Tense, Agreement and Defaults in Child Catalan: An Optimality Theoretic Analysis

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1. Introduction

At the earliest stage of acquisition, children learning languages such as German, English or Swedish often have an "optional infinitive" stage. During this stage, child productions include both verbs used correctly as well as infinitival forms used as matrix verbs (e.g., Weverink 1989, Platzack 1990, Wexler 1994, Schütze 1997). It has been claimed that children learning null subject or richly inflected languages like Spanish, Catalan, or Italian, however, rarely use non-finite root forms (NRFs), or use them only at early stages and for a very short period of time (Guasti 1994, Torrens 1995, Bel i Gaya 1998).

Recent work on the acquisition of null subject/richly inflected languages suggests that their developmental pattern is more complex than previously thought. One line of research indicates that "default"-like forms that do not exhibit tense or agreement may not be limited to the NRFs found in the speech of children acquiring relatively poorly inflected languages. As originally observed by Ferdinand (1996), in addition to using root infinitives and bare participles, French speaking children also overgeneralize the third person singular present indicative (3S-PI) form. Based on the large proportion of 3S-PI forms found in child speech, Grinstead (1998) suggests that Catalan and Spanish-speaking children probably also use the 3S-PI form as a default. Varlokosta et al. (1998) noted that since Modern Greek does not have an infinitive form, NRFs could not be observed in child speech, but they reported that a form ambiguous between the third person singular and the active participle was instead used as a default by Greek children.

A second line of research has shown that during the acquisition of functional projections, children's use of NRFs decreases gradually, not discretely, as they approach an adult-like state (Phillips 1995). Despite this observation, previous accounts of the optional infinitive stage do not contain a mechanism to account for the actual proportions of finite and default forms observed in the child's speech.

In this paper, data from three Catalan-speaking children is used to extend this research. We argue that there are default usages of the 3S-PI forms that can be separated from either correct or ambiguous productions and quantified in order to determine what proportion of children's utterances are either NRFs or defaults. In order to understand the role of defaults in the bigger picture of the acquisition of functional projections, the development of tense and agreement is

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also examined. An Optimality Theoretic (Prince and Smolensky 1993) analysis incorporating these data is developed to explain the children's gradual progression from early syntactic stages to an adult-like grammar.

2. Developmental Stages

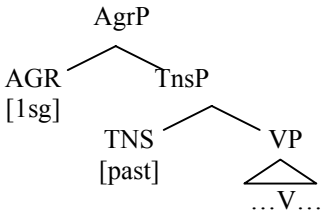
The children examined in this study were all monolingual Catalan learners from the CHILDES database (MacWhinney and Snow 1985). The children included Pep (1;6.23-3;3.18), Gisela (2;1.23-3;10.2), and Laura (1;9.7-3;5) (Serrà-Solé corpus). The data was divided into developmental stages using the Predominant Length of Utterance (PLU) measure developed by Vainikka, Legendre and Todorova (1999). This measure was created as an alternative to age and MLU (mean length of utterance), in an attempt to better characterize the types and proportions of utterances found in child speech that is independent of specific syntactic phenomena. These stages are detailed in the appendix.

Four stages of development—2b, 3b, 4b, and 4c—are found in the corpus. One child, Pep, also showed an intermediate stage that alternated between 3b and 4b which is denoted as 3b/4b. The stage 4c represents an adult-like stage in the development of functional categories. The age of the children at each PLU stage and the number of utterances can also be found in the appendix.

3. NRFs and 3S-Defaults

In adult grammars, it is assumed that Tense (TNS) and Agreement (AGR) each project a functional head (Pollock 1989, Belletti 1990). A typical representation of a first-person past tense verb in Catalan is shown in (1):

(1)



For children, it has been proposed that realizing both tense and agreement might be too complicated, leading to the optional deletion of one of either TNS or AGR features (Schütze and Wexler 1996, Wexler 1998). While these proposals claim that the deletion of one feature alone results in a NRF, it is assumed here that a NRF is a form lacking both TNS and AGR. Additionally, in this analysis, NRFs are not just infinitival forms, but may also include bare participles and bare gerunds. This is illustrated in (2):

(2) a. Lau: No, tu escopir.
no you-NOM spit-INF
"No, you're spitting." (Laura 3b—2;6.25)
b. Pep: Tirat un nen a terra.
threw-PARTIC a boy to ground
"<I> threw a doll on the floor." (Pep 3b—2;1.1)

Consistent with previous findings for Catalan and Spanish child speech, the proportions of NRFs for Pep, Gisela and Laura are relatively low. They can be compared to French data from Legendre et al. (1999), who found much higher proportions of NRFs for children at similar developmental stages:

Table 1. Proportion of NRFs of all verbs for Catalan

Child	**Stage 2b**	**Stage 3b**	**Stage 3b/4b**	**Stage 4b**	**Stage 4c**
Pep	20% (9/45)	10%(10/105)	3% (8/229)	0% (1/314)	0% (1/151)
Gisela	5% (1/22)	4% (2/45)	—	1% (2/334)	0% (1/294)
Laura	3% (1/34)	8% (17/217)	—	2% (7/293)	1% (2/176)

Table 2. Proportion of NRFs of all verbs for French

Child	**Stage 3b**	**Stage 4b**	**Stage 4c**
Grégoire	28% (83/297)	18% (51/287)	1% (7/711)
Stéphane	48% (51/106)	13% (27/205)	2% (3/152)
Philippe	—	22% (105/476)	6% (14/250)

Only Pep exhibits more than 10% NRFs at any point, and it is at stage 2b, which is developmentally earlier than the French children who are still producing almost 30% and more NRFs at stage 3b. One potential interpretation of this data is that children acquiring Catalan exhibit a drastically reduced number of NRFs in their speech compared to learners of other languages. However, as suggested by Grinstead (1998), it may be that Catalan learners are using a different kind of default form, specifically the 3rd singular present indicative (henceforth, 3S-Default). Grinstead's speculation is based on two observations: (1) children use a high proportion of 3S-PI forms in their speech, and (2) most of the children's agreement errors involve substituting a 3S-PI form for a 1st person singular (1S), 2nd person singular (2S), or 3rd person plural (3P) target.

In an effort to quantify this claim, we examined every 3rd person singular form to determine which of them were used as defaults. It is evident that in many cases, children both intend and correctly produce a third person singular target. Consequently, a 3S-PI form is only considered a 3S-Default if it is clearly used when another form was intended. These include person agreement errors, number agreement errors, errors where the utterance would be grammatical if it included the impersonal-*se* clitic, tense errors, or any combination of the preceding types. Examples of such cases are given in (3):

(3) a. Number agreement errors (Laura 3b—2;8.30)

Dad: I on són les boles? Lau: No hi és.
and where are-3PPI the balls? *not here is-3SPI*
"And where are the balls?" "[It] is not here."

b. Missing impersonal-se or Person agreement error (Laura 3b—2;5.8)

Lau: Talla carn.
cut-3SPI meat
"Meat is cut" or "I'm cutting meat"

c. Tense (and Person) agreement errors (Pep 3b—2;1.1)

(Pep and Experimenter are discussing cows on a farm)
Exp: i no s'espantaven de veure't?
and not REFL-scare-IMPERF-3P to see-INF-2S clitic
"And they weren't frightened to see you?"
Pep: Fa por.
make-3SPI scare
"It is scary."
Exp: ah! els feies por!
EXCL them make-IMPERF-2S scare
"Ah! You scared them!"

Like NRFs, 3S-PI defaults are interpreted as missing both TNS and AGR.[1] Although further exploration of this topic is beyond the scope of this paper, it should be noted that the realization of any given non-finite form may be dependent on different types of aspectual content that the child is intending to express (Bel i Gaya 1998, Hyams 2000). Thus, a more accurate proportion of non-finite utterances used by Catalan children can be determined by combining NRFs and 3S-Defaults. The new proportions are given in Table 3:

Table 3. Proportion of default forms in Catalan child utterances

Child	**Stage 2b**	**Stage 3b**	**Stage 3b/4b**	**Stage 4b**	**Stage 4c**
Pep	44%(20/45)	12%(13/105)	6%(13/229)	0%(1/314)	0% (1/151)
Gisela	18%(4/22)	7%(3/45)	—	1%(3/334)	0% (1/294)
Laura	47%(16/34)	15%(33/217)	—	3%(10/293)	1% (2/176)

Given these new proportions, Catalan child speech appears more like French, or other languages like English or Swedish. Having determined the status of 3S-Default forms in Catalan acquisition, we now examine the development of tense and agreement.

4. Patterns of Tense and Agreement

In Section 3, it was noted that children who fail to produce adult-like verbal forms may be deleting one of TNS or AGR or both. In this analysis, we assume that if only one feature is missing, then it is realized as the default value (present for TNS and 3S for AGR) (see Bel i Gaya 1998 for an opposing viewpoint).

That is, if both TNS and AGR are in the input but the child fails to realize one or more features, then the resulting form will appear either as a present tense verb (if TNS is missing) or as a 3S form (if agreement is missing). This is illustrated in (4) for a form that should be specified for [+1S, +past]:

(4)

Missing feature	**Resulting surface form & features**
TNS & AGR	*menjar/menjat/menja* (eat-INFIN./PARTIC./3S-PI)
AGR only	*ha menjat* (eat-3S, past)
TNS only	*menjo* (eat-1S, present)
Neither	*he menjat* (eat-1S, past)

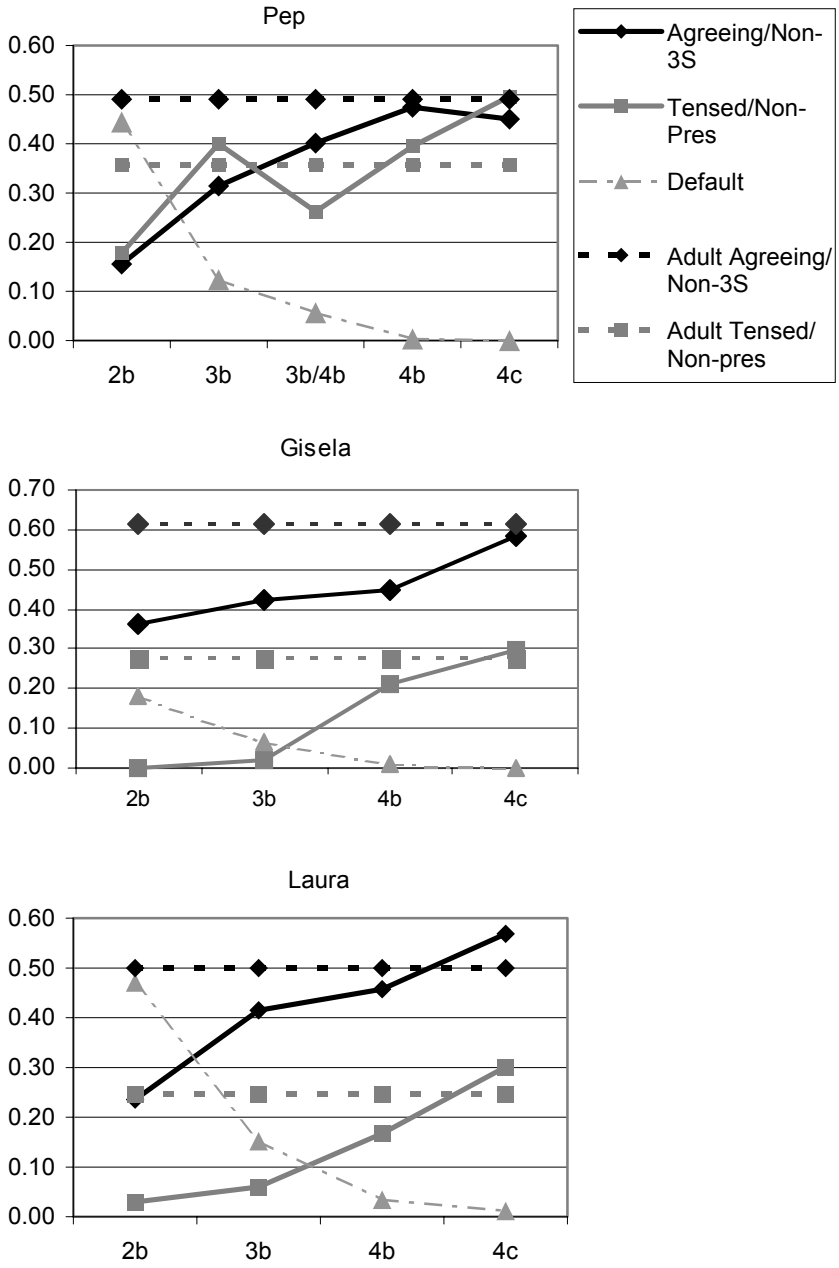
To determine the proportion of TNS and AGR in the child utterances, we counted the tensed and agreeing forms using the criteria in (5). Note that forms which are not tensed may still be considered agreeing, while those which are not agreeing can still be specified for tense. Only forms which are both not 3S and not present are counted as having TNS *and* AGR.

(5) a. A form is counted as *tensed* if it is not present (since present tense is ambiguous between default and correctly tensed forms).
b. A form is counted as *agreeing* if it is not 3S.
c. *Non-default* 3rd singular present indicative forms, including imperatives, are not counted as either tensed, agreeing or default since they do not have overt TNS and AGR. These forms are excluded from further counts. However, those forms which are clearly produced erroneously (i.e. do not match for tense and agreement) are counted as 3S-Defaults.

The child's syntactic progress can be determined by comparing the proportions of tensed and agreeing forms in their speech according to the criteria in (5) with the proportions found for adults using the same counting method. Note that we are not claiming that adult 3S and present tense utterances are not agreeing or tensed; we are simply using the criteria in (5) as a metric for evaluating the progress of the children. That is, because we do not consider the non-erroneous 3S-PI forms for the children, adult 3S-PI forms are also excluded from all counts. Once the children have attained adult-like proportions of tense and agreement according to this metric, then we can assume that all of their verbal utterances are syntactically adult-like. The adult proportions are shown in Table 4 and in the following graphs along with the patterns of tense and agreement in child speech. The actual child numbers are given in the appendix.

Table 4. Adult proportions of TNS and AGR (sampled from various files)

Catalan adults from files for:	**non-present**	**non-3sg**
Pep	36% (127/683)	49% (335/683)
Gisela	28% (149/537)	61% (330/537)
Laura	25% (168/682)	50% (341/682)



These patterns indicate that TNS and AGR show different courses of acquisition from one another. For both Gisela and Laura, the proportion of

AGR is initially greater than TNS. It begins at approximately 50% of target levels, and continues increasing until it is adult-like. TNS, on the other hand, starts out essentially unused, although it too increases linearly until the child achieves the adult target grammar. The difference between TNS and AGR may be due to the proportions of these features in the adult speech; specifically, there is nearly twice as much AGR as TNS in Catalan parental verb forms (53% AGR, 30% TNS, as averaged over the adults).

The patterns exhibited by Pep are somewhat different than those of the other two children since he shows a decrease in the proportion of tensed forms in his speech from stage 3b to stage 3b/4b. Elsewhere it has been argued that Pep overproduces TNS at stage 3b and recovers in the following stage. Although this case will not be discussed here, details can be found in Davidson (2001). The remainder of the paper will focus on the pattern found for Gisela and Laura.

The patterns of development clearly indicate that from stage to stage, the proportions of TNS and AGR in the children's utterances do not increase discretely, but rather continuously. Likewise, the use of defaults does not entirely disappear once children begin to use fully inflected forms. Although it has been recognized that acquisition of functional projections is not a discrete process (Phillips 1995), most previous acquisition accounts do not even address the need to explain such variation (e.g., Pierce 1992, Rizzi 1993/94, Vainikka 1993/94, Meisel 1994, Wexler 1994, 1998). We propose that the proportions of TNS, AGR and default forms at different stages can be captured using Optimality Theory (Prince and Smolensky 1993).

5. An OT Account of the Production of Tense, Agreement, and Defaults

5.1. Producing Variation with Floating Constraints

One tenet of Optimality Theory is that grammar is characterized by competition (Prince and Smolensky 1993). Grammar is an optimizing system of universal well-formedness constraints on linguistic forms in which alternative structural realizations of an input ("candidates") compete. The candidate which best satisfies (or minimally violates) the full set of ranked constraints is the optimal one. Only the optimal structure is grammatical.

In the case of the child that is unable to realize one or both of TNS or AGR, it can be said that she is facing conflicting constraints. Sentences in the target grammar must show both tense and agreement. However, as previously discussed, a sentence realizing both tense and agreement may be too complicated for a child. This is implicit in the initial state of an OT grammar, in which markedness constraints prohibiting structure outrank faithfulness constraints compelling the realization of functional features (cf. Markedness >> Faithfulness in the initial state, Demuth 1995, Gnanadesikan 1995, Smolensky 1996). This idea can be captured by the constraints in (6) and (7):

(6) Economy of Structure (Markedness) Constraints
*F: No functional heads
*F^2: No pairs of functional heads

(7) Faithfulness Constraints
PARSET: Parse Tense
PARSEA: Parse Agreement

The constraint *F^2 is the local conjunction of *F with itself. These constraints are part of a power hierarchy, which means that *F^2 >> *F in every grammar and in the initial state (Smolensky 1997). Unlike the markedness constraints, PARSET and PARSEA are not universally fixed.

As argued by Legendre et al. (1999), the OT analysis can be said to provide a natural synthesis of the Strong Continuity Hypothesis, which maintains that the child has access to adult-like phrase structure from the beginning of syntactic acquisition (e.g., Boser, Lust, Santelmann and Whitman 1992, Poeppel and Wexler 1993) and the Weak Continuity approach, which holds that phrase structure develops gradually (e.g., Vainikka 1993/94, Radford 1996). In OT, it is assumed that the input to the syntactic component is adult-like, and that children are intending to produce the same types of utterances found in adult speech. This is similar to the Strong Continuity position. On the other hand, the ranking of Markedness >> Faithfulness in the initial state requires that children initially posit a minimal amount of phrase structure at the beginning of syntactic development and gradually re-rank constraints in order to settle on the adult state (in which Faithfulness >> Markedness). This corresponds more closely to the Weak Continuity view. In the OT account, the fundamental insights contributed by both of these positions, which were previously considered incompatible, can be incorporated into a single framework.

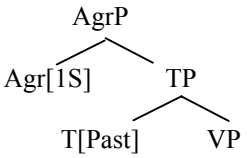
Four candidate structures are relevant to the OT analysis. It is assumed that the *input* to each evaluation contains TNS and AGR features, and that the realization or absence of these features is dependent on the ranking of the constraints in the grammar. Thus, if both markedness constraints are ranked above both faithfulness constraints, neither TNS nor AGR will be realized. The relevant candidate structures for an input with [1S] and [past] features and the constraints they violate and satisfy are shown in (8):

(8) Possible structures (candidates) evaluated for "optimalness":

a. VP
example: *canta* (3S-Default)
violates: PARSEA, PARSET
satisfies: *F, *F^2

b. TP
T[PAST] VP
example: *ha cantat* (3S, past)
violates: PARSEA, *F
satisfies: PARSET, *F^2

c. AgrP
Agr[1S] VP
example: *canto* (1S, present)
violates: PARSET, *F
satisfies: PARSEA,*F^2

d. 

example: *he cantat* (1S, past)
violates: *F, *F^2
satisfies: PARSEA, PARSET

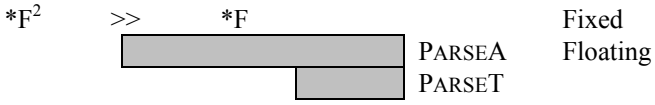
It is typically assumed that in the final (adult) state of an Optimality Theoretic grammar, a speaker has a single fixed ranking of constraints (in this case, PARSEA, PARSET >> *F^2 >> *F). If this were the case in child grammars, we would not see continuous changes in the proportions of TNS and/or AGR or defaults found in child productions. However, if we suppose that a child is entertaining several grammars at a stage S of her development, then it would be possible for multiple outputs to be optimal. In other words, as has previously been proposed by researchers working within Optimality Theory, multiple grammars allow for variation in the types of verbal forms in child utterances (as well as variation in historical linguistics and allophony, e.g. Reynolds 1994, Anttila 1997, Boersma 1998, Legendre et al. 1999, Boersma and Hayes 2001, Smolensky, Davidson and Jusczyk to appear).

The type of variation found in the acquisition of tense and agreement can be captured by partially ranking faithfulness constraints with respect to markedness constraints, as shown schematically in (9) and (10). This example represents a possible set of rankings that could be present at an early stage of acquisition. A child entertaining these grammars will produce only default and agreeing verbs.

(9)

Set of rankings:	*Winning candidates:*
a. *F^2 >> *F >> PARSET >> PARSEA	untensed, non-agreeing verb
b. *F^2 >> *F >> PARSEA >> PARSET	untensed, non-agreeing verb
c. *F^2 >> PARSEA >> *F >> PARSET	agreeing, default tense verb

(10) Partial ranking that will make both grammars possible



The partial ranking in (10) indicates that the constraint PARSEA is not fully ranked with respect to the other three constraints, but rather floats both above and below *F (but not above *F^2). In other words, the child has not yet fixed the ranking of PARSEA, and as such, is entertaining the three different grammars in (9). PARSET, on the other hand, has not yet been reranked at all by the child. Given these possibilities, it is expected that PARSEA and PARSET will be ranked together below *F some of the time (producing grammar (11)a or b.), and that PARSEA will be ranked above *F some of the time (producing grammar (11)c.). As shown in (11), these three grammars will produce two different outcomes.

(11) Grammar a: The surface form is neither tensed nor agreeing.

[cant-, 1S, Past]	*F^2	*F	PARSEA	PARSET
☞ a. canta			*	*
b. canto		*!		*
c. ha cantat		*!		
d. he cantat	*!	*		

Grammar b: The surface form is neither tensed nor agreeing.

[cant-, 1S, Past]	*F^2	*F	PARSET	PARSEA
☞ a. canta			*	*
b. canto		*!	*	
c. ha cantat		*!		
d. he cantat	*!	*		

Grammar c: The surface form is agreeing only.

[cant-, 1S, Past]	*F^2	PARSEA	*F	PARSET
a. canta		*!		*
☞ b. canto			*	*
c. ha cantat		*!	*	
d. he cantat	*!		*	

Since the child is entertaining multiple grammars, multiple forms are grammatical. Variation results from the partial ranking of constraints.

Using Laura as a representative, the next section contains an in-depth look at partial rankings in child speech. Similar analyses of Pep and Gisela can be found in Davidson (2001).

5.2. Estimating Probabilities: Case Study of Laura

The key to accounting for the proportions of tense, agreement and defaults in child language lies in determining how close their productions are to their adult targets. We hypothesize that children are trying to produce agreeing and tensed forms at approximately the same rate as adults. By comparing the proportion of inflection that is observed in child speech with the adult target proportion, it is therefore possible to assess the child's ability to produce agreeing and/or tensed forms. According to this hypothesis, if a child has acquired the ability to produce agreement and/or tense, then the actual proportions of different verb types found in children's speech should be equal to the proportions found in the adult input.

For example, if non-present verbs make up 24% of an adult's total verbal utterances, then the child should be attempting to produce non-present verbs approximately 24% of the time. If the child's proportion of non-present verbs is considerably lower than the adult's, then we conclude that they have not completely acquired the ability to produce tense 100% of the time. If non-

present verbs constitute only 12% of the child's verbal utterances when the target is 24%, then we can say that the child is realizing tense 50% of the time. The computational formulas in (12) illustrate how the child proportions are obtained:

(12) Proportion(AGR in child speech) = $\frac{\text{child non-3S}}{\text{adult non-3S}}$

Proportion (TNS in child speech) = $\frac{\text{child non-present}}{\text{adult non-present}}$

Proportion(AGR&TNS in child speech) = $\frac{\text{child non-3S non-present}}{\text{adult non-3S non-present}}$

Using this data, the probabilities of certain constraint rankings can be estimated, as illustrated in (13) (see Appendix B for actual values):

(13) Stage 2b	AGR (NON-3S)	TNS (NON PRESENT)	AGR&TNS (NON3S, NONPRES)
Laura	24%	3%	0%
Adult	50%	25%	13%
Proportion compared to adult speech	**48%**	**12%**	**0%**

Proportion(AGR) reveals that Laura correctly uses agreement inflection 48% of the time, and Proportion(TNS) indicates that she exhibits tense only 12% of the time. Since forms showing TNS can be produced only when PARSET is ranked (at least) above *F, this data allows us to estimate that the ranking holds 12% of the time. Note that by the definition of probability, this means that PARSET is ranked below *F (100%-12%)=88% of the time. Likewise, PARSEA is ranked above *F 48% of the time, and below it 52% of the time. In this stage, since Laura does not exhibit any AGR&TNS forms, the more parsimonious assumption is that neither of the faithfulness constraints ever float above $*F^2$. This is shown graphically in (14):

(14) Laura, stage 2b

$*F^2$ >>	*F	
48%	52%	PARSEA
12%	88%	PARSET

Furthermore, the estimated probabilities of PARSET and PARSEA (derived from the data) constrain the variation that partial rankings can produce. This allows us to predict the proportions of other forms. Recall that the default is the optimal output when both PARSEA and PARSET are ranked below *F. If we know the likelihood of this ranking, we can predict the proportion of default forms that should be observed.

The likelihood of this ranking is equal to the joint probability of both PARSEA and PARSET floating below *F. This is the product of the proportion of the time that PARSEA is below *F (1-Proportion(AGR)) and the proportion of the time that PARSET is below *F (1-Proportion(TNS)).

For Laura in stage 2b, the probability of this ranking is 47%—the same as the observed proportion of default forms (from Table 3).

(15) Predicted default = P(1-Proportion(AGR)) * P(1-Proportion(TNS))
=52% × 88% = 47%

The PARSET and PARSEA probabilities also make predictions regarding the proportion of forms exhibiting both tense and agreement. Note that once the children begin to exhibit AGR&TNS forms, it is necessarily true that both PARSEA and PARSET are floating above *F^2 for some proportion of the time. This can be demonstrated with data from Laura's next stage:

(16) **Stage 3b**	AGR (NON-3S)	TNS (NON PRESENT)	AGR&TNS (NON3S, NONPRES)
Laura	41%	6%	4%
Adult	50%	25%	13%
Proportion	**83%**	**24%**	**33%**

The relevant rankings are shown in (17):

(17) Laura, stage 3b

*F^2	>>	*F	
83%		17%	PARSEA
24%		76%	PARSET

Forms exhibiting tense and agreement are produced when both PARSEA and PARSET are ranked above both *F and *F^2. The likelihood of this ranking is the joint probability of PARSEA and PARSET floating together above *F^2. Unlike defaults, we cannot directly estimate this probability from the data. As noted above, AGR can be realized either when PARSEA >> *F or when PARSEA >> *F^2. Since agreement will surface whether PARSEA is ranked above *F or *F^2, Proportion(AGR) does not determine the exact ranking of PARSEA with respect to each faithfulness constraint individually (the same holds true for Proportion(TNS) and PARSET).

What these values can determine, however, is the predicted maximum possible value for AGR&TNS. Since *F^2 >> *F, the probability that both faithfulness constraints simultaneously dominate *F^2 must be less than or equal to the probability of both dominating *F. This provides a ceiling on the number of forms showing both TNS and AGR: the observed proportion of AGR&TNS is

predicted to be equal to or less than the joint probability derived from Proportion(AGR) and Proportion(TNS).

The following equation shows the joint probability of Proportion(AGR) and Proportion(TNS), or the predicted maximum value for AGR&TNS, for stage 3b:

(18) Laura, stage 3b: Proportion(AGR)*Proportion(TNS) = 83% × 24% = 20%

The observed proportion of AGR&TNS for stage 3b is 33%, but a chi-square analysis shows that this is not statistically different from the predicted value of .20 ($\chi^2(1)=1.68$, $p > .15$). As for the default, according to the equation in (15), the predicted proportion in stage 3b is 13%, and the observed is 15%.

This probability-based analysis reveals that the Power Hierarchy $*F^2$ >> *F is treated as one constraint. In Laura's stage 3b, her predicted and observed proportion of AGR&TNS are not statistically different. This, in addition to the fact that she still produces 15% default forms at this stage, entails that her faithfulness constraints are either ranked together below *F or above $*F^2$, but are never found between the two markedness constraints. Thus, once Laura begins to produce fully inflected forms, she treats the Power Hierarchy $*F^2$ >> *F as one constraint. This new perspective on Laura's development can be graphically depicted as in (19):

(19) Laura, stage 3b

$*F^2$	>>	*F	
83%		17%	PARSEA
24%		76%	PARSET

In this situation, the only two types of verb forms that will be exhibited are ones that are either fully specified for tense and agreement, or ones that are entirely lacking these features. Forms specified for only agreement or only tense will not be observed. Note that this does not preclude any 3S or present tense forms; it simply means that these forms are fully specified for tense and agreement.

Subsequent developmental stages exhibit this pattern as well. First, Laura's stage 4b is much like her stage 3b, except that all of the proportions are steadily getting closer to the adult target, as shown in (20). This steady progress illustrates the gradual acquisition of the adult grammar.

(20) Laura, stage 4b

Stage 4b	AGR (NON-3S)	TNS (NON PRESENT)	AGR&TNS (NON3S, NONPRES)
Laura	46%	17%	8%
Adult	50%	25%	13%
Proportion	**91%**	**71%**	**65%**

For stage 4b, the observed proportion of AGR&TNS is 65%, which is equal to the predicted maximum value: 91% × 71% = 65%. The predicted proportion for the default in stage 4b is 3%, and the observed is 2.5%. This again indicates that when both PARSEA and PARSET are not ranked below *F, they are ranked together above $*F^2$, as shown in (21):

(21) Laura, stage 4b

$*F^2$	>>	*F	
91%		9%	PARSEA
71%		29%	PARSET

Laura's stage 4c is so similar to the adult target that it can be assumed that by this stage, she has ranked both PARSEA and PARSET above both faithfulness constraints.

(22) **Stage 4c**	AGR (NON-3S)	TNS (NON PRESENT)	AGR&TNS (NON3S, NONPRES)
Laura	57%	30%	19%
Adult	50%	25%	13%

At stage 4c, then, Laura's ranking is the same as that for Catalan adults: PARSEA, PARSET >> $*F^2$ >> *F.

6. Conclusion

This study had two main goals: to examine default forms in child speech and to provide an account of variation in the acquisition of functional features. Following Grinstead (1998), a detailed examination of third-person singular present indicative verbs revealed that they were used even when it was clear from the context that the child intended another verb, such as one specified for a different person, tense, or number. In combination with other non-finite root forms like infinitives or bare participles, the presence of these default forms in child Catalan suggests that, as with other languages, learners of null-subject languages use default forms.

Child acquisition of tense and agreement and subsequent decreases in non-finite forms in their speech can be captured in an OT analysis using partial rankings. Partial rankings allow the faithfulness constraints to float over a range of markedness constraints. This range changes over time, which captures the idea that child grammars change gradually.

Finally, using the proportion of tense and agreement produced at a given stage in child speech, the OT model of Catalan can predict both the default and ceiling on the proportions of forms exhibiting both overt tense and agreement. The floating ranges are constrained by the fact that the proportion of default forms must be equal to the joint probability of (*F >> PARSEA) and (*F >>

PARSET). Likewise, the proportion of fully specified verbs can be no greater than the joint probability of Proportion(AGR) and Proportion(TNS). When this proportion in fact equals the joint probability, then all child verbs which are not default forms must be fully specified for tense and agreement. In OT terms, this indicates that the child treats the Power Hierarchy $*F^2$ >> *F as one constraint.

Notes

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1. Although distributional evidence would be necessary to exhaustively verify the status of 3S-Defaults as non-finite, space limitations preclude the presentation of such evidence in this paper. Despite such evidence, it can be noted that 3S-Defaults are consistent with an analysis that treats them as non-finite. In addition to the fact that children use them erroneously when the appropriate utterance must necessarily realize tense and/or agreement, 3S-PI forms are a good candidate for use as a non-finite default because they do not contain overt tense or agreement morphology.

Appendix

A. Developmental stages

Definitions of PLU Stages (from Vainikka et al. 1999)

Stage 1: Predominantly one-word stage

- Almost all utterances (90%) are of the one-word sentence type

Stage 2: Intermediate stage between one-word and two-word stage

- The one-word sentence type is still very common (60%-89% of the utterances are of the one word-type)

Stage 3: "Two-word" stage

- The one-word sentence type no longer clearly predominates (i.e. fewer than 60% of all utterances are one-word utterances)
- The multiword sentence type is not the most common one

Stage 4: Predominantly multiword stage

- The multiword sentence type is the most common one

Secondary PLU stages (from Vainikka et al. 1999)

Secondary stage a: at most 10% of all utterances contain a verb
Secondary stage b: 11%-60% of all utterances contain a verb
Secondary stage c: more than 60% of all utterances contain a verb

Table 5. Developmental stages

Child	Age	PLU	# of Utterances
Pep	1;6.23-1;10.6	2b	562
	1;11.6-2;2.	3b	681
	2;3.10-2;6.15	3b/4b	800
	2;7.8-3;1.11	4b	1149
	3;2.14-3;3.18	4c	501
Gisela	2;1.23-2;2.6	2b	197
	2;4.25-2;6.23	3b	315
	2;8.0-3;5.15	4b	1088
	3;6.28-3;10.2	4c	941
Laura	1;9.7-2;4.11	2b	809
	2;5.8-2;8.30	3b	1320
	2;11.17-3;0.2	4b	1008
	3;3.21-3;5	4c	767

B. Proportions of tense and agreement

Table 6. Verbs with non-present tense inflection

	Stage 2b	**Stage 3b**	**Stage 3b/4b**	**Stage 4b**	**Stage 4c**
Pep	18% (8/45)	40% (42/105)	26% (60/229)	39% (124/314)	50% (75/151)
Gis	0% (0/22)	2% (1/45)	—	21% (70/334)	30% (87/294)
Lau	3% (1/34)	6% (13/217)	—	17% (49/293)	30% (53/176)

Table 7. Verbs with non-3S agreement inflection

	Stage2b	**Stage3b**	**Stage3b/4b**	**Stage4b**	**Stage4c**
Pep	16% (7/45)	31% (33/105)	40% (92/229)	47% (149/314)	45% (68/151)
Gis	36% (9/22)	42% (19/45)	—	45% (149/334)	59% (172/294)
Lau	24% (8/34)	41% (90/217)	—	46% (134/293)	57% (100/176)

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