Animacy and Child Grammar: an OT account[*]

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Abstract. It is a well known fact about German that animacy plays a role in determining the word order of verbal arguments. In children's production, animacy not only affects the order of the direct and indirect object in non-canonical double object constructions, but it also has an influence on the overt dative case marking of the indirect object. Optimality Theory readily accounts for these data in using well-assessed universal constraints, the same surface constraints as those responsible for the adult grammar. The only difference between the two lies in the constraint hierarchy, a natural conclusion if it is assumed that learning a language amounts to the acquisition of the hierarchy of universal constraints. In this paper, we focus on a pattern found in child grammar which is absent in the corresponding adult grammar, and show that one and the same grammar accounts for both.

1. Introduction

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

Optimality Theory (OT, Prince & Smolensky 1993) introduces a new framework for the study of child language patterns (Smolensky 1996, Gnanadesikan 2004, Pater & Werle 2001, 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 of this grammar is that child and adult grammatical patterns are now both expressible in the same way, with the help of the same principles. It is true that the Strong Identity Hypothesis (Jacobson 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, it has been traditionally puzzling that children seem to first master a set of transformations, rules or parameter settings which are absent in the syntax or in the phonology of their parents, and only later do they abandon their initial grammar to develop another one.

We do not feel this claim to be in contradiction with approaches on learnability in the framework of the minimalist program (Chomsky 1995, 1998, 2001). In this model, the acquisition process is seen to be 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. Roeper 1996, 1998, 1999 and Drenhaus 2000, 2002, 2004). In contrast to the idea of feature specification and selection, OT takes a slightly different road in predicting that all universal properties of grammar are present in all individual instantiations of grammars, thus in all natural languages. 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 Smolensky 1996, Pater 1999, Smolensky, Davidson & Juszczyk 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 mastery of all aspects of grammar, and how they interact with each other. In phonology, it has been shown repeatedly that unmarked patterns are acquired first (Gnanadesikan 2004, Demuth, Fikkert & Levelt 2002 Levelt & van de Vijver 2004, Grimm 2003 among others), and that ranking the markedness constraints higher than the faithfulness constraints at the initial stage makes just the right predictions.

Until now, few syntactic data have been published that support the OT model of language acquisition. In the following pages, we offer data (from Drenhaus 2004) and a new analysis of these data which show that this model is equally good for testing the predictions of OT for language acquisition. We 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.

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

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comments on an earlier version of this paper. No one except ourselves is responsible for shortcomings.
[1] See Hale & Reiss (1998) for a different opinion.

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. Dewert (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 animate 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 Catalan (Prat-Sala & Shillcock 1997, 2000).

In other studies, researchers tested the comprehension of double object constructions in English (Roeper et al. 1981, Cook 1975, O'Grady 1997). 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's (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'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 child language experiments aimed at testing the influence of animacy on word order and case marking in German. More specifically, this study tested the proficiency of children's grammar and verified which strategies children use to produce ditransitive sentences when the direct object precedes the indirect object.[2] The goal of the experiments was to

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[2] In Drenhaus (2004) these results were analyzed in a minimalist framework assuming that children access distinct grammar modules in order to project unambiguous information, and in this way

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

22 German children (3;9-6;8) were tested using a sentence repetition task. Sentences like the ones in (1) and (2) were used in the experiment. These sentences contain *geben* 'to give', *zeigen* 'to show' and *schenken* 'to give as present', accompanied by two objects, a direct object in accusative (the theme), and an indirect object in dative (the benefactor). Two different structures were tested: first, double DP sentences.[4] In all these sentences, the benefactor is animate,[5] but in variant a., the theme is inanimate, whereas in variant b., it is animate.

(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.'

In the second set of sentences, the theme is pronominal, and the benefactor nominal; as a result, the order of the elements is fairly fixed: 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.

(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

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distinguish the objects (Roeper 1999; similarly Müller & Hulk 2001). His proposal can be summed up as follows: When the distribution of animacy differs from the usual distribution in the children's grammar system (animate indirect object and inanimate direct object), children resort to one of two strategies. Either they access the case module in order to disambiguate the indirect from the direct object, or they access the theta module and project the canonical word order (as proposed by O'Grady 1997, among others). In our joint paper, we (tentatively) depart from this model and elaborate a different explanation (in section 3).

[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] The canonical word order of these sentences is benefactor before theme, though in a language like German, it is also true that object arguments can be generated everywhere in the verbal domain.

[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.

'The man wants to give it [= the chair] to the woman.'

b. Der Mann will ihn [= den Hund] der Frau zeigen.

the man wants it_[ACC] the_[DAT] woman show

'The man wants to show it [= the dog] to the woman.'

Consider first the result of the sentences illustrated in (1), with two full DPs in a non-canonical word order. The task for the 22 children consisted in repeating 16 such sentences, thus eliciting 352 utterances. These sentences can be divided into two groups as shown in (3).

(3)   a. DP[accusative / **animate**]   DP[dative / animate]   (n=176)

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

Table 1 summarizes the results for word order. The children had great difficulties in dealing with these double DP structures. Only 158 (46%) sentences replicated the target as far as the word order is concerned. The behavior of the children was below chance. 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 theme of this paper, we discuss it briefly in relation with variation in OT in Section 4.

Table 1. Order in double DP sentences

theme precedes goal (target-like)	158 repetitions (46%)
goal precedes theme (not target-like)	183 repetitions (54%)
no repetition	11 sentences

As can be seen from Table 2, the benefactor is in dative much more often when the theme is animate (49% of the sentences with an animate theme have a dative) than when it is inanimate (18% of the sentences with an inanimate theme have a dative). 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).[6]

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[6] In 32 sentences out of the 183 not target-like repetitions did the children used the dative, though as one can see from Table 2, altogether 54 sentences with a double DP have a dative benefactor. As a result, dative 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 and a marked word order.

Table 2. Distribution of the case of the benefactor in double DP sentences according to the animacy of the theme, and independently of the word order

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

The statistics exhibits 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 mark dative case more often than in structures where only the indirect object is animate. In this latter case, the children often assign accusative as the default case to the indirect object (Tracy 1984; Clahsen et al 1994; Eisenbeiß 1994).

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 (4).[7]

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

The same effect of animacy on the use of dative 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. One conspicuous difference with regard to the double DP constructions concerns the word order. The children repeated the given sentences accurately in 77% of the cases (506 sentences), a performance well above chance level and much better than the repetitions of the double 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 results for the second set of sentences are summed up in Table 3. 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.

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[7] To avoid any misunderstanding, 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 they link the pronoun with an animate direct object (e.g. dog) or an inanimate direct object (e.g. chair).

Table 3. Distribution of the benefactor case 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	262	506

In Table 3 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.

In 154 sentences of this second group, the word order of the constituents was reversed, delivering the word dative-accusative. 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 by 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 us to the same conclusion as before: the distribution of the objects's animacy triggers the children's responses in the tested structures. More precisely, dative case marking on one of the two objects DP 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 instead they 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 exhibit the same effects. In Table 4, the structures with an animate direct object are compared.

Table 4. Case of benefactor (theme is **animate**)

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

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

With respect to structures with an inanimate accusative pronoun or an accusative DP, no statistical difference is found either (compare the results summed up in Table 5).

Table 5. Case of benefactor (theme is **inanimate**)

	Inanimate AccDP	Inanimate Acc-pro	total
dative	14 (18%)	34 (13%)	48
accusative	62 (82%)	228 (87%)	290
total	76	262	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 mark 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. 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, the output of children's grammar 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 available. From the children's perspective, all necessary information is already given by theta roles and, as a result, it is quite natural not to mark dative morphology for this 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), case (morpho-syntax), and, possibly, word order. We believe that OT provides us with a suitable model which 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 syntax (grammar) deviate from adult syntax (grammar) with regard to the interaction of markedness constraints and faithfulness constraints. A last advantage of OT for language acquisition is the expressiibility of variation in a model whose main component resides in 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)[8]. 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 Wunderlich 1997 or Müller 1999 for hierarchies of case) For the sake of simplicity, we will call this hierarchy CASEHIERARCHY.

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).[9] Let us call this second constraint hierarchy THETA-HIERARCHY.

4. In structural case assignment, 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.[10] Case hierarchy and the Theta Role Hierarchy hence interact in an interesting way. Since the benefactor is the third argument in terms of 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 role of 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 & 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, an accusative is associated to a theme and a dative to a

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

[9] Matthias Schlesewsky (p.c.) reminds us that an alternative consists in assuming that the benefactor is more prominent on the theta-role hierarchy than Case because it demotes an animate argument. Our data show that this view is not mandatory.

benefactor, and every deviation from this pattern is counted as a violation of HIERARCHY. In this paper, we are not concerned with the role and case of the subject.

5. Each case occurs only once.[11] There is a uniqueness constraint that bans multiple case assignment. We call this constraint CASEUNIQUENESS (following Fanselow & Féry 2002).

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 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.

8. Word order: accusative is ordered before dative, or the theme is ordered before the benefactor.[12] This is a weak preference in German, since the reverse order is readily available (see, e.g., Lenerz 1977, Haider 1993, Uszkoreit 1987, Müller 1999 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 (5), the constraints introduced are summed up.

(5)   a. PRO > DP: A pronominal argument linearly precedes a full DP

              b. CASEHIERARCHY: *DATIVE >> *ACCUSATIVE >>*NOMINATIVE

         c. THETA-HIERACHY : *BENEFACTOR >> *THEME >>*AGENT

         d. HIERACHY: Harmonic alignment is required between the case hierarchy and the theta-role hierarchy.

         e. CASEUNIQUENESS: Each case is occurs once.

         f. UNAMBIGUOUSARGUMENT/ROLE: The theta roles of the arguments must be semantically recoverable.

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[10] 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.
[11] German has ditransitive verbs with two accusatives, like *fragen* 'to ask' which must be considered as assigned lexically.
[12] English has the opposite order.

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

3.2. *Adults*

Adult performance does not show any remarkable animacy effect on case assignment. In mature German, the benefactor is always in the dative and the theme always in the accusative, which means that HIERARCHY and CASEUNIQUENESS are not violated in the data we are considering here. Of course, this result does not imply that they cannot be violated in other data in German, due, in particular, to lexical case assignment, like in the verb *fragen* 'to ask' which assigns accusative to both its arguments. As a result, UNAMBIGUOUSARGUMENT/ROLE is regularly violated in German since the needs to satisfy the formal criteria of the grammar are stronger than recoverability considerations. However, this is irrelevant for the analysis of our data. PRO>DP and the two hierarchies (of case and of theta roles) are also not violated in our data.

The individual constraints entering the hierarchies of case and theta-roles are violated. We restrict ourselves in 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 UNIQUENESS.

Recall the sentences discussed in Section 2, which are repeated in (6) for the double DP sentences and in (7) for the Pro-DP sentences. The a. sentences have an animate theme, and the b. sentences an inanimate one.

(6)   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.'

(7) 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 zeigen.

    the man wants it$_{[ACC]}$ the$_{[DAT]}$ woman show

    'The man wants to show it [= the dog] to the woman.'

Tableaux 1 and 2 illustrate the competition for the two types of sentences. UNAMBIGUOUSARGUMENT/ROLE is trivially fulfilled, are not shown in the tableaux. Tableau 1 shows first 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 accusative and the benefactor in the dative. As mentioned before, animacy has no influence on 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 argumental word order, 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 harmony agreement, 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 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	UNIQUE	*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 UNIQUENESS.

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	UNIQUE	*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 THETA-HIERARCHY, as well as UNAMBIGUOUSARGUMENT/ROLE are always fulfilled in the optimal candidates, but the markedness constraint against dative case is systematically violated. The very limited amount of data 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 with the same constraints as in the adult hierarchy, but with a different ranking.[13] Children use dative parsimoniously, as has been shown in Section 2. It is used only 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 mature language. But this time, it is lower. However, 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,

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

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	UNIQUE	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	UNIQUE	HIERAR
☞ a. die$_{acc}$ Katze - dem$_{dat}$ Kind		*		
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	UNIQUE	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	UNIQUE	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 only a partial analysis, and a complete proposal would involve other options, as well. Most importantly for our goals, we have shown for these repetitions that the same constraints can be used for the adult's grammar and the children's one, though in a different ranking. Several interesting properties which bear on how OT accounts for the children´s linguistic patterns remain open for discussion. Some of them are the topic of the next section.

4. Discussion

In the introduction to this paper, we claimed that OT provides a suitable framework for implementing the Strong Identity Principle (Jacobson 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 & Stoel-Gammon 1989, 1991 and McDonough & Myers 1991, for instance) contradicts a strict interpretation of the Strong Identity Principle, since acquired rules and parameters must be abandoned at some stage of acquisition and replaced by new ones. 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 & 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.

Our data 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 dative 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. 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 bother about animacy, a vague criterion anyway. A grammar like Optimality Theory is ideal for expressing the difference between the automatic case assignment process found in adult native speakers and the non-automatic one found in children. If grammar is indeed part of the general cognitive system, and if this system influences grammar, it is only natural that children try to simplify their grammar in a different way than adults. 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? One part of the solution is that adults are not confronted with an absolutely new system anymore and do not have to go through that 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 (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 Smolensky (1996), Gnanadesikan (2004) and Pater (1999), among others, the

markedness constraints are at first higher ranked than the faithfulness constraints, and language acquisition is the process of reranking constraints until the adult hierarchy is obtained (see Tesar & Smolensky 2000 for the **R**ecursive **C**onstraint **D**emotion algorithm, and Boersma 1997 and Boersma & Hayes 2000 for the **G**radual **L**earning **A**lgorithm). When evidence arises showing that they had 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 & Reiss 1998 for this issue, as well as the replique by Pater 1999). However, some clues can be gathered from the experimental results. For instance, when a pronominal accusative object was offered, some children repeated the sentences with both the direct and indirect object in dative. This is a structure which is not possible in adult German (double dative). Interestingly, in almost all cases with a wrongly repeated dative pronoun, children did not change gender or number of the given 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 find a natural explanation in the theory of the initial stage proposed by Smolensky and others, who claim that the initial stage involves highly ranking markedness constraints and lowly ranking faithfulness constraints. We have assumed in our analysis that the avoidance of the marked dative is a result of highly 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 production, 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. At the outset of the discussion it was observed that older generative models have not been apt at expressing variation. Rules and parameters are set once and for all, and to vary their results implies a complete new system of rules or parameter settings. Consequently, children who show variation in their productions would be mastering a large number of parallel grammars, a highly implausible situation.[14] 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:

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[14] However compare the learnability approaches of e.g. Roeper (1999) and Drenhaus (2004) (similar, Müller & Hulk 2001). These authors use the notion of module based Multiple Grammars or Minimal Default Grammars.

(8) IO>DO: A dative objects 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 & 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, 2001) 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 constraints 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, which is itself the result of the uncertainty that children typically show in response to the complexity of grammatical rules.

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

4. Conclusion

A typical conflicting pattern in grammar has been shown to find a natural explanation in an OT model. Experimental data by Drenhaus (2004) 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. 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 the 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 account for 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 the implementation of variation into grammar.

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