The acquisition of a complex morphological paradigm

by L1 and L2 children[1]

Marie Labelle & Lori Morris,

Université du Québec à Montréal

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ABSTRACT:

The performances of 690 L1 and L2 submersion children of grades 4 to 6 on a test of past tense (*passé simple*) production in French are compared with the aim of assessing how the two groups of children cope with learning a morphological form belonging to a complex paradigm. Homophony with other verbal forms of the paradigm (syncretisms) appears to play a role in the children's answers. L2 submersion children have significantly lower scores than L1 children and they differ from L1 children in tending to overapply the regular ending. They also seem to be more attentive to agreement and to the visual form of the words than L1 children.

1. INTRODUCTION

In the present paper, the performance of child speakers of French as a native language (L1 learners) is compared to that of children for whom French is the school language but not a mother tongue[2] (L2 learners) on a task in which they had to produce past verbal forms. The aim of the research is to assess how the two groups of children cope with learning a morphological

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[1] This work has been made possible by a grant from […].

[2] Many of these L2 children spoke more than one language other than French at home.

form belonging to a complex paradigm, that is, one in which each lexical item has a large number of inflectional variants.

In Canada, growing numbers of immigrants and declining domestic birthrates have resulted in situations where children with a home language (or languages) other than the official language of instruction form strong majorities in many schools in major urban agglomerations. While rapidly expanding minority language populations are common to many European and North American cities, Canadian cities are relatively unique in that their second language speakers form an extremely heterogeneous group, both within cities and across the country. For example, within a single French-language school board in Montreal – the city targeted in this study - the minority language children speak over 150 different mother tongues drawn from a large array of language groups. A single classroom of 25 pupils may count only five native French speakers, and twenty L2 learners speaking as many as ten different mother tongues, none of them English. Although the school language might well be the only language common to all the children, rich peer input in the language of instruction is often lacking for L2 children in linguistically diverse classrooms.

The few existing studies of children learning an L2 in such a submersion context have demonstrated that they lag behind their monolingual peers in language skills development throughout their school curriculum (e.g. Armand, 2000; Thomas & Collier 2002; Droop & Verhoeven, 2003; Hakuta, Goto Butler & Witt 2000; Morris and Labelle, 2004, 2008). Some studies suggest that there are processing differences between L1 and L2 submersion children. Armand (2000) found L2 submersion children to lag behind L1 children in learning to read, which she attributes in part to their lesser degree of sensitivity to French morphology. Morris and Labelle (2008), using a blank-filling test with first and second graders, found that L1 and L2 children differed in the dominant strategy they relied upon to complete the task. While the L1 children were heavily reliant on using letter-sound correspondences and phonological information, the L2 children compensated their lack of oral knowledge of the language by a

higher reliance on visual information. One striking result of that study is that the most marked L1-L2 processing differences occur in the middle and top thirds of a population of average to above-average children. This suggests that the two linguistic groups might be diverging rather than converging in preferred strategies as they gain in proficiency.

Two research questions are addressed in the present paper: (1) Are L1 children and L2 submersion children sensitive to homonymies (syncretisms) existing between cells of a complex morphological paradigm? (2) Are there differences between the performance of L1 and L2 children that would indicate processing differences between the two groups of children?

It will be shown that both groups of learners are able to detect the regularities within the paradigms of French verbs, and that they are sensitive to syncretisms. However there are differences between L1 and L2 learners. L2 learners are more dependent on rule application than L1 learners. They also prove more attentive to verb agreement than their L1 counterparts and tend to pay more attention to the visual aspect of verbs.

2. THEORETICAL ISSUES AND PREVIOUS RESEARCH

Over the last ten to fifteen years, morphological processing and representation has received considerable research attention. Proponents of single-mechanism models of processing maintain that all items, whether regular or irregular, are stored as lexical items in memory; in the course of acquisition, morphological schemata emerge from associative links between words (Elman et al., 1996; McClelland & Patterson, 2002; Plunkett & Marchman, 1993; Rumelhart & McClelland, 1986; Seidenberg, 1997). Dual-mechanism model supporters argue in favour of lexical storage for irregular items and rule-computation for the treatment of regular items (Marcus et al., 1992; Pinker, 1999; Ullman, 2001a, b; Clahsen, 1999; Clahsen et al., 2003; Marcus, 1996, 2000). Items stored in memory are claimed to be sensitive to token frequency, more frequent items being more readily learned and accessed than less frequent items (e.g. Bybee, 1995a,b, 1999). Similarly, high type frequency patterns are more easily learned and

more easily generalized to new forms (Albright, 2002, 2008; Bybee, 1995a,b, 1999). By contrast, rule application is claimed insensitive to either token or type frequency (Pinker, 1999; Ullman, 2001a). While evidence has been advanced in favour of a dual-mechanism model of morphological processing where regular verbs are processed differently from irregulars (e.g. Pinker, 1999; Clahsen, 1999; Ullman, 2001a, Miozzo, 2003; Marslen-Wilson & Tyler, 2005, and, for L2, Birdsong & Flege, 2001; Hahne et al., 2006 among others), few researchers would currently support a strict interpretation of the dual mechanism model in which regular items are computed exclusively by rule; the data suggest a complex interaction between storage and decomposition. Gordon and Alegre (1999) for example have found frequency effects associated with whole word memory storage for regular lexical items with a frequency higher than 6 per million, suggesting that frequent regular items are stored in memory. Ullmann (2001a, b, 2004; Ullman et al. 1997) argues in favor of a dual access model in which distinct memory systems are responsible for rule computation and for lexical access. According to his Declarative-Procedural Model, declarative memory is responsible for the storage of lexical items, including irregular and frequent regular forms, and procedural memory is responsible for rule computation. When a lexical item is to be computed, the two routes are activated. If a lexical item is found in declarative memory, a message is sent to procedural memory to block rule application. An alternative perspective is offered by Albright who argues that a grammar of context-sensitive rule-like statements or constraints with probabilistic ratings would better account for morphological processing than the less constrained analogical patterning typical of single-mechanism models (Albright, 2002, 2008; Albright & Hayes, 2003; see also Keuleers, 2008; Keuleers et al., 2007; Keuleers & Daelemans, 2007; Yang, 2002, 2005).

Most morphological processing and acquisition research conducted to date focuses on how learners learn to associate a free stem or an infinitive form to an inflected form and does not address the question of the interplay between the different cells of verbal paradigms. A notable exception is Krajewski (2009) who, in a study of Polish nouns, showed that the source form

given to a child as input impacts on his ability to produce a given output form. This finding underscores the necessity of taking into account the whole paradigm when studying morphological acquisition, and considering transitions between various pairs of paradigm cells rather than concentrating exclusively on the transition between a supposed unmarked form and a target form.

In Romance languages, verbs have complex paradigms and pattern into many conjugation classes. The few studies devoted to the acquisition of Romance verbs conducted to date show that the structure of a verb conjugation class influences the acquisition of the past tense. For example, Italian children of six to nine years of age have a tendency to produce a regular form for a conjugation class when it contains a majority of regularly inflected items, and an irregular form when it contains a majority of irregular inflections. In other words, the tendency is for children to irregularize within some conjugation classes despite the availability of a regular ending (Colombo, Laudanna, De Martino and Brivio, 2004). Orsolini, Fanari, and Bowles (1998) have also found that six and eight year old Italian children, but not four year olds, are as likely to apply regular (i.e. first conjugation) patterns to verbs of the second conjugation as they are to apply an existing irregular (i.e. second conjugation) pattern to the same verbs.

Nicoladis, Palmer & Marentette (2007), comparing the use of the English past tense and French past participles by four- to six-year-old monolingual and bilingual children, point out the necessity of taking into account the particular characteristics of the language being learned in any study of the acquisition of verbal morphology. The authors report studies showing that, in French, but not in English, regular verbs constitute the majority of past tense forms in children's input, both in terms of types and in terms of tokens, while irregular verbs tend to be low in type and token frequency. Consistent with the rates of type and token frequency observed in the input, bilinguals were more accurate with French regular verbs than English regular verbs, and less accurate with French irregular verbs than English irregular verbs. Furthermore, the French monolinguals did not overregularize while the English monolinguals did, while the bilinguals

produced fewer regularizations in French than in English. The authors suggest that these results might be explained by the fact that the French verb families—based on the relation between the form of the infinitive and that of the participle—are more predictable than the English families of irregulars.

Royle (2007) reports the results of an elicitation of French past participles from children 35 to 54 months. She finds that accuracy rates are strongly influenced by token frequency. Her analysis of errors reveals that irregular verbs are inflected with the regular first conjugation /e/ ending less often than with the second conjugation /i/ ending (1.6% vs 9.2%), suggesting that children have extracted the dominant irregular[3] pattern from the input. Kresh (2007, 2008), administering an aural lexical decision task on French past participle forms to kindergartners and second-graders, finds no frequency effects for /e/ and /i/ schemata, but strong frequency effects for the /y/ schema and other irregulars. In a production task involving real and novel verbs, her second-graders generalize the regular schema 48% of the time, the /i/ schema 16% of the time and other irregular schemata 13% of the time. The same pattern is maintained in the case of kindergartners. Because the participants do not apply the regular, productive schema by default, but also overapply the irregular schemata, she concludes that a single mechanism model like that of Bybee (1995a, b) accounts for the data better than a strictly interpreted dichotomy between regulars and irregulars.

The previous studies mainly take into account two types of variables, namely frequency (type or token) and regularity, and show that both play a role in morphological acquisition. In the

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[3] Royle (2007) considers the *i* class as regular. We prefer to treat it as irregular because verbs ending orally in /ir/ in the infinitive may belong to the second or third conjugation, making it impossible for learners to predict the inflectional class of an /ir/ verb. In addition, this class is basically unproductive: only one analogical creation has been observed during the 20th century: *alunir* 'to land on the moon', created in 1921 on the model of *atterrir* 'to land' on earth.

present study we are interested in a third variable, namely, the relations between paradigm cells that characterize many complex morpholgical paradigms. In particular, we are focusing on the homonymy existing between distinct paradigm cells.

3. THE MORPHOLOGICAL FORM UNDER STUDY: THE FRENCH PASSÉ SIMPLE

A French verb conjugation comprises an array of 39 simple forms in current use, where most cells of the array represent a [tense-mood-aspect]+[person-number] combination. There are six simple finite conjugations (present, imparfait, future, passé simple, conditional, subjunctive) each with six person-number cells, and three non-finite forms (infinitive, participle, gerund). The targeted form of the present study is the French *passé simple* (PS). The PS is a perfective past tense used to foreground events in written narratives, background events being represented by means of the *imparfait*. It is used exclusively in written narratives (fairy tales, stories, novels), and is therefore confined to the written mode or oral renditions of it. In current speech, foregrounding is achieved using a complex tense, the *passé composé*. Children who are read stories in French at home have oral exposure to the form before entering school, but most pre-schoolers have had very limited contact with the PS. Contact increases in school as children encounter more written narratives, but the form is not explicitly taught before the Grade 6 level in the schools that participated in this study. As will be seen, most children at the end of primary school have had sufficient experience with the form to have developed an implicit knowledge of it, though the form is far from being mastered at that time. In the context of the present study, this situation has many advantages. Firstly, the PS is unlikely to be overlearned by L1 or L2 primary school children; this allows us to observe learners' responses at three levels of proficiency. Secondly, the fact that the PS is learned during the primary school years allows us to assess how L1 and L2 submersion children of the same age cope with learning the form; any processing difference between L1 and L2 children sharing the same classrooms is likely to result from the L1 vs L2 status, and not from age or learning context. Thirdly, by the end of primary

school, both the L1 and L2 submersion children already master the other most frequent verb forms of the paradigm, in particular the past participle and the infinitive with which the PS is syncretic in some cases. This allows us to assess whether children rely on their knowledge of previously acquired forms to learn a new one.

There are four classes of endings for the PS (see Table 1 for a summary). In the singular, the PS ending is a vowel which varies according to conjugation type: /a/ in the regular first conjugation (where regularity is determined by the fact that this conjugation pattern is applied to borrowings and neologisms, and is perfectly predictible from the -er ending of the infinitive), /i/ in the second conjugation, and /i/, /y/, or a nasal vowel /ɛ̃/ in the various sub-classes of the so-called third conjugation. The PS verb classes will be referred to with the vowels typical of each class, i.e. *a, i, u*; *N* (for 'nasal') will be used to represent the nasal vowel. The third person plural ends in /r/ (followed in writing by mute letters indicating agreement, *-ent*). In the regular first conjugation /a/ is changed to the mid-low vowel /ɛ/ in front of /r/. Elsewhere, /r/ is simply added to the singular form.

Table 1–PS verb classes

PS Class	3rd singular	3rd plural	Regularity	Type frequency
1. a	/a/ *mangea* 'ate'	/ɛr/ *mangèrent*	regular	4655
2. i	/i/ *finit* 'ended'	/ir/ *finirent*	irregular	483 (262 of 2nd conj.+ 221 of 3rd conj.)
3. u	/y/ *but* 'drank'	/yr/ *burent*	irregular	70
4. N	/ɛ̃/ *vint* 'came'	/ɛ̃r/ *vinrent*	irregular	26

The type frequency of each class is calculated on the basis of a count of the verbs in the Lexique 3.0 database (New et al. 2001)[4]. The *a* class is the most prevalent, common to the thousands of verbs ending in –er, pronounced /e/, in the infinitive. Next comes the *i* class, taking in 483 verbs (262 verbs of the traditional second conjugation plus 221 verbs of the third). The *u* class has 70 members, and the *N* class includes 26 verbs, all morphological variants of *venir* 'to come' and *tenir* 'to hold'.[5]

For verbs ending in -er in the infinitive (first conjugation verbs), PS formation is derivable by a predictable rule adding the suffix *-a* or *-èrent* to the verb stem. With the other verbs, the vocalic ending is not transparently suffixal. With a number of verbs, the vocalic ending clearly belongs to the root: the -i in *finit* ('finishes', 'finished') appears in the long root *finis-*. This is the case for all verbs of the traditional second conjugation (262 in our data). With other verbs, the vocalic ending follows a root allomorph that may be reduced to a single consonant in some cases (<u>mettr</u>e-<u>mit</u> 'put', <u>pouv</u>oir-<u>put</u> 'can-was able to', <u>ven</u>ir-<u>vint</u> 'come'); in such cases, a word-and-paradigm approach to morphology would treat the phonetic form of the PS as an unanalyzed form following a schema in *i, u* or *N* (cf. Anderson 1992, Stump, 1998, 2001).

Within irregulars, there are homophonies (syncretisms) between the PS form and other paradigm cells. Two cases are of particular interest to us. One of these is the homophony of the singular of the PS and the past participle in /y/ or in /i/ (e.g. *dut – dû* for the verb *devoir* 'must'; *mit – mis* for the verb *mettre* 'put'). The other one is the homophony of the plural of the PS and the infinitive in /ir/. These syncretisms are probabilistic (see Table 2): 91% (342/376) of the verbs having a participle ending in -i are homophonous with the singular of the PS in *i*; 43% (68/159) of

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[4] This database, accessible at www.lexique.org, was compiled from a combination of literary texts (14.7 million words) and film subtitles (50 million words).

[5] This morphological class is purely formal, as many verbs ending in *venir* and *tenir* have no transparent semantic relation with *come* or *hold*, i.e. *intervenir* 'intervene', *abstenir* 'abstain'.

the verbs having a participle in -u form a PS in *u* in the singular; and the vast majority of the verbs ending orally in /ir/ in the infinitive have a PS plural form homophonous with the infinitive. In addition, all verbs of the traditional second conjugation (type *finir* 'finish') have the singular of the PS homophonous with the singular of the present singular (*finit* 'finishes' or 'finished').

Table 2 - Syncretisms (in grey) between PS, participle and infinitive for irregular verbs

	Participle ending				Tot.		Infinitive Ending[1]			Tot.
PS class	**-i**	**-u**	**other**	**none**		**PS class**	**ir**	**Vr**	**Cr**	
i	342[2]	65	41	1[3]	449	**i**	327[2]	9	113	449
i (≠)[4]	33				33	**i (≠)**	33			33
u	-	68	2	-	70	**u**	14	36	20	70
N	-	26	-	-	26	**N**	26	-	-	26
Totals	376	159	43	1	578	**Totals**	400	45	133	578

[1] Infinitive endings: Vr = vowel distinct from /i/ + r; Cr = consonant +r
[2] Includes all 262 verbs of the second conjugation.
[3] *Renaître* ('to come back to life').
[4] Verbs in *i* for which there is no syncretism with the participle or the infinitive.

If noticed, the sub-regularities within irregular verbs introduced by syncretisms may allow a learner to produce a PS form on the basis of the probability that the PS is homophonous with another form of the paradigm. Since the participants in the present study are old enough to have mastered the participle and the infinitive, if they are sensitive to the syncretism between these forms and the PS forms, their PS production should reflect it.

4. METHODOLOGY

4.1. Participants

A total of 697 children from grades 4 to 6 (aged 8 years 10 months to 13 years 7 months), were tested in four schools in the Greater Montreal area (Canada). In two of the schools where the data was collected, L1 children were mixed with L2 children in the same classrooms. In light of the sociolinguistic complexity discussed in the introduction, the diversity of home language contexts made it close to impossible to divide these participants neatly into

monolingual French L1 children versus bilingual French L2 children: many children who spoke French at home were also in contact with a second or a third language. It was decided to label as L1 the children whose parents reported using French as a main language of communication at home and as L2 the children whose parents did not communicate with them in French. The consequence of this decision is that some of the L1 children spoke a least one other language at home in addition to French, making them French-dominant bilinguals. This division of the participants was felt to be acceptable because previous studies found no difference between monolinguals and bilinguals in past tense production their dominant language after the age of six (see Paradis et al., 2007). In order to assess the impact of a multilingual environment on L1 morphological acquisition, two other schools attended only by L1 children were included in the study. These schools were situated in more affluent neighbourhoods than the two multilingual schools, thus introducing socioeconomic status as a factor. In the analyses, the two groups of L1 children are distinguished. Those attending multiethnic schools mixed with L2 children are labelled "L1"; they include French-dominant bilinguals. The children attending monolingual schools in more affluent neighbourhoods are labelled "L10". The distribution of the children by grade and language group is given in Table 3.

Table 3- Distribution of the participants

	L10	L1	L2	Total
Grade 4	102	37	58	197
Grade 5	124	45	83	252
Grade 6	124	54	70	248
Totals	350	136	211	697

4.2. Material and procedure

A narrative text was constructed with 60 verbs in the PS from which the ending was removed (see Appendix 1). All verbs were in the third person, about half of them in the singular and half in

the plural. The number of verbs in each class was not equal: there were 22 class *a* verbs, 19 from class *i*, 11 from class *u*, and 5 from class *N*; this distribution roughly preserves the respective type frequency of the different verb classes, while including a sufficient number of low frequency types to allow for conclusions to be drawn concerning the children's knowledge of these forms. The part of the verb that was provided to the children was the root (it was judged that presenting the infinitive or present form might bias the results by providing implicit clues to word class). The children were asked to read the story and to complete the verbs in writing. The children were not told that a PS was required (the PS is not taught in school before 6th grade). Because the text was narrative it was expected that the children who had some implicit knowledge of the PS would recognize the context for its use and try to provide an appropriate form.

The text was distributed in class. The task was not timed and children were allowed to work at their own pace.

4.3. Data analysis

The answers were coded in terms of both orthographic and phonological correctness. This allowed us to take into account knowledge of the PS that was represented phonologically but not encoded in standard orthography, as is frequently the case at the primary level. Incorrect responses (neither orthographically nor phonologically accurate) were coded according to the type of error observed: verb form ending, person, tense/mood/aspect, word choice, etc. The independent variables were language group (10, 1, 2), grade level (4, 5, 6), PS class (a, i, u, N), and verb number (singular, plural).

Some items were removed from the database: the second occurrence of *faire*, to avoid a learning effect, and *taire,* for which the cue *tu-* inadvertently provided the PS vowel. After observing that 24% of the verb forms produced by the children were in the present, while the PS success rate is barely 21%, it was decided to delete five singular verbs for which the PS is

homophonous with the present singular, i.e. *dit, adoucit, interdit, murit, rougit*, as success on these verbs might not reflect PS knowledge. Finally, three verbs that gave rise to an inordinately high percentage of forms in the *imparfait* (*jouèrent, inventèrent, craignit*) were discarded. The lower success rate for these verbs could be a result of the children seeing the context in which they appear as providing background information, a cue for the use of the *imparfait* in French. The final corpus submitted to statistical analysis contained 50 verbs for each of the 697 children, i.e. 34,850 forms. The verbs mean token frequencies in the final corpus are relatively comparable across verb classes (a: mean 33.2, s.d. 60.9; i: mean 43.7, s.d. 90.4; u: mean 56.0, s.d. 156.0; N: mean 27.5, s.d. 38.8). (Verb frequency was obtained from the Manulex 1-5 corpus, a corpus constructed by sampling French primary readers from Grade 1 to Grade 5 (Lété, Sprenger-Charolles & Colé, 2004).) Four verbs have a token frequency above 100: *demanda* (267), *mit* (304), *prit* (266), and *fut* (524).

5. GENERAL OVERVIEW OF THE RESULTS

A total of 41% of the answers had an ending typical of the PS. The other verb forms produced included the present (24%), the *imparfait* (14%), and other tense-mood-aspect forms of the verb (4%). The remaining answers (16%) included absence of a response or the provision of another part of speech. The children only rarely produced the infinitive (0.18%, i.e. 31/21,090 for irregular verbs; the percentage of infinitives cannot be calculated for regular verbs because it is phonetically homophonous with the participle and children regularly write one form for the other). The overall success rate on the task was 21%. Clearly, the children are far from mastering the PS, as expected. Nevertheless, the fact that 41% of the answers have a PS ending shows that many children have some implicit knowledge of the PS morphology and were willing to attempt producing a PS form in the context of our test.

Three-quarters of the children have a success rate below 35% in the groups of native speakers and below 24% in the L2 group. Because the distribution of overall results is markedly

skewed to the left, the nonparametric Kruskal-Wallis rank sum test was used to estimate the effects of grade and language. There is a significant difference by grade (Kruskal-Wallis chi^2 = 19.6131, df = 2, p-value < .001) and by language group (Kruskal-Wallis chi^2 = 40.7353, df = 2, p-value < .001). The L2 group (mean correct score 16%) has a significantly lower mean correct score than both groups of native speakers (L1 = 23%, L10 = 25%) (Wilcoxon rank sum test with Bonferroni adjustment: L2 vs L1: W=-10830, p= .0001; L2 vs L10: W=-25200, p< .0001). There is no significant difference between the two groups of native speakers (L1 vs L10: W = 21982.5, p=.191).

The effects of language group and verb class on the mean number of correct responses per verb were calculated. There is an effect of language group (Kruskal-Wallis chi^2 = 12.8235, df=2, p=.002) and of verb class (Kruskal-Wallis chi^2 = 30.3826, df=3, p<.001). The L2 group (mean success rate 15.6%) differs significantly from both groups of native speakers (L2 vs L1: W = 816, p = 0.0028; L2 vs L10: W = 789, p = 0.0015, but the difference between the two groups having French as a main or first language is not significant (W = 1188, p = 0.6716). The regular class (*a*) has the highest success rate (27.3% overall), and class *N*, the lowest (7.6%); classes *i* and *u* are in-between (class i: 18.7%; class u: 20.8%). Except for the differences between class *a* and class *u*, and class *i* and class *u*, the comparisons are significant at a confidence level of 0.0083 (Wilcoxon rank sum test with Bonferroni adjustment: a vs i: W=1703.5, p=0.0026; a vs u: W = 1299, p = 0.0132; a vs N: W = 821, p < .0001; i vs u: W = 664, p = 0.76; i vs N: W = 488, p = 0.0013; u vs N: W = 409, p = 0.0002).

Among the verb forms having a PS-like ending, 53% are phonetically correct, 17% have the vocalic ending corresponding to the verb class the verb belongs to, but do not agree with the subject in number (the singular being frequently used instead of the plural), and almost 30% have an erroneous vocalic ending (see Table 4). The verbs whose vocalic ending is of an erroneous verb class are discussed in section 5.

Table 4 - Distribution PS verb forms

Verb Class	Correct Verb Class		Erroneous Verb Class	Total
	Correct	Number agreement error		
a verbs				
- singular	3252 (81.77%)	189 (4.75%)	536 (13.48%)	3977
- plural	550 (37.47%)	530 (36.10%)	388 (26.43%)	1468
i verbs				
- singular	615 (52.52%)	83 (7.09%)	473 (40.39%)	1171
- plural	1207 (34.79%)	1007 (29.03%)	1255 (36.18%)	3469
u verbs				
- singular	1194 (62.48%)	46 (2.41%)	671 (35.11%)	1911
- plural	403 (30.67%)	548 (41.70%)	363 (27.63%)	1314
N verbs				
- singular	237 (42.55%)	23 (4.13%)	297 (53.32%)	557
- plural	28 (12.67%)	20 (9.05%)	173 (78.28%)	221
Totals	7486 (53.14%)	2446 (17.36%)	4156 (29.5%)	14088

In view of the lack of significant differences between the two groups of native speakers, L1 and L10 were amalgamated into a single class of L1 children for subsequent analyses. The seven children who produced no PS forms were discarded from the database, and the remaining children were then divided into three proficiency levels according to their overall task success rates. As the maximum number of correct answers produced by the children was 45 verbs out of a total of 50 verbs, the groups were defined as follows:

- low proficiency group (LP) = those who had between 1 and 14 correct answers (=less than 30%);

- middle proficiency group (MP) = those having between 15 and 29 correct answers (i.e. between 30% and 60%),

- high proficiency group (HP) = those with more than 30 correct answers.

The breakdown of the children by group by grade level is provided in Table 5. There are many more children in the low proficiency group than in the middle and high proficiency groups, and this holds for each grade level. In what follows analyses are provided by proficiency level

rather than by grades since the goal is to discover potential L1 and L2 differences between children at comparable levels of PS proficiency.

Table 5 - Distribution of the children by proficiency level

	L1			L2		
	LP	MP	HP	LP	MP	HP
Grade 4	106 (77.4%)	27 (19.7%)	4 (2.9%)	54 (94.7%)	3 (5.3%)	0
Grade 5	106 (63.1%)	49 (29.2%)	13 (7.7%)	59 (71.1%	18 (21.7%)	6 (7.2%
Grade 6	100 (56.2%)	53 (29.8%)	25 (14%)	51 (76.1%)	11 (16.4%)	5 (7.5%)
Totals	312	129	42	164	32	11

LP = low proficiency (1-14 correct answers)
MP= middle proficiency (15-29 correct answers)
HP = high proficiency (30-45 correct answers)

The *i, u* and *N* classes were amalgamated into a class of irregular verbs, which was then compared to the regular *a* class. There are 20 regular verbs and 30 irregulars. The difference in success rates between regulars and irregulars is significant both for the L1 children (L1+L10: $t(86.876) = 3.8338$, p=.0002) and for the L2 children ($t(43.285)=2.665$, p=.01). The correlation between success rates and the logarithmic transformation of each verb's token frequency was calculated for regular and irregular verbs, after removing three highly frequent verbs to avoid skewing the results (*être* 'to be', *faire* 'to do'). No correlation was found between success rates and lemma frequency. However, when the frequency of the exact PS form targeted (taking into account person and number) was considered, the correlations calculated proved to be significant for irregular verbs. In the case of regular verbs, low proficiency children show no correlation with frequency, but a correlation at the 95% confidence level was found for middle and high-

proficiency L1 children; for middle and high-proficiency L2 children, the p-value exceeds .05. (see Table 6).[6]

Table 6 - Correlation between success rate and PS token frequency

Log PS Frequency (Pearson's)	L1	L2
Low Proficiency		
• Regulars (class *a*)	p-value = .23 r = .28	p-value = .31 r = .24
• Irregulars (classes *i, u, N*)	p-value = .0005 r = .62	p-value = .003 r = .54
Middle and High Proficiency		
• Regulars (class *a*)	p-value = .04 r = .46	p-value = .07 r = .42
• Irregulars (classes *i, u, N*)	p-value = .0005 r = .62	p-value = .0002 r = .65

A child producing a subject-verb agreement error in an otherwise correct PS form knows the PS vocalic ending characterizing the morphological class to which the verb belongs. For this reason, responses with a number agreement error were added to phonetically correct responses to determine the mean number of correct PS forms irrespective of agreement errors. On the basis of these counts, L2 children were again found to lag statistically behind L1 children in their knowledge of PS forms (mean 10.8 vs 15.9; Kruskal-Wallis rank sum test, chi2 =40.2208, df = 1, p< .001). As shown in Table 7, the difference is attributable to the poor success rate of the densely populated low proficiency group.

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[6] The mean estimated *PS* frequency per million for regular verbs was 33,217, and that for irregular verbs 27,923.

Table 7 - Mean number of correct PS ending (with or without agreement) per child

	Mean correct PS per child (std.dev.)		
	LP	**MP**	**HP**
L1	9.45 (5.86)	24.68 (4.56)	37.12 (3.86)
L2	6.48 (4.85)	24.38 (4.07)	36.09 (4.04)

Table 8 presents the percentage of correct PS responses by language group as a function of the total number of PS forms produced, by verb class and proficiency level. For regular verbs, low proficiency L2 children lag behind their L1 peers, but the middle and high proficiency groups are comparable. For class N verbs, however, L2 children surpass L1 children in the high proficiency group but lag behind them in the other groups. In the i and u verb classes, high proficiency L2 children lag behind L1 children.

Table 8 - Proportion of correct PS forms out of total PS forms produced

	L1				L2				
PS Class	LP	MP	HP	Mean	LP	MP	HP	Mean	Global mean
a (reg)[7]	71.4	93.6	97.0	85.5	56.9	92.6	98.0	75.1	83.0
i	57.6	66.2	80.7	64.2	54.2	61.8	74.5	58.6	62.8
u	65.1	69.1	82.7	69.5	57.8	68.5	77.5	63.4	67.9
N	33.3	36.9	61.9	41.2	21.9	29.7	68.8	33.7	39.6

LP = low proficiency (1-14 correct answers)
MP= middle proficiency (15-29 correct answers)
HP = high proficiency (30-45 correct answers)

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[7] To these we can add three forms in -ar- produced by L2 children, *criare, *arrivar, *essuyare*, which, although incorrect, are formed by adding an -r to a singular in –a, displaying knowledge of the morphological class of the verb and of the rule for constructing the plural by adding /r/ to a singular.

If forms with a root choice error but a correct vocalic ending are added to the numbers in Table 8, the overall mean for *i* verbs rises to 79.8% (80.1% for L1 and 78.9% for L2.) The difference is due to the children's responses to two verbs, *écrire* and *conduire*, for which the children, displaying sensitivity to syncretisms, massively produced short root forms homophonous with the present singular in the singular (*écrit, conduit*) and with the infinitive in the plural (*écrire(nt), conduire(nt)*) instead of the expected long roots (*écrivi(ren)t, conduisi(ren)t*). In the other verb classes, forms with a correct ending and a root error were rare and did not significantly change the overall percentages.

6. CHILDREN'S SENSITIVITY TO PARADIGM SYNCRETISMS

Table 9 displays the percentages of regularizations and irregularizations per verb class by proficiency level. Forms in *i* or *u* that happened to be homophonous with the present singular are not included because they might reflect a tense error rather than a verb form error (the excluded forms are listed below the table). Because of the exclusion of these forms, the figures in the table underestimate the percentage of forms that were attempts at producing a PS. For example, the regular verb *cri-er* (yell), for which the plural was expected (*cri-èrent*), has a root ending in /i/. It was produced 12 times as **crirent* (9 examples by L1 children and 3 by L2 children) and 287 times as *crie* (with various spellings)*. *Crirent*, a form in /ir/, is clearly a generalization to the *i* class*. The *crie* forms are homophonous with the present singular, and were not included in the counts. However, the fact that a PS plural in /ir/ (different from the infinitive) is produced for this verb suggests that, for some children, *crie* is a legitimate PS singular form, to which one can add /r/ to obtain a plural (recall that a large number of the /i/ verbs display a syncretism between the PS singular and the present singular). Moreover, as seen above, the children pay relatively little heed to number agreement and frequently produce singular verbs to go with plural subjects. There is, therefore, a strong probability that a certain number of the *crie* answers are PS forms with a number agreement error. While it is impossible to determine the number of such PS verbs

hidden in the 287 *crie* forms, on the basis of the ratio of agreement errors, it can be estimated to be in the 10 to13 occurrences range (approximately the same as the number of plural forms produced). To further err on safe side, cases where there might be a verb choice error were also excluded from counts. For example, many children produced *fut* (PS of *être* 'to be') where *fit* (PS of *faire* 'to do') was expected, or conversely. In some of these cases, the error might well have been a PS ending error rather than a verb choice error. Therefore, the figures in Table 9 are conservative in the number of irregularizations observed.

If regularity plays a dominant role in morphological processing, a preference for regular endings over the irregular endings should be observed in Table 9. In contrast, if type frequency is the major factor, more regularizations than i forms and more i forms than u forms or N forms should be observed. An examination of Table 9 shows that the facts are more complicated than either regularity or frequency would predict. With regular verbs, irregularization is phonologically conditioned: irregular endings tend to be produced with verbs whose root ends in /i/ or /u/: *cri-er* 'to yell', *essuy-er* 'to wipe', *diminu-er* 'to diminish', *continu-er* 'to continue'. With irregular verbs, regular endings are in strong competition with *i* and *u* irregular endings. Verbs having a PS ending in a nasal vowel, give rise to extensions to all the other classes. With this verb class, all the forms in /ir/ are homophonous with the infinitive, and all the forms in /y/ are homophonous with the participle. Table 9 makes it clear that the two irregular endings compete with the regular ending in the participants' answers, with a tendency for the participle to win out and *u* to be preferred to *i*.

Table 9- Percentage (number) of regularizations and irregularizations per verb class

Verb class		L1				L2			
		LP	MP	HP	Total	LP	MP	HP	Total
a verbs[1]	% i	1.11 (18)	1.86 (33)	1.62 (12)	1.52 (63)	1.5 (10)	2.03 (9)	0.51 (1)	1.53 (20)
	% u	1.17 (19)	0.84 (15)	0.54 (4)	0.92 (38)	1.65 (11)	0.45 (2)	0 (0)	1 (13)
i verbs[2]	% reg.	6.71 (115)	11.33 (138)	4.68 (25)	8.02 (278)	5.61 (41)	15.95 (48)	8.51 (12)	8.61 (101)
	% u	9.91 (170)	10.26 (125)	6.55 (35)	9.52 (330)	8.62 (63)	11.3 (34)	5.67 (8)	8.95 (105)
u verbs[3]	% reg.	14.06 (159)	17.34 (154)	7.11 (28)	14.13 (341)	13.86 (65)	17.84 (43)	14.71 (15)	15.15 (123)
	% i	5.57 (63)	8.33 (74)	8.38 (33)	7.05 (170)	5.33 (25)	8.71 (21)	6.86 (7)	6.53 (53)
N verbs	% reg.	30.85 (62)	35.04 (96)	13.43 (18)	28.9 (176)	35.62 (26)	31.25 (20)	15.63 (5)	30.18 (51)
	% i	14.43 (29)	11.31 (31)	7.46 (10)	11.49 (70)	17.81 (13)	20.31 (13)	3.13 (1)	15.98 (27)
	% u	21.39 (43)	16.79 (46)	16.42 (22)	18.23 (111)	24.66 (18)	17.19 (11)	12.5 (4)	19.53 (33)

[1] Not included: forms homophonous with the present singular (*continue, diminue, crie, essuie*) and cases where the child simply added mute letters to *essu-*.
[2] Not included: *fut* for *faire,* and cases where mute letters were added to *enfu-*.
[3] Not included: forms homophonous with the present singular (*lit)*, *crie* for *croire*, and *fit, fuit* for *être.*

Figure 1 presents the observed regularizations and irregularizations of the irregular verbs as a function of the form of the infinitive (first line) and of the participle (second line). Only the plural forms produced by the children were included in the calculation in order to avoid the confounding factor caused by singular forms homonymous with the present singular. As can be seen in the first line of Figure 1, the regular ending is not preferred over the /i/ and /u/ endings. Both L1 and L2 participants show a tendency to produce a PS in *i* when the infinitive ends orally in /ir/, and to avoid it when the infinitive ends in some other vowel followed by /r/ (Vr) or in a consonant followed by /r/ (Cr). In contrast, a PS in *u* is preferred for infinitives in Vr and Cr and rejected with infinitives ending in /ir/. In terms of verb families as defined by the infinitive, preferrence for the *u* ending over the *i* ending in the case of Vr infinitives is coherent with the fact that 80% (36/45) of the verbs having an infinitive in Vr form a participle in *u*. However, the

preference for the *u* ending in the case of Cr infinitives is unexpected, given that only 15% (20/133) of the Cr infinitives have a PS in *u*, the other 85% having a PS in *i* (see Table 2).
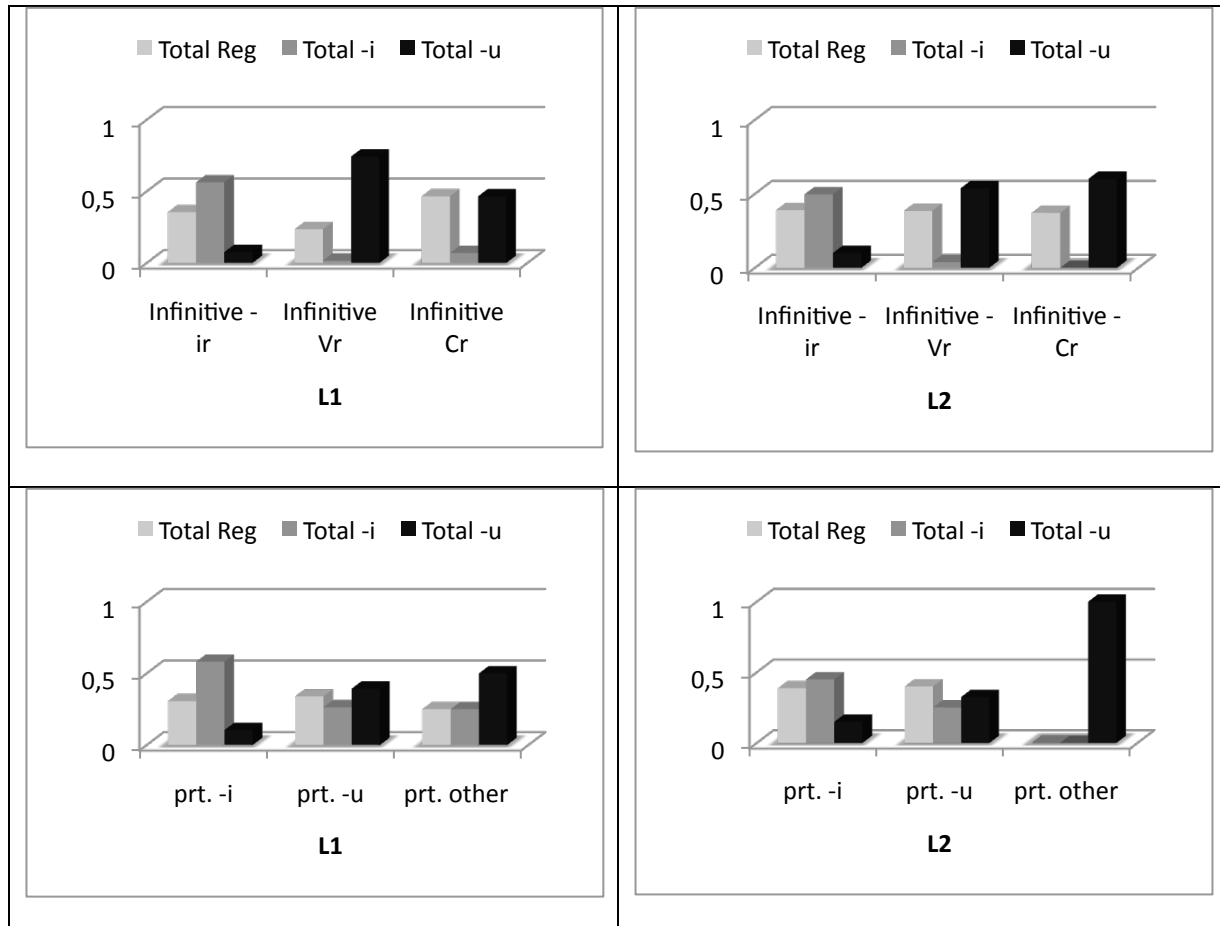

Figure 1 - Types of erroneous endings according to the form of the infinitive (first line) and of the participle (second line) (plurals only)

In the second line of Figure 1, it can be seen that, again, the regular ending is generally not the preferred solution for irregular verbs. When the past participle ends in -i, children show a preference for the *i* ending of the PS. But when it ends in -u, regularizations and forms in *u* are preferred. The *u* ending is also preferred when the participle ends neither in -i nor in -u. Here again, this holds for both L1 and L2 participants. The competition between the three types of

endings in the case of the verbs whose participle ends in -u reflects the fact that the *i* and *u* PS endings have similar probabilities of occurrence with these verbs (41% for *i* and 43% for *u*). However, the preference for the *u* ending with verbs whose participle does not end in -i or -u is unexpected from a strictly probabilistic point of view, as the vast majority of these verbs form a PS in *i*.

To sum up, syncretism with the infinitive or the participle seems to influence the children's choice of ending. However, the preference for the *u* ending in non-syncretic cases shows that other factors are involved. Type frequency is not predictive of this preference for the *u* ending since there are only 70 verbs in the *u* class, compared to 483 in the *i* class.

6.1. Differences between L1 and L2 children

L1 and L2 children do not differ markedly from one another in their preference for one type of ending over another across the various verb classes, as can be seen from Table 9. The behaviour of the two language groups with respect to the erroneous use of i and u endings is statistically similar, and there is no difference between proficiency levels. However, middle and high proficiency L2 children tend overall to regularize more often than L1 children, as shown in Figure 3. The difference in regularization rates between L1 and L2 is statistically significant on the Wilcoxon Rank Sum Test (W=56596, p=.004). The differences between the three proficiency groups are significant both for L1 (Kruskal-Wallis chi-squared=94.57, df=2, p<.001) and for L2 (Kruskal-Wallis chi-squared=44.52, df=2, p<.001).
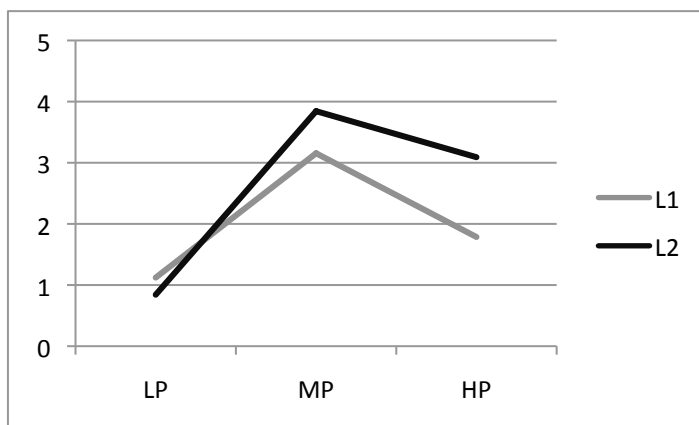
Figure 2 - Mean number of regularizations per child, by proficiency level

In addition, in all proficiency groups the mean number of agreement errors per child is higher for L1 children than for L2 children (mean L1=3.84; mean L2=2.86; $t_{(461.596)}$ = 5.0091, p <.001) (see Figure 3). The difference between proficiency levels is significant (Kruskal-Wallis for L1 chi^2 = 25.13, df-2, p<.001; for L2 chi^2 =6.77, df=2, p<.001).
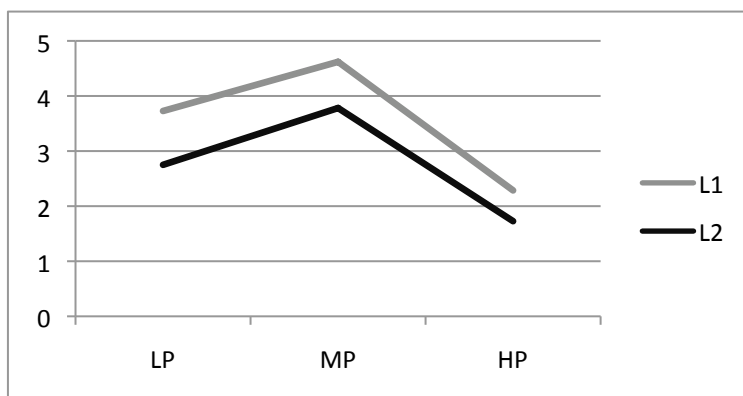

Figure 3 - Mean Number of agreement errors per child

Finally, L2 learners tend to spell the verbs correctly more often than L1 learners (Wilcoxon rank sum test W = 8220.5, p = .0056). Overall, the proportion of correctly spelled verbs is 75% for L2 learners, and 71% for L1 learners. The difference between L1 and L2 children is significant for the sets of middle and high proficiency children (L1 = 77%; L2 = 82%; W = 3681, p = .0087), but not for low proficiency children (L1 = 58%, L2=61%; W = 925.5, p = .4).

7. DISCUSSION

Two research questions were addressed in this study: (1) Are L1 and L2 submersion children able to take into account syncretisms within a paradigm structure? (2) Are there differences in how L1 and L2 children master the verb form under study?

Before answering the first question, recall that token frequency is correlated with success rates in the case of irregulars, but that the type frequency the four PS verb classes is only partially correlated with success rates. Consistent with their respective type frequencies, the regular class has the highest success rate and the *N* class the lowest success rate, but the other two verb classes prove more problematic. The absence of a significant difference in success rates between *i* verbs and *u* verbs despite the fact that there are almost eight times more *i* verbs (type frequency 483) than *u* verbs (type frequency 70) shows that factors other than type frequency are at play in determining success rates. Leading to the same conclusion is the difference in the children's success rates on *u* verbs, relatively well mastered, and *N* verbs, poorly mastered, despite the fact that the type frequency of the *N* class (26) is in the same range as that of the *u* class.

One of the factors explored in this paper is the presence of syncretisms in the paradigm. Syncretisms introduce probabilistic sub-regularities which, if noticed by learners, might help them produce a form not found in memory. The results show that learners likely use these partial regularities to come up with forms not committed to memory. Both L1 and L2 children show sensitivity to syncretisms in the paradigm: they tend to prefer the i ending with irregular verbs having a participle in –i or an infinitive in –ir, but not with verbs having a participle in –u or an infinitive distinct from –ir.

Syncretisms however do not account for the children's tendency to produce a form in *u* with verbs whose participle is distinct from *u* and *i*. This suggests that the the use of a *u* ending is a fallback solution when syncretisms do not help. Why should this be so given the low type

frequency of the *u* ending? One answer might come from a study of the probabilities of syncretisms with the different verb classes. As mentioned previously, 91% of the verbs having a participle ending in -i are homophonous with the singular of the PS in *i* and the vast majority of the verbs ending orally in /ir/ in the infinitive have a PS plural form homophonous with the infinitive. It could be that the lack of a syncretism with a form in *i* leads the child to favor the next most probable form for an irregular verb, i.e. a form in *u*.

Some factors did not seem to influence the participants' responses. One of them is morphological coherence. Participants had little success with *N* verbs even though the members of this class form a coherent family consisting of all and only the morphological derivatives of *venir* and *tenir* — all ending -*enir* in the infinitive—, a group of 26 members which, in terms of type frequency, is comparable in order of magnitude to the 70 members of the *u* class. The fact that with *N* verbs, the form of the PS is not syncretic with another form of the paradigm might explain this lack of learning. The tendency to use an irregular form in *i* potentially based on the infinitive in -*ir* or in *u* based on the participle suggests that syncretisms are psychologically more important to learners than morphological coherence. Furthermore, certain syncretisms have more appeal than others. An examination of the choices children make between the *i* and *u* endings reveals that the participle ending is preferred to the infinitive as a predictor of the PS form.

A second factor that learners do not seem to pick upon is the probability of occurrence of a particular PS ending by verb family. Nicoladis et al. (2007) suggest that once children have learned a certain number of regular and irregular forms, they start to become sensitive to phonological regularities within verb families, where a verb family is based on the form of the infinitive. Learners would then be able to make predictions on the basis of such regularities. In the present research, not only did learners overlook the fact that all verbs ending in -*enir* in the infinitive belong to the *N* class, they also did not appear to notice that the majority of verbs

whose infinitive ends in a consonant followed by /r/ form a PS in *i*. On the contrary, they preferred the low type-frequency *u* ending with these verbs.

As for the second question, the results of the present research replicate the results of previous studies showing that children learning a language in a submersion context in school lag behind their L1 peers even at the end of primary school, after five to seven years of education in the school language (including kindergarten, which is obligatory). Since the morphological form studied here is learned late even by L1 speakers, these results are particularly telling; the L1 advantage is seen to persist in conditions in which L1 and L2 linguistic exposure to a form is far more equitable than is the case for the rest of the verbal paradigm.

When L1 and L2 children of similar levels of proficiency were compared, it was found that middle and high proficiency L2 children regularize more than their L1 peers. From the perspective of dual mechanism models, this goes against the idea that L2 speakers would rely less on computation and more on lexical knowledge than L1 speakers. It suggests that L2 learners tend to be *more* dependent on the rule for the regular paradigm than L1 learners; this holds even for high proficiency L2 learners. This, together with the fact that L2 learners' results display no correlation with frequency when it comes to regular verbs – contrary to the results of L1 learners – suggests that they are perhaps more attentive to rules than L1 learners.

In addition, the L2 participants of the present research seem to be more visually oriented than the L1 participants. This is reflected in their higher percentage of correctly written forms compared to the L1's, and conversely in their lower percentage of forms that are phonologically correct but incorrectly spelled. This finding replicates and confirms the observations of Morris and Labelle (2008) with first and second grade participants (however, the present research did not show that two linguistic groups might be diverging rather than converging in preferred strategies as they gain in proficiency, except perhaps in the rate of regularization in Figure 2). The higher dependence on visual memory of L2 children learning French in a submersion context is likely to be a way of coping with the task of learning to read and write in a second

language before mastering sufficiently its phonology, vocabulary and grammar. This is a winning strategy with a language like French whose orthography is largely opaque, with a many-to-many relation between phonemes and graphemes and a large use of mute letters. Because correct orthography is highly valued by teachers, learning words by sight allows L2 pupils to perform at the level of L1 pupils in school and to compensate for other language deficiencies that they might have. This school-oriented behavior may also account for the fact that L2 children produce fewer agreement errors than L1 children.

8. CONCLUSION

The present study aimed at comparing L1 and L2 submersion children in their acquisition of the French *passé simple*. The L2 participants lag behind native speakers in their knowledge of the PS even though the form is learned late, thus reducing the extent of the usual L1 verbal knowledge advantage. Both groups of learners were sensitive to syncretisms between paradigm cells. This finding highlights the importance of considering paradigm structure in studying morphological acquisition.

Given the similarities in behaviour between the two language groups, the points of divergence between them are all the more interesting. The L2 children, learning French in a submersion context, tended to overapply the regular ending to irregular verbs more often than the L1 children. Moreover, they seemed to be more attentive to spelling and to agreement than L1 learners, who seemed to rely more on memorised phonological forms applied without controlling for agreement. These differences between L1 and L2 children suggest that the L2 children might be approaching the task of learning verbal morphology with a higher reliance on a visual strategy than the L1 children, who tend to be more phonologically oriented. Further research would be required to better understand the particular characteristics of L2 learners, particularly those integrated with native speakers in the regular school system. What the present research shows is that they may achieve similar success rates through slightly different means.

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Appendix 1 – The test.

Lis le texte suivant et complète les verbes. Assure-toi de bien faire l'accord avec le sujet.

Il y a très longtemps il y avait un enfant, Mio, qui avait envie de vivre des aventures avec ses amis. Pendant tout l'été ils jou____ au chevalier et invent____ des histoires de châteaux et de princesses. Lorsque l'automne arriv____ et que le blé mûr____ dans les champs, ils part____ sur la route de la montagne. Ils cheminaient depuis quelques heures dans le bois et commençaient à avoir soif lorsque tout à coup ils aperç____ une source au loin. Ils cour____ jusqu'à la source et b____ l'eau fraîche. Puis, levant les yeux, ils v____ qu'un message était écrit sur le rocher d'où coulait la source. Ils l____ : «Qui me boit …» et le reste était effacé. Soudain le rocher boug____ et un être étrange appar____. Celui-ci rassur____ les enfants et leur expliqu____ que l'eau qu'ils avaient bue était magique et qu'elle leur donnerait des pouvoirs surprenants. Cela pl____ à Mio qui demand____ comment ils pouvaient utiliser ces pouvoirs. L'être étrange les condui____ à l'entrée d'une grotte où se trouvait un monstre qui terrorisait toute la région et il leur di____ qu'avec les pouvoirs conférés par l'eau, ils pouvaient tuer le monstre et délivrer les gens de ce fléau. Les enfants se réjoui____ de connaître une aventure mais ils n'étaient pas rassurés. Seraient-ils capables de combattre le monstre? Ils se tu____, réfléch____, et décid____ d'un plan d'attaque. Voici ce qu'ils f____. Mio pr____ un bâton et en touch____ le sol. Un énorme trou se cré____ dans le chemin. Puis, tous les enfants sauf Mio se t____ à l'entrée de la grotte et cri____ pour attirer le monstre à l'extérieur. Ils attend____. Lorsque le monstre s'approch____, les enfants s'enfu____, mais pas trop vite pour s'assurer que le monstre les suivait. Quand le monstre f____ à l'extérieur, Mio pouss____ un cri et, grâce à ses pouvoirs magiques, un rocher v____ bloquer l'entrée de la grotte. Il interd____ ainsi la retraite au monstre. Les autres enfants ralent____ leur course lorsqu'ils arrivèrent au trou du chemin, ils f____ un bond magique qui les transport____ de l'autre côté. Le monstre qui les poursuivait continu____ sur sa lancée et tomb____ dans le trou. À ce moment, les enfants d____ une formule et il se m____ à tomber de l'eau magique sur le monstre. L'eau roug____ et grésill____ au contact du monstre. Les rugissements du monstre diminu____, puis s'arrêt____. Mio cr____ qu'ils l'avaient tué. En fait, il ne mour____ pas mais son caractère s'adouc____ et il se transform____ en chaton. C'est ainsi que les enfants vainqu____ le monstre; ils en conn____ une grande fierté. Mais que faire maintenant? Mio craign____ que le chaton ne meure dans son trou, et il obt____ l'aide de ses amis pour le sortir de là. Il le

secour____, l'essu____ et il dev____ son ami. Les enfants se souv____ du message écrit sur la source. Ils y retourn____ et écri____ «…vaincra ».