

Running Head: INFLECTION PATTERNS IN FRENCH

Variable effects of morphology and frequency on inflection patterns in French
preschoolers

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Abstract

We studied the emergence of productive verb inflection in pre-school native speakers of Quebec French using a verb elicitation task. We verified whether verb conjugation group (regular vs. irregular morphology) and frequency affect ability to produce correctly inflected *passé composé* forms. Special attention was paid to regularization into regular (default) and sub-regular conjugations, and on irregularization patterns. Results indicate that French-speaking children are able to productively use inflectional rules at very young ages and are sensitive to verb frequency and morphological patterns, both default or sub-regular, as evidenced by differential production patterns for regular and irregular verbs.

Key words: *Dual-route models, single route models, acquisition, overregularization, frequency, French, verbs, conjugation class*

Traditionally, the appearance of overregularizations in child language has been interpreted as an indication of the acquisition of a productive linguistic rule. This is because the overregularized form has not been heard in the input and must therefore be the result of the child's application of a linguistic rule. Linguistic rules are understood here as a mental operation on variables that can vary in shape from language to language (e.g., "add a past participle suffix to a verb stem", or V + [past part]). When a child produces an inflected verb form, we assume that a verb stem is selected and concatenated with a suffix. French-speaking children produce overregularizations, that is, inflections of irregular verbs using productive and regular paradigms, on irregular past participles (e.g., *j'ai *voulé* [ʒe vul-e], with the regular [e] suffix instead of the irregular *j'ai voulu* [ʒe vuly] 'I wanted (to)').

However, French children generally produce fewer overregularizations in spontaneous speech than English-speaking children do (Elin Thordardottir, 2005). It is therefore difficult to verify productive verb use using speech samples. The experiment reported on here was designed to evaluate models of language acquisition and processing through the elicitation of *passé composé* forms in French-speaking children from Quebec¹.

Two major theoretical positions in the field of language acquisition are considered in the present study. The first accounts for language learning by positing that language acquisition is grounded in general pattern-based cognitive processes with no linguistic-specific modules (Bybee, 1995; Marchman & Bates, 1994). Theories of this type are often referred to as single-level or schema-based. In these models, the acquisition of a regular rule is related to the acquisition of a critical mass of vocabulary items (Marchman & Bates, 1994) and to the development of schemata in the form of links between recurring semantics and

phonological forms, such as those found in regular inflectional patterns for past tense (*-ed*) and plural (*-s*) in English (Bybee, 1995). The second position combines both generative rules, as proposed in traditional linguistic theories (Chomsky, 1986), and pattern association mechanisms that operate over items stored in memory (Bartke, Marcus, & Clahsen, 1995; Marcus, 1996; Marcus, Pinker, Ullman, Hollander, Rosen, & Xu, 1992; Pinker, 1999). These are known as dual-route models. According to these models, children approach language learning using item-based learning and schemata, as in single-level models, as well as morphologically-based word construction and analysis (rules).

Traditionally, the existence of rules has been motivated by a number of factors, among them the observations that children learn to manipulate language extremely rapidly and to produce novel forms (e.g. overregularizations) that they did not have as linguistic input. However, the existence of implicit linguistic rules has been called into question by schema-based models and cannot be motivated solely by appealing to a “language instinct”.

Studies of child acquisition of English have shown that overregularization of irregular verbs appears quite early in language acquisition (see Marcus et al., 1992). Studies of child verb production in Italian (Orsolini, Fanari, & Bowles, 1998), German (Clahsen, 1996; Clahsen & Rothweiler, 1993) and Spanish (Clahsen, Aveledo, & Roca, 2002) have shown overregularization into default conjugation classes, but also into sub-regular or less frequent default inflectional patterns. The results of these studies have been interpreted as evidence for both single and dual-route models. For example, Orsolini and colleagues argue that the production of irregularizations by Italian children is evidence for schema-based learning. However, Say and Clahsen (2002) argue that what Orsolini and colleagues term irregularizations are in fact overregularizations into sub-regular patterns. French, like

Italian, has verb conjugation classes with differing levels of regularity, productivity and frequency. Few studies of French have specifically addressed the issue of verb acquisition within the context of these models. In her study on French verb acquisition, Hiriarteborde (1973) verified the ability of 13 children from France aged 3;5 to 3;7 (years;months) to productively use regular verbs. She developed an elicitation task using frequent and less frequent (*commun et insolite* ‘common and unusual’) regular verbs and compared results with spontaneous speech samples gathered from the same children. The experimenter showed pictures to the participants, described the action and then asked the child what had happened. The child was expected to produce the *passé composé* with an auxiliary (AUX) and a past participle (PP) form. For example:

- (1) *La petite fille lance la balle au chien.*

'The little girl throw.^{3s²} the ball to the dog.'

Qu'est-ce qu'elle a fait?

'What did she do?'

Target: *Elle a lancé la balle au chien.*

'She AUX throw.PP the ball to the dog.'

Hiriarteborde (1973) found that some of these children productively produced the *passé composé* by the age of 3;6. However, this occurred only in children who produced at least 4 different *passé composé* types in their spontaneous speech sample. A limitation of this experiment was that it focused solely on regular verbs. The appearance of overregularization patterns on irregular verbs would be a better indication of the acquisition of a productive rule, since these forms are not in the child's input. In addition, as was done by Hiriarteborde, one should also verify if children can inflect novel or low-frequency

verbs, since correct production of high-frequency forms can be the result of lexical extraction from memory, without the need to compute the inflected form. We therefore developed an elicitation task for French verbs to investigate these issues.

The focus of our experiment was to determine whether or not French-speaking preschoolers produce *passé composé* forms productively. We included irregular verbs in order to verify sensitivity to verb conjugation group. However, high-frequency irregular verbs can also be over-learned, or strongly represented, hence not subject to overregularization errors. The inclusion of low frequency verbs allowed us to verify whether response patterns reflect productive language use, since children presumably do not have mental representations for these forms.

French verbs

French verbs are typically divided into three conjugation groups. The first contains verbs ending in *-er* (pronounced [e]) in the infinitive (e.g., *manger* 'to eat'), and makes up the largest verb group (approximately 4000, Grévisse & Goose, 1980). This group is highly regular, with practically no stem allomorphy (only one verb ending in *-er*, *aller* 'to go', is irregular). It contains most of the French loanwords (e.g., *chatter* 'to (web-)chat'), neologisms (*tchorer* 'to steal'), denominals (*fumer* 'to smoke') and onomatopoeia (*ronronner* 'to purr') – all indications of this conjugation's role as the default regular paradigm. French-speaking children from France typically overregularize irregulars into this group (Grégoire, 1937; Guillaume, 1927 [1973]; Hiriarteborde, 1973). The second conjugation group contains verbs ending in *-ir* [iʁ] in the infinitive. Regular forms maintain a consistent stem throughout the paradigm (e.g., *punir* [pyniʁ] 'to punish', *puni* [pyni])

'punish.PP'), and add *-iss-* to the stem in certain forms (e.g. *nous punissons* [pynisɔ̃], 'we punish'). New verbs are occasionally coined into this group (e.g., *atterrir* 'to land'), which also contains deadjectival verbs (*mincir* 'to become thin'; *verdir* 'to (make/become) green'). Children occasionally overregularize into this pattern, as attested in two-year-olds (Guillaume, 1927 [1973]) and three-year-olds (Hiriarteborde, 1973). Irregular verbs ending in *-ir* exhibit stem allomorphy (*venir* [vœnɪ̑] 'to come', *vient* [vjɛ̑] 'come'). We can therefore claim that the second conjugation is sub-regular, since a number, although not all, of the verbs in this class exhibit no stem allomorphy (Say & Clahsen, 2002).³ The third group of verbs contains forms ending in *-re* [ʁə], *-dre* [dʁə] and *-oir(e)* [waʁ] in the infinitive. This group is quite heterogeneous in that its verbs undergo stem changes throughout the verbal paradigm (usually vowel changes and the realization of latent consonants, or even stem allomorphy such as *boire-bu* [bwaʁ-bu] 'to drink-drunk'). As no new forms are coined in this group, this conjugation is not productive. Both the second and third groups contain approximately 300-350 verbs (Bescherelle, 1980; Grévisse & Goose, 1980)⁴, some of which are quite low frequency while others are of high frequency (2nd: *finir* 'to finish', *grossir* 'to get bigger', *nourrir* 'to feed', *remplir* 'to fill', *venir* 'to come' *mentir* 'to lie', *lire* 'to read', etc.; 3rd: *voir* 'to see', *prendre* 'to take', *perdre* 'to lose', *boire* 'to drink', and so on). In his analysis of a child language corpus, Guillaume (1927 [1973]) noted that there were more verb types in the first conjugation (124 or 76%) than sub-regular *-ir* verbs (10.6%) or irregulars (29 or 17.9%). However, there were fewer first-conjugation tokens than third-conjugation ones (in his table, they are classified as third and fourth-conjugation): 36.2% were first-conjugation and 57.8% were third-conjugation. Thus,

irregulars comprised a greater amount of tokens than the *-er* regulars in the corpus. Sub-regular *-ir* verbs comprised only 6% of types (10) and tokens (173) in his corpus. What these numbers tell us is that French irregular verbs are more frequently represented in the corpus than regular and sub-regular verbs combined. However, there were only 29 different irregular verbs for 124 regular and 10 sub-regular verbs. For both models of language acquisition, we would expect overregularizations into the first conjugation, due to the high type frequency of this pattern in French. Both models would also predict sub-regularizations into the second conjugation, the dual-route model by virtue of the second conjugation's semi-productivity, and the single-route model by virtue of its phonological regularity (that is, irregular verbs with thematic *-i-* vowels would be regularized into this pattern). However, the single-route model would also predict irregularizations into the third conjugation because of high token frequency of the [y] ending on irregular past participles (see below for a description of past participles in French).

Finally, it is important to note that, although most irregular French forms undergo stem alternations, they usually preserve regular morphological inflections for person, number and tense (e.g., *buvez* [bɥv-e] 'drink.2pl⁵'). Irregular verbs in French are therefore not irregular in the same way as they are in English. There is usually no confusion between the stem and inflection. That is, the phenomenon of portmanteau morphs is not as prevalent in French as in English. Only auxiliaries and modals have forms where the stem and inflection are indiscernible from one another, as in English irregulars. The production of irregular verbs in French can be said to involve at least two processes: a) stem selection and b)

inflection of the stem. Thus, the inflection of French irregular verbs could involve regular rules in addition to memory-based stem retrieval.

Passé Composé

The *passé composé* in French is formed by using an auxiliary and the past participle form of the main verb. In regular verbs, the past participle (PP) is formed using the verb stem with the suffix [e] for *-er* verbs and the suffix [i] on regular *-ir* verbs.⁶ Irregular verbs have past participles that end either in [i], or [y] or that show idiosyncratic forms (e.g., *il est mort* [mɔʁ] ‘he died’, *il a fait* [fɛ] ‘he did’). A classic overregularization found in French is the production of irregular PPs using the default past participle marker [e], as in (2).

- (2) *Je l'ai *batté [bat-e] / battu [bat^sy]* (personal data 4;6)⁷

I 3sCL⁸-AUX beat.PP

‘I won (against) him’

French verbs and their past participle forms used in the *passé composé* thus offer a point of comparison with the English data on language acquisition, especially in the relations between verb regularity, frequency and the acquisition of productive linguistic processes as evidenced by overregularization. French speakers have four possible production patterns for past participle forms: regular [e], sub-regular [i], irregular [y] and idiosyncratic forms. Overregularization in the [e] pattern is similar to overregularization into the English -ed in that it is productive and the most frequent type in the language, while irregularizations in [y] would mirror gang-type irregularizations in English (low type frequency, high token frequency and phonological similarity effects). A difference from English data would be the observation of overregularizations in [i], a low type and token frequency process. Based

on previous studies of French, Spanish, Italian and German (Clahsen, 1996; Clahsen et al., 2002; Clahsen & Rothweiler, 1993; Hiriarteborde, 1972; Orsolini et al., 1998), we would expect French-speaking children to be sensitive to the properties of productive default and semi-productive conjugation patterns. Overregularization should be observed in both the first and the second conjugations. However, we should bear in mind the differences between the *passé composé* forms in French and the past tense in English. In French, the *passé composé* is both syntactically and morphologically constructed, with an auxiliary, and a participle form bearing a verbal suffix. In English, the past tense is created with a verbal suffix only (or with irregular portmanteau morphs). French children might exhibit acquisition patterns that differ from those of English children, simply due to typological differences between the structures of the two languages. Nevertheless, the French PP form may still be compared to English, as it has both regular and irregular inflectional patterns and is used by children at the earliest stages of language production (Elin Thordardottir, 2005).

Both the dual and single-system models for language acquisition propose to account for differential processing of regular and irregular verbs. Both models account for overregularization patterns by postulating that representations for some low frequency irregular verb forms are not well established, and that these verbs are integrated into a regular paradigm (Bybee, 1995; Marcus et al., 1992). Proponents of single-level models suggest that regular patterns of inflection arise as a consequence of the frequency of input of these conjugations (Bybee, 1995). That is, regular verb inflections, being associated with the largest number of verb types in the language, would be more strongly represented due to the stronger associative connections between form and semantics in the cognitive

architecture. We would therefore expect overregularization into the default [e] patterns to predominate in child language errors. In principle, irregularizations in [ɥ] could be expected according to a single-route model, due to this pattern's high token frequency in the input as well as strong gang effects (*boire – bu* 'drink - drink.PP', *voir – vu* 'see - see.PP', *lire – lu* 'read - read.PP', *devoir – dû* 'have to – have.PP to', *savoir – su* 'know – know.PP', *croire – cru* 'believe – believe.PP', etc.). Dual-route models account for the strength of regular and default morphological representations by appealing to the child's sensitivity to morphological structure and productivity, irrespective of the token frequency of a given morphological process in the discourse. Because token or type frequency of pattern is not necessarily expected to play a role, regularity is of the essence. A dual-route model would allow for overregularization in [i] in French, despite its non-default status and low type and token frequency, specifically due to its status as a semi-productive rule. Dual-route models would not predict irregularizations in [ɥ] owing to the irregularity and non-productivity of the pattern.

Methods

Participants

Fifteen normally developing French-speaking children (7 girls, 8 boys) aged 2;11 to 4;6 from Montreal, Quebec were recruited for the experiment. The children were a subgroup of participants in a study aimed at developing norms for verb acquisition in French (Elin Thordardottir, ongoing⁹). Spontaneous-speech samples and a parental checklist for language development (Trudeau, Frank, & Poulin-Dubois, 1999) were obtained for all

participants. All children were assessed for hearing problems before testing, and none had a history of language or other cognitive deficits, as per parent report, checklist and spontaneous speech-sample.

Materials and Procedure

We developed a verb elicitation task similar to that used by Hiriarteborde (1973). Four groups of eight verbs each ($N = 32$, see Appendices A and B for details) were used: 8 frequent regular -er verbs (e.g., *laver* 'to wash'), 8 frequent irregular verbs (e.g., *ouvrir* 'to open'), 8 infrequent regular -er verbs (e.g., *brider* 'to bridle'), and 8 infrequent irregular verbs (e.g., *fendre* 'to split'). Since there are no frequency counts for French verbs in child language, our proxy measure of verb frequency was based on the spontaneous language output of 28 children aged 1;9–3;10 (Elin Thordardottir, 2005). All frequent regular and irregular verbs used (except *boire* 'to drink') occurred in at least one form (all tenses) in the spontaneous speech samples of at least 2 children at or before 30 months of age. Stimuli were matched across regular and irregular groups for number of tokens used in the corpus, number of children using the verb, age at first production, number of graphemes, syllable length and thematic structure. In addition, neighbourhood density, surface (termed "grapheme") frequency, and lemma frequency were verified in the *Frantexte* written¹⁰ corpus database for French (New, Pallier, Ferrand, & Matos, 2001), as these factors are known to affect verb processing (Alegre & Gordon, 1999; Royle, Jarema, & Kehayia, 2002; Storkel, 2004). Low frequency regular verbs were adapted from stimuli used by Hiriarteborde (1973), and were matched to frequent regulars for length (phonemes and syllables) and conjugation group. Frequency counts in the *Frantext* database were quite

different for both groups of verbs, with more tokens on average for high frequency irregular verbs ($M = 99$, $SD = 96$) than regular verbs ($M = 19$, $SD = 8$) ($t(1,14) = 2.35$, $p = 0.01$, one-tailed), in addition to higher lemma frequencies (Regular, $M = 185$, $SD = 109$; Irregular, $M = 788$, $SD = 500$) ($t(1,14) = 3.34$, $p < 0.01$, one-tailed). However, this should cause easier production of irregulars, assuming that the written corpus frequencies reflect oral language frequencies. Past participle forms of the verbs were matched with low frequency irregulars for length in phonemes and syllables. Phonological neighbourhood, surface frequency and lemma frequency were verified in the *Frantexte* database. Irregular (infrequent) verbs tended to be slightly shorter in number of syllables and phonemes, had fewer phonological neighbours and were generally of higher frequency than regular tokens in terms of both surface (Regular, $M = 1.2$, $SD = 1.9$; Irregular, $M = 4.7$, $SD = 4.3$) and lemma counts (Regular, $M = 15$, $SD = 27$; Irregular, $M = 34$, $SD = 43$) again suggesting an advantage for these forms. However, we assumed that these verbs would not yet be strongly represented in the children's lexicon and would therefore be treated as novel forms.

The experimenters acted out the verbs using props and two dolls (Nicolas & Isabelle) while naming the desired actions. A puppet (Zobo) was used to produce verb forms, interact with the children and encourage them to respond. The puppet would always forget what had happened and would have to ask the child for help in remembering. An example of the script is presented in (3).

(3) Nicolas: *Regarde, elle lance la balle*

'Look.IMP2s¹¹, she throw.3s the ball'

Isabelle: *Moi j'aime lancer la balle*

'Me, I like throw.INF¹² the ball'

- Zobo: *Vous lancez la balle!*
 'You.pl throw.2pl the ball'
- Nicolas: *Zobo, qu'est-ce qu'elle a fait, Isabelle?*
 'Zobo, what did she do, Isabelle?'
- Zobo: *Je ne me souviens plus... Qu'est-ce qu'elle a fait, Isabelle?*
 'I don't remember... (to child) What did she do, Isabelle?'
- Target: *Elle a lancé la balle.*
 'She AUX throw.PP the ball.'

The script was designed to provide children with the 3s present, the 2pl present and the infinitive forms of the verb. When irregular verbs were used, root alternations and a recognizable irregular infinitive form were produced during the script (e.g. Infinitive: *boire* [bwɑʁ]; 3s present *bois* [bwa] and; 2pl *buvez* [bɥve]). We expected this would be sufficient information for the child to recognize the morphological status of the verb (i.e. to which conjugation group it belonged).¹³ A training session with four frequent regular and irregular verbs (*lancer* ‘to throw’, *tomber* ‘to fall’, *lire* ‘to read’, and *asseoir* ‘to sit down’) preceded the experiment proper. Children were given positive corrective feedback, “Yes, she threw the ball,” if they didn’t produce target responses during the training session. Two tasks were developed, the first with frequent verbs and the second with infrequent verbs. We established that participants must be able to produce at least 50% correct responses on the first task (16 high frequency verbs, 8 regular, 8 irregular) in order to participate on the infrequent verb task. This was done primarily to avoid putting the children in a frustrating

situation where they could not respond. In the second task, the experimenter informed the children that they would be learning new words. Again, props were used to illustrate the verbs. However, this time no dolls were used. The experimenter acted out the verbs and Zobo interacted with her. The same three verb forms as for the frequent verb scenario were presented (see [4a] & [4b]). The child was then asked to repeat the verb to make sure they had heard it properly and could articulate it (4c). Finally, the child was asked to produce the *passé composé* form (4d).

- (4) a. Marie-Eve: *Moudre ça veut dire briser en petits morceaux avec une moulinette. Tu vois, je mouds du café.*

'grinder. You see, I grind.3s coffee.'

- b. Zobo: *Vous moulez du café.*

'You.pl grind.2pl coffee.'

- c. Zobo: *Peux-tu dire "moudre"?*

'Can you say "grind.INF"?'¹⁴

- d. Zobo: *Qu'est-ce qu'elle a fait, Marie-Eve?*

'What did she do, Marie-Eve?"

Target : *Elle a moulu (du café).*

'She AUX grind.PP (some coffee).'

On all trials, children were scored one point for producing the complete *passé composé* with the target verb and auxiliary. All responses were recorded and error types were compiled. Of particular interest to us were target responses, regularizations ([e] and [i]

types) and irregularizations ([q] or other idiosyncratic creations) and how these patterns interacted with frequency and conjugation group.

Results

All children participated in the first sub-test for frequent verbs. The mean number of target responses was 6.93/16 (range 0 -12). Eight children produced over 50% correct responses on the first task and proceeded to inflect lower frequency verbs. In these children, the mean number of target responses for frequent verbs was 9.5/16 (range 8 - 12) and 2.63 for infrequent ones (range 0 – 7). First, we present analyses for the frequent verb task, followed by a comparison of frequent and infrequent verbs for the subgroup of 8 children able to perform both tasks.

Frequent Verbs (All Participants)

A repeated measures ANOVA run on results from the frequent verbs, with verb conjugation group (regular vs. irregular) as a within-subjects factor, revealed a significant effect of conjugation group, ($F(1, 14), 19.64, p < .01$). The children produced fewer correct irregular ($M = 40.63\%, SD = 12.94$) than regular forms ($M = 78.13\%, SD = 14.6$). This result indicates that ability to respond was sensitive to the verb conjugation group. An overview of response patterns is presented in Table 1.

INSERT TABLE 1 ABOUT HERE

Focusing on target responses only, we observe that the participants overwhelmingly produced appropriate responses, especially for the regular verbs. In addition, 10.94% of responses to irregular verbs were overregularized into the regular pattern, of which 4.69% were regularized to the [e] pattern, as illustrated in (5a), and 6.25% to the sub-regular [i] pattern, illustrated in (5b). These latter errors are important, as they illustrate that French-speaking children are sensitive to regular morphological patterns with low type frequency.

- (5) a. *Elle a *tené [tən-e] / tenu [tənɥ]* *l'auto*

she AUX hold-PP the car

‘she held the car.’

- b. *Elle a *ouvri [uvʁ-i] / ouvert [uvɛʁ]* *la boîte*

she AUX open.PP the box.

‘she opened the box.’

In addition, when the children produced an alternative to the target verb (Other responses), they nevertheless tended to use the *passé composé* form (AUX + PP), showing that they were sensitive to the morphosyntactic constraints of the task. This is illustrated in Figure 1.

INSERT FIGURE 1 ABOUT HERE

We performed an analysis of target responses with age as a co-variate in order to verify whether production patterns on regular and irregular verbs were influenced by participants’

age. We found a significant age effect ($F(1,14)$, 14.32, $p < .01$), indicating that production levels are related to linguistic maturity. However, this effect did not interact with regularity ($F(1,13)$, 3.79, $p = .07$). Thus, response patterns were similar across ages (better responses on regulars), except for the three youngest participants, who had difficulty producing all verb types. In addition, overregularization levels remained consistent across all ages, as illustrated in Figure 2.

INSERT FIGURE 2 ABOUT HERE

From Figure 2, we see that the children exhibit strikingly similar patterns of verb production across the age range shown here. There appears to be no gradual increase in inflectional ability after 38 months, nor changes in overregularization patterns.

Frequent and Infrequent Verbs (High Performing Children Only, n=8)

The group of children who qualified to participate in the second part of the test ranged in age from 38 to 54 months. Data analysis included a repeated-measures ANOVA on target responses, with verb conjugation group (regular vs. irregular) and frequency (frequent vs. infrequent) as within factors. Significant frequency ($F(1, 7) = 36.32, p < .01$) and regularity effects ($F(1, 7) = 25.86, p < .01$) were observed. While no interaction between these effects was found ($F(1, 7) = 0.704, \text{ ns}$). Participants had less difficulty correctly inflecting frequent

($M = 59.4\%$, $SD = 8.8$) as opposed to infrequent verbs ($M = 16.4\%$, $SD = 18.3$), and regular ($M = 53.9\%$, $SD = 17$) versus irregular ones ($M = 21.9\%$, $SD = 8.8$). Mean correct responses for the four groups of verbs are presented in Table 2.

INSERT TABLE 2 ABOUT HERE

Low frequency irregulars were the most difficult for the children in this group to produce; high frequency regulars were the easiest. These results indicate that children's ability to produce correct responses is sensitive to both the surface frequency and morphological structure of the items. No [q] irregularizations were produced. We verified the data for the possible influence of age on output. We ran ANOVAs with age as a covariate, and verb conjugation (2 levels) and frequency (2 levels) as within factors. No age effect was found in this sub-group ($F(1,6) = 0.84$, ns).

In order to verify whether response patterns were sensitive to verb frequency and morphological structure, we performed an ANOVA of response types to different verb targets. An analysis was performed using response type as dependant variable (1 – target, 2 – [e] overregularization, 3 – [i] overregularizations, 4 - Other). A 2 x 2 frequency by verb conjugation (-er, irregular) repeated ANOVA was performed on outputs. Main effects of frequency ($F(1,7) = 16.42$, $p < .01$) and regularity ($F(1,7) = 10.46$, $p < .02$) were found ($F(2,14) = 2.42$, ns), but no interaction of these. Tables 3 and 4 present average participant responses on all verbs (see bottom lines).

INSERT TABLE 3 ABOUT HERE

We observe that the participants were, on average, more than twice as accurate in producing regular versus target irregular verbs, even though we took great pains to control items for age of acquisition. The children also showed a stronger tendency to replace irregular than regular verbs (Other responses) with other verbs in the target tense.

Focusing on the interaction of frequency and response type effects, we see that frequency has a strong effect on output. Means by response type are presented in Table 4 (lines 1 and 2). All error types are more common on infrequent targets (except OR [i] responses). Target outputs are almost four times as likely on frequent versus infrequent verbs. Other responses were twice as likely on infrequent versus frequent targets, while overregularizations on infrequent targets are double those on frequent ones. These results suggest that the token frequency of the target is mediating the child's response pattern.

INSERT TABLE 4 AROUND HERE

Overregularizations accounted for close to 10% of all responses with target irregular verbs. On all low frequency targets, overregularizations were into the first conjugation (e.g., *Elle a *tordé [tɔrd-e] / tordu [tɔrd'y] la serviette* 'she wrung the towel').

Overregularizations, albeit observed in only a subset of the stimuli, appear to be used productively by children acquiring French.

In Other responses, participants generally produced the *passé composé* form of another (usually frequent) verb, accounting for close to 70% of all Other responses. As with the frequent verbs, we performed an analysis with age as a co-variate to verify whether participant age affected response patterns. We found that age was not a significant factor affecting response patterns in this sub-group ($F(1,6) = 0.887$, ns).

INSERT FIGURE 3 ABOUT HERE

Discussion

We have seen that French-speaking children are able to use the morphosyntactic rules for *passé composé* production at very young ages, with production starting around the age of 38 months and extension to novel verbs around the age of 46 months.¹⁵ This is demonstrated by their ability to inflect known and unknown regular verbs, their overregularization of irregular verbs, and their sensitivity to morphological patterns in their input, particularly with respect to sub-regular -*ir* conjugation patterns. The children seem to be aware that certain verbs fall outside the default -*er* pattern, and accordingly inflect them using the -*ir* conjugation. However, the default -*er* pattern is predominant, especially when the child is exposed to a low-frequency form not yet stored in the lexicon and therefore not

classified by conjugation group.¹⁶ In addition, no [y] irregularizations were observed, suggesting that [i] irregularizations in these children are not based on gang effects alone. Furthermore, frequency effects were apparent in that (a) the children had more difficulty inflecting low-frequency than high-frequency forms and (b) they had a tendency to inflect low-frequency forms with the default pattern or to replace them with higher-frequency verbs.

Nevertheless, the results for infrequent verbs pose some interpretation problems. It is difficult to explain the low results on these items when the children were relatively expert at producing frequent verbs. However, from Figure 3, we observe two quite distinct patterns in the participants' results. Half the children (ages 46, 48, 51 and 52) are able to produce a reasonably high number of appropriate responses (usually regulars). All but one of these children also produce overregularizations. One additional child (aged 46 months) produced four overregularizations on irregular verbs, but since this child produced only bare past participles, responses were coded as Other and were not included in the overregularization column. The other half of this group produced no target responses and almost no overregularizations. This might mean that the children under age 4 (and one older child, aged 54 months) are unable to fast map unknown verbs and employ productive rule processes at the same time. Another possible interpretation of the data is that the ability to inflect frequent verbs at younger ages (between 38 and 46 months) does not signify the acquisition of a productive rule (i.e., not extendable to novel forms).

If children learning French did in fact make use of stored lexical representations in a rote learning of past tense forms, we would expect similar levels of correct responses on high

frequency regular and irregular verbs, which were matched for age of acquisition. In fact, based on surface frequency counts, we should have found better results on irregular verbs. However, as shown in results, children produced significantly more appropriate regular than irregular forms. We must therefore account for the fact that regulars were almost twice as easy to produce as irregular verbs. This capacity to produce more target forms on regular verbs can be explained by postulating that a rule-based system is helping the children produce outputs. This interpretation is reinforced by the mean target responses on infrequent regular verbs, which suggests that a productive rule-based system can assist children in inflecting unknown verbs. On the other hand, infrequent irregulars are not accurately produced. Indeed, they are often overregularized, presumably because they have no memory trace and cannot be retrieved from the lexicon. The better production of high-frequency versus low-frequency irregulars is indicative of stronger representations for these forms in the child's mental lexicon. We could also argue that a single-system model might account for these effects, due to the high type frequency of regular *-er* verb conjugation patterns in the language, which would be expected to promote regular patterns in a pattern-based model of acquisition. However, this explanation does not readily account for the sub-regularizations into the second conjugation, which does not have high type frequency in French. In addition, according to schema-based models, we would expect to observe at least a similar number of [y] as [i] irregularizations, whereas in fact, no [y] irregularizations were evidenced.

One possible explanation for the sub-regularizations into the *-ir* conjugation might be the formal properties of the verb stem. That is, since irregular *-ir* verbs share phonological

properties with sub-regular verbs, they are attracted to this pattern due to a gang effect.

Data from our experiment (presented in 6) and from Hiriarteborde's (1973) article (in 7) speak to this question. Gang effects could account for patterns on verbs such as *lire* 'to read,' where the verb stem, containing an *-i-* vowel, is constant throughout the verbal paradigm and shows irregularity only in the past participle (7a). However, this does not account for the sub-regularization of *ouvre* (6a), *boire* (7b) or *perdre* (7c), since only the infinitive form of (6a) bears a stem with the *-i-* vowel, while no stem form in the verbal paradigm of (7b) or (7c) contains this vowel. We must therefore posit that the child is either

a) abstracting the stem from the infinitive form and wrongly using it in the past participle (in the case of [6a]), or [6b]) adding a sub-regular [i] suffix to a stem to form the past participle. In either case, a morphological parser is implied.

- (6) a. *Ouvre* [uvr] *ouvrez* [uvre] *ouvrir* [uvrir]

*elle a *ouvri* [uvr-i] / *ouvert* [uvr̥] 'she opened'

- b. *Moud* [mu], *moulez* [mule], *moudre*[mudr̥]

*elle a *moudré* [mudr̥-e] / *moulu* [mulu] 'she ground'

- (7) a. *Lit* [li] *lisez* [lize] *lire* [lix]¹⁷

*Elle a *li* [li] / *lu* [lu] 'she read'

- b. *Boit* [bwa] *buvez* [bve] *boire* [bwaz]

*Il a *boizi* [bwaz-i] / *bu* [bu] 'he drank'

- c. *On les a *pardi* [pardi]¹⁸ / *perdu* [peɔdy]

We them AUX lose.PP 'We lost them' (Hiriarteborde,1973)

Finally, one might want to propose that an *-ir* infinitive form is sufficient to trigger the

sub-regular gang effect in *-ir* irregulars. To support this notion, we would have to prove that the infinitive form in the verbal paradigm has a special status for the development of conjugation paradigms (that is, that the inflected forms are constructed based on the infinitive) and that children are sensitive to that status. Especially since French-speaking children are exposed to many more forms than just the present, past and infinitive. However, this would not account for the overregularization of the second conjugation irregular verbs into the first conjugation (e.g., see 5a above). Additional anecdotal evidence in (8) supports the notion that the presence of an *-ir* infinitive is not a necessary condition for the sub-regularization of irregular verbs. As was discussed for *boire* and *perdre*, the sub-regularized verb *répondre* [ʁepɔ̃d(ʁ)] (8) has no stem with an -i- vowel.

- (8) *Il a *répondi* [ʁepɔ̃d^zi] / *répondu* [ʁepɔ̃d^zɥ] (5;10)¹⁹

‘He answered’

These results are in agreement with previous studies of German (Clahsen, 1996; Clahsen & Rothweiler, 1993), Italian (Say & Clahsen, 2002) and Spanish (Clahsen et al., 2002) that show overregularization into sub-regular and less frequent default inflectional patterns. Sub-regularizations into these inflection classes indicate that patterns with low type-frequency may be overregularized. Clahsen and colleagues (2002) argue that these errors cannot be explained by phonological similarity, since Spanish children over-apply regular suffixes to irregular stems or chose inappropriate irregular stems. The French data parallels the Spanish findings in that only regular patterns, but not irregular ones, are over applied by young language learners. Our results therefore support the notion that French children are sensitive to morphological structures and that their overregularizations are not necessarily

related to gang effects, but rather follow patterns extracted from the morphological structure of the input. Because these children also show strong frequency effects, it appears that French-speaking children use both pattern association and symbolic computation to learn verb inflection paradigms.

We have shown that children learning French are sensitive to the morphological properties of verbs. We have also shown that children are sensitive to verb frequencies. It is therefore possible that they initially learn and produce verbs using rote learning and schema. However, children rapidly become quite proficient inflectors and show sensitivity to the structural properties of the verbs. They thus develop representations that are grouped into morphological classes (here conjugations) and inflect the verbs appropriately. When faced with novel forms, children tend to integrate these into productive and semi-productive conjugation classes. When doing this, they produce overregularizations. Data presented here do not provide strong evidence for gang effects, as irregulars are more often than not inflected with the default *-e* in the past participle. In addition, the presence or absence of the thematic *-i-* vowel in the stem or infinitive form of the verb does not seem to have a bearing on whether the verb form will be integrated into the first or second conjugation.

This study thus provides a first step towards a better understanding of the processes involved in verb acquisition in French. They present additional cross-linguistic evidence for proposals that children are sensitive to word structure at very early stages of language acquisition. In particular, they show that low type-frequency patterns can be significant cues to word structure, insofar as they are regular. Further research on the phonological and morphological properties of regular and irregular *-ir* verb conjugation patterns in children

should help us understand better the relative importance of these factors on paradigm building in children.

APPENDIX A

Past participle forms of frequent verbs used in the elicitation task

Verb	Tokens ^a in corpus	N of Children Using Verb	Age at 1st Token	N of Phonemes	N of σs	N of Phono. Neighbours	Frequency ^b	Lemma Frequency ^c	Thematic Structure
IRREGULAR									
<i>bu</i> – 'drank'	1	1	26	2	1	15	21.77	482.66	T/I
<i>dormi</i> – 'slept'	6	5	23	5	2	2	13.74	145.44	I
<i>mis</i> – 'put'	25	9	26	2	1	13	199.74	944.56	T(2)
<i>ouvert</i> – 'opened'	8	6	27	4	2	3	64.13	431.13	T
<i>parti</i> – 'left'	9	4	26	5	2	7	112.71	1,210.10	I
<i>sorti</i> – 'took out'	6	4	33	5	2	3	38.06	748.70	T/I/T(2)
<i>tenu</i> – 'held'	12	9	26	4	2	3	55.81	615.19	T
<i>vu</i> – 'saw'	12	4	33	2	1	13	282.71	1,726.48	T
MEAN	9.875	5.25	27.5	3.625	1.625	14.75	98.584	788.033	
STDEV	7.079	2.712	3.585	1.408	0.517	10.333	95.703	499.758	
REGULAR									
<i>caché</i> – 'hid'	10	3	27	4	2	30	21.94	134.68	T/R
<i>cassé</i> – 'broke'	5	4	24	4	2	29	13.26	79.21	T/R
<i>glissé</i> – 'slid'	17	7	25	5	2	8	12.23	132.41	I
<i>joué</i> – 'played'	16	9	33	3	2	16	33.13	353.68	I
<i>lavé</i> – 'washed'	4	2	33	4	2	17	7.06	51.16	T
<i>mangé</i> – 'ate'	20	9	26	4	2	13	15.87	160.73	T/I
<i>monté</i> – 'went up'	23	8	26	4	2	16	20.52	289.18	T/I
<i>tourné</i> – 'turned'	4	2	26	5	2	9	26.84	277.15	T/I/R
MEAN	12.373	5.5	27.5	4.125	2	17.25	18.856	184.775	
STDEV	7.614	3.070	3.505	0.641	0	8.242	8.477	108.752	

^a Any inflected form of the verb

^b Grapheme frequency per million, from *Frantexte* (New et al., 2001)

^c Cumulative frequency per million, from *Frantexte* (New et al., 2001)

APPENDIX B

Past participle forms of low frequency verbs used in the elicitation task.

Verb	<i>N</i> of Phonemes	<i>N</i> of σs	<i>N</i> of Phono. Neighbours	Frequency ^a	Lemma Frequency ^b	Thematic Structure
IRREGULAR						
<i>battu</i> – 'beat'	4	2	8	12.97	133.91	T
<i>cousu</i> – 'sewed'	4	2	6	2.06	14.19	T
<i>fendu</i> – 'chopped'	4	2	10	2.81	20.11	T
<i>moulu</i> – 'grinned'	4	2	12	1.03	2.96	T
<i>mû</i> – 'moved'	2	1	27	2.48	18.43	T
<i>rompu</i> – 'broke'	4	2	6	9.68	47.53	T/I
<i>tondu</i> – 'shaved'	4	2	5	1.84	5.40	T
<i>tordu</i> – 'wrung'	5	2	8	4.81	29.51	T/R
MEAN	3.875	1.875	10.25	4.71	34.005	
ST DEV	0.835	0.354	7.146	4.315	42.753	
REGULAR						
<i>biné</i> – 'hoed'	4	2	18	0.03	0.37	T
<i>bridé</i> – 'bridled'	5	2	13	0.35	10.56	T
<i>gravé</i> – 'engraved'	5	2	12	5.71	80.54	T
<i>lové</i> – 'coiled'	4	2	12	0.55	5.16	T/R
<i>poncé</i> – 'sanded'	4	2	14	0.32	2.18	T
<i>sanglé</i> – 'strapped'	5	2	8	1.26	9.62	T
<i>soudé</i> – 'soldered'	4	2	12	1.1	12.72	T
<i>souqué</i> – 'tied up'	4	2	7	0.03	0.38	T
MEAN	4.375	2	12	1.169	15.192	
ST DEV	0.518	0	3.423	1.890	26.828	

^a Grapheme frequency per million, from *Frantexte*(New et al., 2001)

^b Cumulative frequency per million, from *Frantexte* (New et al., 2001)

Acknowledgements

This research was undertaken under a post-doctoral fellowship awarded to Phaedra Royle entitled “The acquisition of verbs and inflection in French-speaking children with and without language impairment” (SSHRC ref. 756-2002-0338), and within the context of a research project entitled “A cross-linguistic investigation of the role of high-frequency verbs in lexical and syntactic development” (Elin Thordardottir, FCAR Research Grant ref. 2002-NC-727222). Marie-Eve Rivard assisted in data compilation, while Charles Fugère, Marie-Eve Rivard and Andréanne Gagné assisted in the transcription of the speech samples. I thank all the children and family members who volunteered to participate in the research. Many thanks to Elin Thordardottir, Peter Gordon and two anonymous reviewers for their comments on previous versions of this paper. All errors are the author’s sole responsibility.

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Table 1

Response types for all participants in percentages (standard deviations in parentheses) on frequent forms

	Target	OR [e]	OR [i]	IR	Other
Regular	78.13 (14.56)	—	—	—	21.88 (14.56)
Irregular	40.63 (12.94)	4.69 (9.3)	6.25 (6.68)	—	48.44 (10.43)

OR = Overregularization

IR = Irregularization

Table 2

Mean correct responses for High Performing Children (n = 8) in percentages (standard deviations in parentheses) on frequent and infrequent, regular and irregular verbs

	Regular	Irregular
Frequent	78.13 (14.56)	40.63 (12.93)
Infrequent	29.69 (31.99)	3.13 ^a (8.84)

^aOnly one child produced these outputs

Table 3:

Mean percentages (standard deviations in parentheses) of responses types by High Performing Children (n = 8) for regular and irregular verbs

	Target	OR [e]	OR [i]	Other
Regular	53.91 (23.28)	—	—	46.09 (23.28)
Irregular	21.88 (10.88)	11.7 (17.2)	6.25 (6.68)	63.28 (21.15)
All	37.89 (13.56)	11.7 (17.2)	6.25 (6.68)	

OR = Overregularization

IR = Irregularization

Table 4:

Mean percentages (standard deviations in parentheses) of responses types for High Performing Children (n=8) on frequent and infrequent targets

	Target	OR [e]	OR [i]	Other
Frequent	59.38	4.69	6.25	31.16
	(8.8)	(9.3)	(6.68)	(12.5)
Infrequent	16.41	18.8	—	74.22
	(18.28)	(25)	—	(31.93)
All	37.89	11.7	3.13	54.69
	(13.56)	(17.2)	(3.34)	(22.22)

OR = Overregularization

Figure Captions

Figure 1. Verb production patterns on frequent target and non-target regular and irregular verbs for all participants

Figure 2. Responses on frequent verbs (maximum 8) by age, all participants

Figure 3. Responses on infrequent verbs (maximum 8) by age, 8 participants

Figure 1

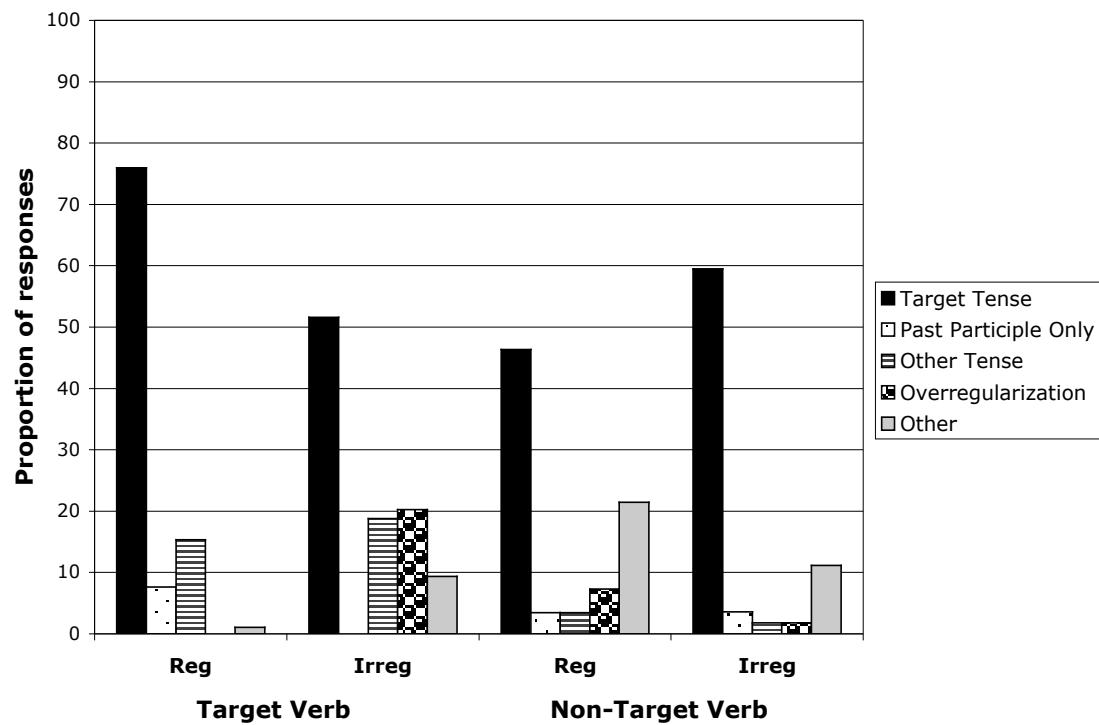


Figure 2

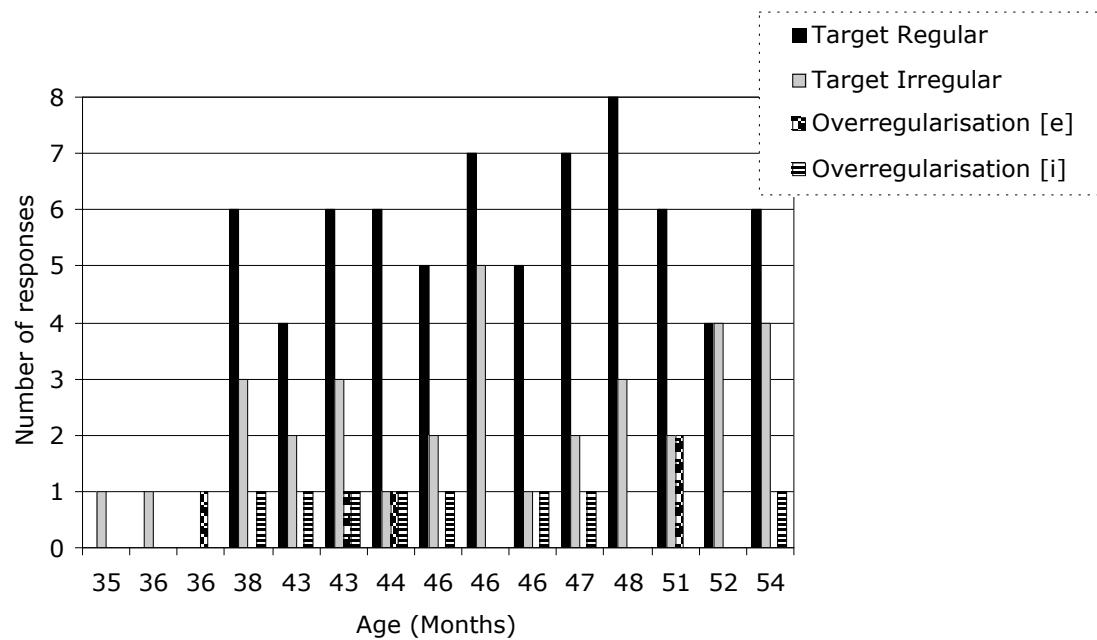
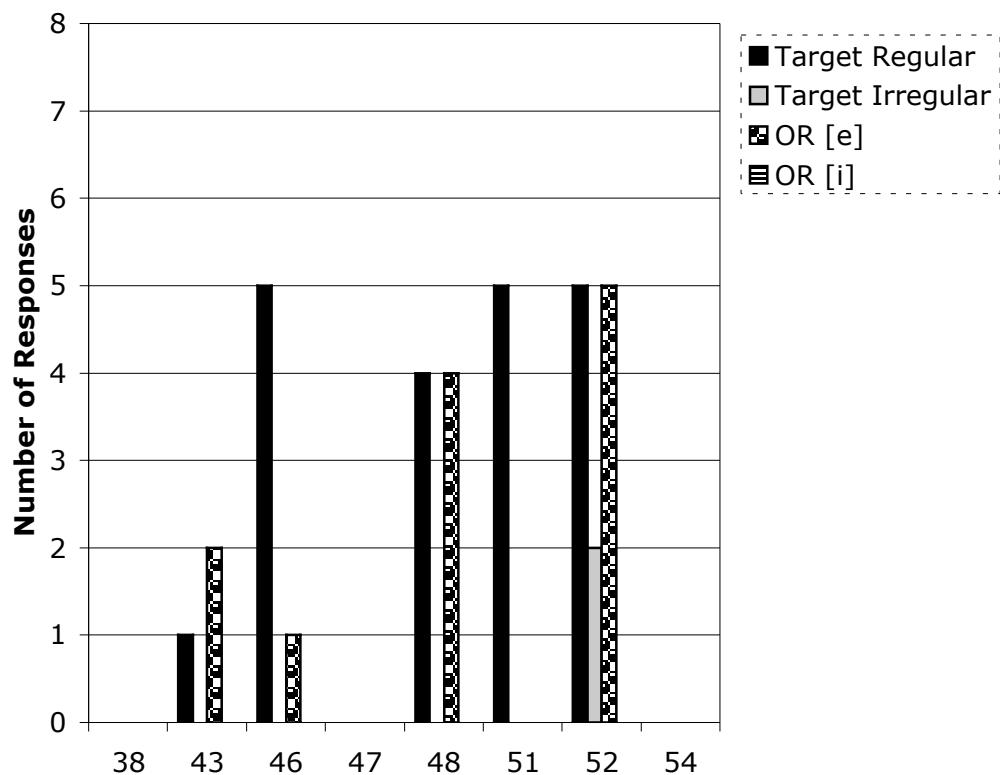


Figure 3



Footnotes

¹ Unless otherwise specified, we refer hereafter to French-speaking children from Quebec, a province of Canada.

² Third person singular present.

³ Note that the fact that 2nd conjugation verb pattern is linked to the thematic *-i-* vowel in the stem does not disqualify it as a regular linguistic rule. It simply renders it non-default (Marcus et al., 1992; Say & Clahsen, 2002).

⁴ Irregular *-ir* verbs are classified as belonging to the third group in French grammars.

⁵ Second person plural present.

⁶ These forms are homophonous with the stem in this conjugation group. However, since we observe overregularizations into this conjugation pattern, we propose that [i] is the second conjugation past participle suffix in French.

⁷ The author's son, a French-dominant bilingual.

⁸ Third person singular direct object clitic.

⁹ A cross-linguistic investigation of the role of high-frequency verbs in lexical and syntactic development.

¹⁰ No equivalent spoken language database exists for French.

¹¹ Imperative, second person singular.

¹² Infinitive

¹³ That is, the child is not just randomly providing an output. An anonymous reviewer asked whether this information is used to produce the past tense. We cannot know for sure, but presumably, the French child builds verb paradigms using all verb forms in the input

(not just paired present-past forms, as is traditionally presented in English experiments and discussions of verb tense). In addition, excepting the second person plural present, these are among the first forms to occur in the spontaneous speech of young French-speaking children (Guillaume, 1927 [1973]; Elin Thordardottir, 2005).

¹⁴ Even though the citation form is the infinitive in French, the present singular was elicited for regular verbs, since the infinitive form of regulars is homophonous with the past participle.

¹⁵ However, age of acquisition can vary in individual children, as can be seen in Figures 2 and 3.

¹⁶ We would like to thank an anonymous reviewer for pointing this out.

¹⁷ This verb was used in the practice trials for the first task, but is also attested as an example of sub-regularization in Hiriarteborde's spontaneous-speech corpus (1973).

¹⁸ An anonymous reviewer asked why the child produced [pardi] instead of [perdi]. We cannot address this question as we do not know whether it was simply the result of an output error or a specific feature of the child's dialect or idiolect.

¹⁹ The author's son.