

# Constraints on Feature Selection in Second Language Acquisition: Processing Evidence from the French Verbal Domain

Claire Renaud  
Arizona State University

## 1. Feature selection in second language acquisition: A debate

It is generally agreed upon that, in first language (L1) acquisition, the child, provided with ample primary linguistic data, relies on a Universal Grammar (UG) from which it selects the functional categories and features necessary to parse the input. Although the learning task for adult second language (L2) learners is not necessarily different from that of the L1 child, important differences, such as previous linguistic knowledge and developed cognitive skills, lead to a less straightforward acquisitional process. For instance, despite their ability to acquire subtle interpretative differences (e.g., Dekydtspotter & Hathorn, 2005), L2 learners make serious morphological errors, even though morphological information is present in the input. A great deal of research has investigated this morphological problem: Some researchers (e.g., Franceschina, 2002; Franceschina & Hawkins, 2003; Hawkins & Casillas, 2008; Hawkins & Chan, 1997; Hawkins & Liska, 2003; Liszka, 2004; Tsimpli & Dimitrakopoulou, 2007) argue that features not instantiated in the L1 are unavailable in L2 acquisition, whereas other researchers (e.g., Gavrusseva & Lardiere, 1996; Hazdenar & Schwartz, 1997; Lardiere, 1998a, 1998b, 2005, 2007, 2009; McCarthy, 2007, 2008; Prévost & White, 2000) argue that all features are accessible in the L2 but that other factors, such as communication pressures, lead to the observed morphological variability.

### 1.1. Interpretability hypothesis

Hawkins and colleagues (Franceschina, 2002; Hawkins & Chan, 1997), with the failed functional features hypothesis, assume that adult L2 learners rely on L1 features while acquiring L2 morphophonological forms; however, for those features not instantiated in the L1 grammar, learners rely on surface rules via domain-general learning. This proposal has been developed further—see the interpretability hypothesis (Hawkins & Hattori, 2006; Tsimpli, 2003; Tsimpli & Dimitrakopoulou, 2007)—by proposing that uninterpretable features that have not been selected during L1 acquisition are no longer available to adults despite access to L2 input that demonstrates selection of these features. More recently, Hawkins and Casillas (2008) proposed the contextual complexity hypothesis, which states that, at first, all learners' grammars are limited to context-sensitive strategies based on distributional regularities in the input. If features are available following the interpretability hypothesis (i.e., part of the L1 grammar), this stage is then followed by rule-based optimization. Otherwise, learners continue to rely on context-sensitive rules of co-occurrences. Lardiere (2009) provided conceptual objections to this body of research asserting that if “features reflect ‘the grammaticalization of fundamental cognitive categories’ (Harley & Ritter, 2002: 482), there is little reason to think that the categories encoded by features are substantially different crosslinguistically or especially that they are ultimately inaccessible to adult learners” (p. 46).

## 1.2. *Feature reassembly hypothesis*

Another group of researchers claim that L2 learners have access to and rely on all features instantiated in the L2 input (e.g., Gavruseva & Lardiere, 1996; Hazdenar & Schwartz, 1997; Lardiere, 1998a, 1998b, 2005, 2008, 2009; McCarthy, 2007, 2008; Prévost & White, 2000). In other words, L2 morphological variability reflects the cost of feature calculations and the use of defaults to alleviate these costs. Proponents of the missing surface inflection hypothesis (Hazdenar & Schwartz, 1997; Prévost & White, 2000), assuming the framework of distributed morphology (e.g., Halle & Marantz, 1993), argue that, even though L2 learners have acquired specifications of functional categories, production pressures trigger the insertion of underspecified forms; that is, it is believed that all functional categories and values related by Agree are fully activated in L2 grammars. To account for comprehension data that also reveal asymmetries suggestive of underspecified lexical representations, McCarthy (2007) proposed the morphological underspecification hypothesis, which primarily contrasts cases of underspecified forms (i.e., to reduce cost, default forms—or forms with underspecified values—may be inserted instead of a fully specified form) versus cases of feature clash (i.e., ungrammatical forms as a result of a feature mismatch).

This body of research converges on Lardiere's feature reassembly hypothesis (Choi & Lardiere, 2006a, 2006b; Lardiere, 2005, 2008, 2009), which is rooted in Chomsky's (1995, 1998, 2001, 2005) Minimalist framework. Lardiere (2009) proposed that acquiring a (L2) grammar is not a question of the availability of features. Instead Lardiere, extending Schwartz and Sprouse's (1994, 1996) full transfer full access model, claimed that the task of acquiring a (L2) grammar requires the selection of relevant features from a universal set, their composition into matrices for functional categories, and their assembly into lexical items—mediated by a universal computational system. In other words, for Lardiere, because of the universal nature of features and of their status as “fundamental cognitive categories” (Harley & Ritter, 2002, p. 482), all features are available. Following Brown's (2000) proposal for phonology, Lardiere (2009) suggested that the L1-grammar feature organization acts as a kind of filter on L2 acquisition that needs to be overcome. Lardiere further proposed that what guides the acquisition of new feature matrices are “the morphosyntactic feature contrasts [... that] appear to be detectable even for uninterpretable features such as for case, agreement” (p. 214). Crucially, “any feature contrast that is detectable is, in principle, ultimately acquirable” (p. 214). However, the task of appropriately reassembling new feature matrices for functional categories and lexical items and determining the specific conditions under which their properties may or may not be morphophonologically realized presents a serious challenge (Choi & Lardiere, 2006a, 2006b; Lardiere, 2005). Thus, Lardiere assumed that learners are able to detect relevant features in the input but she does not specify the learning mechanism. Therefore, a central learning question arises: What is the constraint on feature selection? More specifically, will any feature plausibly be entertained in the analysis of a morphological dependency?

## 2. **A universal parser**

It is hypothesized that, based on the assumption that what cannot be represented cannot be learned (Fodor, 1998), the parser constitutes the trigger that can lead to grammatical change. That is to say that the manner of processing will determine what (representations) can be acquired. Because it will not provide suitable triggers, processing that is domain-general in character will not lead to the adoption of a domain-specific grammatical representation. Therefore, to trigger a UG-constrained grammatical change, the parser needs to minimally be UG-compatible. It is hypothesized, following Dekydtspotter (2001), that the universal parser is the learning mechanism that constrains L2 acquisition. It is proposed that the contents of the parser are provided by UG, increased by a language-specific lexicon (Crocker, 1996; Dekydtspotter, 2001; Schwartz, 1999). Therefore, each step of the (grammatical) parse is established on the basis of UG-constrained relations local to the sentence and is licensed by the grammar. Additionally, it is assumed that learning is failure driven: A parse that is required by the input but unlicensed will thus trigger a change (Fodor, 1998). Therefore, the interlanguage grammar presumably develops as a result of the need to fully structure the input with greater efficiency.

Such a model makes specific predictions, which are detailed here for the L2 acquisition of the French verbal paradigm. In the acquisition of the verb *avoir* “to have” in French, the parser needs to fully specify grammatical contrasts such as *vous avez* “you have” versus *nous avons* “we have” as alternate forms of HAVE in the lexicon. Therefore, at any time *t*, the parser limits the specification of feature matrices of these forms to those features that specify *vous* “you” and *nous* “we” at time *t* (i.e., person and number) and to the checking configuration. Hence, by building correspondences between lexically encoded phonological forms and formal matrices (putting aside concepts), learners can arrive at a more complete lexicon. In the case of gender agreement on past participles in L2 French, if the Agree operation remains universal, uninterpretable gender (*u*Gender)—inherent in the universal component—must implicitly be part of the grammatical state of the learner, although *u*Gender is not explicitly part of knowledge of English—it is not part of the Lexicon. Following McCarthy’s (2007) morphological underspecification hypothesis, *u*Gender will only need to be specified for feminine, and *u*Number for plural, as is schematically represented in (1), because the masculine and the singular are considered the default representations. Indeed, the expletive pronoun *il* “it” is a nonreferential expression that is both masculine and singular.

- (1) *u*Gender: [feminine], Ø  
*u*Number: [plural], Ø

Given the default status of masculine, *u*Gender is checked via the Agree operation in a feature matrix under the verbal phrase (VP) with feminine and (default) masculine as gender values, and principles of economy of representations constrain possible morphophonological realizations. For instance, whereas the masculine form *offert* “offered” does not include a value for *u*Gender, the past participle *offerte* “offered” spells out the valued feature [~~*u*Gender: Feminine~~] associated with a tenseless verbal expression in the VP. As long as feature clash is avoided (e.g., McCarthy, 2008), expressions are allowed to be inserted into matrices; however, feature matrices need not be completely spelled out. In other words, the past participle *offert* “offered” can appear as a spell-out of both [~~*u*Gender: Feminine~~] and [~~*u*Gender: Masculine~~].

In light of the differences between English and French in both the selection and the assembly of features in the verbal domain, the task of English learners French will be to “reconfigure or remap features from the way these are represented in the L1 into new formal configurations on possibly quite different types of lexical items in the L2” (Lardiere, 2009, p. 173). Although English and French have similar abstract representations for subject-auxiliary agreement, features are mapped differently. And, to realize agreement on French past participles, features not selected in English (i.e., *u*Gender and *u*Number) need to be valued.

## 2.1. Auxiliaries

In both English and French, two features need to be selected for subject-verb agreement: person and number. Therefore, the selection of features is similar in English and in French; that is, similar feature matrices are required on the Tense (T), or Inflection, category. However, Pollock (1989) proposed that, given word-order differences with adverbs and negation for lexical verbs, French and English differ in that the Agreement (Agr) node “in English, unlike Agr in French, is not ‘rich’ enough morphologically to permit transmission of the verb’s  $\theta$ -role(s)—in other words, that it is ‘opaque’ to  $\theta$ -role assignment, unlike French Agr, which, being richer morphologically, is ‘transparent’ to  $\theta$ -role assignment” (p. 385). Note that, because *be* and *have* are not  $\theta$ -role assigners, “(auxiliary) Be/Have Movement to (Agr and to) [Past] is obligatory” according to Pollock (p. 395); only the movement of lexical verbs is blocked by this opaque Agr in English. This means that the uninterpretable and unvalued phi-features [*u*Person] and [*u*Number] will be assembled in slightly different ways to reflect different checking relations, because *be* and *have* are not  $\theta$ -role assigners in English but, presumably, are in French.

A main difference between the French and English (compound) past tense is that English has one auxiliary, *to have*, whereas, in French, there are two auxiliaries to choose from, *être* “to be” and *avoir* “to have” (only the auxiliary *avoir* “to have” is of interest here). Additionally, in English, only the

third person singular form, *he has*, differs at spell-out, whereas all other forms are realized as *have*. Note, however, that the verb *to be* more consistently marks person and number at spell-out (e.g., *I am*, *you are*, *he is*). In French, most of the forms of *avoir* are realized differently at spell-out as a result of the checking of the person and number features (e.g., *j'ai* “I have,” *tu as* “you have,” *nous avons* “we have”); the only exceptions are the second and third person of the singular, both pronounced [a] but with different spellings (*as* and *a*, respectively). Therefore, despite the similar feature matrices on T in English and French, feature bundles differ in their assembly, triggering different morphophonological realizations.

To analyze subject-verb agreement, learners must first detect and select features, presumably from a universal store. In particular, the analysis of the auxiliary depends on the establishment of a checking relation in a specifier (Spec)-head configuration (between the subject and the auxiliary). For instance, a sentence as in (2) will be analyzed as in (3): The local properties of input (i.e., the features of the subject) constrain the features relevant for auxiliary agreement under the analysis in (3).

- (2) *Pierre et moi avons cherché le chat.*  
 Pierre and I -1<sup>st</sup>/PI have-1<sup>st</sup>/PI looked for the cat
- (3) [<sub>FinP</sub> [<sub>TP</sub> Pierre et moi [<sub>vP</sub> [<sub>vP</sub> avons [<sub>V</sub> cherché <Pierre et moi> [<sub>DP</sub> le chat]]]]]]]

This relies on a dependency between a feature F and its uninterpretable counterpart *uF*. The candidate set for F must be an inflectional feature in the interlanguage. For L1-English and L2-French, the candidates are person and number.

## 2.2. Past participles

In the nominal domain, the gender feature is almost nonexistent in English (with the exception of the pronouns *he*, *she*, *him*, *her*), and the number feature restricted to the noun at the morphophonological level. In French, both the gender and the number features are expressed at the morphological level on the different elements in the determiner phrase (DP): The gender feature generally appears in the singular on the article and on the adjective, and the number feature in the plural on the article and the adjective as well. Note that the number feature is most often not realized at spell-out with the exception of liaison cases, which force phonological realization, as in *les petits enfants* “the little children” where the plural affix *-s* is realized as [z] on *petits* “little.”

Although French and English select similar feature matrices on T for subject-verb agreement, “T in English will not have to include [*uGender*], since in English there is no subject [or object]-verb agreement with respect to gender” (Lardiere, 2009, p. 181). In contrast, French exhibits both subject- and object-verb agreement with respect to gender on past participles. With the auxiliary *avoir* “to have,” this agreement is only possible with the direct object when it occurs before the auxiliary—that is, after movement—as shown in (4) and (5). (Note that with the auxiliary *être* “to be,” the agreement of the past participle always occurs with the subject.)

- (4) *La robe verte, Jean l' a offerte à Julie.*  
 the dress green-FEM Jean it has offered-FEM to Julie  
 “The green dress, Jean offered it to Julie.”
- (5) *La robe verte, Julie l' a achetée hier.*  
 the dress green-FEM Julie it has bought-FEM yesterday  
 “The green dress, Julie bought it yesterday.”

Thus, to analyze past participle forms, learners must first detect and select features, presumably from a universal store, given the local properties of input. For a sentence as in (4), the properties consist in the features of the topic and of the clitic that constrain the features relevant for the past participle under the analysis in (6). In other words, to analyze a sentence as in (4), learners need to establish a checking relation in a Spec-head configuration (between the moved object clitic and the *v*-head hosting the past participle).

(6) [TopP [DP la robe verte] [FinP [TP Jean [vP l' [vP a [v offerte <la>]]]]]]

As before, with subject-verb agreement, this local checking configuration relies on a dependency between a feature *F* and its uninterpretable counterpart *uF*. The candidate set for *F* must be a *D*-feature in the interlanguage. For L1-English and L2-French, the candidates are gender and number, since these features are also deployed in English.

In the case of a past participle with *avoir* “to have,” agreement is optional and often not produced by native speakers of French in speech. It is important to note that, unless the feminine marker *-e* follows a consonant, as illustrated in (4) in which the past participle’s last consonant [t] is pronounced, neither the feminine marker *-e* nor the plural marker *-s* are phonologically realized. Additionally, although the number feature is almost never realized at the phonological level, cases of liaison exhibit overt agreement, as [z], in certain circumstances in formal speech, as illustrated in (7) between the past participle *allés* “went” and the preposition *à* “to.”

(7) *Ils sont allés à Paris hier.*  
 “They went to Paris yesterday.”

In sum, the task of L2 learners in the case of French past participles is to reassemble abstract feature matrices on light *v*, which includes features (i.e., *uGender* and *uNumber*) not selected in their L1 English, as well as to specify morphophonological realizations.

### 2.3. Hypothesis

Following Dekydtspotter and Renaud (2009), and in line with Lardiere’s (e.g., 2009) proposal, it is hypothesized that the universal parser constrains the selection of features that are instantiated in the representations of lexical items. Moreover, it is the context of the sentence itself that determines the features relevant to the parse, which, in turn, determines the nature of the representations to be stored in the lexicon. As such, aspects of feature (re)assembly might be detectable in processing prior to lexical knowledge: Processing should exhibit reflexes of the nature of the representations being processed.

The hypotheses proposed to account for the morphological problem make different predictions on the nature of the feature calculus in L2 acquisition. According to the interpretability hypothesis (Hawkins & Hattori, 2006; Tsimplici, 2003; Tsimplici & Dimitrakopoulou, 2007), because it is hypothesized that learners cannot acquire uninterpretable features not present in their L1 grammar, processing will initially be limited to context-sensitive strategies based on distributional regularities in the input; that is, processing will result from domain-general associations. Hawkins and Casillas (2008) proposed that when L2 learners have no access to uninterpretable features, phonological realizations of dependencies can nevertheless be “identified as recurrent and stable phonological strings in the input. Their representation in the Vocabulary is in the form of context-sensitive rules specifying the nodes with which they cooccur” (p. 602). In contrast, according to the feature reassembly hypothesis (Choi & Lardiere, 2006a, 2006b; Lardiere, 2005, 2008, 2009), learners’ processing should exhibit reflexes of the computation of features given the constraints imposed by the local context. It is important to note that not all feature systems have the same processing consequences (Dekydtspotter & Renaud, 2009); that is, evidence for reflexes stemming from domain-general associations versus reflexes stemming from checking and spell-out of features should be in evidence in processing. Therefore, processing as well as acceptability judgment data from two experiments that examine agreement in the verbal domain in L2 French are analyzed here. The first experiment investigated subject-auxiliary agreement, and the second, past-participle agreement with a moved object clitic.

### 3. *u*Number and auxiliaries

#### 3.1. *Participants*

Three groups of American learners of French completed this experiment: second-semester ( $n = 25$ ), fourth-semester ( $n = 12$ ), and advanced learners ( $n = 11$ ). A group of French natives ( $n = 11$ ) was included as a control. The intermediate learners were all undergraduate students at a large Midwestern university, whereas the advanced learners and the native speakers were graduate students at the same university pursuing advanced degrees in French literature or linguistics.

#### 3.2. *Task*

Participants first completed a short background questionnaire and then took part in a judgment task in a non-cumulative self-paced moving-window format, which was delivered on a computer. This task consisted of 24 experimental items, which contained a context paired with a sentence in which the auxiliary agreed in both person and number (8b) or only in person (8a) with the subject of the second sentence. Note that auxiliaries marked for both number and person, as in (8b), are the expected answer because auxiliaries that only agree in person yield an ungrammatical sentence.

- (8) *L'hôtel avait un terrain de tennis et des raquettes.*  
 “The hotel had a tennis court and rackets.”
- a. \**Christine / et moi / ai /                    donc / joué / au tennis.*  
 Christine and me have-SING thus played tennis.
- b. *Christine / et moi / avons /                donc / joué / au tennis.*  
 Christine and me have-PLU thus played tennis.  
 “Christine and I have thus played tennis.”

Participants first read the entire context sentence and then the second sentence in six segments starting at the left of the screen. (Slashes are used in the examples to show the segmentation of the test items into segments.) To see the following word and keep reading, participants pressed a button. At the end of each item, participants were asked to indicate whether, in their opinion, the second sentence was a good follow-up to the first sentence (i.e., participants were not asked to focus on grammar), by pressing YES (a green button) or NO (a red button).

Final acceptability judgments and reading times (RTs) on the auxiliary as well as the following adverb segments (reported in ms) were recorded and analyzed. The data were coded with SPSS, and extreme RTs (e.g., at two standard deviations from the mean) were eliminated and replaced with the mean for all participants. The significance level was set at .05. It was expected that native speakers would show knowledge of grammar—rejection of the mismatched agreement and high acceptance of the matching agreement—and reflexes of morphological expectations—longer RTs on mismatching versus matching forms. For the learner data, reflexes of the computation of features in processing (i.e., asymmetries in RTs indicative of feature reassembly) may be found before grammatical knowledge (i.e., acceptance rates) if the parser constitutes the trigger for learning. In other words, the learner data could exhibit reflexes of morphological expectations or underspecification of the number feature—that is, shorter RTs on the singular (mismatching) forms.

#### 3.3. *Results*

##### 3.3.1. *Acceptance rates*

Figure 1 provides the acceptance rate patterns for each group. A repeated-measures ANOVA revealed a main effect of agreement,  $F(2, 110) = 110.476$ ,  $p < .0001$ , as well as an interaction of Agreement x Group,  $F(6, 110) = 10.404$ ,  $p < .0001$ . A post hoc Bonferroni test showed that second-semester learners differ significantly from advanced learners,  $p < .01$ , and from native speakers,  $p < .005$ , and that fourth-semester learners tend to differ from native speakers,  $p = .072$ .

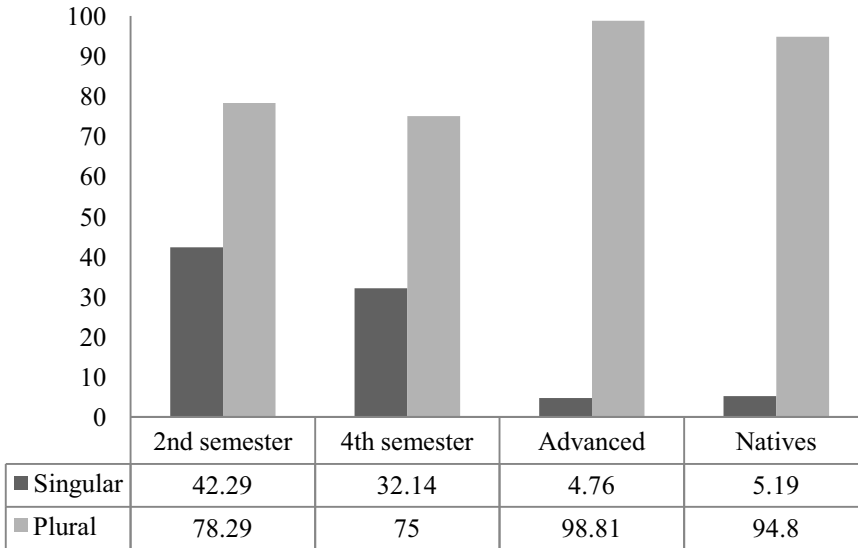


Figure 1. Acceptance rates (in %)

The high acceptance rates by all learners of the plural auxiliary show knowledge of subject-verb agreement; however, the lower proficiency learners still accept the underspecified singular auxiliaries at fairly high rates. In contrast, advanced learners show nativelike acceptance patterns.

### 3.3.2. Reading times

The raw RTs (in ms) on the auxiliary and the adverb segments by condition (i.e., singular or plural) and by group are provided in Table 1. A linear mixed model was conducted on the auxiliary segment to adjust for the letter difference between the singular and the plural forms of the auxiliary segment (*ai* “have-1<sup>st</sup> Sing” vs. *avons* “have-1<sup>st</sup> Pl” or *as* “have-2<sup>nd</sup> Sing” vs. *avez* “have-2<sup>nd</sup> Pl”) to avoid this potential confound of the results. It revealed a main effect of group,  $F(3, 57.482) = 8.846$ ,  $p < .0001$ . On post hoc Bonferroni tests, second-semester learners were found to differ from native speakers,  $p < .05$ , but not from fourth-semester learners,  $p = .081$ , and fourth-semester learners were found to differ from advanced learners,  $p < .005$ , and from native speakers,  $p < .001$ .

Table 1: Raw RTs (in ms)

Group	Auxiliary		Adverb	
	Plural	Singular	Plural	Singular
2 <sup>nd</sup> semester	776.67	797.17	557.49	510.32
4 <sup>th</sup> semester	1023.85	1147.96	676.24	563.21
Advanced	513.31	586.32	472.40	467.33
Native	411.03	454.22	411.62	410

Because the same adverb, *donc* “thus,” was used in all sentences, the adverb segment did not vary in length. Therefore, a repeated-measures ANOVA was conducted on this segment; it revealed a main effect of agreement,  $F(1, 56) = 4.219$ ,  $p < .05$ . Post hoc Bonferroni further showed that fourth-semester

learners differ from advanced learners,  $p < .05$ , and from native speakers,  $p < .005$ . Planned  $t$  tests confirmed that fourth-semester learners read the adverb significantly faster when it followed the forms with the (incorrect) singular value of  $u$ Number,  $t(11) = 1.956$ ,  $p < .05$  (one-tailed). This result suggests a spill-over effect on the adverb segment: This short latency is indicative of underspecification of the singular value of the Number feature. Note that this result alone is also compatible with a feature association account because an incorrect form association should induce later inhibitions.

## 4. $u$ Gender and past participles

### 4.1. Participants

In this experiment, there were also three groups of American learners of French who completed the task: second-semester ( $n = 25$ ), fourth-semester ( $n = 12$ ), and advanced learners ( $n = 12$ ). A control group of French native speakers ( $n = 11$ ) was also included. These participants were recruited from the same university as the ones reported in the previous experiment and had the same characteristics: The intermediate learners were all undergraduate students, and the advanced learners and the native speakers were all graduate students in French.

### 4.2. Task

Participants completed a judgment task in a non-cumulative self-paced moving-window format. This task consisted of 28 experimental items in a 2x2 design: Each context (i.e., masculine or feminine) was paired with a sentence that contained a past participle either in the masculine or in the feminine form, as illustrated in (9)-(10). Note that all the past participles selected (i.e., *mis(e)* “put,” *fait(e)* “done,” *écrit(e)* “written,” *peint(e)* “painted,” *ouvert(e)* “opened,” *décrit(e)* “described,” and *découvert(e)* “discovered”) exhibited a phonologically realized agreement.

- (9) a. Masculine context  
*La grand-mère a demandé un paragraphe amusant.*  
 The grand-mother has asked for one paragraph funny-MASC  
 “The grand-mother asked for a funny paragraph.”  
 b. Feminine context  
*La grand-mère a voulu une belle lettre.*  
 The grand-mother has asked for one beautiful-FEM letter  
 “The grand-mother asked for a beautiful letter.”
- (10) a. Masculine form  
*Les femmes / l' / ont / donc / écrit / le lundi.*  
 The women it have thus written-MASC on Monday  
 b. Feminine form  
*Les femmes / l' / ont / donc / écrite / le lundi.*  
 The women it have thus written-FEM on Monday  
 “The women thus wrote it on Monday.”

The procedure for this task was the same as the judgment task in the subject-auxiliary agreement experiment. Acceptability judgments and RTs on the past participle segment reported in milliseconds were recorded and analyzed. The data were coded with SPSS, and extreme RTs (e.g., at two standard deviations from the mean) were eliminated and replaced with the mean for all participants. The significance level was set at .05. It was expected that native speakers would show knowledge of grammar as reflected in their acceptance rates and reflexes of morphological expectations: Longer RTs when the feature on the past participle did not match that of the moved object clitic. For the learner data, assuming that the parser constitutes the trigger for learning, we may expect to find reflexes of the computation of features in processing—that is, longer RTs on feminine forms in both masculine and feminine contexts, and possibly shorter RTs on masculine forms in feminine contexts as a result of underspecification—ahead of grammatical knowledge (i.e., acceptance rates). Therefore, it is expected



that the RT data would provide a window into the processing of agreement in the L2 in addition to offline data provided by the final acceptance rates.

### 4.3. Results

#### 4.3.1. Acceptance rates

The results for the acceptance rates are provided in Figure 2. An ANOVA revealed significant interactions between Form x Context,  $F(1, 56) = 313.459, p < .0001$ , and between Form x Context x Proficiency,  $F(3, 56) = 113.969, p < .0001$ . Planned  $t$  tests revealed that the second-semester learners accepted more masculine than feminine forms in the feminine context,  $t(24) = 2.192, p < .05$ , which suggests a preference for the default form. There were no significant differences in the fourth-semester learners (i.e., they accepted all forms in all contexts at chance). Like the native speakers,  $t(10) = 12.551, p < .0001$ , advanced learners were found to accept more feminine than masculine forms in the feminine context,  $t(11) = 17.234, p < .0001$ .

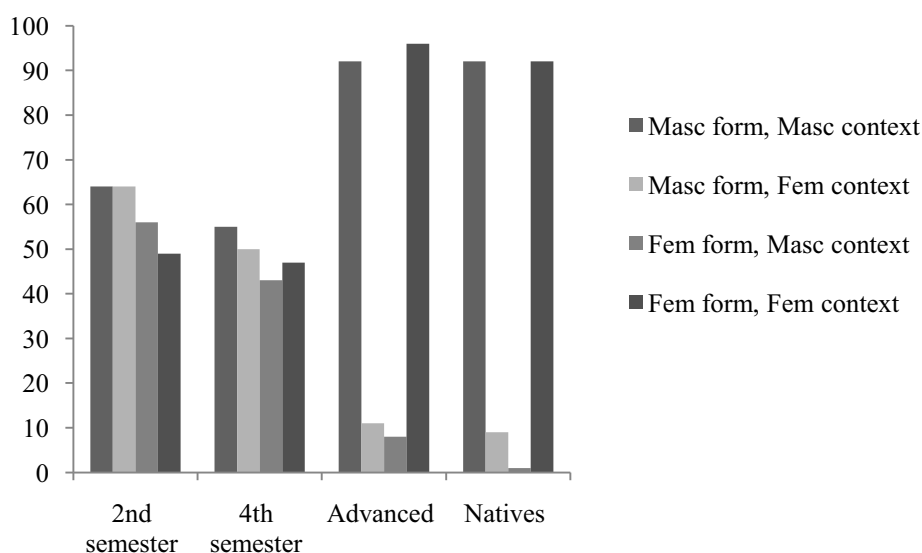


Figure 2. Acceptance rates (in %) by form and context by group

Two patterns thus seem to emerge. First, the lower proficiency learners accept all past participle forms independently of context. Second, the advanced learners pattern like the native speakers, whose judgments reflect knowledge of grammar.

#### 4.3.2. Reading times

Table 2 presents the RTs for the past-participle segment for each group. It can be seen that all learner groups exhibited faster RTs for the masculine form in the feminine context. In contrast, feminine forms of past participles in feminine contexts induced the longest RTs for all learner groups. For the native speakers, the RTs are slower when there is a mismatch between the context and the form of the past participle: The longer latencies on mismatching conditions reflect morphological expectations. An ANOVA revealed a main effect of form,  $F(1, 56) = 19.476, p < .0001$ , and of context,  $F(1, 56) = 5.277, p < .05$ , as well as a significant interaction between Form x Context x Proficiency,  $F(3, 56) = 5.423, p < .005$ .

Planned  $t$  tests were performed. Faster RTs for masculine forms in feminine versus in masculine contexts were revealed for second-semester learners,  $t(24) = 2.496, p < .05$ , and for fourth-semester learners,  $t(11) = 2.597, p < .05$ . Similarly, there were faster RTs for masculine versus feminine forms in feminine contexts for second-semester learners,  $t(24) = 3.207, p < .005$ , and for fourth-semester

learners,  $t(11) = 3.582, p < .005$ . In advanced learners, this difference was found to be marginally significant,  $t(11) = 2.077, p = .062$ . Native speakers' data revealed a theoretically significant tendency: They had faster RTs for masculine forms in masculine compared to feminine contexts,  $t(10) = 2.093, p = .063$ .

Table 2: RTs (in ms) by form and context by group

Group	Masculine form		Feminine form	
	Masculine context	Feminine context	Masculine context	Feminine context
2 <sup>nd</sup> semester	866 (496)	695 (257)	955 (428)	892 (481)
4 <sup>th</sup> semester	1183 (505)	865 (291)	1112 (425)	1257 (518)
Advanced	824 (355)	754 (224)	888 (249)	862 (251)
Natives	561 (174)	674 (262)	737 (284)	621 (175)

*Note:* Standard deviations are provided in parentheses.

Two processing profiles were revealed by the RT data. First, the native speakers' RTs exhibit asymmetries that reflect morphological expectations: They had faster RTs when verbal morphology matched the gender of the direct objects in both contexts. Second, the learners' data suggest that their processing is guided by checking and valuation of  $\nu$ Gender (i.e., the processing cost of agreement): They exhibited longer RTs with feminine forms as well as with masculine forms in masculine contexts. However, the learners' data also appear to show a reflex of underspecification of masculine (in feminine context). It is noteworthy that the detectable asymmetries in early stages of acquisition of past participles suggest the reflex of a learning mechanism that incorporates operations on  $\nu$ Gender.

## 5. Discussion

### 5.1. Agreement and auxiliaries

The results from the acceptability judgments on auxiliaries clearly demonstrate that learners, even at lower proficiency, have knowledge of grammatical forms. All learners accepted the subject-auxiliary agreement in a plural context with an auxiliary marked for both person and number at consistent high rates (at least 75%). However, lower proficiency learners also accepted the singular form of the auxiliary in a plural context at non-negligible rates of 42% and 32% for the second- and fourth-semester learners respectively. It can be suggested that subject-verb agreement is more local, which may make it easier for learners to latch on to the mismatch in agreement. The relatively high acceptance of the singular auxiliary could be argued to be an effect of proximity. In all sentences, the subject consisted of a complex noun phrase in which the second pronoun was always marked with the singular. This may have influenced lower proficiency learners' acceptance of the singular auxiliary form. In any case, frequency alone cannot explain this finding because the more frequent singular forms would have been expected to be accepted more often than plural forms; however, this is not the case.

### 5.2. Agreement and past participles

As far as the past participles are concerned, lower proficiency learners were found to accept the feminine forms in masculine context at relatively high rates. This result seems to suggest a failure of

the current interlanguage grammar to license dependencies that rely on *uGender* (see Lardiere, 2009). In contrast, the advanced learners exhibited nativelike behavior, which indicates eventual convergence on a French-like grammar. The asymmetries found in the RT data (i.e., longer latencies for feminine forms in both contexts and for masculine forms in masculine contexts as well as shorter latencies for masculine forms in feminine contexts) suggest that the processing remains the same across learners, independently of proficiency (or grammatical) performance patterns: This processing is characterized by feature valuation of *uGender* and morphological underspecification of masculine. The fact that the processing profile continues at the different stages of grammatical development is very suggestive of the nature of the learning mechanisms. It appears that the parser provides the intake for the development of lexical specification and values of functional categories.

In previous studies of gender agreement (e.g., McCarthy, 2008; White, Valenzuela, Kozłowska-Macgregor, & Leung, 2004), two types of errors were revealed—namely, feature clash and underspecification. The acceptance rates data of the present study showed that lower proficiency learners accepted the masculine form independently of context (second-semester learners: 64% in both contexts; fourth-semester learners: 55% in masculine and 50% in feminine contexts). However, these lower proficiency learners also accepted the feminine forms in masculine context at fairly high rates (second-semester learners: 56%; fourth-semester learners: 43%)—a finding that is problematic for McCarthy's morphological underspecification hypothesis. Indeed, the lower proficiency learners in this study do not seem to reject feature clash as predicted, on the contrary, they accept these cases at fairly high rates. An investigation that only depends on offline results would thus not seem compatible with a proposal that feature clashes will be rejected. In contrast, the acceptance rate behavior of advanced learners converges on native speakers' norm.

When examining the RT data (i.e., online evidence), however, all learner groups seem to react to feature clash: They had longer RTs with feminine forms in masculine contexts than with masculine forms in feminine contexts (second-semester learners:  $t(24) = 4.480$ ,  $p < .0001$ ; fourth-semester learners:  $t(11) = 2.340$ ,  $p < .05$ ; advanced learners:  $t(11) = 2.949$ ,  $p < .05$ ). The processing data therefore suggest that learners are sensitive to underspecification of the masculine form but also to the feature clash occurring with the feminine form in the masculine context, as predicted by McCarthy (2008). These findings highlight the importance of investigating online in addition to offline data: A methodology that only relies on offline evidence could potentially arrive at diverging conclusions from a methodology that also relies on online data.

### 5.3. *Parsing as a learning mechanism*

For all learner groups, the processing data revealed costs associated with checking relations of specified versus default values: Default use of masculine was significantly faster than agreeing feminine and masculine forms ( $p < .05$ ). The native-speakers' RTs reflected morphological expectations. The findings of the current study mirror those of Dekydtspotter and Renaud (2009), who tested the processing of the uninterpretable gender feature on past participles in English learners of French. They also found patterns of asymmetries that seem to reflect a specific mental organization, with an underspecified value of the gender feature as well as a dependency between an interpretable gender feature on the pronoun and an agreeing *uGender* feature on the past participle. The detectable asymmetries found in early stages of acquisition are suggestive of a learning mechanism that involves the computation of *uGender* on the past participle ahead of robust lexical knowledge, as revealed by the acceptance rates. Additionally, this processing pattern appeared—and was maintained—ahead of robust knowledge of morphophonological forms. The processing data thus suggest that learners rely on agreement in local checking relations, which limit the potential number of feature candidates, constraining it to (number and) gender for the past participles and to number and person for the auxiliaries. In other words, learners appear to rely on feature valuation, underspecification, and spell-out requirements during L2 acquisition. In sum, the processing profile found from the early stages of acquisition suggests that L2 grammar acquisition is mediated by a domain-specific parsing.

## 6. Conclusion

First, processing evidence in addition to offline data provided a more complete picture of the L2 acquisitional process. In other words, the findings of a study based on a methodology that does not include processing data may only reveal part of the story. For instance, the current study allowed for the observation that learners exhibited processing reflexes ahead of robust lexical knowledge—RT asymmetries but acceptance rates at chance level on the past participles. The offline data alone would have suggested that lower proficiency learners in this study accepted cases of feature clash, a finding contradictory to McCarthy's (2008) hypothesis. The inclusion of the RT data enabled us to observe processing differences, reflected by longer RTs, in cases of feature clash, as predicted by McCarthy. A methodology that includes both online and offline data thus seems most appropriate in the quest to uncover L2 acquisitional processes.

Second, the feature reassembly hypothesis (e.g., Lardiere, 2009) appears to provide the best account for the data from agreement in the verbal domain in L2 French. Explanations based on a domain-general association system (e.g., Hawkins & Casillas, 2008) do not seem to be able to account for the patterns of asymmetries exhibited by the learners in this study. Instead, the processing data suggest specific agreement mechanisms—feature checking or valuation and use of morphological defaults. The data also indicate that the parser, constrained by the structure of the representations, guided the selection of the relevant features as well as their reassembly for the analysis of forms ahead of lexical encoding. In sum, the processing data point to the sentence analyzer as a central learning tool during the L2 acquisitional process.

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