

An Optimality-Theoretic Model of Acquisition of Tense and Agreement in French

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Abstract

We present a novel theoretical model of multiple stages in the acquisition of tense and agreement in Child French. First, we show that tense and agreement inflection follow independent courses of acquisition. Over the three stages of development attested in the data, tense production starts and ends at near-adult levels, but suffers a “dip” in production at the second stage. Agreement develops linearly, going roughly from none to 100% over the same time. This profile suggests a *competition* between tense and agreement at the second stage which is naturally expressed in terms of constraint violability and constraint re-ranking (Optimality Theory, Prince & Smolensky, 1993). By incorporating the further mechanism of partial rankings of constraints, our analysis successfully predicts, over three stages, the frequency with which children use tensed, agreeing, and nonfinite verbs.

The Attested Development of Tense and Agreement in French

It is cross-linguistically well-attested that young children (around the age of 2) often produce simple sentences with a non-finite root (verb) form (NRFs), ungrammatical in the adult language, while also producing adult-like finite verbs with tense and agreement marking (Wexler, 1994, 1998, *inter alia*). What has been previously overlooked, however, is whether the distinct inflectional categories of tense and (person/number) agreement develop independently over time. A detailed analysis of spontaneous speech production data from three French children from the CHILDES Database (MacWhinney & Snow, 1985) provides strong evidence that the two categories indeed follow a different path of development.¹

As a preliminary step of analysis the relevant files were analyzed by hand and classified into PLU (Predominant Length of Utterance) stages (Vainikka, Legendre & Todorova, 1999). This independent measure refines the traditional observation that children progress through one-word, two-word, and multi-word stages and has proven better suited to capture syntactic development than the well-known MLU measure (Brown, 1973).

French presents specific challenges for a study of the development of finiteness because the overwhelming majority of verbs used by young children belong to the first conjugation class (‘-er verbs’) which displays considerable homophony across morphological person inflections. In the absence of an overt subject (which is frequently omitted by young children) it cannot be determined whether a given phonetic form like [dās] *danse* ‘dance’ in the present tense carries correct agreement in person and number. However, clitic subject pronouns in French (e.g., *je* ‘I’) provide a diagnostic

crosslinguistically (Vainikka, Legendre & Todorova 1999). We have done in-depth work on transcripts from eight different children at this stage of development, covering English, French, Polish, Russian, and Swedish. Further analyses are underway as well. We should point out that while the conclusions drawn in this paper are made on the basis of data from (only) three children, we believe (following well-established tradition in the study of the acquisition of syntax by children) that examining a small number of subjects in detail allows us to uncover complexity that would be missed in a necessarily less detailed overview of a larger group of subjects. Furthermore, there is strong evidence to suggest that syntactic acquisition proceeds in a highly constrained and species-universal manner. Given this, we do not expect to find a great deal of variation from child to child, increasing the likelihood that the results reached on the basis of these three children will generalize across French-speaking children.

¹ The data we report on in this paper is part of a larger project aimed at studying the acquisition of tense and agreement

for agreement marking: Following Lambrecht (1981), Suñer (1988), Legendre (1999), and others, we take subject clitics to be an overt realization of agreement, rather than considering them to be overt subjects. Agreeing with Pierce (1992), we consider them to provide a reliable diagnostic for finiteness in child French. We also count verbs with a finite morphological shape which occur with an appropriate overt subject as agreeing.

The widespread tendency of young children to omit auxiliaries raises another issue with respect to coding. A past participle with no auxiliary has an adjectival use in adult French, and in the absence of an auxiliary it is nearly impossible to determine which use was intended by the child (adjective, main verb, or past tense). Similarly, a bare infinitive might represent either the future tense with no auxiliary, or a true NRF. We have coded only forms of the verb consisting of both the auxiliary and the participle/infinitive as instantiations of tense. Participles and infinitives used without the auxiliary were coded as non-finite forms.

We calculated the proportions of forms morphologically inflected for tense and/or agreement out of the total number of verbs produced by each child at each attested PLU stage. It is well-known that the third person singular and present tense forms are the first to appear in child productions, and for a time may be the only finite forms produced by the child. Furthermore, young children tend to overuse third person singular and present tense forms. This suggests that these serve as “default” forms, making it unclear whether a third person singular (3sg) verb is truly agreeing with a 3sg subject or whether it lacks agreement and is taking on an “elsewhere” form (see also Ferdinand, 1996). To determine the proportion of children’s verbs which actually show

agreement (and not a default form), we have counted only non-3sg and non-present forms as unambiguously showing agreement, and we present our results in these terms.

Tables 1–2 below summarize our findings relating to the use of tense and agreement, respectively, by each child. The numbers in Table 1 show the proportion of tensed verbs which had non-present forms, those in Table 2 show the proportion of verbs which appeared with non-3sg agreement. Of the verbs showing present tense or 3sg agreement, some presumably reflect a default form, while others reflect correct 3sg agreement or present tense. We will estimate the proportion of correct vs. default tense/agreement marking following the discussion below.

The combined results are graphed in Figure 1 to illustrate the development of tense and agreement across the attested PLU stages.

Because the figures in Table 1 are the percentages of overall utterances that contain *non-present* tense forms in Table 1, we do not ever expect these figures to reach 100%. To understand what level of production these percentages correspond to, we need to know what *adult-like* production of non-present tense forms is. To determine this, we ran a similar count on the adult utterances in two of the CHILDES files (Philippe 11 and Grégoire 9) in order to get at least a reasonable estimate of what adult use of non-3sg and non-present forms is. These results are given in Table 3.

Assuming that adults always produce finite verbs and given that they produce non-present tense verbs roughly 31% of the time, we can reasonably take the children’s 35% production of non-present tense (out of unambiguously tensed verbs) at stage 3b to be an adult-like level of production. On the other hand, we can also reasonably assume that the 4% production of non-3sg (of agreeing verbs) at stage 3b indicates that the children are not realizing agreement and are using a default (3sg) form.

As we can see from Tables 1–2 and Figure 1 below, tense and agreement undergo distinct patterns of development. At stage 3b, the proportion of agreeing forms in the children’s speech is negligible—it is clear that they are not yet using agreement. At the same time, the proportion of tensed forms is sufficiently high to allow us to conclude that tense is already in regular use. At the subsequent stage, 4b, agreement emerges at a significant, though not yet adult-like, level. Notice that at stage 4b, tense suffers a dip

Table 1: Verbs with non-present tense inflection (out of unambiguously tensed verbs)

Child	Stage 3b	Stage 4b	Stage 4c
G	34% (66/194)	21% (44/212)	32% (205/646)
S	37% (19/52)	10% (17/179)	25% (34/135)
P		13% (44/334)	30% (74/246)
Avg	35% (85/246)	15% (105/725)	31% (313/1027)

Table 2: Verbs with non-3sg agreement inflection (out of unambiguously agreeing verbs)

Child	Stage 3b	Stage 4b	Stage 4c
G	3% (5/156)	19% (33/172)	34% (221/650)
S	5% (2/43)	12% (13/109)	38% (51/133)
P		15% (44/303)	40% (98/246)
Avg	4% (7/199)	15% (90/584)	36% (370/1029)

Table 3: Adult usage of non-3sg and non-present tense

Adults from file	non-present	non-3sg
Grégoire 9	28% (184/661)	35% (231/659)
Philippe 11	34% (173/507)	41% (205/506)
Avg	31% (357/1168)	38% (437/1165)

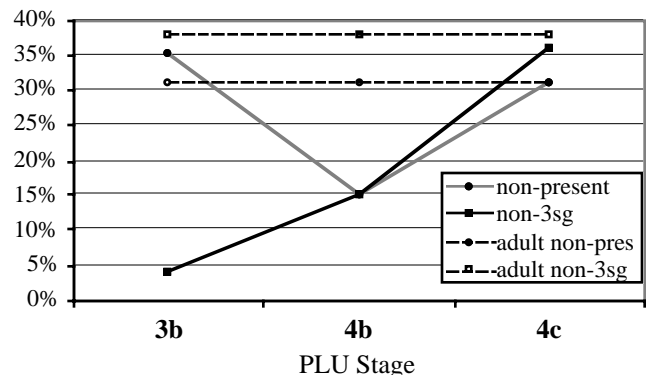


Figure 1. Tense and agreement

in production compared to stage 3b. This interesting correlation between increased use of agreeing forms and decreased use of tensed forms suggests a temporary competition between the two before they both stabilize at the subsequent stage, 4c.

The dissociation between tense and agreement is especially striking in the child production of periphrastic tenses; throughout stage 3b, Grégoire and Stéphane produce numerous instances of the past and future tenses; however, the auxiliary that appears in these utterances is always 3rd person singular: *Papa et Maman est parti* ‘Father and Mother is gone’ (Grégoire 2;0.5).

Turning now to NRFs, we found that children produce steadily fewer of these as their age/PLU stage increases. Our findings are given in Table 4 and graphed in Figure 2.

Comparing Figures 1–2, we can see that the reduction in the use of NRFs over time appears to be inversely correlated with the development of agreement: in a sense, the NRF pattern is the mirror image of the pattern we have found for agreement (Table 2). By contrast, the decrease in NRFs does not appear to correlate with the development of tense; compare Figure 2 to the previous graph of tense (Figure 1). This observation is important in light of existing claims that relate the occurrence of NRFs to the development of Tense. For example, Wexler (1994) has proposed that the underspecification of Tense is responsible for the presence of NRFs (his ‘root infinitives’) in young children’s speech. Our findings suggest at the very least that the development of agreement is also involved; the profile of NRFs is not directly linked to the profile of realization of tense.

An Optimality-Theoretic Model of Development

Informally, the main idea behind our proposal is the following: At Stage 3b, constraints requiring realization of finiteness compete with constraints on economy of structure,

Table 4: Non-finite root forms (NRFs) out of all verbs

Child	Stage 3b	Stage 4b	Stage 4c
G	28% (83/297)	18% (51/287)	1% (7/711)
S	48% (51/106)	13% (27/205)	2% (3/152)
P		22% (105/476)	6% (14/250)
Avg	33% (134/403)	19% (183/968)	2% (24/1113)

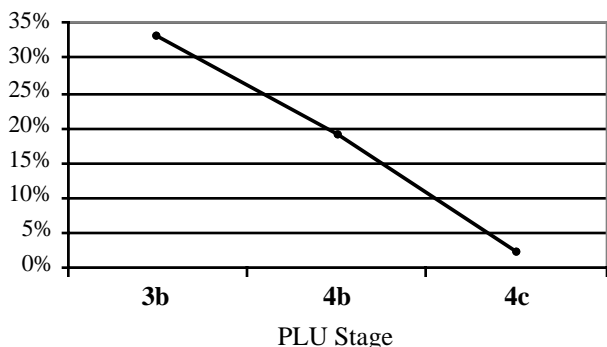


Figure 2. Non-finite root forms out of all verbs

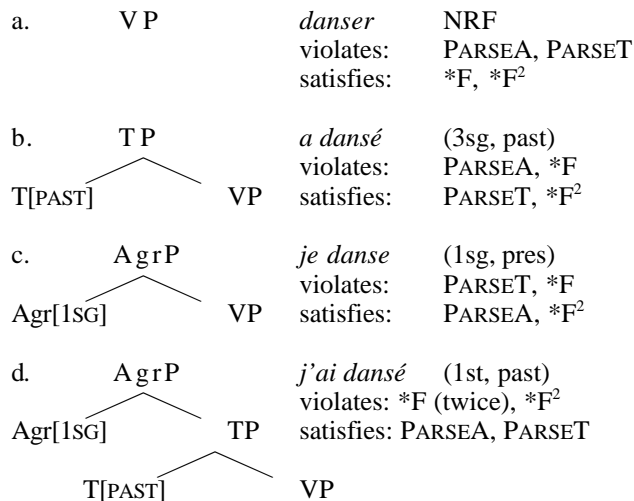


Figure 3. Candidates for input containing past tense and 1st singular agreement features

sometimes resulting in the production of finite verbs and sometimes resulting in the production of NRFs. At Stage 4b, tense and agreement compete for a single structural position; a functional projection which can realize the features either of tense or of agreement (but not both). At Stage 4c, two positions are available, allowing both tense and agreement features to be realized without competition.

Formally, the constraints which require parsing of the functional features (PARSET(ense), PARSEA(reement)) rise in the ranking relative to a fixed hierarchy of constraints penalizing structure. PARSET and PARSEA are Faithfulness constraints ensuring that what is expressed (the output of the grammar) differs minimally from what is intended (the input to the grammar).

Assuming, as is standard in generative syntax since Pollock (1989), that the presence of inflectional categories is indicative of phrase structure above that instantiating lexical categories, the constraints penalizing structure can be stated as *F (‘No functional heads’) and *F² (‘No pairs of functional heads’) with the invariable ranking *F² >> *F.²

There are four candidate structures relevant to this analysis (we assume that the input to every evaluation has tense and agreement features subject to Faithfulness constraints). They are given in Figure 3 along with examples and the constraints each satisfies and violates.

The key to our proposal is the ability of the Faithfulness constraints to “float” over a certain range in the ranking (unlike the Economy of Structure constraints *F, *F² discussed above, which remain fixed in their relative ranking) during the course of development. Formally, the model relies on partial constraint ranking (Reynolds, 1994; Anttila 1997, Nagy & Reynolds, 1997) and can predict not only that we see variation in outputs of the developing grammar, but also with what frequency we will see each output. As illustrated in Figure 4, a partial ordering (a) translates into a set of

² F² >> F invariably because they are part of a Power Hierarchy: F² is a local conjunction of two instances of *F (Legendre, Smolensky & Wilson, 1998; Smolensky, 1995).

Fixed		$*F^2$	>>	$*F$	
Floating:	PARSET				
	PARSEA				
	⇒				
a.	PARSET>>PARSEA>> $*F^2$ >> $*F$	⇒	tensed, agreeing		
b.	PARSEA>>PARSET>> $*F^2$ >> $*F$	⇒	tensed, agreeing		
c.	$*F^2$ >> $*F$ >>PARSET>>PARSEA	⇒	NRF		
d.	$*F^2$ >> $*F$ >>PARSEA>>PARSET	⇒	NRF		
e.	$*F^2$ >>PARSET>>PARSEA>> $*F$	⇒	tensed		
f.	$*F^2$ >>PARSEA>>PARSET>> $*F$	⇒	agreeing		
g.	PARSET>> $*F^2$ >>PARSEA>> $*F$	⇒	tensed		
h.	PARSEA>> $*F^2$ >>PARSET>> $*F$	⇒	agreeing		
i.	PARSET>> $*F^2$ >> $*F$ >>PARSEA	⇒	tensed		
j.	PARSEA>> $*F^2$ >> $*F$ >>PARSET	⇒	agreeing		
k.	$*F^2$ >>PARSET>> $*F$ >>PARSEA	⇒	tensed		
l.	$*F^2$ >>PARSEA>> $*F$ >>PARSET	⇒	agreeing		

Figure 6. Stage 4b

Fixed		$*F^2$	>>	$*F$	
Floating:	PARSET				
	PARSEA				
	⇒				
a.	PARSET>>PARSEA>> $*F^2$ >> $*F$	⇒	tensed, agreeing		
b.	PARSEA>>PARSET>> $*F^2$ >> $*F$	⇒	tensed, agreeing		

Figure 7. Stage 4c

Two of these rankings, (a–b), yield verb forms which are both tensed and agreeing (that is, essentially adult forms), since under those rankings it is more important to realize both tense and agreement than it is to avoid having two functional projections. Another two rankings, (c–d), yield NRFs, since under these rankings it is more important not to have any functional projections than it is to realize either tense or agreement. The rest of the rankings (e–l) yield finite forms which are either tensed (when PARSET outranks PARSEA) or agreeing (when PARSEA outranks PARSET), but not both.³

This predicts, then, that only 17% (2 out of 12) of the verb forms uttered at Stage 4b should be NRFs. We observed (Table 4) 19% NRFs, very close to the prediction. Of the remaining verbs, all finite, 17% are predicted to be adult-like (with both tense and agreement), the remaining forms having only one or the other (33% of them with only tense, 33% of them with only agreement). Again, this lines up well with the observations. Further, of the finite verbs we predict 19% non-present forms and observe 15% (Tables 1

³ Note that a higher degree of constraint overlap yields a larger number of possible rankings for each evaluation, but this does not mean that the child must “exert more effort to choose” where the number of possible rankings is large. If, metaphorically, the child’s task before evaluation is to choose a random position (within its range) for each constraint, the size of this task is affected only by the number of constraints, not by the amount of overlap. Looking in from outside, we can compute which rankings could result and what the individual likelihood is of each, but this has no effect on the actual process of fixing a ranking.

and 3), and predict 23% non-3sg forms and observe 15% (Tables 2 and 3).⁴

Compare stage 4b to stage 3b with respect to the realization of tense. Notice that, while at stage 3b, 100% of the finite utterances were tensed, at stage 4b only 60% (6 out of 10) of the finite forms are tensed. In other words, we predict (and in fact observe) a “dip” in the child’s production of tensed forms. If children were simply “learning tense” (speaking vaguely), we would not have expected them to get worse at any point during the course of development. The proposed analysis provides an explanation for this otherwise puzzling fact. Back in stage 3b, PARSEA was ranked so low as to ensure that tense features were realized in the single functional projection allowed. What has happened at stage 4b is that the tense features and agreement features now compete for realization in the single functional projection available. Since tense sometimes (in fact, half the time) loses to agreement, we predict the observed dip in the proportion of tensed forms, which coincides with an increase in the proportion of agreeing forms.

In the last stage covered in our data, stage 4c (Figure 7 above), PARSET and PARSEA together move to a position high enough in the hierarchy that they invariably outrank $*F^2$. This yields 2 rankings, but both produce the same optimal candidate, a finite form which realizes both Tense and Agreement. At this stage, we predict no NRFs, and we observed only 2% NRFs in child speech (Table 4). We also expect the children’s production of non-present forms and non-3sg forms to match the proportion in adult speech, which it does quite well; we observed (Tables 1–3) 31% non-present tense forms compared with 31% for adults, and 36% non-3sg forms compared with 38% for adults.

Figures 8–9 (next page) summarize graphically how the predictions of the model match the observed child data.

Concluding Remarks

To sum up, our research has uncovered previously overlooked properties of the acquisition of tense and agreement. We found that tense and agreement in French follow distinct courses of acquisition over the three stages studied. While the use of tense starts and ends strong, it suffers a “dip” at the intermediate stage. Meanwhile, agreement develops in a more linear way while the proportion of NRFs drops, also linearly. The distinctive profile naturally leads to an analysis in which, at the intermediary stage, tense and agreement are competing for realization. In particular, an Optimality-Theoretic analysis making use of “floating constraints” (defining partial ranking orders) allow us to predict not only the occurrence of the observed types of utterances, but their frequency as well. This result is novel; previous analyses (e.g.

⁴ The predictions here are again scaled by the “expected” proportion of non-present forms and non-3sg forms based on what we found in the observed adult speech (Table 3). 60% of forms are predicted to be tensed by our analysis, and adults produce 31% non-present forms, so we expect to find $60\% \times 31\% = 19\%$ of (finite) child utterances to be in a non-present form. Similarly, since adults produce 38% non-3sg forms, we expect to find $60\% \times 38\% = 23\%$ non-3sg forms in the children’s (finite) utterances.

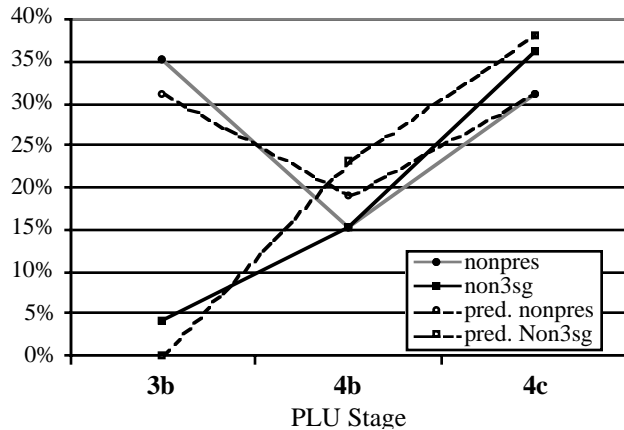


Figure 8. Predicted vs. observed tense and agreement data

Ferdinand, 1996; Pierce, 1992; Wexler 1994, 1998) have provided no clear way even to describe the facts about the changing frequencies of tense and agreement realizations over the course of acquisition. Under our proposal, the frequency predictions are a natural consequence of the re-ranking mechanism. The fundamental principle of OT, that grammars share the same constraints but rank them differently with respect to one another, requires that the acquisition process be one of re-ranking constraints. We have proposed that this re-ranking occurs not in sudden jumps but by spreading constraints across ranges in the rankings, narrowing in on the correct adult ranking. These “floating” or partially ranked constraints allow our model to make frequency predictions that seem to be borne out in child French.

Acknowledgments

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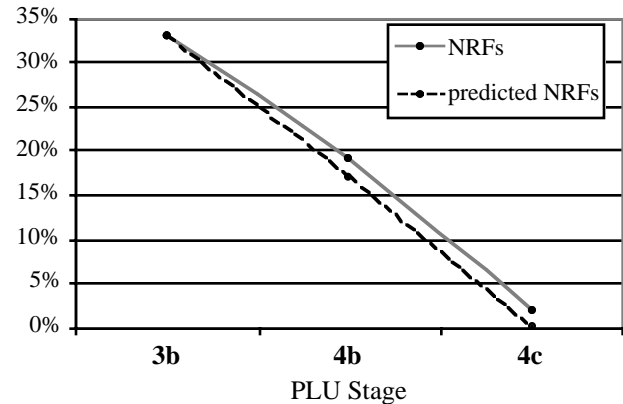


Figure 9. Predicted vs. observed NRF data

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