Adult L2 Acquisition of French Grammatical Gender: investigating sensitivity to phonological and morphological gender cues

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Honours Thesis
May 2006
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1 Introduction

This paper investigates second language (L2) acquisition of French grammatical gender. More specifically, it examines first language (L1) English speakers' sensitivity to phonological and morphological cues to French nominal gender.

1.1 French Grammatical Gender

Gender is an abstract grammatical quality of certain lexical categories in French, as well as Spanish, Russian, Latin, etc. In French, which has two genders, all nouns are classified as either masculine or feminine. The gender of nouns is inherently attributed to them. Gender is also necessary on determiners,[1] adjectives and pronouns. The gender of these lexical categories differs from that of nouns because it is derived through agreement with the noun head within the appropriate syntactic domain.

Categories whose gender is derived through agreement will have two phonological forms for the same concept. For example, the definite article in French has two forms: *le* and *la*, as seen in *la bonne livre* (the good book), as compared to *le bon roman* (the good novel).

This paper considers gender within the framework of Universal Grammar (UG), although it does not directly test claims of current generative theory beyond supporting the acquisition of internal structure by testing morphological knowledge. The classification of nouns according to grammatical gender is largely independent from semantic or referential content. For this reason it is impossible that the existence of a

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[1] It is only apparent on singular forms like *le, la, un, une, mon, ta,* etc. Plural forms like *les, des,* and *ses* are uninformative regarding gender.

gender distinction is bootstrapped from conceptual categories in the language (Carroll 1989). Instead, in accordance with generative theories, gender is an inherently available parameter of UG.

The nominal gender feature is included in the lexical entry of nouns. It is considered to be "interpretable," meaning that it informs semantic interpretation[2]. The gender features of determiners and adjectives are "uninterpretable." Uninterpretable features are deleted through feature checking, which results in the derivation of gender agreement (Carstens 2000) (as cited in Hawkins & Franceschina 2004).

In both L1 literature (Karmiloff-Smith 1979) and L2 literature (White, Valenzuela, Kozlowska-Macgregor and Leung 2004), there is evidence that masculine is the unmarked gender and that learners often have a masculine default.

Even without a detailed description of feature checking, it is clear that the gender feature of nouns must be available at the level of syntactic processing, in order to trigger gender agreement. Carroll (1989, p. 554) describes several levels of representation required for gender agreement. She postulates that speakers must have:

1) the ability to represent different lexical categories, because gender is an attribute of specific categories
2) different phonological forms of adjectives, determiners and pronouns which directly indicate gender
3) a distinction between attributed gender (as in the case of nouns) and derived gender (as in the cases of determiners, adjectives)
4) hierarchical syntactic representations which define the domain of gender agreement (such as c-command and antecedence)

Carroll (1999, p 49) adds the requirement that "Francophones be capable of representing French in terms of morphosyntactic structures whose properties are neither objectively present in the speech signal nor derivable from the word's meaning." The importance of morphological knowledge will be discussed throughout the introduction.

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[2] White et al. (2004) points out that cases where gender is informative are in the minority.

This paper focuses on the L2 acquisition of the attributed gender feature of French nouns. However, not all nouns are alike in terms of gender attribution. There is a small subset (about 300 words) of French noun pairs which are homophonous, semantically unrelated and only distinguished from each other by their gender. For example, *le livre* (book) and *la livre* (unit of mass or currency). Aside from these exceptional words, nouns fall into two categories: animate nouns with natural gender and inanimate nouns.

Gender has real semantic content in the case of many animate nouns. Some animate nouns manifest predictable alterations, based on the natural gender of the referent. Some alterations are audible, as in *la Canadienne* as opposed to *le Canadien*. Others, such as *une ingénieure* compared to *un ingénieur* have only orthographic differences. In French, the term *épicène* is used to describe nouns which have both genders and nouns whose gender does not change despite the gender of the referent. *Un enfant* and *une enfant* are an example of the former. Cases like la giraffe mâle demonstrate the latter. The exact representation of words like *enfant* is disputed. They differ from pairs like *le livre/ la livre* because of the obvious semantic connection. Carroll (1989, p. 549) argues that masculine *enfant* and feminine *enfant* are two distinct lexemes, while Pinker (1984, pp 174-175) (as cited in Carroll 1989) writes that they are paradigmatically organized as two variants of the same lexical entry. However, this study does not address the question of épicène nouns.

Most of the complexity of gender attribution centers on the gender of inanimate, non-homophonous nouns. Morphologically complex nouns take on the gender of their head. Compounds, which are left headed, have the same gender as their left-most noun, as in the case *of une pause-café*, which is composed of *une pause* and *un café*.

Interestingly, deverbal compounds such as *un porte-monnaie* (verb + feminine noun) are always masculine (Carroll 1989, p. 565). In nouns with derivational suffixes, the suffix is the head and thus it determines the gender of the noun. There are a few cases of homophonous suffixes which indicate opposing genders. For example, the *–eur* of un *tricheur,* has an agentive sense and masculine gender while the *–eur* of *une valeur* denotes an abstract quality and is a feminine affix. Morphological knowledge of gender is highly productive but the gender of a given suffix is still arbitrary.

The gender of inanimate nouns can also be at least partially predicted by the phonological shape of the word's ending. Aronoff (1994 cited in Carroll 1999) suggests that many languages have similar types of gender cues. The basic prediction about phonological gender cues in French was made by Harley (1979). She proposes that words ending in consonant-vowel-consonant (CVC) stressed syllables tend to be feminine while those ending in consonant-vowel (CV) stressed syllables tend to be masculine. For example these cues predict the genders of *le Canadien* and la *Canadienne*. The validity and relevance of phonological cues will be discussed in section 1.2 on the acquisition of gender.

Grammatical gender is part of a native speaker's competence. L1 French speakers are highly accurate in their comprehension and production of gender. Knowledge of gender for the native speaker is so internalized that they are often unaware of the morphological and phonological patterns described above.

However, native speakers do in fact make gender errors. Adult native speakers interviewed in Tucker, Lambert and Rigault (1977) reported having occasional difficulty,

particularly with vowel-initial words, which have less informative input.[3] Additionally,

Klapka (2002) (as cited by White et. al. 2004) found inconsistent gender assignment 7%

of the time in 19th century Quebec French.

Indeed, specific noun gender varies slightly, based on the region of the

Francophone community. Such differences are particularly evident in treatment of

animate nouns, such as words which denote professions. Unsurprisingly specific

instances of gender have also changed over time, resulting in some modern variability.

Le Bon Usage (p. 715), an authoritative source on French (prescriptive) grammar, lists

pages and pages of nouns whose gender varies in different expressions or even across

singular and plural. For example :

> *Amour au sens « passion d'un sexe pour l'autre… » est ordinairement*
> *masculin au singulier et souvent féminin au pluriel… Cependant, on*
> *trouve, soit dans une langue littéraire assez recherchée, soit dans*
> *l'usage populaire que reflètent d'autres textes littéraires, amour au*
> *féminin singulier, tandis que le masculin pluriel appartient à tous les*
> *niveaux de langue, même au niveau littéraire.*

This existing variability in French and the imperfect usage of gender by individual

Francophones, is relevant because experimental work must define a concrete threshold of

acquisition. Section 1.3 on L2 acquisition of gender contains a discussion of definitions

of acquisition based on experimental performance.

1.2 L1 Acquisition of Gender

There is much debate about the cues used by both L1 and L2 learners in their

acquisition of gender. Below is a summary of previous research, with emphasis on the

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[3] Both masculine and feminine definite determiners surfaces as l' before a vowel as in *l'arbre* (m) and *l'aria* (f).

debate about the relative importance of syntactic cues as opposed to phonological and morphological cues.

Tucker et al (1968, 1977) did a landmark study of L1 French and phonological clues to gender. They statistically analyzed the nouns in the *Petit Larousse* and found a systematic relationship between gender and word ending. Then they tested native speakers of French and found that they assign gender to rare and nonce nouns "in accordance with the distributional regularities between gender classification and noun ending (p. 64)." They propose that francophones process new or less familiar words from right-to-left, stopping when they find a termination that "becomes a coherent, meaningful unit from the standpoint of gender assignment." By their analysis, L1 acquisition of gender is rule-governed and dependent on sufficient relevant linguistic input.

Karmiloff-Smith (1979) built on Tucker et al. evidence for the importance of phonological cues. She tested francophones between the ages of three and eleven for their reliance on different types of cues when determining gender. To compare syntactic and phonological cues, she gave the children an indefinite article and a noun which contained a phonological cue. She then elicited the same noun with a definite article. Some of the input had conflicting clues, such as *un goltine*, where the article is masculine but the *–ine* ending suggests feminine. In cases where the cues did not conflict, kids of all ages performed very accurately. Younger children gave more weight to the phonological cues, matching the gender of the definite article provided to the gender predicted by the noun ending. She writes, "As early as 3 to 4 years, i.e. as soon as articles were used consistently, the child constructed a very powerful, implicit system of phonological rules, based on the consistency, but not necessarily on the frequency, of

phonological changes in word endings (p. 167)." As the age of the subjects increased, their attention to the syntactic input increased, eventually winning over phonological cues.

In another task, children were given a picture suggesting natural animate gender and a noun with a phonological cue. When these cues conflicted, the phonological cue won over the semantic cue for children of all ages. She also included test cases for nouns which did not include a phonological cue. In the absence of phonological cues, even the younger children successfully used syntactic and semantic cues (p. 168).

She notes that phonology remained important for the older children, even as they relied more and more on syntactic cues. She writes:

> "they also consistently made revealing changes in the suffixes so that the latter agreed with the article or the sex of the person (e.g. for 'un forsienne' they respond 'le forsien'; for 'une bicron' they respond 'la bicronne') or they avoid pronouncing the suffix by using the definite article and agreed adjective (ie 'la grise' instead of 'la bicron grise'). In both cases they avoided the conflict between two competing procedures, leaving the phonological one intact (p. 168)."

Carroll (1989) agrees that phonology plays an important role in the early development of L1 gender, but she works from a different angle and directly disagrees with Karmiloff-Smith's analysis. Phonology is important only insofar as it is helpful in determining the variable syntactic representation and role of determiners, not the phonological form of the noun. In her analysis, determiners are the predominant cue. Many researchers (Sourdot 1977), have found that articles are initially analyzed as being part of nouns in young children's L1 French. In Carroll's analysis, this is a key difference in L1 and L2 acquisition. It is the initial collapsing of determiners and nouns by L1 learners and the subsequent reanalysis of determiners as distinct lexemes which

activates the gender feature of UG (p 573).   She maintains that L1 speakers do not make systematic gender errors, even at very young ages. She uses this fact to argue against a rule-based system or one based on forming and testing hypotheses.

Carroll (1989) rejects the importance of phonological word endings proposed by Tucker et. al. (1977) and Karmiloff-Smith (1979). She argues that given her claim that adults do not use phonological word endings, Karmiloff-Smith's theory would require a 'radical discontinuity' between child and adult grammars. She also points to the lack of rigor in defining 'endings' structurally[4] and writes that gender is simply not predictable from them. Carroll (1999) revises her previous claim about endings and suggests that they be viewed as 'low-level phonetic schemata.'

1.3 L2 Acquisition of Gender

An important question in L2 acquisition of gender is the effect of L1 transfer. A discussion of transfer is relevant to this paper because it makes predictions about the possible L2 end-state of speakers whose L1 has no grammatical gender, as in the case of L1 English.

The failed functional feature hypothesis (FFFH) states that adult learners are incapable of acquiring uninterpretable features in their L2 which are not used in their L1. (Hawkins & Franceschina 2004) (as cited in White et. al. 2004). The FFFH predicts that L1 speakers of a language like Spanish, which has gender, can successfully acquire gender in an L2 like French. However, without the transfer from a gendered L1, L2 gender can never be acquired. It proposes that speakers of a language such as English are incapable of acquiring the uninterpretable features on determiners and adjectives, which

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[4] She means that non-suffix endings are ill-defined.

arise through agreement with the interpretable gender feature of the noun. In other words, Anglophones can learn the gender of nouns but they cannot learn gender agreement. Hawkins and Franceschina (2004) claim that advanced L2 speakers of French (with L1's like English) have grammars that are similar to early L1 French grammars, where they have failed to establish the uninterpretable feature for gender agreement.

The FFFH claims that the problem is in gender agreement rather than representation in the lexical entries of nouns. Therefore my experiment, which tests L2 acquisition of gender on nouns, with no mention of syntactic agreement, does not directly address the proposal of the FFFH.

In contrast to the FFFH, the Full transfer/Full access (FTFA) model predicts the possibility of acquisition of all L2 features by advanced speakers, due to their continued access to UG (Schwartz and Sprouse 1994, 1996) (as cited in White et. al. 2004). White et. al. (2004) supports the FFFH in a study of L2 Spanish where L1 French and English speakers perform similarly well on production and comprehension tasks.

Like the FFFH, Carroll (1989) predicts non-acquisition of gender by L1 speakers of a language like English. However, she disagrees with the FFFH regarding the source of the L2 problem. She proposes that adult L2 learners cannot acquire gender in the lexical entries of nouns themselves because the gender feature 'atrophies' when it is not employed by the L1 (p. 574).

A critical problem with both Hawkins and Franceschina (2004) and Carroll (1989) is that they have made their theories of non acquisition unfalsifiable by justifying high L2 performance as something other than the acquisition of gender. Hawkins and

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Franceschina (2004) compared the spontaneous production of L2 Spanish of highly

advanced L1 English and L1 Italian speakers. They found that the Italians performed

perfectly while the Anglophones made gender agreement errors 8% of the time. To

explain the success of the Anglophones without allowing that they acquired the

uninterpretable gender feature, they write:

> "Speakers with long immersion in and L2 are presumably likely to get
> close to native-like D-N gender concord with nouns which they use
> actively in production, even if they have a concord system based on
> selecting articles probabilistically in terms of noun phonology. This is
> because extensive exposure to primary linguistic data would allow them to
> learn exceptions to semi-productive rules."

Similarly Carroll (1989 p. 578) writes that "… Anglophones should not be able to

retrieve the gender specification of the noun on-line (although they might be able to

resort to some heuristic, a testable prediction)."

An examiner of Hawkins and Franceschina (2004) commented on the high

performance of the Anglophones. Their response was that errors can carry more weight

than a simple percentage can suggest. They write:

> "… Epstein, Flynn and Martohardjono point out that '… it is simply not
> clear whether there is a correlation between any percentage of correct
> usage of a particular aspect of grammar and knowledge of that aspect'
> (1998: 64-65). The problem is that we know that spontaneous production
> data may only be indirectly associated with underlying representations….
> The decision about what weight is to be given to non-target-like properties
> is ultimately determined by the theory one holds about the representation
> of the property in question (Hawkins & Franceschina p. 201 note 10)."

This paper, approaches second language acquisition (SLA) in the framework of

FTFA, meaning that regardless of L1, advanced L2 learners of French are expected to be

able to acquire gender, in principle.[5] Because there are only four tokens of each type on

the testing day, acquisition will be defined as 75% accuracy.

1.4 Cues in Gender Acquisition

Carroll (1999) writes that, "If the learner is to learn, he must perceive the

objective properties of the stimulus so that patterns can be detected and encoded, but his

cognitive system serves as a filtering function (p. 44)." It is only logical that speakers

with different linguistic experience will have different cognitive systems and thus make

different initial observations and generalizations, causing them to follow different paths

to acquisition; speakers of different L1's in the process of L2 acquisition and children in

the process of L1 acquisition will be sensitive to different types of input cues for

grammatical gender. Controversy over the interaction of phonological, phonetic,

morphological, syntactic and semantic cues used in L2 acquisition motivated this study.

The form of the determiner is the most important gender cue in L1 acquisition,

according to Carroll (1989). Native speakers first produce unanalyzed determiner + noun

combinations (Sourdot 1977) (as cited in Carroll 1989). When they realize that

determiners are distinct syntactic words they are able to abstract gender from their

phonological form and trigger the parameterized gender property of UG. Carroll

acknowledges the strength of morphological cues, without crediting them with a role in

the activation or acquisition of gender features. She denies the relevance of phonological

and phonetic cues, stating that "there are many counter-examples to any rule that operates

on the basis of final syllable shape. Gender is simply not predictable from it," (p. 564).

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[5] The L1 is still significant to the process of acquisition and FTFA does not predict that speakers from different L1 will perform similarly at all developmental stages of their L2 grammar.

By Carroll's (1989) theory, L2 learners initially analyze the determiner as a distinct syntactic word, transferring their L1 knowledge of definiteness, possession, number, etc. This causes them not to be sensitive to the gender information contained in the determiner.[6] Their linguistic maturity causes their conceptual and lexical knowledge to take precedence over the objective input. Carroll (1999) did a study of beginner adult L2 French (L1 English) in which she tested their sensitivity to phonological, morphological and semantic cues. She controlled for frequency and reliability of cues by teaching learners lists that exemplified different possible generalizations. Her results showed that early L2 beginners were predisposed to semantic cues, which might be a result of semantically based gender on English pronouns. They appeared to have ready access to morphological structure but no sensitivity to the phonological ends of words.

Hawkins and Franceschina (2004) agree with Carroll (1989) that syntactic cues are critical to the acquisition of gender agreement. In further agreement with Carroll (1989), Hawkins and Franceschina reject the claim of Karmiloff-Smith (1979) that phonological cues are important for L1 learners. They suggest that L2 learners with L1's like English "will not proceed beyond the stage of probabilistic selection of the determiner forms on the basis of noun phonology, (p. 187)" resulting in non-acquisition of the uninterpretable gender features of determiners and adjectives.

Because of my focus on cues, it is worth mentioning one theory outside the domain of generative linguistics. Sokolik and Smith (1992) used a computer learning model that can successfully classify nouns by gender based on words input in their orthographic forms. Their results challenge the fundamental claims of traditional linguistics; they propose that there are no rules of gender attribution or agreement, no

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[6] It is also argued that L2 learners do not recognize the obligatory clitic status of French determiners.

concept of nouns marked by features, and no attention to the phonological or morphological structure of the words. These claims are consistent with the Competition Model (MacWhinney 1987), which proposes acquisition based on the strength and validity of cues in the input, without a mechanism such as UG. A critical limitation of Sokolik and Smith (1992) is that it seems unlikely that their model can be extended to auditory input. There are considerably more possible spelling combinations than there are sounds that they represent. Nevertheless, recognition of the concepts of cue strength and validity is relevant to this study.

1.5 Present Focus

This study is largely motivated by Carroll's (1999) results which suggest that L2 learners do not observe phonological patterns. She studied extreme beginners and so I test intermediate L2 speakers, to see how or if their sensitivity to cues has developed along with their overall proficiency. My study is also designed to test learners' sensitivity morphological structure, which would suggest fallibility in proposals such as that of Sokolik and Smith which ignore structure.

It is true that by isolating nouns from naturalistic context and giving immediate feedback in some tasks, I have created a very metalinguistic task. However, like Tucker et. al. and Carroll (1999), I suggest that metalinguistic studies can be very informative. One advantage my test has over spontaneous production is that subjects cannot avoid unfamiliar words or words whose gender is unfamiliar. I can also control the input and thus include rare cues.

The inclusion of text-to-speech (TTS) stimulus is inspired by the practical consideration of new possibilities for personalized and focused methods of second language education. Technologies such as TTS are continuously evolving and so it is necessary to periodically test whether or not they are ready for use in new applications. Although they currently do not sound quite like a real speaker in most cases, their quality might be sufficient for some educational purposes.

2 Method

2.1 Participants

Participants were 24[7] native speakers of English and four native speakers of Quebec French. They were recruited through an advertisement on the McGill University online classifieds which sought beginner to intermediate adult learners of French, or native speakers, in the latter case. Subjects were paid 15$ for their participation.

All subjects were present or former university students between 19 and 30 years of age, with an average age of 22 years. On the first day of testing, they were asked questions about their linguistic backgrounds[8] and asked to rate themselves on their French proficiency. For the L2 learners of French, the average age of exposure to French was 13. The median age was 13 and the range of ages was 9 to 21.

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[7] Four subjects were excluded because of extremely early exposure to French or another gendered language.
[8] See appendix A.

Chart 2.1

Age of Exposure to French

A bar chart titled "Age of Exposure to French" with the y-axis labeled "Subjects" ranging from 0 to 4, and the x-axis labeled "Age" ranging from 9 to 21. The values are: age 9 = 2, age 10 = 3, age 11 = 2, age 12 = 2, age 13 = 3, age 14 = 3, age 15 = 2, age 17 = 1, age 18 = 1, age 21 = 1.
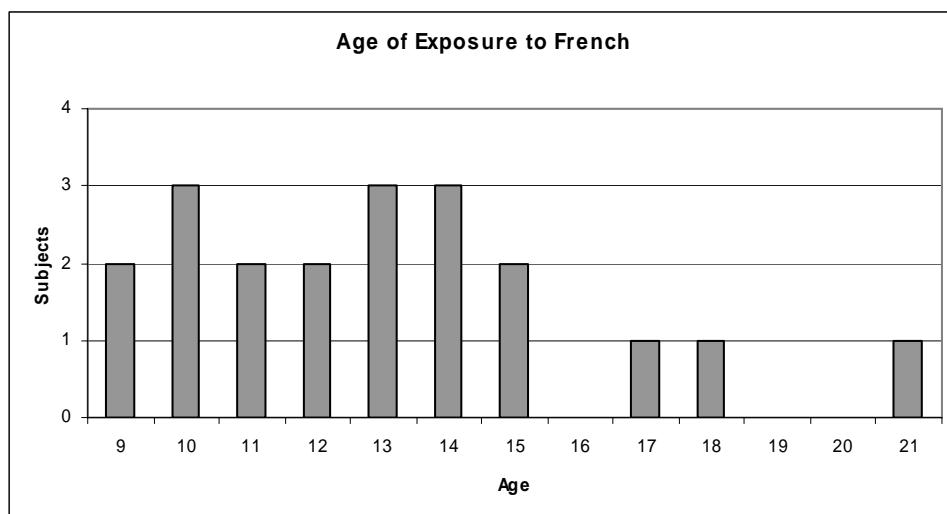
Because of the emphasis on bilingualism in Canadian education and subjective definitions of exposure and learning, these figures are assumed to have limited accuracy. Many subjects reported starting French at age 10 in school but "only singing songs and stuff and not really learning to speak at all until the age of about 14." The range of French levels among subjects is due to this variability in self-ratings of proficiency. They were placed in to groups according to their language backgrounds and the order in which they were tested.

2.2 Materials

Tests were conducted in the McGill linguistics department using an Apple powerbook G4 laptop, a headset and a USB mouse. A Java applet program displayed a simple interface, consisting of 'masculine,' 'feminine,' and 'next' buttons and presented subjects with isolated French nouns, in audio format only.

Two different voices were used for the audio stimulus, a genuine human voice and an artificially generated voice. The former was the voice of a 22 year-old female

francophone Montréaler. The latter was a text-to-speech (TTS) voice made by Cepstral

LLC[9]. I used *Isabelle*, their Canadian French female voice. Both the real voice and the

TTS voice were prerecorded and included in the applet as .mp3 files.

2.3 Stimuli

All words and measures of frequency come from subsets of a lexicon downloaded

from www.lexique.org. This corpus includes 52,000 nouns. I restricted this to a group of

29,600 singluar and single-gender nouns. Frequency and accuracy of morphological cues

was determined from this set of words.

Table 2.3.1 - Morphological cues

cue	tokens	% masc	% fem	example
jER	301	0.3	99.7	*fleurière*
sj§	1904	0.2	99.8	*fluxion*
aZ	970	99.2	0.8	*pâturage*
scope	27	100	0	*laparoscope*
@	1073	99.2	0.8	*soulagement*
eur	1253	100	0	*tricheur*
ism*	799	100	0	*nepotisme*
t?	229	8.31	92	*simplicité*
tyd	44	0	100	*concrétude*

The phonological cues were selected from a slightly more selective and better-regulated

set of 22, 632 words. Accuracy and frequency measurements represent the absolute

count of words with a given phonetic ending. It is not restricted to monomorphemic

words.[10]

Table 2.3.2 - Phonological cues

cue	tokens	% masc	% fem	example
/b/	39	53.8	46	*bombe*
/d/	244	29.1	71	*seconde*
/f/	115	77.4	23	*giraffe*
/g/	50	48	52	*blague*
/G/	19	100	0	*parking*
/k/	138	0	##	*rubrique*
/l/	627	51.5	49	*voyelle*
/m/	212	81.1	19	*victime*
/n/	462	20.8	79	*tisane*
/N/	35	25.7	74	*montagne*
/p/	100	39	61	*pipe*
/R/	1441	66.1	34	*voiture*
/s/	733	26.1	74	*sauce*
/S/	126	26.2	74	*touche*
/t/	664	19.6	80	*pointe*
/v/	97	10.3	90	*grève*
/z/	307	12.1	88	*pause*
/Z/	341	89.7	10	*rage*
/i/	782	34.65473	65	*tapis*
/e/	1509	46.52087	53	*sanglier*
/a/	390	81.79487	18	*repas*
/*/	859	67.86962	32	*sucre*
/y/	168	59.52381	40	*but*
/u/	87	82.75862	17	*trou*
/O/	451	92.01774	8	*peau*
/E/	292	93.83562	6	*forêt*
/2/	92	100	0	*jeu*
/5/	344	98.54651	1	*faim*
/@/	935	99.35829	1	*talent*
/§/	1454	94.3	6	*cochon*

The stimuli for the first day of testing are detailed in table 2.3.1. The set

consisted of 96 words, of which 50 were feminine and 46 were masculine. The intention

was to include eight words per category for six feminine and six masculine endings. An

error resulted in an imperfect balance of tokens per word type.[11] However, this slight imbalance is not significant for the final data set. Half of the masculine and half of the feminine words have transparent morphological suffixes. The remaining words are overtly mono-morphemic and their cues are phonological.

Table 2.3.1 – Day One Words

tokens	sound	gender	example	cue type	description
8	z	fem.	*surpise*	phonological	c-final pattern
8	t	fem.	*suite*	phonological	c-final pattern
8	v	fem.	*guimauve*	phonological	c-final pattern
8	S	fem.	*lèche*	phonological	c-final pattern
2	s	fem.	*drisse*	phonological	c-final pattern
8	tyd	fem.	*concrétude*	morphological	c-final pattern
8	té	fem.	*simplicité*	morphological	exception to v-final pattern
6	a	masc.	*chocolat*	phonological	v-final pattern
6	@	masc.	*talent*	phonological	v-final pattern
8	2	masc.	*dieu*	phonological	v-final pattern
8	O	masc.	*numero*	phonological	v-final pattern
8	eur	masc.	*tricheur*	morphological	exception to c-final pattern
8	ism*	masc.	*nepotisme*	morphological	exception to c-final pattern
2	m@	masc.	*enseignement*	morphological	v-final pattern

The second day's stimuli consist of 112 words. There are 10 novel endings introduced on day two, shown in the upper part of table 2.3.2. Five endings are feminine cues and five are masculine. Four cues are phonological and six are morphological. For each of these new endings, the word set includes two new existing French words and two nonce[12] words. These endings account for 40 words.

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[11] The group for the phonological ending /@/ inadvertently included two words which were further specified to have the morphological ending /m@/, as in *soulagement*. Both phonological /@/ and morphological /m@/ are masculine cues. Two tokens of /s/ were accidentally substituted for two tokens of /a/.

[12] All nonce words were reviewed by a native speaker of Quebec French to verify that they had the ring of real French words.

The remaining 72 words include six words[13] per ending for each of the 12 endings included in the day one stimuli. For each ending there are two new existing words, two nonce words and two words repeated from the day one set.

Table 2.3.2 – Day Two Words

tokens	sound	gender	example	group	cue type	description
4	N	fem.	*vigogne*	novel	phonological	c-final pattern
4	n	fem.	*bécane*	novel	phonological	c-final pattern
4	s	fem.	*drisse*	novel[14]	phonological	c-final pattern
4	jER	fem.	*fleurière*	novel	morphological	c-final pattern
4	sj§	fem.	*fluxion*	novel	morphological	exception to v-final pattern
4	E	masc.	*genêt*	novel	phonological	v-final pattern
4	5	masc.	*scrutin*	novel	phonological	v-final pattern
4	u	masc.	*licou*	novel	phonological	v-final pattern
4	aZ	masc.	*pâturage*	novel	morphological	exception to c-final pattern
4	skOp	masc.	*laparoscope*	novel	morphological	exception to c-final pattern
6	z	fem.	*surpise*	day 1	phonological	c-final pattern
6	t	fem.	*suite*	day 1	phonological	c-final pattern
6	v	fem.	*guimauve*	day 1	phonological	c-final pattern
6	S	fem.	*lèche*	day 1	phonological	c-final pattern
6	té	fem.	*simplicité*	day 1	morphological	exception to v-final pattern
6	tyd	fem.	*concrétude*	day 1	morphological	c-final pattern
6	a	masc.	*chocolat*	day 1	phonological	v-final pattern
4	@	masc.	*talent*	day 1	phonological	v-final pattern
6	2	masc.	*dieu*	day 1	phonological	v-final pattern
6	O	masc.	*numero*	day 1	phonological	v-final pattern
2	m@	masc.	*soulagement*	day 1	morphological	v-final pattern
6	eur	masc.	*tricheur*	day 1	morphological	exception to c-final pattern
6	ism*	masc.	*nepotisme*	day 1	morphological	exception to c-final pattern

---

[13] The exception is that /@/ again included two words whose cue was actually /m@/. One /m@/ word was nonce and the other was a repeat from day one, meaning that /@/ included one nonce word, one repeat word and two new existing words.

[14] The /s/ ending is listed as novel because only two tokens of /s/ were included in the day one stimuli, as compared to eight tokens of the other endings taken from day one.

2.4 Procedure

2.4.1 General

On the first day, subjects were asked the language background questions included in appendix A. They were placed in test groups, according to their proficiency, as described in section 2.1. I devised a proficiency index, based on my own estimations of the relative importance of aspects of the subjects' language backgrounds. It was calculated with the equation below:

- Proficiency Index = Age of Exposure + overall proficiency + speaking proficiency

Subjects who started French between the ages of 9 and 13 were given 3 points for Age of Exposure. Those who started between the ages of 14 and 21 were given 2 points. Overall proficiency and speaking proficiency are on a scale of 0 to 4 and come from subjects self-evaluations.

Test groups were defined by the voice used in the version of the test program and the instructions given to subjects. Table 2.4.1 describes the distribution of subjects into test groups. Subjects heard the same voice for both the first and second day of testing. The twelve L2 learners in the *directed* groups were told "to pay special attention to the end of the word" when trying to determine its gender. The *undirected* group was not given any hint about the importance of word endings to gender. The francophones were also not given any directions regarding word endings. All groups were told that they were not expected to know all of the words, and that guessing was expected.

Table 2.4.1 – Distribution of Subjects

	L2 French				L1 French	
	directed	undirected				
Real voice	8 subjects	8 subjects		**Real voice**	2 subjects	
TTS voice	4 subjects	4 subjects		**TTS voice**	2 subjects	

Subjects listened to one word at a time. Then they used the mouse to click 'masculine' or 'feminine' on the screen. To hear the next word,[15] they pushed 'next.' They were told to answer at a "quick but steady pace." The results of using the program were printed to the command line, which was not visible to the subject. After each test, the data were manually copied from the shell into text files and saved.

Every word corresponded in one line of data, a sample of which is shown in table 2.4.2. Iteration is Boolean, which will be further explained in section 2.4.2. The possible values for errorType are: z for correct feminine responses, y for correct masculine responses, w for the over application of feminine, and x for the over application of masculine. For example, the second line of the table shows us that user *orly*, heard the word "*fossette*" from the TTS voice. The cue for *fossette* is a phonological /t/ ending. It took *orly* a little less than three seconds to respond with the correct answer, which was feminine, making her errorType value z. At this point, she has labeled 1% of 96 words correctly.

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[15] One problem with the applet program was that when subjects went through words too quickly, occasionally (maximally two in ten words) a word would fail to play when they clicked 'next.' For this reason, there was a 'replay' button at the bottom of the screen. Subjects were told that they were only to hear words once, so they should only use the replay button when they failed to hear any audio for a word.

Table 2.4.2 – Sample Output

user,	test, voice, listenTime, respTime, syllables, cue, word, iteration, frequency, accuracy, gender, errorType, score
1	orly, day1a, TTS/, 9:46:43:377, 9:49:50:405, 2, O, vélo, false, 13, wrong, m, w, 0%
2	orly, day1a, TTS/, 9:49:51:419, 9:49:54:22, 2, t, fossette, false, 1.19, right, f, z, 1%
3	orly, day1a, TTS/, 9:49:57:59, 9:49:59:513, 2, v, alcôve, false, 2.97, wrong, f, x, 1%
4	orly, day1a, TTS/, 9:50:0:596, 9:50:2:398, 1, 2, noeud, false, 10.9, right, m, y, 2%
5	orly, day1a, TTS/, 9:50:3:667, 9:50:5:539, 1, S, roche, false, 14.9, right, f, z, 3%
6	orly, day1a, TTS/, 9:50:6:596, 9:50:8:766, 3, @, pétillement, false, 0.71, right, m, y, 4%
7	orly, day1a, TTS/, 9:50:9:812, 9:50:12:125, 3, 2, camaïeu, false, 2.13, right, m, y, 5%
8	orly, day1a, TTS/, 9:50:13:444, 9:50:16:133, 4, tyd, féminitude, false, 0.03, right, f, z, 6%

2.4.2 Day One - Teaching

I refer to the first day of testing as the teaching day, because subjects were given feedback and the opportunity to correct their mistakes. The feedback came in the form of immediate positive input, from which subjects could infer the accuracy of their responses. After a subject clicked *masculine* or *feminine*, the background color of the applet changed, to indicate the correct gender of the word the subject had just labeled. While the subject listened to a word, the screen was white. Then they clicked their response. If the word was feminine, the screen changed to a dark pink color. If it was masculine, the screen color changed to royal blue. Upon clicking *next*, to hear the next word, the screen color returned to white.

Another teaching aspect of day one was the opportunity for subjects to learn from their mistakes. At the end of a teaching set, the screen displayed the subject's percentage of accuracy with an invitation to repeat the words on which they had made errors. At this point, they were permitted to take a short break before clicking *yes* to begin the second iteration of the words they originally missed. In table 2.4.2, the value of iteration is false in all cases, meaning that *orly* was on her first pass at the given words. The second

iteration also gave color feedback, but the percentage accuracy for the second pass at the words was not shown at the end.

On the first day, the procedure was explained and then subjects did a short practice set,[16] so that they could see how the color feedback worked. The practice set consisted of five familiar words: bouche (f), garcon (m), maison (f), stylo (m) and voiture (f). Next subjects went through a randomized set consisting of the 96 words described in table 2.3.1. Then they saw their percentage accuracy and went through a second iteration of the words they missed. After a break, where the data from the first set were saved, they went through the same 96 words again, in a different randomized order. Again, they saw their score and cycled through the words they missed.

Lastly, they were asked about the difficulty of the task. More specifically they were asked if some words were easier or more difficult than others.

2.4.3 Day Two – Testing

On the second day, there was no feedback and no opportunity to correct mistakes. The screen was white throughout the randomized set of 112 words described in table 2.3.2. Subjects were not shown their final percentage.

After they finished, they were debriefed about the basic vowel/consonant phonological pattern and the importance of suffixes.

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[16] The words in the practice set were recordings of the author, who is Anglophone. None of the subjects heard TTS in the practice set.

3 Hypotheses

3.1 General Hypotheses

    3.1.1 Both the control group and the learners will be unaffected by the difference in quality of the TTS voice as compared to the real voice. The phonetic quality of the TTS voice will not affect their ability to hear/learn (or not hear/learn) phonological and morphological.

    3.1.2 All L2 groups will have a masculine default

This would be consistent with other findings, such as those of White et. al. 2004.

3.2 Teaching Day Hypotheses

    3.2.1 The directed group will be more accurate than the undirected group on both morphological and phonological cues during teaching.

Carroll's (1999) results suggest that L1 English L2 French beginner learners are more

sensitive to morphological cues than phonological cues.

3.3 Testing Day Hypotheses

    3.3.1 Native speakers will assign gender to existing and nonce words in accordance with morphological cues and the open syllable/ closed syllable pattern proposed by Harley (1979).

    3.3.2 The undirected group of L2 learners will not recognize the closed syllable / open syllable cue and will assign gender randomly to monomorphemic words.

    3.3.3 Those who learned (or knew) the open syllable / closed syllable cue on the teaching day will correctly incorporate new words with phonological endings first presented on the testing day.

    3.3.4 Morphological cues learned on the teaching day will not be extended to new morphological cues on the testing day, resulting in higher phonological scores on day 2.

4 Results

Charts 4.1 and 4.2 show that accuracy does improve with proficiency. Because the sample sizes of the TTS group an the Real group are very small and proficiency varies widely among individuals, a statistical comparison of the group does not makes sense. Instead I address hypothesis 3.1.1. with charts 4.1 and 4.2, which show that the TTS subjects perform within where they would be expected to perform if they had been listening to the real voice. From this I conclude that the lesser quality of TTS does not impact the learners' sensitivity to auditory cues.

Chart 4.1

Combined TTS and Real Voice Directed Group Accuracy

Chart 4.2

Combined TTS and Real Voice Undirected Group Accuracy
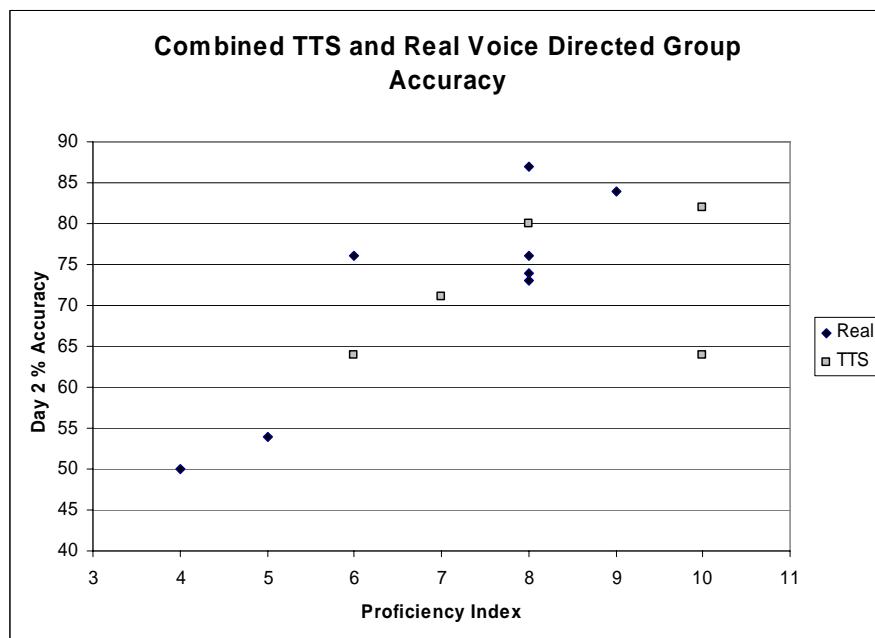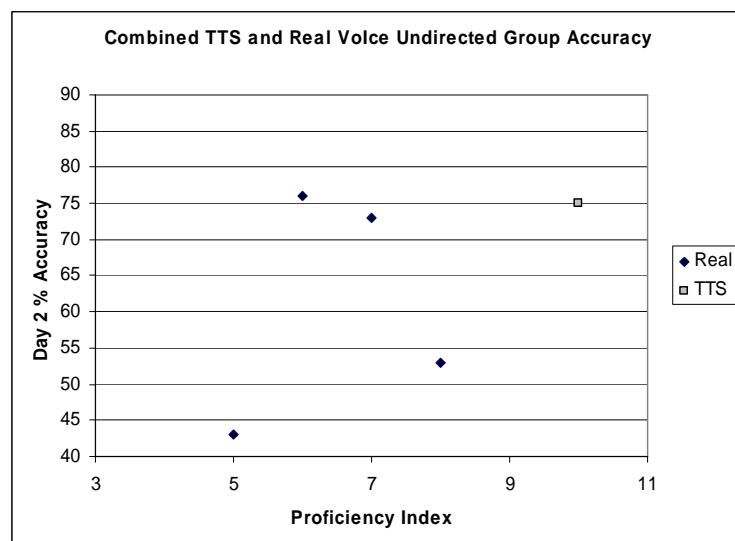
The undirected group is smaller than planned because some people placed in the group had actually had explicit instruction on gender in French class. Those people were added to the directed group, resulting in the imbalance.

Table 4.3 Redistribution of Subjects (compare to Table 2.4.1)

L2 French		L1 French
directed	undirected	
13 subjects average proficiency = 7.46	5 subjects average proficiency = 7.2	4 subjects

Because of the unevenness of the groups and the small size of the undirected group, most statistical comparisons are not applicable. Differences between the groups will be examined in the form of graphs, which might suggest patterns for further study.

The four native speakers (NS) did not all perform as accurately as expected. Their scores are described by table 4.3. It is not clear if the TTS voice had an effect on them. The lower performance of the TTS group might be due to the particular subjects. Subject Paris was a Montrealer who did all of her education in French prior to McGill. She said that she was better in French than anything else, but she did speak Chinese with her mother. Subject Vincennes was particularly nervous about the task, but had no potential language conflict.

Table 4.4

subject	day 1a %	day 1b %	day 2 %	Voice
paris	91	94	81	TTS
vincennes	86	89	88	TTS
bayonne	94	97	90	Real
cannes	93	97	92	Real

Based on the L2 TTS and Real comparison, which indicates no TTS effect, the two groups will be collapsed for the rest of the analysis, as shown in table 4.3. Charts 4.5 and 4.6 are histograms of the proficiencies of the informed and uninformed groups.

Chart 4.5

Chart 4.6

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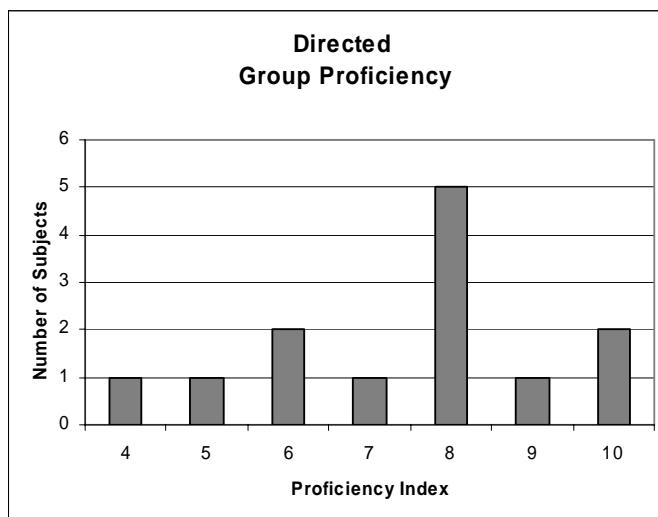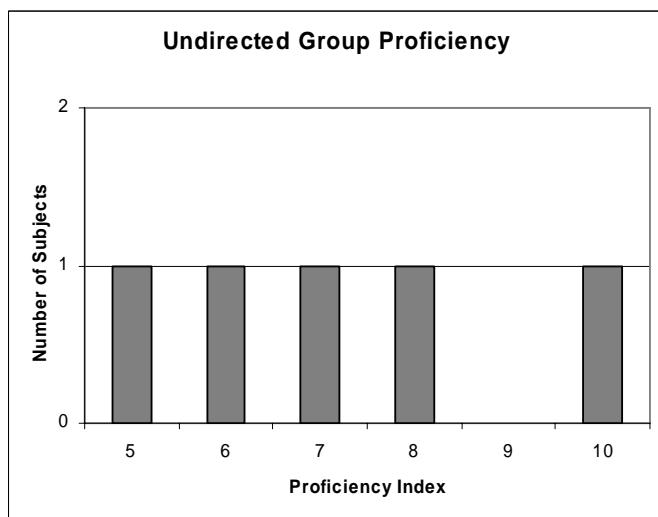
Based on Charts 4.7, directing the subjects' attention to the end of the words made a slight difference in performance. However, the undirected group is too small to make any strong claims.

Chart 4.7
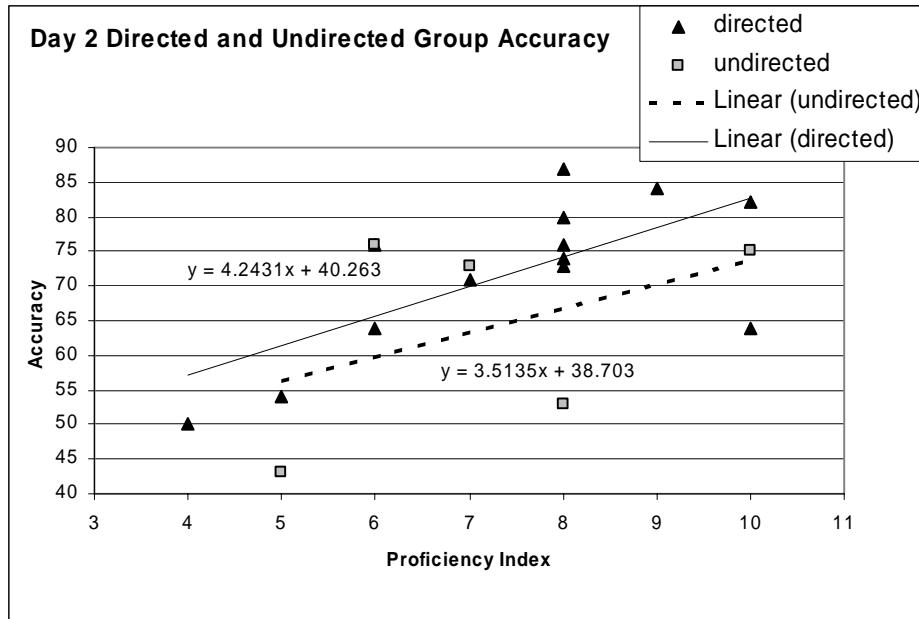
Chart 4.8 compares directed and undirected subjects' performance on the first day 1 set, when they have had considerably less feedback than on day 2, in chart 4.7. There appears to be a similar difference in performance, based on proficiency. Also, the slopes of the regression lines in chart 4.8 are less than those in 4.7, indicating that higher proficiency subjects improved more through the experiment.

Notice that the lowest accuracy subjects in charts 4.7 and 4.8 are within a few percentages of 50%, indicating that they were basically guessing randomly.

Chart 4.8

Day 1a Directed and Undirected Group Accuracy

Legend:
- ▲ directed
- ☐ undirected
- - - Linear (undirected)
- —— Linear (directed)

y = 1.8824x + 64.647

y = 2.4054x + 47.081

(y-axis: Accuracy, values 40, 50, 60, 70, 80, 90, 100)
(x-axis: Proficiency Index, values 3, 4, 5, 6, 7, 8, 9, 10, 11)
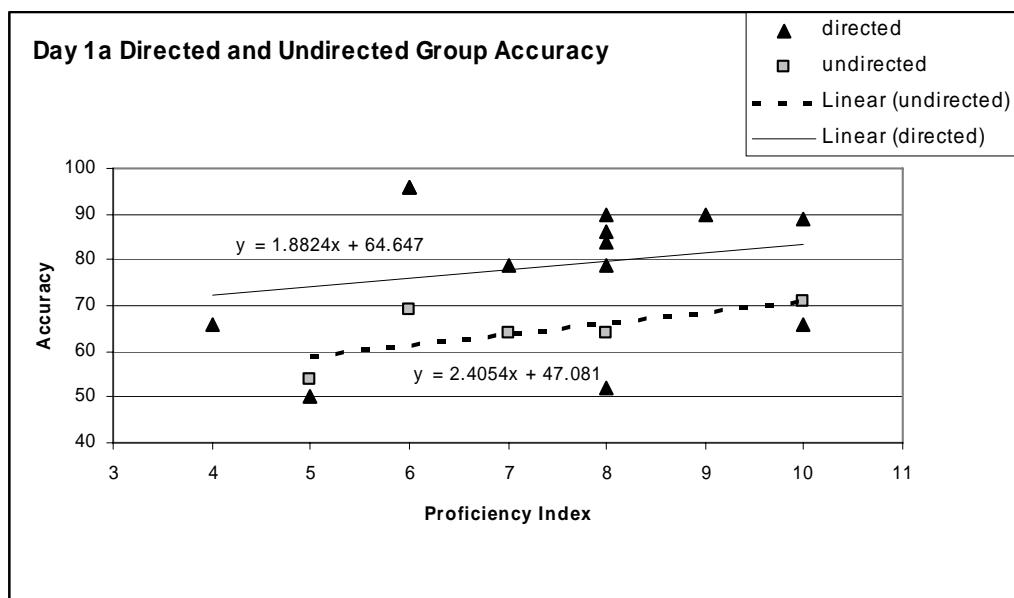
The directed and undirected groups are combined for the analysis of defaults,
making a group of 18 subjects. In charts 4.9 and 4.10, the x-value is calculated by
subtracting the number of w-errors (over application of feminine) from the number of x-
errors (over application of masculine). This means that the negative x-values represent a
feminine bias, while the positive values represent a masculine bias.

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Chart 4.9[17]

Day 1a Errors - Over Application

$y = -1.1617x + 11.306$

Masculine (x) / Feminine (w) vs Proficiency Index

Chart 4.10[18]

Day 2 Errors - Over Application

$y = -1.1126x + 8.2764$

Masculine (x) / Feminine (w) vs Proficiency Index

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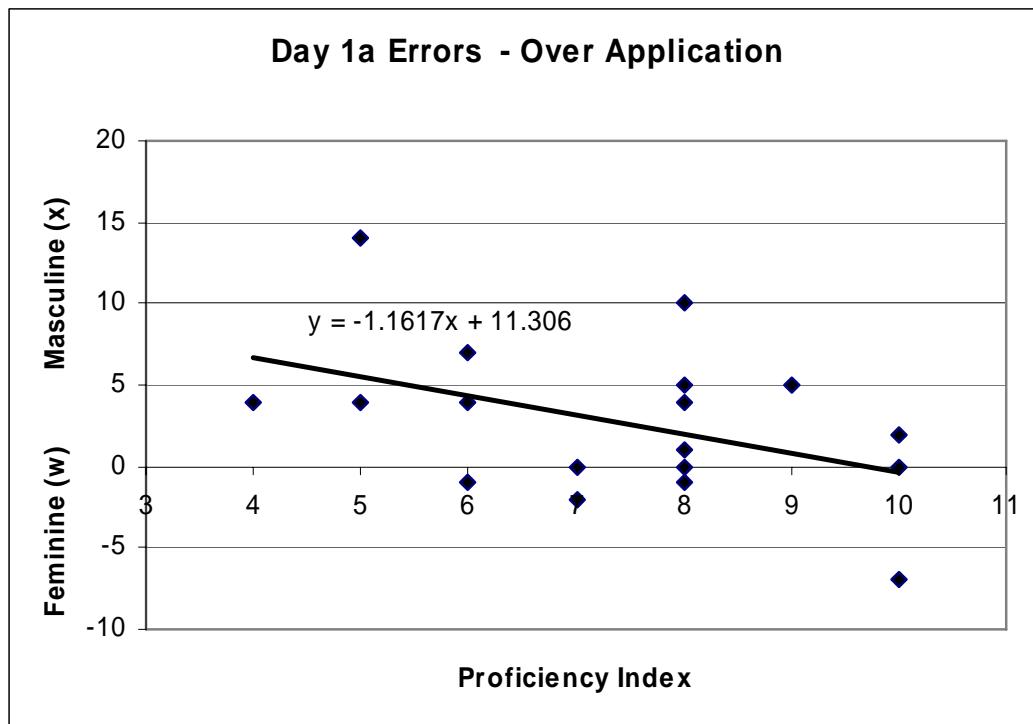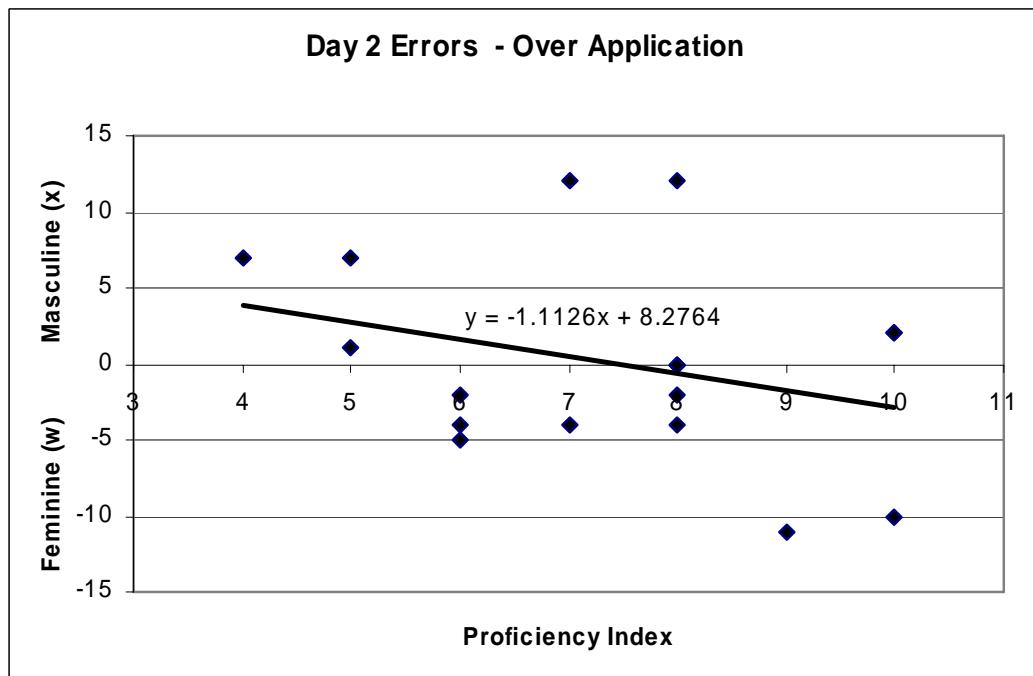
[17] Day 1 had 4 more feminine words than masculine words.
[18] Day 2 had 56 words of each gender.

The slopes of the trend lines in Charts 4.9 and 4.10 are almost identical, but the x-intercept of Chart 4.10 corresponds to a higher proficiency, indicating more over application of feminine on day 2. In table 4.11, the shift can be seen in terms of the number of subjects per default type. If a masculine default in more common, as suggested by the literature, these results could indicate hypercorrection due to the feedback of the teaching day (day 1).

Table 4.11 - Quantification of Defaults

n = 18	masculine default x > w	feminine default x < w	no preference x = w
day 1a	11	4	3
day 2	7	8	3

Table 4.12 - Individual Acquisition of undirected and directed groups ranked by proficiency index (ind)

	ind	d1 phon cues	a	@	2	O	z	t	v	S	d2 phon cues	5	u	E	s	n	N	d1 morph cues	eur	ism*	té	tyd	d2 morph cues	aZ	skOp	sjʃ	jER	d1	d2
				m				f					m			f				m		f			m		f			
a	5	1			x						2	x					x	0					1			x		1	3
b	6	6	x		x	x	x	x		x	5	x	x	x	x	x		2	x		x		4	x	x	x	x	8	9
c	7	4	x			x	x	x			4	x	x	x	x			4	x	x	x	x	1			x		8	5
d	8	2	x			x					2					x	x	1	x				1				x	3	3
e	10	5		x		x	x	x		x	2	x		x				3	x			x	x	4	x	x	x	x	8	6

	ind	d1 phon cues	a	@	2	O	z	t	v	S	d2 phon cues	5	u	E	s	n	N	d1 morph cues	eur	ism*	té	tyd	d2 morph cues	aZ	skOp	sjʃ	jER	d1	d2
				m				f					m			f				m		f			m		f			
f	4	2		x	x						1	x						1	x				0					3	1
g	5	0									2	x		x				0					1	x				0	3
h	6	4	x	x		x		x			3		x		x	x		2		x	x		1				x	6	4
i	6	8	x	x	x	x	x	x	x	x	5	x	x		x	x	x	4	x	x	x	x	0					12	5
j	7	8	x	x	x	x	x	x	x	x	4	x	x	x	x			4	x	x	x	x	0					12	4
k	8	4	x	x		x	x				5	x	x	x	x	x		1			x		0					5	5
l	8	8	x	x	x	x	x	x	x	x	6	x	x	x	x	x		2		x		x	1				x	10	6
m	8	7	x	x	x	x	x	x		x	4	x	x	x	x			4	x	x	x	x	2		x	x		11	6
n	8	8	x	x	x	x	x	x	x	x	5	x	x	x		x	x	4	x	x	x	x	2			x	x	12	7
o	8	7	x	x	x	x	x	x			4	x	x	x				4	x	x	x	x	4	x	x	x	x	11	7
p	9	8	x	x	x	x	x	x	**x**	x	5	x	x		x	x	x	4	x	x	x	x	2			x	x	12	7
q	10	5	x	x	x	x		x			3	x			x	x		2			x	x	1				x	7	4
r	10	7	x	x	x	x	x	x		x	3	x			x	x		4	x	x	x	x	1				x	11	4

The x's in table 4.12 represent 75% accuracy and I refer to the cues with 75% accuracy as 'acquired.' The day 1 data in table 4.12 was calculated by grouping all the data from day 1a, day 1b and both iterations where subjects had the opportunity to correct errors. The number of times a subject heard a cue is based on their individual performance. If they scored perfectly, they heard the cue 16 times on day 1. If they missed every single token of a cue, they heard the cue 32 times. The day 2 accuracy percentages are out of only four tokens per cue, where 3 of 4 or 4 of 4 is considered acquired.

Because the size of the directed and undirected groups are small and unmatched, it is difficult to compare them statistically. Adding the individual results of table 4.12, I get group scores for the directed and undirected group, as shown in table 4.13.

Table 4.13 - Group Acquisition

	day 1		day 2	
	phon	morph	phon	morph
undirected n = 5	18/40(45%)	10/20(50%)	15/30(50%)	11/20(55%)
directed n =13	75/104(72%)	36/52(69%)	48/78(61%)	15/52(29%)

The most surprising result in table 4.13 is that the undirected group performed much better than the directed group on day 2 morphological cues . The scores of the directed group illustrate how knowledge of phonological cues on day 1 transferred to success on day 2, while morphological cues were hit-or-miss because the morphological learning of day 1 did not transfer to day 2.

Table 4.14 is extracted from table 4.12 with cue acquisition sums at the bottom of the columns.

Table 4.14 - Individual Morphological Acquisition of undirected and directed groups

	index	d1 morph cues	eur	ism*	té	tyd	d2 morph cues	aZ	skOp	sj§	jER
			m		f			m		f	
a	5	0					1			x	
b	6	2	x		x		4	x	x	x	x
c	7	4	x	x	x	x	1			x	
d	8	1	x				1				x
e	10	3	x		x	x	4	x	x	x	x
			4	1	3	2		2	2	4	3

	index	d1 morph cues	eur	ism*	té	tyd	d2 morph cues	aZ	skOp	sj§	jER
			m		f			m		f	
f	4	1	x				0				
g	5	0					1	x			
h	6	2		x	x		1				x
i	6	4	x	x	x	x	0				
j	7	4	x	x	x	x	0				
k	8	1			x		0				
l	8	2		x		x	1				x
m	8	4	x	x	x	x	2		x	x	
n	8	4	x	x	x	x	2			x	x
o	8	4	**x**	**x**	**x**	**x**	4	x	x	x	x
p	9	4	x	x	x	x	2			x	x
q	10	2			x	x	1				x
r	10	4	x	x	x	x	1			x	
			8	9	10	9		2	2	5	6

One difficulty in choosing cues is the fact that phonological cues could be applied or misapplied to morphological endings. In table 4.14, the highlighted suffixes contradict the general -CV/masculine -CVC/feminine pattern. Their exact phonetic endings were excluded from the phonological cue set. The only day 2 morphological cue which did conform to the phonological pattern is -jER. Notice that both the directed and undirected groups were more accurate on -jER than other day 2 suffixes, when they had no feedback. Another possible conflict is that -jER is an animate suffix, mostly used in

words for feminine professions. The high performance of the undirected group on -eur, which is also animate, suggests that they might be more sensitive to animate suffixes.

On day 1, -tude conforms to the phonological pattern, but the overall accuracy is not much different than that of other suffixes, perhaps because of the feedback and correction.

It looks like subjects do apply phonological cues to morphological endings, particularly -aZ and -skOp. The higher accuracy of -sj§ suggests that they are also affected by the frequency and accuracy of the cue in the French language.

Table 4.15 - Comparison between day 2 performance and phonological cue frequency and reliability [19]

	masc			fem		
	E	**5**	**u**	**N**	**n**	**s**
corpus count	292	344	87	35	462	733
corpus % accuracy	**93.8**	**98.5**	**82.8**	**74.3**	**79.2**	**73.9**
L1 % accuracy	**87.5**	**87.5**	**68.8**	**56.3**	**100**	**56.3**
directed L2 % accuracy	**66.8**	**89**	**73.5**	**33.25**	**70.8**	**69.5**
undirected L2 % accuracy	**69.8**	**91**	**80.3**	**41**	**76.8**	**73.3**

Chart 4.16

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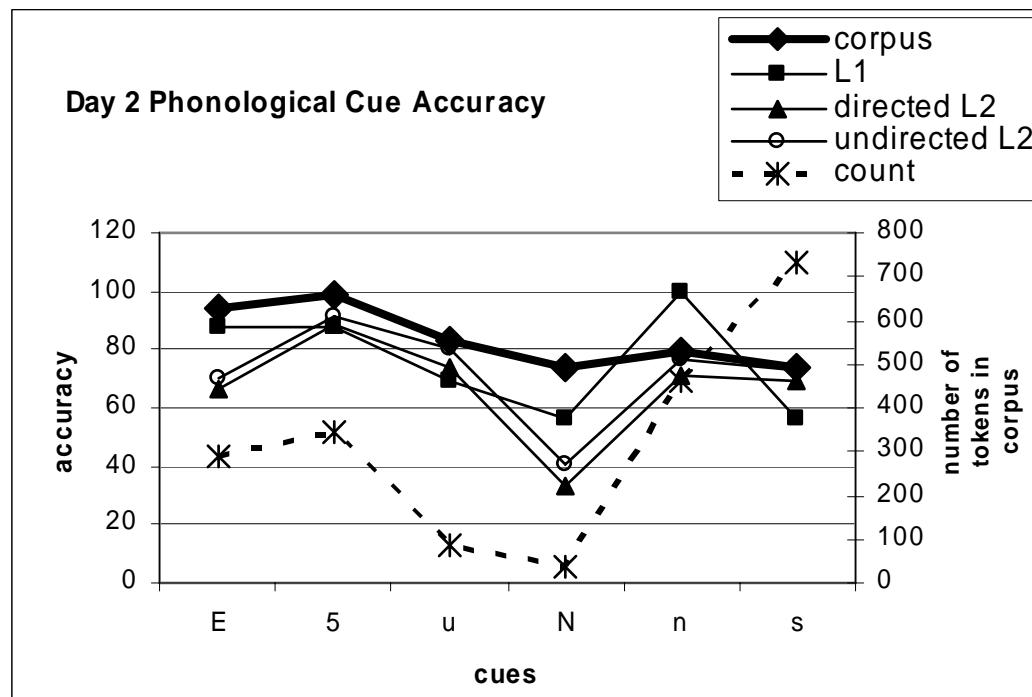
[19] There is a more detailed version of this table in the appendix.

Chart 4.16 supports the claim that subjects are influenced by the frequency and reliability of cues in the language, and thus in their natural input.

Table 4.17 - Comparison between day 2 performance and morphological cue frequency and reliability [20]

	fem **jER[21]**	fem **sj§**	masc **aZ**	masc **skOp**
count	301	1904	970	27
accuracy	**99.7**	**99.8**	**99.2**	**100**
L1 % accuracy	**100**	**93.8**	**100**	**68.8**
directed L2 % accuracy	**51.8**	**50**	**25**	**41**
undirected L2 % accuracy	**60**	**85**	**65**	**50**

Chart 4.18

Day 2 Morphological Cue Accuracy

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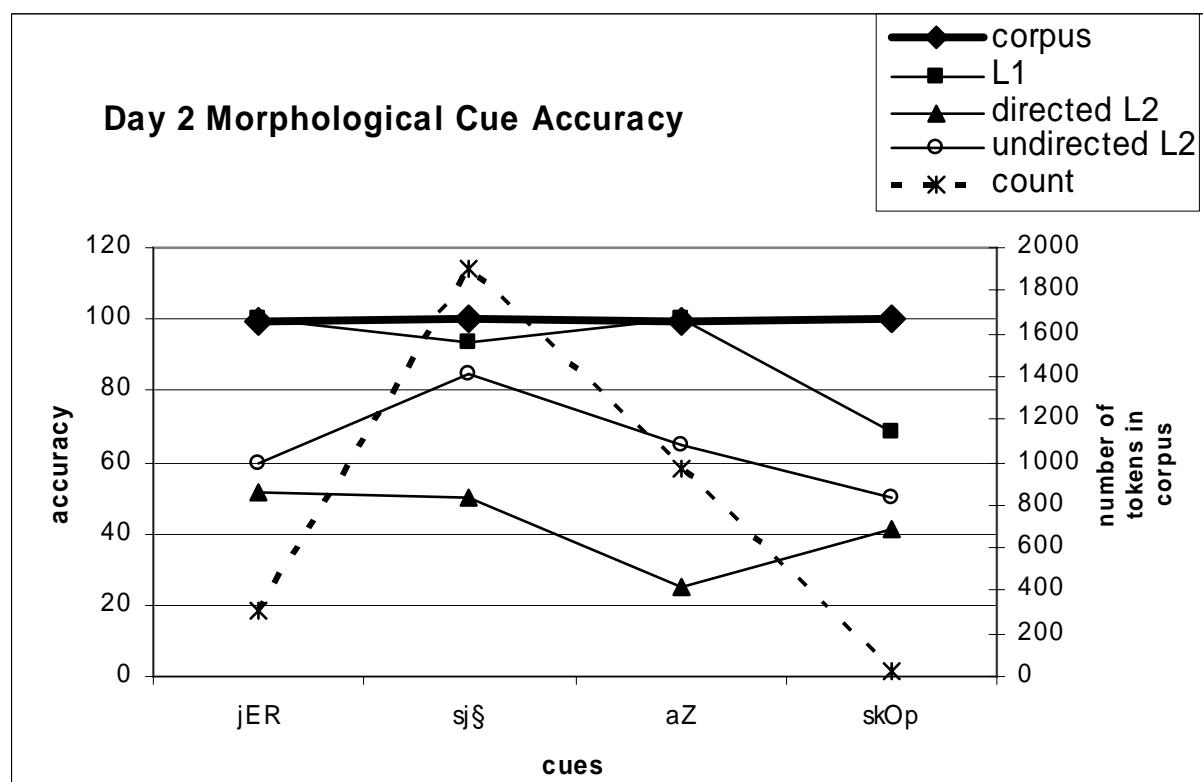
[20] There is a more detailed version of this table in the appendix.
[21] The corpus frequency and reliability was calculated using the following spellings:-ière, -tion, -xion, -sion, -age, -scope.

As evidenced by charts 4.16 and 4.18 and tables 4.15 and 4.17, the distribution of both phonological and morphological cues in the language affects learners' knowledge of the gender they predict. This happens despite the fact that I controlled for frequency and reliability in my test data.

Table 4.18 - Individual cue acquisition for undirected and directed groups

undirected	index	d1 phon cues	d2 phon cues	d1 morph cues	d2 morph cues	d1 total	d2 total
a	5	1	2	0	1	1	3
b	6	6	5	2	4	8	9
c	7	4	4	4	1	8	5
d	8	2	2	1	1	3	3
e	10	5	2	3	4	8	6

directed	index	d1 phon cues	d2 phon cues	d1 morph cues	d2 morph cues	d1 total	d2 total
f	4	2	1	1	0	3	1
g	5	0	2	0	1	0	3
h	6	4	3	2	1	6	4
i	6	8	5	4	0	12	5
j	7	8	4	4	0	12	4
k	8	4	5	1	0	5	5
l	8	8	6	2	1	10	6
m	8	7	4	4	2	11	6
n	8	8	5	4	2	12	7
o	8	7	4	4	4	11	7
p	9	8	5	4	2	12	7
q	10	5	3	2	1	7	4
r	10	7	3	4	1	11	4

Using the information from table 4.18, I found that on average, both groups had few acquired cues on day 2, with the exception of the undirected group which made a slight improvement on the morphological cues. As mentioned above, this might be due to their sensitivity to animate morphological cues.

Without limiting test items to nonce words, it is impossible to control exactly which test items are familiar to the subject. In table 4.19 and chart 4.20, I evaluate word frequency and found that L2 subjects showed a similar pattern to that of NS subjects. The word frequency statistic in the lexicon I use indicates the number of times a word occurs per million words in a large corpus of online text. I defined my word frequency groups as follows:

rare	frequency < 1
medium	$1 \leq$ frequency < 5
common	$5 \leq$ frequency

Table 4.19

	nonce	rare	medium	common
NS	149/176 (84.6%)	86/108 (79.6%)	102/104 (98.1%)	58/60 (96.7%)
L2	533/792 (67.3%)	327/486 (67.3%)	343/468 (73.3%)	217/270 (80.3%)

Chart 4.20

Word Frequency Effect on Proficiency
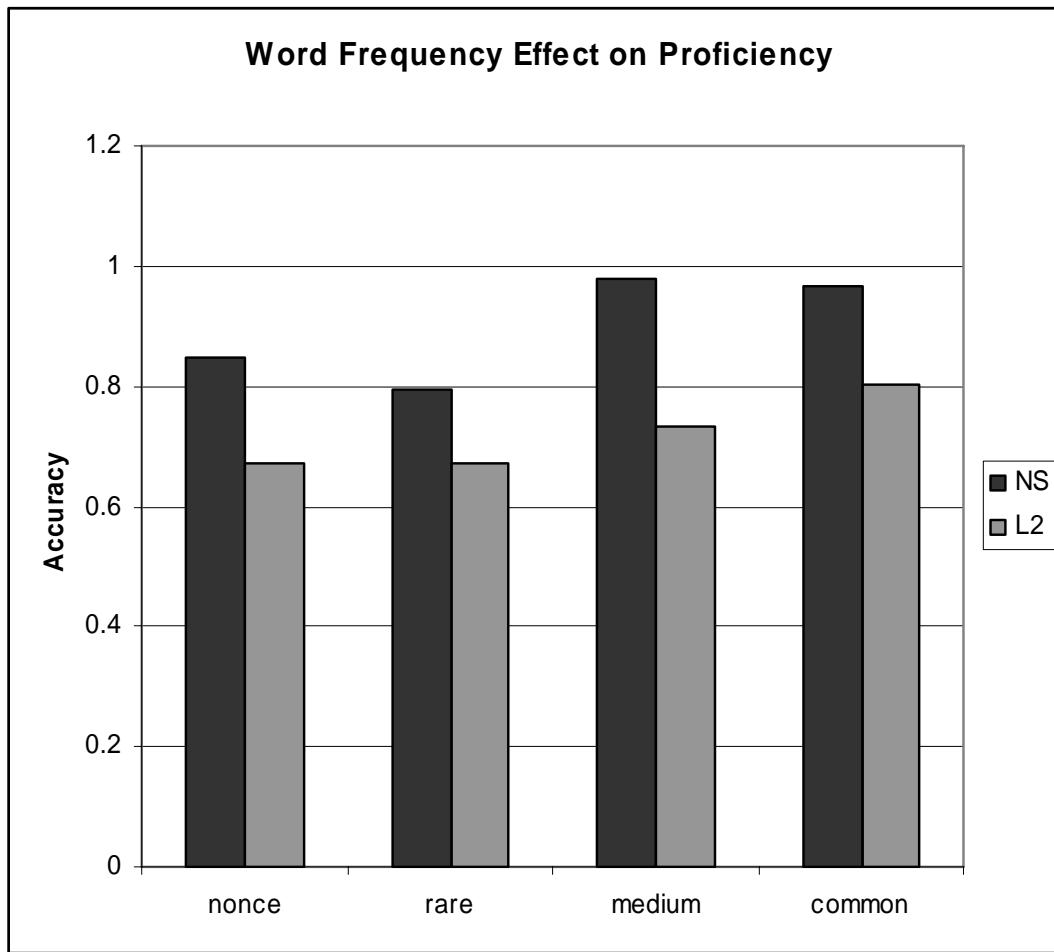
5 Discussion

> ***3.1.1*** *Both the control group and the learners will be unaffected by the difference in quality of the TTS voice as compared to the real voice. The phonetic quality of the TTS voice will not affect their ability to hear/learn (or not hear/learn) phonological and morphological.*

True. Chart 4.1 illustrates that TTS group subjects performed similarly to Real voice group subjects of similar proficiency.

> ***3.1.2*** *All L2 groups will have a masculine default*

False. Chart 4.9 and 4.10 show an interesting effect of proficiency on defaults. More advanced subjects were more likely to over apply feminine, particularly on day 2. As awareness of cues increased from the feedback of day 1, subjects used feminine more.

> ***3.2.1*** *The directed group will be more accurate than the undirected group on both morphological and phonological cues during teaching.*

True. Table 4.13 shows that the directed group was more accurate on day 1 cues. The differences between the groups appear to be significant.

> ***3.3.1*** *Native speakers will assign gender to existing and nonce words in accordance with morphological cues and the open syllable/ closed syllable pattern proposed by Harley (1979).*

True. Table 4.4 shows the accuracy of the four NS's. The scores are in the same range as the best L2 subjects.

> ***3.3.2*** *The undirected group of L2 learners will not recognize the closed syllable / open syllable cue and will assign gender randomly to monomorphemic words.*

False. Some undirected learners were highly accurate on monomorphemic, phonological cue words. Accuracy was related to proficiency as seen in charts 4.7 and 4.8.

> ***3.3.3*** *Those who learned (or knew) the open syllable / closed syllable cue on the teaching day will correctly incorporate new words with phonological endings first presented on the testing day.*

True. Table 2.12 shows that people who did well on the phonological cues on day 1 tended to also do well on the phonological cues on day 2.

> ***3.3.4*** *Morphological cues learned on the teaching day will not be extended to new morphological cues on the testing day, resulting in higher phonological scores on day 2.*

True. Table 4.14 compares individual day 1 and day 2 morphological cue performance. There are several subjects whose performance decreased significantly on morphological cues.

Phonological performance on day 2 was related to the distribution of the cue in the language, as shown in table 4.15 and chart 4.16. Morphological performance was also related to the natural input. Chart 4.18 shows that the gender of more familiar words is more accurately evaluated, as one would assume. This supports associationist claims.

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It also suggests that the process of acquisition is not purely rule-based. However, the fact that at least some of the subjects were more sensitive to morphological cues than phonological cues is evidence against the claims of Sokolik and Smith.

The performance of the L2 subjects on the rare and nonce words suggests that they are every bit as sensitive to phonological and morphological cues as the NS subjects. As expected because of their level, they are just not as practiced in applying the cues. This means that Carroll's (1999) results about sensitivity only apply to true beginning L2 learners.

This study would be improved by including a pretest (without feedback) on the first day so that more comparisons could be made to the testing day, without the concern of very direct metalinguistic influence during the teaching sets. Also, better control of the proficiency and background of the subjects would allow for more definite results that could statistically verified.

6 Acknowledgments

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Appendix

L2 Acquisition of French Grammatical Gender

Username:

Contact Information (confidential)

Preferred method of contact: phone / email

Phone number_____

Email address_____

Language Background

Age_____

Native Language_____

Foreign languages _____

Age of exposure to French_____

Age of first formal French instruction_____

Are you currently in a French class?   If so, what level?   _____

Approximately how many hours a week do you use your knowledge of French? Include class time, studying, conversations, TV, etc. _____

Please use the following scale to rate your French proficiency
1   2   3   4   5   (where 1 is low and 5 is high)

	self score
reading	
writing	
speaking	
listening	
overall	

Words

	Day 1a					
cue	file	word	phonetic	gend	freq	group
O	velo	vélo	velO	m	13	first
t	fossette	fossette	fOsEt	f	1.19	first
v	alcove	alcôve	alkOv	f	2.97	first
2	noeud	noeud	n2	m	10.9	first
S	roche	roche	ROS	f	14.9	first
@	petillement	pétillement	petijm@	m	0.71	first
2	camaieu	camaïeu	kamaj2	m	2.13	first
tyd	feminitude	féminitude	feminityd	f	0.03	first
S	brioche	brioche	bRijOS	f	2.68	first
a	chocolat	chocolat	SOkOla	m	17.7	first
t	conquete	conquête	k§kEt	f	16.7	first
z	mainmise	mainmise	m5miz	f	1.58	first
eur	balayeur	balayeur	balEj9R	m	0.77	first
té	declivite	déclivité	deklivite	f	0.61	first
@	talent	talent	tal@	m	24.8	first
tyd	promptitude	promptitude	pR§tityd	f	1.94	first
v	prerogative	prérogative	pReROgativ	f	0.77	first
a	certificat	certificat	sERtifika	m	19.4	first
O	goulot	goulot	gulO	m	5	first
t	dynamite	dynamite	dinamit	f	1.58	first
ism*	syndicalisme	syndicalisme	s5dikalism*	m	9.74	first
2	dieu	dieu	dj2	m	78.3	first
tyd	hebetude	hébétude	ebetyd	f	2.42	first
eur	remunerateur	rémunérateur	RemyneRat9R	m	0.45	first
ism*	nudisme	nudisme	nydism*	m	0.23	first
t	compote	compote	k§pOt	f	1.61	first
eur	pecheur	pêcheur	pES9R	m	9.65	first
té	etrangete	étrangeté	etR@Zte	f	4.71	first
v	solive	solive	sOliv	f	0.16	first
@	vent	vent	v@	m	141	first
tyd	vicissitude	vicissitude	visisityd	f	0.13	first
O	maillot	maillot	majO	m	9.13	first
a	fra	fra	fRa	m	2.26	first
t	suite	suite	s8it	f	243	first
v	preuve	preuve	pR9v	f	48.1	first
@	descendant	descendant	des@d@	m	13.8	first
S	clenche	clenche	kl@S	f	0.19	first
a	froid	froid	fRwa	m	109	first
eur	tricheur	tricheur	tRiS9R	m	1.23	first

S	pimbeche	pimbêche	p5bES	f	0.35	first
v	missive	missive	misiv	f	0.94	first
2	tonlieu	tonlieu	t§lj2	m	0.06	first
tyd	vastitude	vastitude	vastityd	f	0.1	first
ism*	modernisme	modernisme	mOdERnism*	m	1.48	first
O	niveau	niveau	nivO	m	119	first
2	enjeu	enjeu	@Z2	m	5.9	first
té	spontaneite	spontanéité	sp§taneite	f	4.68	first
a	emploi	emploi	@plwa	m	91.5	first
v	guimauve	guimauve	gimOv	f	1.19	first
z	symbiose	symbiose	s5bjOz	f	1.94	first
ism*	rhumatisme	rhumatisme	Rymatism*	m	7.97	first
té	solennite	solennité	sOlanite	f	5.13	first
O	petiot	petiot	p*tjO	m	11.3	first
S	mouche	mouche	muS	f	12.5	first
@	onguent	onguent	§g@	m	0.29	first
tyd	solitude	solitude	sOlityd	f	46.7	first
O	crapaud	crapaud	kRapO	m	3.45	first
z	meprise	méprise	mepRiz	f	5.45	first
té	lachete	lâcheté	laSte	f	5.68	first
v	nave	nave	nav	f	0.52	first
@	bilan	bilan	bil@	m	11.4	first
té	tenacite	ténacité	tenasite	f	2.9	first
ism*	nepotisme	népotisme	nepOtism*	m	0.16	first
z	glose	glose	glOz	f	0.48	first
eur	lecteur	lecteur	lEkt9R	m	28.3	first
t	boite	boîte	bwat	f	58.8	first
eur	chomeur	chômeur	SOm9R	m	1.35	first
2	milieu	milieu	milj2	m	215	first
z	fraise	fraise	fREz	f	2.71	first
S	leche	lèche	lES	f	3.52	first
ism*	bilateralisme	bilatéralisme	bilateRalism*	m	0.23	first
S	tache	tâche	taS	f	49.3	first
O	ego	ego	egO	m	2.16	first
a	soja	soja	sOZa	m	0.61	first
z	surprise	surprise	syRpRiz	f	52	first
té	simplicite	simplicité	s5plisite	f	21.4	first
2	richelieu	richelieu	RiS*lj2	m	6.9	first
eur	farceur	farceur	faRs9R	m	1.42	first
t	guerite	guérite	geRit	f	2.13	first
O	numero	numéro	nymeRO	m	39.8	first
s	drisse	drisse	dRis	f	0.26	first
tyd	concretude	concrétude	k§kRetyd	f	0.06	first
z	incomprise	incomprise	5k§pRiz	f	0.45	first

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ism*	pessimisme	pessimisme	pesimism*	m	2.74	first
s	coalescence	coalescence	kOalEs@s	f	0.61	first
t	braguette	braguette	bRagEt	f	2.9	first
@	cadogan	cadogan	kadOg@	m	0.26	first
v	greve	grève	gREv	f	21.7	first
2	lieu	lieu	lj2	m	552	first
eur	directeur	directeur	diREkt9R	m	55.1	first
z	marchandise	marchandise	maRS@diz	f	18.9	first
S	valoche	valoche	valOS	f	0.97	first
tyd	lassitude	lassitude	lasityd	f	10.1	first
té	nouveaute	nouveauté	nuvOte	f	13	first
ism*	mercantilisme	mercantilisme	mERk@tilism*	m	0.87	first
@	enseignement	enseignement	@sENm@	m	167	first

cue	file	word	phonetic	gend	freq	group
	Day 1b					
@	petillement	pétillement	petijm@	m	0.71	second
t	compote	compote	k§pOt	f	1.61	second
a	soja	soja	sOZa	m	0.61	second
2	milieu	milieu	milj2	m	215	second
s	drisse	drisse	dRis	f	0.26	second
té	solennite	solennité	sOlanite	f	5.13	second
eur	balayeur	balayeur	balEj9R	m	0.77	second
z	mainmise	mainmise	m5miz	f	1.58	second
@	cadogan	cadogan	kadOg@	m	0.26	second
té	simplicite	simplicité	s5plisite	f	21.4	second
O	velo	vélo	velO	m	13	second
v	preuve	preuve	pR9v	f	48.1	second
2	enjeu	enjeu	@Z2	m	5.9	second
tyd	lassitude	lassitude	lasityd	f	10.1	second
ism*	pessimisme	pessimisme	pesimism*	m	2.74	second
S	clenche	clenche	kl@S	f	0.19	second
eur	pecheur	pêcheur	pES9R	m	9.65	second
S	roche	roche	ROS	f	14.9	second
v	solive	solive	sOliv	f	0.16	second
tyd	vastitude	vastitude	vastityd	f	0.1	second
2	tonlieu	tonlieu	t§lj2	m	0.06	second
S	brioche	brioche	bRijOS	f	2.68	second
ism*	syndicalisme	syndicalisme	s5dikalism*	m	9.74	second
t	conquete	conquête	k§kEt	f	16.7	second
O	ego	ego	egO	m	2.16	second
ism*	bilateralisme	bilatéralisme	bilateRalism*	m	0.23	second
eur	remunerateur	rémunérateur	RemyneRat9R	m	0.45	second
v	missive	missive	misiv	f	0.94	second
eur	tricheur	tricheur	tRiS9R	m	1.23	second
ism*	rhumatisme	rhumatisme	Rymatism*	m	7.97	second
z	glose	glose	glOz	f	0.48	second
O	goulot	goulot	gulO	m	5	second
té	lachete	lâcheté	laSte	f	5.68	second
@	descendant	descendant	des@d@	m	13.8	second
t	braguette	braguette	bRagEt	f	2.9	second
S	mouche	mouche	muS	f	12.5	second
tyd	solitude	solitude	sOlityd	f	46.7	second
ism*	modernisme	modernisme	mOdERnism*	m	1.48	second

té	declivite	déclivité	deklivite	f	0.61	second
2	noeud	noeud	n2	m	10.9	second
O	crapaud	crapaud	kRapO	m	3.45	second
z	meprise	méprise	mepRiz	f	5.45	second
eur	lecteur	lecteur	lEkt9R	m	28.3	second
tyd	promptitude	promptitude	pR§tityd	f	1.94	second
S	valoche	valoche	valOS	f	0.97	second
s	coalescence	coalescence	kOalEs@s	f	0.61	second
a	fra	fra	fRa	m	2.26	second
té	nouveaute	nouveauté	nuvOte	f	13	second
t	guerite	guérite	geRit	f	2.13	second
O	maillot	maillot	majO	m	9.13	second
z	marchandise	marchandise	maRS@diz	f	18.9	second
2	camaieu	camaïeu	kamaj2	m	2.13	second
eur	farceur	farceur	faRs9R	m	1.42	second
S	tache	tâche	taS	f	49.3	second
v	greve	grève	gREv	f	21.7	second
O	niveau	niveau	nivO	m	119	second
té	etrangete	étrangeté	etR@Zte	f	4.71	second
z	fraise	fraise	fREz	f	2.71	second
O	petiot	petiot	p*tjO	m	11.3	second
v	alcove	alcôve	alkOv	f	2.97	second
tyd	hebetude	hébétude	ebetyd	f	2.42	second
z	incomprise	incomprise	5k§pRiz	f	0.45	second
t	boite	boîte	bwat	f	58.8	second
a	chocolat	chocolat	SOkOla	m	17.7	second
v	nave	nave	nav	f	0.52	second
S	leche	lèche	lES	f	3.52	second
2	lieu	lieu	lj2	m	552	second
@	talent	talent	tal@	m	24.8	second
té	tenacite	ténacité	tenasite	f	2.9	second
z	surprise	surprise	syRpRiz	f	52	second
ism*	mercantilisme	mercantilisme	mERk@tilism*	m	0.87	second
a	certificat	certificat	sERtifika	m	19.4	second
t	dynamite	dynamite	dinamit	f	1.58	second
S	pimbeche	pimbêche	p5bES	f	0.35	second
a	emploi	emploi	@plwa	m	91.5	second
@	vent	vent	v@	m	141	second
tyd	feminitude	féminitude	feminityd	f	0.03	second
ism*	nudisme	nudisme	nydism*	m	0.23	second
@	onguent	onguent	§g@	m	0.29	second
t	fossette	fossette	fOsEt	f	1.19	second
v	guimauve	guimauve	gimOv	f	1.19	second
a	froid	froid	fRwa	m	109	second

2	dieu	dieu	dj2	m	78.3	second
tyd	concretude	concrétude	k§kRetyd	f	0.06	second
eur	directeur	directeur	diREkt9R	m	55.1	second
ism*	nepotisme	népotisme	nepOtism*	m	0.16	second
t	suite	suite	s8it	f	243	second
@	bilan	bilan	bil@	m	11.4	second
z	symbiose	symbiose	s5bjOz	f	1.94	second
v	prerogative	prérogative	pReROgativ	f	0.77	second
tyd	vicissitude	vicissitude	visisityd	f	0.13	second
2	richelieu	richelieu	RiS*lj2	m	6.9	second
té	spontaneite	spontanéité	sp§taneite	f	4.68	second
eur	chomeur	chômeur	SOm9R	m	1.35	second
O	numero	numéro	nymeRO	m	39.8	second
@	enseignement	enseignement	@sENm@	m	167	second

cue	file	word	phonetic	gend	freq	group
	Day 2					
cue	**file**	**word**	**phonetic**	**gend**	**freq**	**group**
cue	file	word	phonetic	gender	frequency	category
a	gattroi	gattroi	XX	m	0	nonce
n	fouline	fouline	XX	f	0	nonce
skOp	laparascope	laparoscope	lapaROskOp	m	0.03	new
s	meubrice	meubrice	XX	f	0	nonce
sj§	fluxion	fluxion	flyksj§	f	0.42	new
ism*	parachutisme	parachutisme	paRaSytism*	m	0.52	new
v	flesave	flèsave	XX	f	0	nonce
a	beffroi	beffroi	befRwa	m	0.58	repeat
tyd	mansuetude	mansuétude	m@s8etyd	f	1.32	new
@	bilan	bilan	bil@	m	11.4	repeat
O	bivelot	bivélot	XX	m	0	nonce
n	pelerine	pèlerine	pElRin	f	2.48	new
jER	hipeuliere	hipeulière	XX	f	0	nonce
aZ	paturage	pâturage	patyRaZ	m	2.1	new
N	duegne	duègne	d8EN	f	0.42	new
E	dianechet	dianèchêt	XX	m	0	nonce
S	devouche	dévouche	XX	f	0	nonce
u	guilledou	guilledou	gijdu	m	0.1	new
eur	tricheur	tricheur	tRiS9R	m	1.23	repeat
O	landau	landau	l@dO	m	3	new
v	ganuve	ganuve	XX	f	0	nonce
sj§	crusation	crusation	XX	f	0	nonce
z	toise	toise	twaz	f	1.29	new
té	souverainete	souveraineté	suvREnte	f	13	new
E	hochet	hochet	hOSE	m	0.77	new
S	leche	lèche	lES	f	3.52	repeat
z	soupomise	soupomise	XX	f	0	nonce
jER	betonniere	bétonnière	betOnjER	f	0.35	new
n	themane	thèmane	XX	f	0	nonce
a	forcat	forçat	fORsa	m	1.03	new
ism*	cabrinisme	cabrinisme	XX	m	0	nonce
z	diastase	diastase	djastaz	f	0.97	new
s	coalescence	coalescence	kOalEs@s	f	0.61	new
u	kichou	kichou	XX	m	0	nonce
jER	fleuriere	fleurière	XX	f	0	nonce
aZ	pegisage	pégisage	XX	m	0	nonce
té	simplicite	simplicité	s5plisite	f	21.4	repeat

u	benatou	bénatou	XX	m	0	nonce
O	goulot	goulot	gulO	m	5	repeat
@	cadogan	cadogan	kadOg@	m	0.26	repeat
sj§	vimonation	vimonation	XX	f	0	nonce
tyd	lassitude	lassitude	lasityd	f	10.1	repeat
t	bimotte	bimotte	XX	f	0	nonce
z	mainmise	mainmise	m5miz	f	1.58	repeat
v	lessive	lessive	lesiv	f	4.84	new
2	camaieu	camaïeu	kamaj2	m	2.13	repeat
N	rigne	rigne	XX	f	0	nonce
t	braguette	braguette	bRagEt	f	2.9	repeat
aZ	gaspillage	gaspillage	gaspijaZ	m	3.32	new
skOp	heleoscope	héléoscope	XX	m	0	nonce
u	licou	licou	liku	m	0.29	new
@	saudan	saudan	XX	m	0	nonce
t	conduite	conduite	k§d8it	f	44.7	new
E	genet	genêt	Z*nE	m	0.87	new
5	scrutin	scrutin	skRyt5	m	7.61	new
eur	fournisseur	fournisseur	fuRnis9R	m	2.35	new
@	boschiman	boschiman	bOSim@	m	0.03	new
a	bat	bât	ba	m	1.77	new
N	vigogne	vigogne	vigON	f	0.1	new
S	coqueluche	coqueluche	kOklyS	f	1.9	new
@	soulagement	soulagement	sulaZm@	m	11.3	new
s	drisse	drisse	dRis	f	0.26	new
jER	beurriere	beurrière	b9RjER	f	0.06	new
5	joquelin	joquelin	XX	m	0	nonce
eur	neaspeur	néaspeur	XX	m	0	nonce
té	tenacite	ténacité	tenasite	f	2.9	repeat
a	inegas	inégas	XX	m	0	nonce
ism*	nepotisme	népotisme	nepOtism*	m	0.16	repeat
O	sanglot	sanglot	s@glO	m	5.16	new
2	tonlieu	tonlieu	t§lj2	m	0.06	repeat
skOp	stereoscope	stéréoscope	steReOskOp	m	0.16	new
sj§	clochardisation	clochardisation	klOSaRdizasj§	f	0.16	new
S	guiche	guiche	giS	f	0.1	new
5	godin	godin	gOd5	m	0.52	new
n	becane	bécane	bekan	f	2.1	new
ism*	filanisme	filanisme	XX	m	0	nonce
tyd	promptitude	promptitude	pR§tityd	f	1.94	repeat
s	giovace	giovace	XX	f	0	nonce
eur	ginocheur	ginocheur	XX	m	0	nonce
aZ	trounage	trounage	XX	m	0	nonce
té	telenite	télénité	XX	f	0	nonce

N	joulogne	joulogne	XX	f	0	nonce
v	preuve	preuve	pR9v	f	48.1	repeat
5	pidin	pidin	XX	m	0	nonce
skOp	getroscope	gètroscope	XX	m	0	nonce
2	desaveu	désaveu	dezav2	m	0.58	new
ism*	modernisme	modernisme	mOdERnism*	m	1.48	repeat
v	prerogative	prérogative	pReROgativ	f	0.77	repeat
@	bicramment	bicramment	XX	m	0	nonce
E	salnet	salnêt	XX	m	0	nonce
2	moyeu	moyeu	mwaj2	m	1.23	new
t	buite	buite	XX	f	0	nonce
tyd	genetude	gènétude	XX	f	0	nonce
2	siveu	siveu	XX	m	0	nonce
S	priomiche	priomiche	XX	f	0	nonce
t	compote	compote	k§pOt	f	1.61	repeat
v	creve	crève	kREv	f	8.39	new
O	mipreau	mipreau	XX	m	0	nonce
eur	pecheur	pêcheur	pES9R	m	9.65	repeat
a	cadenas	cadenas	cadna	m	1.42	repeat
tyd	decrepitude	décrépitude	dekRepityd	f	1.23	new
z	tontase	tontase	XX	f	0	nonce
té	vragite	vragité	XX	f	0	nonce
tyd	juritude	juritude	XX	f	0	nonce
eur	tricoteur	tricoteur	tRikOt9R	m	0.1	new
O	niveau	niveau	nivO	m	119	repeat
z	meprise	méprise	mepRiz	f	5.45	repeat
ism*	narcissisme	narcissisme	naRsisism*	m	1.16	new
2	cipreu	cipreu	XX	m	0	nonce
t	jatte	jatte	Zat	f	1.29	new
S	tache	tâche	taS	f	49.3	repeat
té	pluviosite	pluviosité	plyvjOzite	f	0.58	new

Detailed version of Table 4.15 - Comparison between day 2 performance and phonological cue frequency and reliability

	masc			fem		
	E	**5**	**u**	**N**	**n**	**s**
corpus count	292	344	87	35	462	733
corpus % frequency	2.17	2.56	0.647	0.26	3.44	5.45
corpus accuracy	**93.8**	**98.5**	**82.8**	**74.3**	**79.2**	**73.9**
L1 average responses	3.5	3.5	2.75	2.25	4	2.25
L1 % accuracy	**87.5**	**87.5**	**68.8**	**56.3**	**100**	**56.3**
directed L2 average correct responses	2.67	3.56	2.94	1.33	2.83	2.78
directed L2 % accuracy	**66.8**	**89**	**73.5**	**33.25**	**70.8**	**69.5**
undirected L2 average correct responses	2.79	3.64	3.21	1.64	3.07	2.93
undirected L2 % accuracy	**69.8**	**91**	**80.3**	**41**	**76.8**	**73.3**

Detailed version of Table 4.17 - Comparison between day 2 performance and morphological cue frequency and reliability

	fem	fem	masc	masc
	jER	**sj§**	**aZ**	**skOp**
corpus count	301	1904	970	27
corpus % freq	1.01	6.43	3.23	0.0912
corpus accuracy	**99.7**	**99.8**	**99.2**	**100**
L1 average correct responses	4	3.75	4	2.75
L1 % accuracy	**100**	**93.8**	**100**	**68.8**
directed L2 average correct responses	2.07	2	1	1.64
directed L2 % accuracy	**51.8**	**50**	**25**	**41**
undirected L2 average correct responses	2.4	3.4	2.6	2
undirected L2 % accuracy	**60**	**85**	**65**	**50**