Animacy and Child Grammar: An OT account

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Abstract. In this paper we report the results of an elicited imitation task on dative case marking in non-canonical double object constructions with 22 German children (3;9-6;8). The aim was to test the proficiency of the children's grammar and to see which strategies they use to produce ditransitive sentences in which the direct object precedes the indirect object. The analysis of the children's utterances/imitations shows that the animacy of the direct object affects the overt dative case marking of the indirect object. Children made more errors repeating dative case marking when the direct object was inanimate, i.e., they produced the accusative case on the indirect object (non-adult-like). When both objects were animate, children correctly produced the dative case on the indirect object. We describe and account for these performance strategies of the children in the framework of Optimality Theory. Assuming that the same universal constraints are at work as in the adult grammar, the difference between adults and children lies in the constraint ranking. We focus on a prominent pattern found in children's performance, which is absent (or rather oppressed) in the corresponding adult performance, and show that one and the same grammar accounts for both (in the sense of "strong continuity").

KEYWORDS: language acquisition, case, animacy, Optimality Theory

1. Introduction

It has not always been clear how grammatical models can accommodate acquisition data. Very early generative theories in particular have often made the assumption that children have completely different grammars compared to adults (see among others Felix 1987, 1991, 1992; Smith 1973, and the introduction of Kager et al. 2004 for discussion). This has resulted in the elaboration of idiosyncratic grammatical models which often turn out to be even more complex than the corresponding adult grammars.

Optimality Theory (OT, Prince and Smolensky 1993) introduces a new framework for the study of child language patterns (Gnanadesikan 2004; Pater and Werle 2001; Smolensky 1996; Smolensky et al. 2004, to cite just a few authors), and provides a simple and insightful solution to the problem of the distinct but similar child grammar. For the sake of the present paper, the most important property

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of this grammar is that child and adult grammatical patterns are both expressible in the same way, with the help of the same principles. It is true that the Strong Identity Hypothesis (Jakobson 1968) has been an underlying *leitmotiv* in the study of language acquisition for several decades, and, as a result, the insight that children's and adults's grammars are one and the same is not new, but the architecture of most generative grammars has hindered a formal implementation of this hypothesis, rather than facilitated it (see Williams 1997).

In this paper, we explore the claim that has been expressed in the OT literature that learning a language amounts to learning a ranking of the universal constraints. An important insight of OT is that some linguistic structures which are a peculiarity of child language now find a natural explanation. The idiosyncratic patterns are accounted for by constraint reranking. In a more classical generative pattern, by contrast, one has been confronted with the puzzle that children seem first to master a set of transformations, rules or parameter settings which are absent in the syntax (see, e.g., Roeper 1998, 1999 for discussion) or in the phonology of their parents, and only later do they have to reset their parameters to reach the adult grammar. We also provide evidence that the results of works on phonological acquisition, namely the different interactions between markedness and faithfulness constraints in children's grammar as compared to adult grammar, can be extended to the acquisition of syntax. Until now, few syntactic data have been published that support the OT model of language acquisition. In the following, we present a new analysis of a data set on animacy and case marking which is taken from Drenhaus (2004). In Drenhaus (2004) experimental results, presented in section 2.2, were analyzed in a minimalist framework assuming that children access distinct grammar modules (theta module and/or case module) in order to project unambiguous information, and in this way distinguish the objects (Roeper 1999). Drenhaus' proposal can be summed up as follows: In order to distinguish between direct and indirect object, children use different module-based strategies licensed by the feature animacy. These strategies trigger distinct syntactic processes (dative case marking and word order). Additionally, a feature like animacy triggers interactions between different grammar modules, as, for instance, between theta grammar and case grammar. The acquisition process can be described in the following way: First, distinct grammar modules provide compatible solutions for a certain context; in the case under discussion, ditransitive structures; that is either theta grammar or case grammar can apply. Second, the grammar system is confronted with a structure or context which cannot be analyzed by application of only one module. This situation arises when both objects are [+animate]. In this case, case grammar intersects with theta grammar. At a later stage, the grammar system moves in the direction of an adult system, and these intersections are established.

We do not feel a contradiction between our approach to learnability and the minimalist program (Chomsky 1995, 1998, 2001). In this latter model, the acquisition process is understood as a selection from a finite set of universal features whereby elements are combined by operations provided by Universal Grammar (in the line of, e.g., Drenhaus 2000, 2002, 2004 and Roeper 1996, 1998, 1999). Similar to acquisition approaches following the Strong Continuity Hypothesis (e.g., Weissenborn 1994; Roeper and Weissenborn 1990), OT predicts that all properties of grammar are present in all individual instantiations of grammars, thus in all natural languages. However, in

contrast to the idea of feature specification and selection, it is by ranking the responsible constraints low in the hierarchy that some of the properties become less active than others, but none are completely obliterated. Consequently, as all constraints are present, even low-ranking ones can trigger effects in some parts of the grammar: the so-called 'emergence of the unmarked'. Children prefer to use unmarked patterns when they start to produce language (see, for instance, Pater 1999; Smolensky 1996; Smolensky et al. 2004).[1] One reason for this preference can be located in the comparatively smaller cognitive load necessary for unmarked linguistic structures; another reason is the lack of competence in other aspects of grammar, and how they interact with each other (Reinhart 1999). In phonology, it has been shown repeatedly that unmarked patterns are acquired first (Demuth 1995; Fikkert and Levelt 2002; Gnanadesikan 2004; Grimm 2003; Levelt and van de Vijver 2004 among others), and that ranking markedness constraints higher than faithfulness constraints at the initial stage makes just the right predictions.

2. Animacy, Case and Theta-Role

2.1. *Previous experimental results*

Experimental studies in a number of languages show that adult speakers are more likely to produce an animate entity early in the sentence (Bock 1982, 1987; Feleki 1996; Prat-Sala; Branigan, Pickering and Shillcock 1996) and that they have a tendency to place the animate patient before an inanimate agent. In this kind of context, adults often produce a passive structure rather than an active one (for instance, *A man is being run over by a car* vs. *A car is running over a man*).

Similarly, acquisition studies have suggested that animacy plays a considerable role in child language by influencing both the syntactic structure and the comprehension of sentences. Clark (1965) tested English sentences that included an animate and an inanimate element. He was able to show that the preferred word order is one in which the animate noun preceded the inanimate one. Dewart (1979) used a repetition task to test the influence of animacy in passive voice in English child language at the age of 6 to 8 years. He used test sentences, presented in passive voice, involving an animate agent and an inanimate patient. His results showed that children have the tendency to recall these sentences as active sentences (for example, *The grass was mown by the gardener* was repeated as *The gardener mowed the grass*). However, structures presented to the children in active voice and containing an animate patient and an inanimate agent were more likely to be recalled by the children in passive voice (for instance, *The blanket covered the baby* was repeated as *The baby was covered by the blanket*). Similar results were found by McDonald et al. (1993), as well as by O'Grady (1997), Roeper et al. (1981). Similarly, Harris (1978) also established a connection between animacy and the passive. In the latter experiment, children were asked to describe pictures, and produced more passive clauses when the patient was animate and the agent was inanimate (as in, *The man was hit by the bottle* for *The bottle hit the man*). The same observation holds in the acquisition of word order and syntactic voice in English (Lempert 1988, 1990) and in

[1] See Hale & Reiss (1998) for a different opinion.

Catalan (Prat-Sala & Shillcock 1997; Prat-Sala et al. 2000).

In other studies, researchers tested the comprehension of double object constructions in English (Cook 1975, O'Grady 1997, Roeper et al. 1981). It was shown that children also rely on animacy to distinguish the direct from the indirect object in sentences containing a ditransitive verb. Moreover, Cook (1975) presented evidence that such sentences were best understood by children if the indirect object is animate and the direct object is not. They had more difficulties in understanding sentences where both objects were inanimate than in the previously mentioned construction.

In the next section, Drenhaus' (2004) results are summarized, showing that German children attribute an important role to animacy: the distribution of animacy triggers dative case assignment in ditransitive structures. This result relates to Roeper et al.'s (1981) observation that English children use animacy as a strategy to identify the indirect and the direct object and to Fillmore's (1968) observation that some languages depend on animacy to distinguish between direct and indirect objects.

2.2. *Results of Drenhaus (2004)*

Drenhaus (2004) reports the results of an elicited imitation task with German children aimed at testing the influence of animacy on word order and case marking in German.[2] More specifically, this study tested the proficiency of the children's grammar and investigated which strategies children use to produce ditransitive sentences when the direct object precedes the indirect object.

The goal of the experiments was to induce children to produce non-canonical ditransitive sentences, a structure that they do not spontaneously utter very often.[3] The results indicate an interaction between the theta role, case marking, and animacy in sentences with non-canonical word order.

2.2.1. *Participants*

22 German children (3;9 to 6;8 years, mean age 5;4 years) were asked to repeat sentences with ditransitive verbs (*geben* 'to give', *zeigen* 'to show' and *schenken* 'to give as a present').[4] The experiment took place in a kindergarten in Leverkusen near Cologne. All children spoke German as their first and only language. The repetitions of the children were tape-recorded, transcribed and

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[2] Compare Hoberg (1981), Lenerz (1997) and Müller (1999) for word order patterns in German. See also Wunderlich (1997) for an overview of morphological case marking.

[3] The entire Simone-corpus (Miller 1976, made available by the CHILDES database) contains only 107 sentences in which the child (called Simone) used the verbs *geben* 'give' and *zeigen* 'show', to the exclusion of other ditransitive verbs.

[4] An anonymous reviewer informs us that the elicited imitation task has been criticized in the literature. Children's responses might reflect their linguistic representations in which case imitations would only reflect performance instead of grammatical competence. In our view, this criticism is not entirely justified since according to Lust et al. (1998), children's imitations are not random and can not be explained by reduced memory load. In the experiment reported here, especially in Table 2, it is evident that children show grammatical competence. Children's answers often reverse the non-canonical order that they are asked to repeat. Thus they analyze and understand the structure before they repeat the sentence and render in this way what they hear compatible with their grammar. This is crucial evidence that the tested children are aware of the structures. A further indication that they

coded.

2.2.2. Materials

The test sentences contained either two object DPs in non-canonical order or an accusative object pronoun and a dative object DP (see (1) and (2)). All test sentences consisted of a main clause ($DP_{[NOM]}$ AUX direct object DP/$Pronoun_{[ACC]}$ indirect object $DP_{[DAT]}$ main verb). In all sentences, the benefactor is animate[5] but the theme may be animate, as in (1b) and (2b), or inanimate, as in (1a) and (2a). Pictures with person(s) and object(s) or animal(s) related to the order of the objects were presented to the children simultaneously with the oral presentation. This was done to make sure that the pronoun was correctly linked to the object.

(1) Sentences with two full DPs
   a. Der Mann will das Auto dem Kind geben.
      the man wants $the_{[ACC]}$ car $the_{[DAT]}$ child give
      'The man wants to give the car to the child.'
   b. Der Mann will die Katze dem Kind geben.
      the man wants $the_{[ACC]}$ cat $the_{[DAT]}$ child give
      'The man wants to give the cat to the child.'

(2) Sentences with one pronoun and one full DP
   a. Der Mann will ihn [= den Stuhl] der Frau geben.
      the man wants $it_{[ACC]}$ $the_{[DAT]}$ woman give
      'The man wants to give it [= the chair] to the woman.'
   b. Der Mann will ihn [= den Hund] der Frau geben.
      the man wants $it_{[ACC]}$ $the_{[DAT]}$ woman give
      'The man wants to give it [= the dog] to the woman.'

Other studies on the acquisition of the German (Clahsen et al. 1994; Tracy 1984) report that children overgeneralized the accusative case in the context of dative case marking. However, these studies did not discuss the influence of animacy on case marking explicitly.

In Eisenbeiß (1994) it was shown that replacing the dative suffix *-m* by the accusative suffix *-n* in children's utterances might be related to morphophonological similarity; see Table 1 which gives the case paradigm for German dative and accusative determiners. All genders discriminate between the dative case and the accusative case.

Table 1. Case paradigm for German definite DPs (dative and accusative)

	masc.	fem.	neuter	pl
	the grandpa	the woman	the child	the children
dative	dem Opa	der Frau	dem Kind	den Kindern
accusative	den Opa	die Frau	das Kind	die Kinder

Clahsen et al. (1996) and Schütze (1997) controlled for these forms in their analysis and consequently hardly find any overgeneralization for the accusative case.

To minimize morphophonological similarities, we constructed the material for test sentences like (1)

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are grammatically informed is that they point to the correct picture while repeating the sentences.

[5] Expressions like *Ich gebe dem Tisch einen Tritt* 'I give the table a kick', with two inanimate objects, were excluded from the experiments. It was assumed that these verbs build a complex expression with the direct object 'a kick', and consequently have an idiomatic flavor.

in the following way: Children had to imitate structures with a masculine dative DP two times, a feminine DP two times, a neuter DP two times and two times a plural DP combined with an animate accusative DP and an inanimate DP respectively, resulting in 16 experimental sentences. For the second set of experimental sentences (2), children had to repeat structures with a masculine dative DP five times, a feminine DP five times and a neuter DP five times. These DPs were combined with an animate accusative DP and an inanimate DP respectively. Resulting in 30 test sentences. Sentences with plural dative DPs were not included in order not to overstrain the children.

2.2.3. Procedure

Before the experiment was carried out, all children were tested as to their ability to inflect the dative and the accusative case correctly. To test dative case marking each child had to comment pictures on which someone 'gives' (*geben*), 'shows' (*zeigen*) or 'gives as a present' (*schenken*) something to someone. The subjects and objects on the pictures were introduced to the children. After presenting the picture, children had to answer questions like in (3) and (4).

(3) *Was hat die Person der anderen Person gegeben?*
(What did the person on the picture give to the other person?)
and then:
(4) *Wem hat die Person etwas gegeben?*
(To whom did the person on the picture give something?)

The first question requires an answer in the accusative case (direct object) and the second one an answer in the dative case (indirect object). Children who fail this test were eliminated from the study. Additionally, another pretest was performed to test their awareness of the different meaning of accusative or dative case marking in similar structures. To this aim, a wooden ring was placed on the floor in front of the child. The child was asked to perform tasks like (5) and (6):

(5) *Springe bitte mal in dem [dative] Ring.*
(Would you be so kind to jump up and down in the ring.)
Afterwards we asked the child:
(6) *Springe bitte mal in den [accusative] Ring.*
(Would you be so kind to jump into the ring.)

The different case morphology led to different meanings of the sentences. Children who did not act proper in these two situations were not included in the main experiment After this, the main experiment was carried out, as explained above.[6]

2.2.4. Results [7]

In the main experiment, two different structures were tested. First, double DP sentences were tested.[8]

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6 In all pretests and in the main experiment each child was tested separately.

7 The appendix provides the raw data for individual children.

8 The canonical word order of these sentences is benefactor before theme, though in a language like German, it is also true that the opposite order is also possible.

In all these sentences, the benefactor is animate, but in one variant, the theme is inanimate (see (1a)), whereas in the other variant it is animate (see (1b)). In the second set of sentences, the theme is pronominal, and the benefactor nominal. As a result, the order of the elements is fixed: in German, the pronoun precedes the DP, regardless of the function of the pronoun. The same restriction on animacy as before applies: the indirect object has to be animate, otherwise the structure becomes ungrammatical. These sentences were used to study the way children resolve the conflict between two requirements: the pronoun has to come first, and the animate object has to come first. It must be noticed that the second set of sentences has the expected word order, whereas in the first set of sentences, word order is slightly marked.

Consider first the result of the sentences with two full object DPs in a non-canonical word order, like those in (1). The task for the 22 children consisted in repeating 16 such sentences, which means that altogether 352 reactions were elicited. These can be divided into two groups as shown in (7).

(7)	a. DP[accusative / **animate**]	DP[dative / animate]	(n=176)
	b. DP[accusative / **inanimate**]	DP[dative / animate]	(n=176)

Table 2 summarizes the results of the children's answers for word order. They had great difficulties in dealing with these double DP structures. Only in 158 (46%) sentences the target was replicated in the presented word order. In 54% of the cases (183 sentences) the children reversed the order of the DPs. These results speak for IO-DO as the unmarked word order in child grammar. Though word order is not the topic of this paper, we discuss it briefly in relation with variation in OT in Section 4.

Table 2. The order of objects in double DP sentences

theme precedes benefactor (accurate repetition)	158 repetitions (46%)
benefactor precedes theme (inaccurate repetition)	183 repetitions (54%)
no repetition	11 sentences

As can be seen from Table 3, the benefactor is in dative more often when the theme is animate (49% of the sentences with an animate theme have a dative benefactor) than when it is inanimate (18% of the sentences with an inanimate theme have a dative benefactor). In the vast majority of the utterances, the case of the benefactor is accusative (in 51% of the cases when the theme is animate, and 82% when it is inanimate).[9]

[9] The children used the dative in 32 sentences out of the 183 inaccurate repetitions, altogether 54 sentences with a double object DP have a dative benefactor (see Table 3). As a result, dative marking is used more often when the word order is changed to the canonical order, reducing the total markedness of the sentences. Only 22 sentences have both a dative benefactor and a marked word order.

Table 3. Distribution of the case of the benefactor in double object DP sentences according to the animacy of the theme, and independently of the word order (correct repetitions)

	theme is animate	theme is inanimate	total
dative benefactor	40 (49%)	14 (18%)	54
accusative benefactor	42 (51%)	62 (82%)	104
total	82 (52%)	76 (48%)	158

The statistics exhibit a highly significant difference (Chi-square (df=1) 16.160 p=.0001) depending on the animacy of the accusative DP and the following indirect object DP. When both objects are animate, the children use dative case more often than in structures in which only the indirect object is animate. In this latter case, the children often assign accusative as the default case to the indirect object.[10]

The second type of sentences, illustrated in (2), included a pronominal accusative object followed by a full dative object. The same 22 children were asked to repeat 30 sentences of this type (660 utterances in total) which were distributed in terms of animacy, as shown in (8).

(8) a. pronoun[accusative / **animate**] DP[dative / animate] (n=330)
b. pronoun[accusative / **inanimate**] DP[dative / animate] (n=330)

The children repeated the given sentences accurately in 77% of the cases (506 sentences), a much better performance than the repetitions of the double object DP sentences discussed above, where the children repeated the given target order in only 46% of the cases. This result was expected, given the very strong preference for realizing a pronoun before a full DP in German. The same effect of animacy on the use of dative as in the structures with double object DPs was observed in this series of sentences as well. Thus, the dative was used on the benefactor when the pronominal theme was animate, but when it was inanimate, the children did not feel the urge to disambiguate the theta role of the argument with the help of case, and they often preferred to use a double accusative construction.

The results for the second set of sentences are summed up in Table 4. Again the dative was used for the benefactor more often when the theme was animate (46% of the sentence with an animate theme) than when it was inanimate (13% of the sentence with an inanimate theme). In the remaining sentences (54% of the sentence with an animate theme and 87% of the sentences with an inanimate theme), the case of the benefactor was accusative.

[10] As mentioned above and also highlighted by an anonymous reviewer, in studies by Clahsen et al. (1996) and Schütze (1997) no overgeneralization of accusative case could be established when the similarity of the accusative ending *–n* and the dative ending *–m* were controlled for. Therefore, we calculated a statistics for children's repetitions which included only sentences with feminine, neuter and plural dative DPs. We found a significant difference depending on the animacy of the accusative DP and the following dative DP (Chi-square (df=1) 12.77 p=.0004). The statistics that includes only masculine dative DPs showed a similar effect (Chi-square (df=1) 3.78 $p < .05$). In this sense, our results contradict those of earlier studies which found an overgeneralization of accusative case. The

Table 4. The case marking of the benefactor in Pronoun-DP sentences according to the animacy of the theme

	Animate Acc-pro	Inanimate Acc-pro	Total
dative benefactor	112 (46%)	34 (13%)	146
accusative benefactor	132 (54%)	228 (87%)	360
total	244 (48%)	262 (52%)	506

In Table 4 we see again a significant effect of the theme's animacy on the dative case assignment of the indirect object DP (Chi-square (df=1) 66.720 p=.0000). If both objects are animate, the dative case marking on the indirect object DP is favored as compared to the inanimate condition.[11]

In 154 sentences of the set under discussion, the word order of the constituents was reversed, delivering a dative-accusative pattern. These sentences do not constitute a homogeneous class, though the general picture was that, here too, dative marking was influenced by animacy. An interesting, though small, subgroup of sentences comprised those in which the children replaced the pronoun by a full DP, possibly revealing that the children preferred the 'canonical' word order in which the dative precedes the accusative object.

This second group of sentences, thus, leads to the same conclusion as before: the distribution of the objects' animacy triggers the children's responses in the tested structures. More precisely, dative case marking on one of the two DP objects is more likely if both objects are animate. Case is used to disambiguate the object arguments when other strategies lead to an ambiguous solution, namely, to contradictory and conflicting results.

One remaining question is whether children treat both structures in exactly the same way or whether they rather apply different strategies in structures with accusative pronouns and structures with accusative DPs with respect to animacy and dative case marking. In order to answer this question, it is necessary to check whether the structures with an animate direct object or an inanimate direct object exhibited the same effects. Table 5 compares the structures with an animate direct object.

Table 5. Case marking of the benefactor (theme is **animate**)

	Animate AccDP	Animate Acc-pro	total
dative	40 (49%)	112 (46%)	152
accusative	42 (51%)	132 (54%)	174
total	82 (25%)	244 (75%)	326

The statistic analysis does not yield any significant difference (Chi-square (df=1) .300 p=.5864) between the two structures. As far as the case marking is concerned, the children handle both structures —the AccPro + DatDP and the double object DP sentences— similarly.

reason for the difference might lie in the influence of the factor animacy in our study.

[11] We calculated separate statistics for structures with feminine and neuter dative DPs. We found a significant effect with regard to animacy and case marking in this subset of the children's data when only feminine and neuter dative DPs are considered (Chi-square (df=1) 40.79 p=.0000). The subset of the masculine dative DPs showed a similar effect (Chi-square (df=1) 26.47 p=.0000).

With respect to structures with an inanimate accusative pronoun or an accusative DP, no statistical difference is found either (cf. the results summed up in Table 6).

Table 6. Case marking of the benefactor (theme is **inanimate**)

	Inanimate AccDP	Inanimate Acc-pro	total
dative	14 (18%)	34 (13%)	48
accusative	62 (82%)	228 (87%)	290
total	76 (22%)	262 (78%)	338

Here also, there is no significant difference (Chi-square (df=1) 1.43 p=.2313) between the two structures. The children marked dative similarly in both structures. The presence of an animate theme influenced dative case marking on the benefactor in both experimental conditions in the same way.

To sum up this section, children show a stronger tendency to use the dative case if the direct object is animate than if it is inanimate; this holds in both structures with two full DPs and in structures with a pronoun and a DP object. When one object is animate and the other is inanimate, this information alone is enough to distinguish between the objects: case marking becomes superfluous.

In this respect, children's performance strategies can be considered economical as far as the markedness and the case hierarchy (see Sections 3 and 4) are concerned, especially when compared to the adult grammar, in which the option to omit case is not suitable. From the children's perspective, all necessary information is already given by theta roles and, as a result, it is quite natural not to use the dative marking if information is redundant.

In the next section, we develop an OT analysis to account for the data presented in this section, and in Section 4, some points of theoretical interest are discussed. In the remainder of this paper, we show that OT is especially apt at capturing the complex interaction between animacy (a semantic feature) and case (morpho-syntax). We believe that OT provides us with a suitable model which describes and accounts for data, which are typical of child language but atypical or even impossible in adult language, like the case assignment pattern that has been described in this section. It will be shown that children's performance strategies deviate from adult strategies with regard to the interaction of markedness constraints and faithfulness constraints. A further advantage of OT for language acquisition is the expressibility of variation in a model whose main component resides in the reranking of violable constraints.

3. Optimality-theoretic analysis

3.1. *Constraints*

The set of surface markedness constraints postulated by OT is universal. In other words, no two general markedness constraints are possible that truly contradict each other. Faithfulness constraints can be different in different languages because they take existing structures, like phonological segments, theta-roles and scope of operators, as their objects of evaluation though their general format is universal as well. Logically, if markedness constraints are universal and if children prefer

to fulfill them when starting to speak, it should be possible to identify the constraints entering universal grammar by analyzing the linguistic behavior of children (see Davidson et al. 2004 for this view). Moreover, the pattern appearing from their grammar should also be in line with adult languages (see Gnanadesikan 2004).[12] In this section and the next one, we show that our data support such a view.

Let us first give a list of the grammatical components which have been shown to play a role in our data.

1. If one of the arguments is a pronoun, then the order pronoun before full DP is strongly preferred (though not completely obligatory): PRO > DP.

2. In terms of markedness, two hierarchies interact and regulate the association of case with arguments, a case hierarchy and a theta-role hierarchy. For case, the following hierarchy is universally active (where > means "is less marked than"): Nominative > Accusative > Dative, translated into OT as *DATIVE >> *ACCUSATIVE >> *NOMINATIVE (for instance Müller 1999; Wunderlich 1997 or Woolforf 2001 for hierarchies of case.).

3. As for the theta-role hierarchy, it takes the following form: an agent is less marked than a theme (or a patient) which is itself less marked than a benefactor (or a goal). In an OT ranking: *BENEFACTOR >> *THEME >> *AGENT (for discussion, see Grimshaw 1991, 1997 regarding OT and Bowerman 1990 and Pinker 1996 for acquisition).[13]

4. As far as structural case assignment is concerned, if a sentence has only one argument, this argument is expressed in the nominative. A second argument would be in the accusative, and the dative is reserved for the third argument.[14] The Case hierarchy and the theta-role hierarchy hence interact in an interesting way. Since the benefactor is the third argument in terms of the theta-role hierarchy, it is this argument which gets the dative (the third case). The theme, being the second argument, is in accusative (the second case), and the nominative, being the least marked case, expresses the least marked role, in our sentences, always the agent (the least marked of one hierarchy combines with the least marked of the other hierarchy, see Prince and Smolensky 1993 for harmonic alignment). In the following, we call the constraint responsible for this interaction HIERARCHY. It requires assignment of the least marked case to the least marked argument, the second marked case to the second marked argument, etc. Formally, it can be expressed by the interaction of the two hierarchies just introduced, but, for the sake of simplicity, we prefer to express the role of harmonic alignment by means of a single constraint. By the action of this constraint, accusative is associated with a theme and dative with a benefactor, and every deviation from this pattern is counted as a

[12] This is not a novel view to describe child grammar. For similar proposals within the framework of Government and Binding see, e.g., Roeper and Weissenborn 1990; Weissenborn 1994 among others.

[13] We explicitly exclude lexical case assignment where the arguments receive Case through a lexical specification of the verb. A prototypical example in German is the verb *helfen* 'to help' which assigns dative to its only object.

[14] Matthias Schlesewsky (p.c.) reminds us that an alternative view might be that the benefactor is more prominent on the theta-role hierarchy than the theme because it denotes an animate argument. Our data show that this view is not mandatory.

violation of HIERARCHY. In this paper, we are not concerned with the role and case of the subject.

5. Each case occurs only once.[15] There is a uniqueness constraint that bans multiple case assignment. We call this constraint CASEUNIQUENESS (Fanselow and Féry 2002; Wunderlich and Lakämper 1999).

6. We also posit a recoverability constraint whose effect is that arguments are unambiguously associated with their theta-role, or, in other words, that no ambiguity as to the role of the argument should arise: UNAMBIGUOUSARGUMENT/ROLE. Again, this constraint is a simplification and can be replaced in a more formal framework by the interaction of CASEUNIQUENESS and the theta-role hierarchy. If two arguments can have the same theta-role and the same case, it is the task of case to disambiguate which argument has which role. Moreover, as was shown in Section 2, a theme can be animate or inanimate, but a benefactor is always animate (at least with regard to the tested verbs, see footnote 5). This requirement is not stated explicitly below, and we will consider only candidates which do not violate it. In a more elaborate model, this will also be expressed in the form of a constraint.

7. Word order: accusative is ordered before dative, or the theme is ordered before the benefactor.[16] This is a weak preference in German, since the reverse order is readily available (see, e.g., Haider 1993; Lenerz 1977; Müller 1999; Uszkoreit 1987 among others for relevant discussion about word order in German). The experimental design outlined in Section 2 biases against the preferred word order in imposing the marked word order in the repetition tasks. We thus refrain from expressing word order with the help of a constraint, and —except for PRO > DP— ignore this issue in the discussion of this section. We return to word order to illustrate variation in OT in Section 4.

In (9), the constraints introduced are summed up.

(9)
a. PRO > DP: A pronominal argument linearly precedes a full DP
b. CASEHIERARCHY: *DATIVE >> *ACCUSATIVE >>*NOMINATIVE
c. THETAHIERACHY : *BENEFACTOR >> *THEME >>*AGENT
d. HIERACHY: Harmonic alignment is required between the case hierarchy and the theta-role hierarchy.
e. CASEUNIQUENESS: Each case occurs only once.
f. UNAMBIGUOUSARGUMENT/ROLE: The theta roles of the arguments must be (semantically) recoverable.

The next two subsections examine in turn the ranking of the constraints for the adult language and the child language.

3.2. *Adults*

15 German has ditransitive verbs with two accusatives, like *lehren* ‘to teach’ which must be considered as assigned lexically.

16 English has the opposite order.

In adult German, the benefactor is always dative and the theme always accusative, which means that HIERARCHY and CASEUNIQUENESS are not violated in the data considered here. Of course, this does not imply that they cannot be violated in other structures; an example of such a violation is found in the verb *lehren* 'to teach' which assigns accusative to both its arguments. As a result, UNAMBIGUOUSARGUMENT/ROLE is regularly violated in German since the need to satisfy the formal criteria of the grammar are stronger than recoverability considerations. However, this is irrelevant for this paper and we do not include such verbs in our analysis.

The individual constraints entering the hierarchies of case and theta-roles are violated. We restrict ourselves to showing the effect of *DATIVE which is systematically violated in German, as soon as there is an indirect object in the sentence. Obviously even if *DATIVE is the highest constraint of the case hierarchy, it is still relatively low ranking, and crucially, it is lower-ranking than CASEUNIQUENESS.

Recall the sentences discussed in Section 2, which are repeated in (10) for the double object DP sentences and in (11) for the Pro-DP sentences. The a. sentences have an inanimate theme, and the b. sentences an animate one.

(10) Sentences with two full object DPs
a. Der Mann will das Auto dem Kind geben.
the man wants the$_{[ACC]}$ car the$_{[DAT]}$ child give
'The man wants to give the car to the child.'
b. Der Mann will die Katze dem Kind geben.
the man wants the$_{[ACC]}$ cat the$_{[DAT]}$ child give
'The man wants to give the cat to the child.'

(11) Sentences with one pronoun and one full object DP
a. Der Mann will ihn [= den Stuhl] der Frau geben.
the man wants it$_{[ACC]}$ the$_{[DAT]}$ woman give
'The man wants to give it [= the chair] to the woman.'
b. Der Mann will ihn [= den Hund] der Frau geben.
the man wants it$_{[ACC]}$ the$_{[DAT]}$ woman give
'The man wants to geben it [= the dog] to the woman.'

Tableau 1 and Tableau 2 illustrate the competition for the two types of sentences. UNAMBIGUOUSARGUMENT/ROLE is trivially fulfilled and not shown in the tableaux. Tableau 1 shows the competition for two full DPs. It includes animate and inanimate themes in one tableau, because, due to the effect of higher ranking HIERARCHY, the theme is always in the accusative and the benefactor in the dative. In adult German, animacy does not interact with case assignment. Both candidate a. (DP-ben$_{dat}$- DP-theme$_{acc}$) and candidate c. (DP-theme$_{acc}$ - DP-ben$_{dat}$) win the competition. Both the order accusative before dative and the order dative before accusative are allowable because we do not have a constraint regulating the word order of the arguments, as discussed in the preceding section. In a more elaborate analysis, which also takes word order into consideration, only one candidate would survive. Both optimal candidates are better than candidate b. which violates HIERARCHY by associating a dative with a theme, thus triggering a violation of the harmonic alignment, and they are also better than candidate d, which violates UNIQUENESS because

both arguments are in accusative. Crucially, the optimal candidates violate *DATIVE, the highest constraint of the case hierarchy. Due to the relatively low rank of this constraint, however, it does not possess the power to eliminate a candidate. The constraint PRO>DP is inactive in this first tableau and has only been added in order to render Tableaux 1 and 2 comparable.

Tableau 1. Inanimate DP Theme: Der Mann will das$_{[ACC]}$ Auto dem$_{[DAT]}$ Kind geben **or**
Animate DP theme: Der Mann will die$_{[ACC]}$ Katze dem$_{[DAT]}$ Kind geben

DP (Theme) + DP (Ben)	HIERAR	PRO>DP	CASEUNIQUE	*DATIVE
☞ a. DP-ben$_{dat}$- DP-theme$_{acc}$				*
b. DP-theme$_{dat}$- DP-ben$_{acc}$	*!			*
☞ c. DP-theme$_{acc}$ - DP-ben$_{dat}$				*
d. DP-ben$_{acc}$- DP-theme$_{acc}$			*!	

Tableau 2 evaluates candidates consisting of one DP argument and one pronominal argument (the theme). Here, PRO>DP forces the order of pronoun before the full DP. There is only one winner, candidate a., which again violates only low-ranked *DATIVE. Candidates b. and c. violate the hierarchy in associating a marked case with an unmarked role. Candidates c. and d. violate PRO>DP, the constraint requiring pronouns to come before full DPs and candidate e. violates CASEUNIQUENESS.

Tableau 2. Inanimate Pro Theme: Der Mann will ihn$_{[ACC]}$[=den Stuhl] der$_{[DAT]}$ Frau geben **or**
Animate Pro theme: Der Mann will ihn$_{[ACC]}$ [=den Hund] der$_{[DAT]}$ Frau zeigen

DP (Ben) + Pro (Th)	HIERAR	PRO>DP	CASEUNIQUE	*DATIVE
☞ a. Pro-Theme$_{acc}$-DP-Ben$_{dat}$				*
b. Pro-Theme$_{dat}$- DP-Ben$_{acc}$	*!			*
c. DP-Ben$_{acc}$- Pro-Theme$_{dat}$	*!	*		*
d. DP-Ben$_{dat}$- Pro-Theme$_{acc}$		*!		*
e. Pro-Theme$_{acc}$ -DP- Ben$_{acc}$			*!	

To sum up this subsection, it has been shown that adults rank HIERARCHY, PRO > DP, and UNIQUENESS high in the constraint hierarchy. CASEHIERARCHY and THETAHIERARCHY, as well as UNAMBIGUOUSARGUMENT/ROLE are always fulfilled in the optimal candidates, but the markedness constraint against dative case is systematically violated. The restricted part of adult grammar considered here does not allow us to establish a definitive ranking, but it allows us to compare the adult grammar with the children's in the next subsection.

3.3. *Children*

The children's data we are interested in can be accounted for by using the same constraints as in the

adult hierarchy, but with a different ranking.[17] Children use dative parsimoniously, as has been shown in Section 2. There is a stronger tendency to use the dative case when the animacy of the participants would otherwise be insufficient to disambiguate their roles, which means that *DATIVE is high in their hierarchy, and violated only when the still higher ranking UNAMBIGUOUSARGUMENT/ROLE must be fulfilled. A second difference is that HIERARCHY is not trivially fulfilled, as it was in the adult ranking, but only when UNAMBIGUOUSARGUMENT/ROLE requires an extra case on the benefactor, meaning that HIERARCHY, as well, has a different ranking from the one held in the adult language. But this time, it is lower. Additionally, due to the data we are considering, PRO>DP is also always fulfilled. This constraint is not shown in the tableaux of this section, and only candidates fulfilling it are considered.

In the tableaux, animate and inanimate themes must now be kept apart since in the former configuration, animacy is not enough to disambiguate the role of the arguments (both are animate) and in the latter structure, the inanimate argument must be the theme.

In the input we specify the role of the arguments and whether they are full DPs or pronouns. We do not give case as part of the input since, in the data we are interested in, the children impose their own case system in their repetitions. Tableaux 3 and 4 illustrate the competition with two full DPs, Tableau 3 with an inanimate theme and Tableau 4 with an animate one. Considering first Tableau 3, candidate a. wins because it is the only candidate which does not violate *DATIVE. UNAMBIGUOUSARGUMENT/ROLE is fulfilled because the arguments are disambiguated by animacy.

Tableau 3. Inanimate DP Theme: Der Mann will das$_{[ACC]}$ Auto dem$_{[DAT]}$ Kind geben

DP (ThemeInan) - DP (Ben) das Auto‘ the car’ - dem Kind ‘the child’	UNAMBIG A/R	*DAT	CASEUNIQUE	HIERAR
☞ a. das$_{acc}$ Auto - das$_{acc}$ Kind			*	*
b. das$_{acc}$ Auto - dem$_{dat}$ Kind		*!		
c. dem$_{dat}$ Auto - das$_{acc}$ Kind		*!		*

The situation changes in Tableau 4. Both arguments are animate, and in this case, animacy is vacuous in its function as disambiguator. Candidate b., with two accusative arguments, thus violates UNAMBIGUOUSARGUMENT/ROLE and is eliminated. Only case can fulfill this function, and the two arguments are bound to be disambiguated by their case, even if this implies a violation of high ranking *DATIVE. Because of HIERARCHY, the theme must be in the accusative and the benefactor in the dative. This eliminates candidate c.

Tableau 4. Animate DP theme: Der Mann will die$_{[ACC]}$ Katze dem$_{[DAT]}$ Kind geben

DP (ThemeAn) - DP (Ben) die Katze ‘the cat’ - dem Kind ‘the child’	UNAMBIG A/R	*DAT	CASEUNIQUE	HIERAR
☞ a. die$_{acc}$ Katze - dem$_{dat}$ Kind		*		

[17] In this subsection, we focus on the variant of the productions with dative case only when both arguments are animate. How to address variation in the production in OT is briefly discussed in section 4.

b. die$_{acc}$Katze - das$_{acc}$ Kind	*!		*	*
c. der$_{dat}$Katze - das$_{acc}$ Kind		*		*!

Tableaux 5 and 6 illustrate the competition for a pronoun and a full DP respectively. These tableaux are similar to Tableaux 3 and 4.

Tableau 5. Inanimate Pro Theme: Der Mann will ihn$_{[ACC]}$ [=den Stuhl] der$_{[DAT]}$ Frau geben

Pron (ThemeInan) > DP (Ben) ihn 'it' - der Frau 'the woman'	UNAMBIG A/R	*DAT	CASEUNIQUE	HIERAR
☞ a. ihn$_{acc}$- die Frau$_{acc}$			*	*
b. ihn$_{acc}$- der Frau $_{dat}$		*!		

Tableau 6. Animate Pro Theme: Der Mann will ihn$_{[ACC]}$ [=den Hund] der$_{[DAT]}$ Frau zeigen.

Pron (ThemeAn) > DP (Ben) ihn 'him'-der Frau 'the woman'	UNAMBIG A/R	*DAT	CASEUNIQUE	HIERAR
☞ a. ihn$_{acc}$- der Frau$_{dat}$		*		
b. ihn$_{acc}$- die Frau$_{acc}$	*!		*	*

This concludes the OT analysis of these data from the perspective of the relationship between animacy and case. We have shown that the same constraints can be used for the adult grammar and the child grammar, though in a different ranking. Several properties which bear on how OT describes and accounts for the children's linguistic patterns remain open for discussion. Some of them are the topic of the next section.[18,19]

4. Discussion

[18] An anonymous reviewer suggested to compare our analysis with studies that were developed within the Competition model of Bates and MacWhinney (1989). Studies by, e.g., MacWhinney et al. (1984) for German or Hakuta (1981, 1982) for Japanese showed that for adult speakers case information is a more prominent cue (cue strength) than cues like animacy or word order when processing a sentence. Following, the suggestion about language learning, the strength of a cue like case and therefore the mapping of form and function must be established over the time course of language acquisition by the competition of different available cues. The child is trying to find the reliable cues in its language by strengthening some cues and weakening others. In this sense, it does not astonish that children first are using different cues (like e.g. animacy) before they reach the adult system (compare, Bates and MacWhinney 1987). Additionally, Lindner (2003) showed that German children gradually learn to ignore animacy (and word order) and simply look for case markers like nominative and accusative (Lindner, 2003). With regard to our OT analysis, the change in the ranking of children's system in the direction of the adult's ranking can be interpreted in the same way. Animacy information becomes less reliable to distinguish arguments and this triggers case marking.

[19] An anonymous reviewer suggested to provide evidence from other languages for the role of animacy on other phenomena. Aissen (2003) discusses various languages where animacy and definiteness plays an important role for object marking. For instance, in Sinhalese, in which case marking is optional, only animate-referring objects may be case marked (See also, e.g., Malchukov this issue; Silverstein 1981 and Woolford 2001).

In the introduction to this paper, we claimed that OT provides a suitable framework for implementing the Strong Identity Principle (Jakobson 1968). This claim requires elaboration and is addressed as the first point of this section. Second, language acquisition is a good place to study the difference between markedness and faithfulness constraints, and, in particular, to raise the issue of the initial stage. And finally, violable rerankable constraints allow the formal implementation of variation into the grammar. Child language, by its very nature, is full of variation, and provides an ideal set of data to discuss this aspect of the theory.

The data we have investigated have an interesting characteristic: they are typical of child language, but are entirely absent from the corresponding adult language. They share this property with consonant harmony, a phonological pattern in which consonants spread their place of articulation across vowels. According to Vihman (1978), 1 to 32% of children exhibit consonant harmony, but not a single adult. An explanation of consonant harmony in terms of rules and parameters (like the one offered by Stemberger and Stoel-Gammon 1989, 1991 and McDonough and Myers 1991, for instance) contradicts a strict interpretation of the Strong Identity Principle, since acquired parameter settings must be reset at some stage of acquisition. Moreover, it must be assumed that children develop an early acquisition pattern that is never found in their target language. Obviously, by ranking universal constraints, OT provides a much better way to tackle this issue. The different rankings can be understood as different stages of the grammar during the process of acquiring a target system. It has been advanced in the OT literature that the primary task of the child acquiring a grammar is to rank the constraints in the right order (see Tesar and Smolenksy 2000). Consonant harmony may reflect the initial tendency of children to align prominent place of articulation features with prominent positions, like the beginning of the word (see Beckman 1998 for positional faithfulness). The consonant harmony emerging at the surface is just a consequence of this realignment, which is itself a natural repair strategy in a grammar heavily influenced by high ranking markedness constraints (Levelt 1994; Grimm 2003). In OT, alignment of prominent features with prominent positions comes naturally, as a consequence of constraints existing independently, but, in a rule schema, such a configuration is hard to express. In order to formulate that a place of articulation from a consonant late in the word is also aligned with the beginning of the word, the one-to-one relationship between segments and features must be abandoned, or association lines are to be crossed (see Goldsmith 1976 for the No-Crossing Constraint). Furthermore, as we have pointed out before, the rules responsible for positional alignment are different from those that the speakers have to acquire ultimately. In a similar way, the explanation we have offered in the preceding section for the correlation between case pattern and animacy can also be understood as a repair strategy. We saw that a dative DP is badly marked, as it requires too much effort from the child's point of view, and the repair calls for the use of a less marked case, like the accusative. We are in the presence of a typical conflict situation, since the default case is only used when the still higher constraint requiring unambiguous theta role assignment to arguments is satisfied independently. OT also accounts for the fact that the constraints responsible for across-the-board case assignment become progressively higher ranked as time passes and the child becomes more and more familiar with the morphological pattern for case. At a certain point, it may become more economical to replace semantic features, like

animacy, by a more automatized distribution of inflectional features.

The pretests as well as the data of the elicited imitation task also show that the children may have already acquired case assignment, but that they are reluctant to use it unless absolutely necessary. Their use of the dative marking in an ambiguous situation proves that they know how to apply it and that they master the correct morphological endings, and still, the cognitive load to effectively insert them may be too high. That means that the dative case marking in the ambiguous context leads to a structural improvement in children's grammar whereas the case marking in the unambiguous context does not; on the contrary the dative marking in the latter case would lead to a higher complexity. Therefore, it comes as no surprise that children learning a grammar avoid overloading their cognitive capacity as much as possible. As a result, children follow different strategies (constraint-rankings) from those of adults. The question arises as to why adults seem to act uneconomically compared with children in applying a marked case even when it is not indispensable for the sake of communication. We suspect that the answer lies in postulating a stricter obedience to the grammatical rule system. Once acquired, it could be more economical to apply the case system across the board than to take animacy into account. A grammar like Optimality Theory expresses the difference between the automatic case assignment process found in adult native speakers and the non-automatic one found in children (for a similar view from a different theoretical perspective see Avrutin 2004). If grammar is indeed part of the general cognitive system, and if this system influences grammar, it is natural that children try to simplify their grammar in a different way than adults. One could speculate that the preference for placing animate arguments in front of inanimate ones in the adult language might even be a relic of an ontologically older stage of grammar where this feature played an active role.

What distinguishes children's grammars from the adult target system?[20] Adults are not confronted with an absolutely new system anymore and do not have to go through the changes and adaptations like children do. This does not mean that the adult system is completely frozen. We find cases where adult utterances are similar to children's[21] (compare Gerken 1994, 1996): the grammar apparatus may then be forced to deviate from the 'normal' ranking and to use a marked and not so efficient grammar system. This 'distinct' system is suitable for certain situations, and holds in language perception, too. These deviant systems help adults understand children's non-adult-like utterances, at least up to a certain point.

A second point to which our data make a fruitful contribution is the issue of the initial stage of grammar. According to Gnanadesikan (2004); Smolensky (1996) and Pater (1999), among others, the markedness constraints are at first ranked higher than the faithfulness constraints, and language acquisition is the process of reranking constraints until the adult hierarchy is obtained (see Tesar and Smolensky 2000 for the Recursive Constraint Demotion algorithm, Boersma 1997 and Boersma and Hayes 2000 for the Gradual Learning Algorithm). When evidence arises showing that they had

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[20] Similar arguments, which are in the following paragraphs, have been made in generative theories of language acquisition by, for instance, Hyams (1996) and Rizzi (2002).

[21] Adults quite often use what is called 'default strategies' they produce a structure which is not part of the target system, for instance, they use the wrong plural inflection on the noun, or they use weak verbal inflection where the strong verbal inflection is required (*er gehte* 'he goed' instead of *er ging* 'he went').

hypothesized an erroneous ranking, children demote the constraints violated by the winner (or promote the constraints violated by the losers), in one step in the RCD and in several steps in the GLA.

With regard to the experimental task, one might argue that it is not clear whether the children just mechanically repeat the heard structure, without projecting a grammatical structure, or whether they really reflect on the pattern (see Hale and Reiss 1998 for this issue, as well as the replique by Pater 1999 and footnote 4). But some clues can be gathered from the experimental results that lead us in one direction. For instance, when a pronominal accusative object was offered, some children repeated the sentences with both the direct and indirect object in dative. This double dative structure is not possible in adult German. Interestingly, in almost all cases with a wrongly repeated dative pronoun, children did not change gender of the accusative pronoun. Hence, it can be claimed that, at least in some cases, children had really parsed the given sentences but projected their own grammar in their production.

Our data can be explained in the theory of the initial stage proposed by Smolensky and others, who claim that the initial stage involves high ranking markedness constraints and low ranking faithfulness constraints. We have assumed in our analysis that the avoidance of the marked dative is a result of high ranking *DATIVE, a markedness constraint which overrides faithfulness to the case pattern presented. Avoidance of markedness differs from the adult system, as shown extensively in the preceding section.

The third and last issue to be discussed is the variation displayed by the children's imitations, and the best way to account for it formally. Variation is very prominent in child language, and reflects the distinct strategies (rankings) involved in learning a grammar. OT is rather ambivalent on the issue of variation. On the one hand, by its strict ordering of the constraints, it is as categorical as any other generative approach. Only one candidate is optimal, and all others are ungrammatical. On the other hand, because of the use of violable and rerankable constraints, it is a potentially ideal system to express variation. Recall from Section 2 that when the children had to repeat sentences with two DPs in the order DO>IO, they changed the word order in 54% of the cases and 46% of the realizations were faithfully reproduced. Following a widely accepted view among German syntacticians, we assume that the unmarked word order is IO>DO and formulate a constraint to this effect:

(12) IO>DO: A dative object is located before an accusative one.

This constraint is often in conflict with a constraint which requires faithfulness to the presented word order. Following McCarthy and Prince (1995), we call this constraint LINEARITY. In order to account for the variation found in the word order, free ranking between these two rankings has to be allowed.

Several ways of changing the architecture have been developed in the last decades (like for instance Anttila's (1997, 2002) multiple grammars, Keller's (2000) weighted constraints, etc), one of which, the GLA, has been successfully applied to language acquisition. In the following, we restrict ourselves to summing up the main lines of GLA without entering the details, and without trying to give a formal account of how the GLA can explain our data.

The main ideas behind the GLA is that, first, instead of being based on a complete ranking of the constraints, as in standard OT, it assumes that constraints have a ranking value on a continuous scale of constraint strictness. A shorter distance between two constraints than between two others is meaningful and shows that the relative ranking between the two constraints is less fixed. The second difference, crucial for our concerns, is what happens at the moment of speech. In standard OT, evaluation takes place in terms of the constraint ranking. In Boersma's (1997, 1999) stochastic model, the constraint values are temporarily perturbed by a random value, the same for each constraint, and, as a result, constraints behave as if they were associated with a range of values rather than with one single value. This effect is called the evaluation noise and is an amount of normally distributed noise temporarily added to the ranking value of each constraint. This effect allows constraints to overlap and variation to arise. In language acquisition, the constraints can climb or descend the hierarchy, as evidence for a necessary reranking is encountered. Reranking does not happen at once, but only when two constraints change their order progressively.

As a result, GLA is able to account both for the synchronic variation and for the diachronic development which characterize child language. One single grammar (one ranking) may allow for different candidates to be simultaneously optimal as well as allowing for constraints to change their ranking over time. Variation thus finds a natural explanation. Furthermore, the greater indeterminacy of the child grammar results in a larger noise value.

In word order variation, the constraint IO>DO is ranked just a little bit higher than LINEARITY. When a child has to reproduce the word order DO>IO, due to the overlapping between the two responsible constraints, both word orders are nearly equally probable.

To summarize this section, we have shown that OT describes and accounts nicely for different grammatical properties which we have found to be crucial for language acquisition in general: the Strong Identity Hypothesis, the initial stage, and variation.

5. Conclusion

A typical conflicting pattern in grammar has been shown to find a natural explanation in an OT model. Experimental data have revealed that German speaking children often choose to mark a benefactor with the dative, as do adults, when both themes and benefactor are animate, but refrain from doing so when the theme is inanimate (and the benefactor animate). In the former case, the arguments are ambiguous, whereas in the latter situation, the animacy of only one argument forces it to be the benefactor, and there is thus no ambiguity as far as the theta roles are concerned. Children seem to rely on extragrammatical factors like animacy to avoid having to implement a marked morpho-syntactic feature like dative.

In accounting for such conflicting situations (avoidance of markedness vs. unambiguous theta role assignment) with violable and rerankable constraints, OT not only provides a simple way to model the data, but also allows several features of grammar to be accounted for, like the Strong Identity Thesis, the issue of the initial stage of grammar, and variation in grammar.

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Appendix

child	*age*	*Double DP: theme is animate (dative benefactor)*	*Double DP: theme is animate accusative benefactor)*	*Double DP: theme is inanimate (dative benefactor)*	*Double DP: theme is inanimate accusative benefactor)*	*total*	*Pronoun-DP: theme is animate (dative benefactor)*	*Pronoun-DP: theme is animate accusative benefactor)*	*Pronoun-DP: theme is inanimate (dative benefactor)*	*Pronoun-DP: theme is inanimate accusative benefactor)*	*total*
childania	3;9	2	2	0	2	6	3	5	1	12	21
childanib	4;1	2	2	0	2	6	4	6	0	13	23
childanic	4;3	1	1	2	3	7	5	7	1	10	23
childanid	4;5	2	2	0	2	6	6	7	2	10	25
childanie	4;6	1	2	1	2	6	4	5	0	9	18
childanif	4;7	1	2	1	3	7	4	4	1	11	20
childanig	4;10	2	2	0	2	6	6	7	2	9	24
childanih	4;11	3	2	0	4	9	4	3	2	12	21
childanii	5;0	2	2	1	3	8	5	6	2	12	25
childanij1	5;3	1	1	1	2	5	6	7	1	6	20
childanij2	5;3	2	1	0	3	6	5	7	2	12	26
childanik	5;5	1	2	1	2	6	4	4	2	11	21
childanil1	5;9	2	1	1	3	7	5	8	2	10	25
childanil2	5;9	3	3	1	2	9	7	7	1	9	24
childanim	5;11	2	2	0	4	8	5	6	2	13	26
childanin	6;1	2	1	0	3	6	4	5	1	7	17
childanio	6;1	3	2	1	3	9	6	8	1	8	23
childanip	6;2	2	2	0	2	6	4	4	0	10	18
childaniq	6;4	2	3	1	4	10	5	8	3	9	25
childanir	6;7	1	2	1	3	7	9	5	3	12	29
childanis	6;7	2	2	1	4	9	5	6	2	12	25
childanit	6;8	1	3	1	4	9	6	7	3	11	27
total		40	42	14	62	158	112	132	34	228	506