Uninterpretable Features in the Processing of Past Participle Agreement in L2 French

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1. L2 morphological variability

A great deal of research has investigated morphological variability in—mainly the production of—second language (L2) learners. 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 L2 morphological variability is a reflex of unavailable features, whereas others (e.g., Gavruseva & Lardiere, 1996; Hazdenar & Schwartz, 1997; Lardiere, 1998a, 1998b, 2005, 2007, 2009; McCarthy, 2007, 2008; Prévost & White, 2000) argue that it is a reflex of the feature calculus in human language. Other proposals have also investigated the role that prosodic representations (Goad, White, & Steele, 2003) may have in L2 morphological variability.

1.1. Morphological variability as a reflex of unavailable features

Proponents of the failed functional features hypothesis (e.g., Franceschina & Hawkins, 2003; Hawkins & Chan, 1997) proposed that features absent from the first language (L1) are not accessible in SLA. Tsimpli and Dimitrakopoulou (2008), with the interpretability hypothesis, refined this position by precising that uninterpretable features absent from the L1 are not accessible in SLA. More recently, the contextual complexity hypothesis (Hawkins & Casillas, 2008) has proposed that all learners' grammars are initially limited to context-sensitive strategies based on distributional regularities in the input followed by rule-based optimization, if features are available.

1.2. Morphological variability as a reflex of the feature calculus in human language

Assuming distributed morphology (e.g., Halle & Marantz, 1993), proponents of the missing surface inflection hypothesis (Hazdenar & Schwartz, 1997; Prévost & White, 2000) argued that specifications of functional categories can be acquired, but that production pressures lead to the insertion of underspecified forms.

In the nominal domain, evidence for underspecified representations has come, among others, from a study by White, Valenzuela, Kozlowska-Macgregor, and Leung (2004), which focused on gender and noun phrase (NP) ellipsis in Spanish. They investigated French (n = 48) and English (n = 68) learners at three proficiency levels (i.e., low, intermediate, advanced). The results of two elicited production tasks, a picture identification task, and a vocabulary test indicate that the variability was mostly due to the overuse of masculine determiners and adjectives with feminine nouns. In production, learners' accuracy was lower on feminine than on masculine nouns, whereas in comprehension, their accuracy was lower on masculine than on feminine nouns. These findings suggest that resorting to default forms is not confined to production.

McCarthy's (2008) study on gender with clitics and adjectives provides further evidence for underspecified representations in comprehension. She tested 24 English learners of Spanish (15 intermediate and 9 advanced) and 10 Spanish native speakers. The participants completed an elicited production task, a picture identification task, and a vocabulary test. McCarthy, like White et al. (2004), found that variability consisted mostly in the overuse of masculine with feminine forms. Learners' production yielded lower accuracy on feminine than on masculine forms, whereas learners' comprehension was less accurate on masculine than on feminine forms. McCarthy thus concluded that

variability is persistent and rather systematic, that it is found in both production and comprehension, and so even at high levels of L2 proficiency. The fact that variability is found in comprehension seems to undermine the argument of the missing surface inflection hypothesis that it results from communication pressure. This observation led McCarthy (2007, 2008) to posit the morphological underspecification hypothesis whereby learners are expected to show evidence of underspecified forms but to reject (i.e., not to produce or admit) feature clashes.

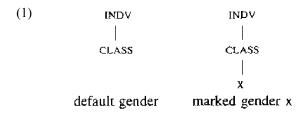
More recently, Lardiere, with the feature assembly hypothesis (Choi & Lardiere, 2006a, 2006b; Lardiere, 2005, 2008, 2009), proposed that the task of acquiring new feature matrices for functional categories and lexical items presents a serious challenge as a function of the L1 grammar. The L1-grammar feature organization needs to be overcome as a results of new features and feature-configurations being detected from the input. The main problem that learners face then "lies in assembling just the right combination of features into the right lexical items for each language, and in determining their appropriate conditioning environments for their expression" (p. 215). Such an assembly of features requires features to be checked, and this feature-checking via valuation makes specific processing commitments that are distinct from general association patterns (Dekydtspotter & Renaud, 2009). If learners rely on gender-classifications, inhibitory effects of gender mismatches over gender matches are expected. If learners are checking features and relying on morphological underspecification, a cost of feature checking or matching under insertion is expected.

The current study investigates further the feature calculus in SLA. It is hypothesized that a universal parser acts as a learning mechanism (Dekydtspotter, 2001)—that is, it is the source of reassembly of feature matrices. Guided by UG, the parser limits the set of potentially relevant features that must then be lexically encoded. Assuming that learning is failure-driven (Fodor, 1998), the interlanguage grammar develops as a need to license the parse of the input. The processing of uGender on past participles will serve as a test of this hypothesis.

2. On the nature of features

Lardiere (2009) stated 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. 214). If we take the gender feature as an example, the dependence of masculine and feminine on the notion gender requires that the feature Gender and its uninterpretable counterpart uGender mediate the features [feminine] and [masculine]—Universal Grammar (UG) constrains this dependency.

Assuming distributed morphology (e.g., Halle & Marantz, 1993), Harley (1994) and Harley and Ritter (2002), among others, argued that (interpretable) features are modeled in hierarchical geometries. Note that syntactic default fill-in rules may nonetheless apply. For example, [feminine] is dependent on [gender] (or on class, to use Harley and Ritter's terminology), whereas the feature [masculine] is not part of underlying representations. These relations are schematically represented in (1).



(Harley & Ritter, p. 514)

Crucially, the computational system imposes restrictions on admissible features (Dekydtspotter & Sprouse, 2003). Assuming a universal parser, UG constrains the number of potentially relevant features to complete the parse. It is thus assumed that uGender is implicitly part of the grammatical

state of the English learner of French—it is inherent in the universal component—and that uGender is not explicitly part of knowledge of English—it is not part of the Lexicon.

This study thus attempts to answer the following research question:

What are the mechanisms that underlie

- (a) the development of L2 morphosyntactic representations and
- (b) the licensing of morphophonological representations in the syntactic structure?

3. What is the nature of gender agreement on past participle in French?

In French, past participles agree in number and gender with the subject or the object of a sentence. Only the agreement that involves uGender is of concern here. There are two possibilities: First, with the auxiliary $\hat{e}tre$ "to be," past participles agree with the subject in gender (and number) as illustrated in (2).

(2) La robe verte a été offerte à Julie. the dress green-FEM has been offered-FEM to Julie "The green dress was offered to Julie."

Second, with the auxiliary *avoir* "to have," past participles do not agree with the subject but with a moved direct object in the form of a clitic (or a *wh*-word), as shown in (3).

(3) 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."

Note that this agreement occurs systematically in formal registers (e.g., in orthography), but it is optional in informal registers (e.g., in speech). It is also important to note that there are two different types of past participle agreement with uGender: silent, as illustrated in (4), versus overt, as illustrated in (5), at the (morpho-)phonological level.

- (4) La robe verte, Jean l'a achetée pour Julie. the dress green-FEM Jean it has bought-FEM for Julie "The green dress, Jean offered it for Julie."
- (5) 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."

In the case of silent agreement, it may be the case that it is a mere orthographic convention on the basis of the patterns found with overt forms. Therefore, this type of agreement will not be of concern here. In contrast, overt agreement represents part of the primary linguistic data that learners encounter in the (classroom) input. These forms are thus the focus of the present study, which attempts to determine what learners do with this overt gender agreement.

To find out the nature of input classroom learners, like the ones in this study, are exposed to, 6h 40 min of class on composite tenses were recorded. This observation revealed a mismatch between instruction and the actual input that learners receive. Of the 324 past participle forms—218 of which were produced orally—that were presented in class, there were only two audible cases of past participle agreement of the type of interest here. These two forms are provided in (6) and (7):

- (6) *Elle l'a prise* "she took it-FEM"
- (7) *Il l'a prise* "he took it-FEM"

This observation indicates that the primary linguistic data (PLD) are therefore impoverished. In other words, if learners show evidence of increased processing costs associated with the checking of

uGender and decreased costs due to underspecification of masculine, it is presumably because they treated relatively few PLDs in a domain-specific manner.

Another crucial learnability problem is that the way in which past participles are processed (with their specific character) is not anywhere in evidence in the input. It is purely a function of the mental system. Thus, it is hypothesized that if uGender is not selected, domain-general classes of expressions are constructed piecemeal with frequency, as a central determining factor. On the other hand, if uGender is selected, it enters into a feature checking calculus of matrices of functional categories as well as into morphophonological spell-outs.

4. The study

4.1. Participants

Three groups of American learners of French 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.

4.2. Materials

After completing a short background questionnaire, participants took part in a judgment task in a self-paced moving window format. This task consisted in 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 shown in (8)-(9).

(8) a. Masculine context

La grand-mère a demandé un paragraphe amusant.

The grand-mother has asked for one paragraph funny-MASC b. Feminine context

La grand-mère a voulu une belle lettre.

The grand-mother has asked for one beautiful-FEM letter

(9) 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

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 overt agreement.

4.3. Procedure and Analysis

This task was delivered on a computer in a self-paced moving-window format. Participants read the entire context sentence first and then the second sentence in six segments starting at the left of the screen, as shown in (10). To see the following word, participants pressed a button. 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 (the green button) or NO (the red button).

(10) Les femmes / l' / ont / donc / écrit / le lundi./
The women it have thus written-MASC on Monday
YES NO

Acceptability judgments and reading times (RTs) reported in milliseconds (ms) were recorded and analyzed. The data was 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. Only the past participle segment was analyzed. The significance level was set at .05.

4.4. Results

4.4.1. Acceptance rates

Table 1 provides the results for the acceptance rates by form and context for each group. 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 were performed, and 2nd-semester learners were found to accept more masculine than feminine forms in feminine context, t(24) = 2.192, p < .05, which indicates a preference for the default form. In the 4th-semester learners, no difference reached significance; that is, they accepted all forms in all contexts at chance. Advanced learners accepted more feminine than masculine forms in feminine context, t(11) = 17.234, p < .0001, like the native speakers, t(10) = 12.551, p < .0001.

Table 1. Acceptance rates (in %) by form and context and by group

	Masculii	ne form	Feminine form		
Group	Masculine context	Feminine context	Masculine context	Feminine context	
2nd semester	64	64	56	49	
4th semester	55	50	43	47	
Advanced	92	11	8	96	
Natives	92	9	1	92	

Thus, two patterns seem to emerge: lower proficiency learners, who accept all past participle forms independently of context, versus advanced learners and natives, whose judgments reflect knowledge of grammar.

4.4.2. RTs

The RTs for the past participle segment for each group are provided in Table 2. This table shows 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. The native speakers' RTs reflect morphological expectations: There is a spike in RTs when there is a mismatch between the context and the form of the past participle.

An ANOVA revealed a main effect of form, F(1, 56) = 19.476, p < .0001, and of context, F(1, 56) = 5.277, p < .03, as well as a significant interaction between Form x Context x Proficiency, F(3, 56) = 5.423, p < .005. Planned t tests were conducted and revealed faster RTs for masculine forms in feminine than in masculine contexts for 2nd-semester learners, t(24) = 2.496, p < .05, and for 4th-semester learners, t(11) = 2.597, p < .03. In feminine contexts, faster RTs for masculine than feminine forms were also found for 2nd-semester learners, t(24) = 3.207, p < .005, and for 4th-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 also exhibited a theoretically significant tendency: They had faster RTs for masculine forms in masculine than in feminine contexts, t(10) = 2.093, p = .063.

Table 2	Reading	times	(in ms)	hv	form and	l context o	and by group
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	Masculin	ne form	Feminine form		
Group	Masculine context	Feminine context	Masculine context	Feminine context	
2nd semester	866 (496)	695 (257)	955 (428)	892 (481)	
4th 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.

Therefore, the RT data revealed two processing profiles: The native speakers' RTs reflect morphological expectations built by a parser that anticipates structure. They exhibited faster RTs when verbal morphology matched the gender of the direct objects in both contexts. The learners' RTs reflect a two-step process: (a) the processing cost of agreement (i.e., feature checking or calculation of values of feature matrices) and (b) spell-out by morphophonological forms, in which the masculine forms are underspecified. Crucially, the detectable asymmetries in early stages of acquisition of past participles reflect a learning mechanism that incorporates operations on *u*Gender.

5. Discussion

The illicit acceptance of feminine forms in lower proficiency learners seems to suggest a failure of the current interlanguage grammar to license dependencies that rely on uGender (see Lardiere's, 2009, feature assembly hypothesis). In contrast, the nativelike behavior of advanced learners indicates eventual convergence on a French-like grammar. The RTs suggest that, across proficiency (or grammatical) performance patterns, the processing remains the same: It is characterized by feature valuation of uGender and morphological underspecification of masculine. The continuity of processing across grammatical development is revealing of the nature of the learning mechanisms: The parser provides the intake for the development of lexical specification and values of functional categories.

Let us return to the two error types highlighted by McCarthy (2008) and White et al. (2004)—namely, feature clash versus underspecification. The acceptance rates data showed that lower proficiency learners accepted the masculine form independently of context (2nd-semester learners: 64% in both contexts; 4th-semester learners: 55% in masculine and 50% in feminine contexts). However, the nonnegligible acceptance of feminine forms in masculine context by lower proficiency learners (2nd-semester learners: 56%; 4th-semester learners: 43%) appears to pose a problem for McCarthy's morphological underspecification hypothesis: Indeed, learners do not seem to reject feature clash as she predicted, but they accept these cases at fairly high rates. The advanced learners, in contrast, exhibited convergence on native speakers' norm. An investigation solely based on offline results does not seem compatible with a proposal that feature clashes will be rejected.

If the RTs data (i.e., online evidence) are taken into account, however, all learner groups seem to react to feature clash: They exhibited longer RTs with feminine forms in masculine contexts than with masculine forms in feminine contexts (2nd-semester learners: t(24) = 4.480, p < .0001; 4th-semester learners: t(11) = 2.340, p < .04; advanced learners: t(11) = 2.949, p < .02). Thus, the RT data 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.

6. Conclusion

It was found that L2 learners' parsing reflects nativelike reflexes, whereas their judgments (i.e., for those learners at a lower proficiency level) appear to lag behind. The processing data is suggestive of feature valuation, morphological defaults, and spell-out desiderata, which support a feature reassembly account (e.g., Lardiere, 2009). In sum, the processing profile found in early stages of acquisition suggests that L2 grammar acquisition is mediated by a universal parser.

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