (1977) who assume that all endocentric uses derive from the exocentric use of demonstrative pronouns. More recently, Diessel (1999) has provided evidence for the assumption that the exophoric use is basic. Apart from the fact that exophoric demonstratives are the unmarked members in languages that have anaphoric demonstratives and grammatical reanalysis usually originating from the three endocentric uses, Diessel discusses mechanisms of the acquisition of deictic words in English. Clark (1978) has shown that before acquiring deictic expressions, English children use pointing gestures and later combine pointing gestures with demonstratives before their linguistic skills are sufficiently developed to capture situational cues in a way that makes pointing gestures superfluous. This finding is in line with recent proposals claiming that children's ability to maintain joint attention is crucial for linguistic development (Tomasello 2003, Kidwell and Zimmerman 2007). In Clark's study, four stages were identified, see Table 4.

Table 4: From deictic gesture to deictic word (adapted from Clark 1978)

Stage	Gesture	Utterance	Example
1	point		
2	point	+	'da' (= 'that')
3	point	+	'that shoe'
4		+	'that coat is mine'

The development of deictic reference from the use of gestures, combinations of gestures and deictic elements to the use of deictic expressions without an accompanying gesture in English children is in sharp contrast to the findings in the Russian and the Bulgarian data. For Russian children the use of deictic expressions seemed irrelevant in the task. Bulgarian adults also refrained from the use of demonstrative pronouns. For the German children it could be possible that they follow a developmental path that is similar to the English children if it is assumed that their use of *der* is at first accompanied by a gesture. The question remains why *der* is so prominent in the German children's data and which property licenses Bulgarian demonstrative pronouns to be present in the data of the three-year-olds and the four-year-olds.

In the study of Gundel, Hedberg, and Zacharski (1993), substantial differences between the Russian and the English system could be observed. As illustrated in Table 5, English displays some clear-cut divisions.

Table 5: Distribution of English noun phrases according to cognitive status⁵

	in focus	activated	familiar	unique	referential	type	totals
<i>it</i>	214	1					215
<i>this</i>		15					15
<i>that</i>	1	17					18
<i>this</i> N	1	11					12
<i>that</i> N		10	7				17
<i>the</i> N	30	95	47	108			280
<i>a</i> N					41	55	96
totals	246	149	54	108	41	55	652

For the cognitive statuses *referential* and *type identifiable* indefinite noun phrases are used. Definite noun phrases can be used for all other statuses, but there is a clear preference to use personal pronouns for the status *in focus*. The *activated* status allows the greatest number of different kinds of noun phrases with the highest proportions divided between adnominal and pronominal uses of

⁵ Table adapted from Gundel, Hedberg, and Zacharski (1993).

demonstratives *this* and *that* and definite noun phrases. For the cognitive status *activated* expressions which are marked for relative distance are highly relevant.

For Russian, no such clear-cut distinctions can be observed, see Table 6. Bare noun phrases serve as a kind of default which is represented by the highest proportion in all cognitive statuses, but *in focus* where personal pronouns are most likely to occur. With regard to the cognitive status *activated* there is some use of pronominal and adnominal *etot*, but not in proportions as high as in the English data.

Table 6: Distribution of Russian noun phrases according to cognitive status (adapted from Gundel, Hedberg and Zacharski 1993)

	in focus	activated	familiar	unique	referential	type	totals
∅	18						18
<i>ono</i>	51	2					53
<i>èto</i>	2	9					11
<i>èto</i> N	1	7	2				10
N	25	29	22	66	21	28	191
total	97	47	24	66	21	28	283

As no such analysis is available for German or Bulgarian it would be interesting to see how the distinctions are represented in these languages and in child data. It can be expected that the statuses *in focus* and *activated* are most relevant in child discourse. It would have to be shown how deixis interacts with different degrees of focus relating to cognitive status and why German children exploit the properties of *der* and Russian children make no use of distance marked demonstratives while Bulgarian children do so for a limited amount of time.

6 References

- Ariel, M. (2001). Accessibility Theory: An Overview. In: T. Sanders, J. Schilperoord, & W. Spooren (eds.), *Text Representation*. Amsterdam, Philadelphia: Benjamins, 29-88.
- Ariel, M. (2004). Accessibility marking: Discourse functions, discourse profiles, and processing cues. *Discourse Processes* 37(2): 91-116.
- Bosch, P., G. Katz, & C. Umbach. (to appear). The Non-Subject Bias of German Demonstrative Pronouns. In: M. Schwarz-Friesel, M. Consten, & M. Knees (eds.), *Anaphors in Texts: Cognitive, formal and applied approaches to anaphoric reference*, 145-164.
- Bosch, P., Rozario, T., & Y. Zhao. (2003). Demonstrative Pronouns and Personal Pronouns. German *der* vs. *er*. *Proceedings of the EACL2003: Workshop on The Computational Treatment of Anaphora*. Budapest.
- Bühler, K. (1934/1999). *Sprachtheorie: Die Darstellungsfunktion der Sprache*. Stuttgart: Lucius and Lucius.
- Chafe, W. (1996). Inferring Identifiability and Accessibility. In: Fretheim, T. & J. K. Gundel (eds.), *Reference and Referent Accessibility*. Amsterdam/Philadelphia: Benjamins, 37-46.

- Clark, E. V. (1978). From gesture to word: on the natural history of deixis in language acquisition. In: Bruner, S. & A. Garton (eds.), *Human growth and development: Wolfson College lectures 1976*. Oxford: Oxford University Press, 85-120.
- Diessel, H. (1999). The morphosyntax of demonstratives in synchrony and diachrony. *Linguistic Typology* 3: 1-49.
- Franks, S. (1995). *Parameters of Slavic Morphosyntax*. Oxford: Oxford University Press.
- Grosz, B.J., Joshi, A.K., and S. Weinstein (1995). Centering: A Framework for Modelling the Local Coherence of Discourse. *Computational Linguistics* 21 (2): 203-225.
- Gülzow, I. and N. Gagarina (2006). Analytical and Synthetic Verb Constructions in Russian and English Child Language. In: Gagarina, N. & I. Gülzow (eds.), *The Acquisition of Verbs and their Grammar: The Effect of Particular Languages* (Studies in Theoretical Psycholinguistics 33). Dordrecht: Springer, 229-259.
- Gundel, J., Hedberg, N., & R. Zacharski (1993). Cognitive status and the form of referring expressions in discourse. *Language* 69: 274-307.
- Hickmann, M. (2003). *Children's discourse: Person, space and time across languages*. Cambridge: Cambridge University Press.
- Himmelman, N. (1996). Demonstratives in Narrative Discourse: A Taxonomy of Universal Uses. In: Fox, B. (ed.), *Studies in anaphora* (Typological Studies in Language 33). Amsterdam: Benjamins, 205-254.
- Himmelman, N. (1997). *Deiktion, Artikel, Nominalphrase: zur Emergenz syntaktischer Struktur*. Tübingen: Niemeyer.
- Huang, Y. (2007). *Pragmatics*. Oxford: Oxford University Press.
- Jungbluth, K. (2005). *Pragmatik der Demonstrativpronomina in den iberoromanischen Sprachen*. Tübingen: Niemeyer.
- Kidwell, M. & D.H. Zimmerman (2007). Joint attention as action. *Pragmatics* 39(3): 592-611.
- Krasavina, O. and C. Chiarcos (2007). Aspects of topicality in the use of demonstrative pronouns. Paper presented at the annual meeting of the DGfS, Siegen.
- Lyons, J. (1977). *Semantics*. Cambridge: Cambridge University Press.
- Strube, M. and U. Hahn (1999). Functional centering. *Computational Linguistics* 25(3): 309-344.
- Tomasello, M. (2003). *Constructing a language: a usage-based theory of language acquisition*. Cambridge, MA: Harvard University Press.