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Dan Frost

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**THE PERCEPTION OF WORD STRESS
IN ENGLISH AND FRENCH:
WHICH CUES FOR NATIVE ENGLISH AND FRENCH SPEAKERS?**

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ABSTRACT

English prosodic features, particularly word stress, have long proven a source of debate. Word stress plays an essential role in the segmentation of speech, a crucial process in language comprehension, acquisition and learning. Incorrect use of English word stress by non-native speakers can lead to problems in comprehensibility. The English and French phonological systems are vastly different, especially in the domain of stress, and this leads to many problems for native French speakers learning English. This article presents a study which focuses on the four acoustic cues to word stress (F₀, duration, amplitude and formant structure) and their perceptual correlates (pitch, length, loudness and timbre). The results support the hypothesis that French and English native speakers listen differently for stress.

Key Words: Cues; English; French; linguistic transfer; perception; stress.

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Introduction

Oral English skills, both speaking and listening, are given much importance in the French National Curriculum². Yet this emphasis on spoken English is often not so evident in classroom practice, especially in schools, where large classes make such work difficult, and emphasis is often placed on understanding written texts. As foreign language classes are compulsory for most students in universities and other institutes of higher education in France, speaking and listening skills are often a major preoccupation for language teachers. In the case of English, the vast differences between the phonological systems of English and French combined with relatively little oral practice in schools lead to serious problems in oral production and comprehension for many French students. Nowhere is this problem more evident than in the area of prosody. English and French prosody, in particular stress, are so different that some French authors have posited the existence of “stress deafness” in certain individuals (Dupoux & Peperkamp, 1999; Dupoux et al. 2002; Peperkamp & Dupoux, 2002). Stress plays an extremely important part in segmenting running speech, and therefore in the acquisition of many first languages (L1) and in the learning of many second languages (L2). For this reason, we are extremely interested in investigating the nature of stress perception by both French and English native speakers, so that we may improve the teaching of prosodic features and ultimately improve the communicative competence of French students.

To better understand the way stress perception works for native English and native French speakers both in English and in French, we devised an experiment which focuses on the acoustic cues of word stress and their perceptual correlates. After briefly presenting the nature of word stress and the phenomenon of linguistic transfer, we will present this experiment and its implications for language teaching.

Towards a definition of stress

Stress has always seemed to resist all attempts at definition: the more one tries, the more it seems to slip out of reach. Along with intonation, stress is a feature of the prosody of language. It is often called a suprasegmental feature, because it may extend beyond segmental features such as phonemes and syllables. One of the reasons it is so difficult to define is surely because stress is not simply an acoustic feature, but also a perceptual feature, i.e. in defining it, one must take account not just of its production, but also of its perception by the interlocutor. Cooper-Kuhlen defines stress as “nothing

2 *Les Instructions Officielles* for schools and *Le Programme Pédagogique National* for IUTs, or University Institutes of Technology. The National curriculum for schools and colleges is published by the National Ministry of Education (MEN).

more than the fact that in a succession of spoken syllables or words some will be perceived as more salient or prominent than others” (1985, p. 19). Stress is therefore also a relative feature, and the stressed syllable must be defined in relation to its surrounding environment.

One thing is certain about stress, however: unusually for human language, it is highly iconic (Pennington, 1996, p. 137), i.e. the acoustic effort involved in marking stress coincides with the relative magnitude of the stress. The stressed (or accented) syllable is marked by four acoustic cues: fundamental frequency (F0), amplitude, duration and formant structure. The perceptual correlates of these four acoustic cues are respectively pitch, volume, length and timbre. Phonologists and phoneticians do not all agree about which of these cues is the most important in English, but most seem to agree with Bolinger (1958), who affirmed that stress in English is above all linked to variations in the fundamental frequency of the stressed syllable (the “pitch accent”).

As stress is a relative phenomenon, several degrees of stress exist. There is some disagreement as to how many levels of stress exist in English, but according to Pennington (1996, pp. 131-132), four to six levels suffice for a detailed transcription. According to Cruttenden (1986, p. 21), we can distinguish four levels: primary stress, secondary stress, tertiary stress and unstressed.

Phoneticians and phonologists traditionally distinguish three types of stress: contrastive stress, sentence stress and word stress. The first type of stress is universal, i.e. it is possible in all languages to stress one syllable for contrastive purposes. As for the other two types of stress, the situation varies according to the language concerned. English, for example, has stress at the level of the word (sometimes known as lexical stress) and at the level of the sentence (sometimes referred to as rhythm). An example of word stress in English is the word “**university**”³, where the primary word stress falls on the third syllable. If any syllable other than the third syllable is pronounced with more stress than the other syllables, this is considered as a speech error. The third category, sentence stress, is laid over the pattern formed by word stress. In a short sentence, one syllable will typically receive more stress than the others in that sentence. In English, this syllable is generally the stressed syllable of the last lexical word (i.e. a verb, noun, adverb or adjective) of the sentence. In longer sentences, the picture is more unclear, and each prosodic group or tone-unit may contain a strongly stressed syllable.

3 We represent the stressed syllable by using bold print.

Stress in French

The situation in French is no less problematic than in English. Comparing French to other European languages, certain authors have even concluded that French does not have stress. Rossi (1979) for example, after conducting several experiments on the production and perception of stress, concluded that French was a language without stress, in the sense that stress and intonation in French, both by their nature and by their function, do not constitute two distinct entities (Rossi, 1979, p. 39). However, empirical research has shown that the French do rely on certain acoustic cues in the rhythm of the language to segment speech (Wenk & Wioland, 1982, p. 196). Stress in French depends on the separation of sentences into prosodic units or tone units, which are given different names by different authors, both in English and in French. Many authors in English simply refer to these prosodic units as “rhythmic groups” (for example Cutler, Dahan & van Donselaar, 1997). In fact, we may distinguish two levels of prosodic unit in French. The smaller of the two, a “stress group” (Di Cristo, 1998) or an “Accentual Phrase” (Jun & Faugeron, 1995) may contain several syllables or even words. Di Cristo states that French has a “rhythmic stress”, which is “regularly assigned to the final full syllable (i.e. not containing a schwa) of the last lexical item of a stress group.” He describes a stress group as “a prosodic unit containing a stressed syllable preceded by a number of unstressed ones” (Di Cristo, 1998, p. 4). The larger prosodic units, “intonative units” (Di Cristo, 1998) or “Intonation Phrases” (Jun & Faugeron, 1995) may contain several of the smaller units. Jun and Faugeron (2000) later added a third unit, the Intermediate Phrase.

In terms of production, the group-final syllable in French is marked most notably by an increase in its duration (Bengurel, 1973; Di Cristo, 1998; Lacheret-Dujour & Beaugendre, 1999, p. 41; Jun & Faugeron, 2000; Astésano, 2001), but this may also be in part a contextual effect. As Astésano states, it may be that increased syllabic duration in French is a result of the presence of stress, or it may be a possible component of stress (Astésano, 2001, p. 54). Whichever is the case, this syllable is consistently longer than the others, and is generally marked by the pitch contour, often with a rise. However, when the stress group occurs at the end of an intonation unit, the stressed syllable will frequently be accompanied (at least in declarative utterances) by a fall in both F₀ and in amplitude (Di Cristo, 1998, p. 4). Nonetheless, these modifications may simply result from the position of the syllable at the end of the rhythmic group (Faure & Di Cristo, 1973, p. 234). During an utterance, the acoustic energy invested by the speaker often diminishes towards the end of each prosodic unit, particularly intonative units, as the articulatory force diminishes, and in French, this phenomenon is especially evident. The phenomenon of final syllable lengthening is also

apparent in isolated words, which has been interpreted by some as a sort of word stress in French (for example Delattre, 1965; Dahan & Bernard, 1996). Whatever the interpretation of this “final accent”, it has no discriminating value, and although it may aid in segmenting speech, it adds nothing to the meaning of the word on which it happens to occur.

Stress in English vs. French

Perhaps the most well-known and well-documented prosodic difference between French and English is that of isochrony, i.e. the tempo of the two languages. The traditional view is that French is a syllable-timed language, in that it accords a more or less equal period of time to each syllable (apart from the final syllable of each breath group, as we have seen). English on the other hand, is generally held to be stress-timed, as the distance in time between stressed syllables is fairly constant, no matter how many syllables occur between those stressed syllables. As a consequence, English often reduces unstressed syllables (schwa is the prime example of a reduced vowel) and certain vowels or even syllables may disappear altogether. It is undoubtedly the reduction or the suppression of unstressed syllables which causes the most difficulties for native French speakers when they attempt to reconstruct the meaning from running speech in English (Pennington, 1996, p. 146-8). Since Pike (1945) posited the dichotomy of stress and syllable-timed languages, authors have consistently sought to question the validity of the two categories, as Bertinetto (1989) points out. For example Jenkins states “the concept of stress-timing appears to have little basis in reality” (2000, p. 149). Wenk and Wioland prefer the terms “trailer-timed” for French and “leader-timed” for English (1982, p. 204), although this term seems more subjective than based on a logically constructed analysis. It is clearly true, however, that the syllable on which primary word stress falls in

Table 1. A comparison of the position of primary word stress in English and French (Delattre 1965: 29)

Words of:	French				English			
	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th
1 syllable	100%				100%			
2 syllables	0%	100%			74%	26%		
3 syllables	0%	0%	100%		55%	39%	6%	
4 syllables	0%	0%	0%	100%	33%	36%	29%	2%
Syllables:								

English is more often towards the beginning of a word than at the end. In a study comparing several European languages, Delattre (1965, p. 21) found the position of word stress to be a major difference between French and English (Table 1).

Perhaps the most informative view on the question is that of Peter Roach, who concludes “one is obliged to conclude that the basis for the distinction is auditory and subjective – a language is syllable-timed if it sounds syllable-timed” (1982, p.78). This tallies with our view that stress is as much (if not more so) a perceptual phenomenon as an acoustic one.

To summarize the main differences between English and French regarding stress, we can therefore establish four major points:

1. English has three types of stress (word stress, sentence stress and contrastive stress), and these may be separated into between four and six levels. French, on the other hand, has neither word stress nor sentence stress as such, but does mark out the final syllable of each breath group, especially by its duration.
2. Of the four cues to stress in English, F0 (or pitch) seems the most important, whereas duration (or length) is the most obvious candidate in French.
3. In terms of isochrony, English tends to base its tempo more on the stressed syllables, interspersing them with unstressed syllables, whereas French tends to give a more equal value to all syllables, apart from final lengthening.
4. Stress in English tends to fall towards the beginning of the word, and in French, the last syllable is treated differently.

As language teachers, we are all aware that learners’ L1 impacts heavily on the acquisition of an L2, on the level of production, but also on the level of perception. In the next part, we shall briefly examine the question of linguistic transfer and how it contributed to our hypothesis.

Linguistic transfer

Linguistic transfer, often referred to as L1 interference, is a major factor to be taken into account when examining L2 acquisition. Some errors present in learners’ interlanguage are individual, some are universal, but most errors are related directly or indirectly to the learners’ L1. Indeed, MacWhinney’s “Unified Competition Model (2008) takes its very name from the competing forces at play between a learner’s L1 and L2 when forming “self-organizing maps” of the target language.

Whereas a child seems to learn its L1 (or even several languages) with little or no conscious effort, adults find the task more challenging. An adult may continue to learn vocabulary all his life, but the effects of the L1

will be felt most strongly when it comes to speaking (Pennington, 1996). The concept of linguistic transfer is far from recent, especially for linguists and language teachers with an interest in phonology; indeed, in order to explain this phenomenon, the Prague Linguistic Circle coined the term “phonological deafness” (Polivanov, 1931; Trubetzkoy, 1939). It is interesting to note that in the formulation of this concept, the Czech linguists were more interested in perception than in production. Whereas teachers are often concerned with oral production, this is perhaps because the speech errors of learners are “visible”. The literature shows that researchers working in this field are more likely to be interested in the relationship between perception and production, and most of the perception models since the 1950s highlight the active nature of perception (see for example Rost, 2002 or Tatham & Morton, 2006 for an overview of perception models).

Current research in Interlanguage (IL) theory would suggest that a learner’s IL will be restructured according to the nature of the language input and how it is analysed. Successful learning happens when significant features are noticed and modified as necessary (Randall, 2007, p. 154). The current study focuses on one feature of the IL of French and English native speakers learning each others’ language; that feature is stress. The Prague Circle also developed another notion which may help us to understand why the particular aspects of IL which concern this study are problematical in the French context. Over fifty years ago, Lado’s contrastive analysis hypothesis (1957) suggested that for a given learner, language points which are similar in L1 and L2 will be easier to learn, whereas those which are less similar will be harder to master. Eckmann (1977) continues in the same vein as Lado, but integrates the theory of markedness, another notion which comes to us from the Prague linguists. Originally conceived to describe phonological features which were literally marked in a written form of a language, this term has not been generalised to include any set of linguistic features. According to Eckmann, markedness, or the relative scarcity of a linguistic feature in an L2 compared to the L1, has a bearing on the ease with which it may be acquired. Eckmann explains his “markedness differential hypothesis” as follows:

The areas of difficulty that a second-language learner will have can be predicted on the basis of a comparison of the first language and the target language such that:

1. Those areas of the target language that are different from the first language and are relatively more marked than in the first language will be difficult.
2. The degree of difficulty associated with those aspects of the target language that are more different and more marked than in the native

language corresponds to the relative degree of markedness associated with those aspects.

Those areas of the target language that are different from the first language but are not relatively more marked than in the first language will not be difficult.

In this conceptualization, markedness is defined in the following terms: 'A phenomenon or structure X in some language is relatively more marked than some other phenomenon or structure Y if cross-linguistically the presence of X in a language implies the presence of Y, but the presence of Y does not imply the presence of X'. (Eckman, 1977, p. 321)

As we shall see, this hypothesis complements current thinking on IL and may help us to understand some of the questions underlying the study presented in this article, since stress in English when compared to French corresponds to the concept of "structure X" in Eckmann's explanation.

We are interested in stress, which is a prosodic feature, and it was in relation to prosodic features in the French language that Dolbec and Santi (1995) suggested the existence of a "linguistic filter", which, they claimed, was particularly important in the areas of stress and intonation. They suggested that the L1 acted as a "linguistic filter which conditions or orients the interpretation of the acoustic signal" (*ibid.*, p. 46).

The term "stress deafness" is also the result of a team of French researchers (Dupoux & Peperkamp, 1999; Dupoux et al., 2002; Peperkamp & Dupoux, 2002). They originally developed the concept whilst working on French and Spanish corpora and subjects, but then enlarged the scope of their research to take in other European languages, most notably English. According to Dupoux and Peperkamp (1999), the listening apparatus of interlocutors is tuned to a greater or lesser degree according to their L1. As a result, they often have difficulties when exposed to a language other than the one to which they were exposed as children (*ibid.*, p. 203).

The form of linguistic transfer which particularly interests us as teachers of English living and working in France is what has been referred to as "stress deafness". Although this term is somewhat dramatic, we have found that stress in English does create great difficulties for certain French learners of English. We believe that the problems which many native French speakers have in deciphering authentic running speech in English stem largely from the four main differences which we listed at the end of the first part of this article. In order to investigate this question more fully, we conducted a study of stress perception which we will present in the next part.

The experiment

Hypothesis

As the term “stress deafness” implies, certain French native speakers appear unable to identify stressed syllables in English. As we mentioned in the first part, there are four acoustic cues to word stress: fundamental frequency (F0), amplitude, duration and formant structure. In terms of perception, these four acoustic cues correspond to pitch, volume, length and timbre. Based on what we know about the production of stress in English and French, one might easily assume that speakers of these two languages listen for stress differently. To be more precise, it may be that the relative order of the perceptual correlates of the acoustic cues of stress varies according to the L1 of a given speaker. One may also wonder whether, given the phenomenon of linguistic transfer, that –if this is indeed so– the relative importance of the cues is carried over into the L2. These questions led us to formulate the following hypothesis: French native speakers and English native speakers do not perceive stress in the same way in English and in French.

The experiment is therefore an attempt to determine the relative importance the subjects attribute to the acoustic cues and/or their perceptual correlates according to their nationality, and according to the language they are listening to. The cues which we chose to focus on were F0 (pitch), duration (length) and formant structure (timbre). We chose not to include the variable of amplitude (volume) as existing research on English and French has shown that F0 and duration are the most important cues in the two languages respectively. We added the cue of formant structure, as syllable reduction is a phenomenon which is much more common in English than in French, and is a commonly held to be a problem area for French learners by language teachers and resource developers in France.

Subjects

This study featured twenty subjects, of which ten were native English speakers and ten were native French speakers. All were aged between twenty and twenty-five years old. The French subjects were all studying History and Geography, whereas the group of English speakers was more heterogeneous, comprising a mixture of students studying in France on the Erasmus university exchange programme.

Corpus

In the tradition of the experiments carried out in the Haskins labs in the 1950s (for example Bolinger, 1958), we chose to work on two-syllable word pairs where the positioning of word stress depends on the grammatical category. We therefore focused entirely on word stress. The corpus consisted

of four words: two English, two French. For the English words, we chose “**transfer**” (noun) and “**transfer**” (verb). As we saw in the first part of this article, French does not have word stress as such, but we were able to use the local French accent to constitute our French corpus. In the Midi region of France, the final *-e* is pronounced. This vowel is known in French as “*e-caduc*” or “*e-muet*”, and is no longer pronounced in standard French, but remains in songs and in the everyday French of certain regions of France, especially in the South. Whilst not actually a schwa (it is a little more closed, tense, rounded and front than schwa), this vowel was as close as we could get in French to the final vowel of the English word “**transfer**”. Using this idea, we chose the French words “*boîte*” and “*boiteux*”. This pair of words, whilst not actually being distinguished by word stress, behaves acoustically in a similar fashion to our English word-pair.

The four original words were recorded in the anechoic chamber of the *Laboratoire Parole et Langage* at the *Université de Provence*, Aix-en-Provence. The two French words were read by a French native speaker from the town of Marseilles, and the two English words by a native British English speaker. The corpus was then validated by ten native speakers for each language as isolated words and also embedded in utterances.

Next it was necessary to synthesize the four words in order to create the stimuli for the experiment. We used MBROLA⁴ to modify the duration and the formant structure and MoMél⁵ to modify the F₀ curve. In total, we created 100 stimuli from the four original words, 50 from the English word-pair and 50 from the French word-pair. For the purposes of explaining this process, we shall call a word stressed on the first syllable W1 and a word stressed on the second syllable W2. We generated five stimuli from W1 in each language, with vowel durations varying between W1 and W2 (i.e. three intermediate stimuli). Next, we repeated the process, but using W2 to generate the five stimuli for each language. This gave us ten words for each language. The 50 experimental stimuli for each language were obtained from these “words” by modifying the F₀ curve over five stages from W1 to W2. In this way, we obtained 50 stimuli for each language where F₀, duration and formant structure could each be identified as somewhere between W1 and W2. For example, a stimulus could be “transfer” (W1D4F3). This stimulus would originate from W1 (therefore the formant structure is akin to “**transfer**” not to “**transfer**”), the relative duration of each syllable is four-fifths of the way between “**transfer**” and “**transfer**” and the F₀ curve is three-fifths of the way between “**transfer**” and “**transfer**”.

⁴ MBROLA is a speech synthesis program developed at the University of Mons, Belgium.

⁵ MoMél (*Modélisation de la mélodie*) is a program developed by the *Laboratoire Parole et Langage*, Aix-en-Provence.

Protocol

The subjects' task was simple: they had to tick a box corresponding to the syllable which they thought was stressed. The subjects listened to the stimuli through headphones in a language laboratory. First, the subjects read the instructions. Then they completed a warm-up test, consisting of ten items in their L1. Next they listened to the 50 stimuli played in a random order twice each in their L1. After a few minutes' pause, the subjects completed the same warm-up test then the same test of 50 items played twice in their L2. The experiment may therefore be represented thus: $L_2 * W_2 * D_5 * F_5 * R_2 * N_2 < S_{10} >$ where:

L = Language

W = Word generated from W_1 or from W_2

D = modification of duration

F = Modification of F0 curve

R = Repetition of stimuli

N = Nationality of subjects

S = Number of subjects

Results

For each test (the French stimuli and the English stimuli), there was one dependant variable (the subjects' answers) and four independent variables, WORD (if the subject "correctly" identified whether the stimulus had been generated from W_1 or W_2), DURATION and NATIONALITY). From the first ANOVA table of the results, it was clear that the factor WORD

Table 2. English stimuli (recoded without WORD)
ANOVA Table for "right/wrong"

	DF	Sum of Squares	Mean Square	F-Value	P-value
WORD	1	.008	.008	.039	.8444
DURATION	4	21.205	5.301	25.519	<.0001
WORD * DURATION	4	.927	.232	1.116	.3474
F0 CURVE	4	42.140	10.535	50.713	<.0001
WORD * F0 CURVE	4	.992	.248	1.194	.3115
DURATION * F0 CURVE	16	3.005	.188	.904	.5642
WORD * DURATION * F0 CURVE	16	6.073	.380	1.827	.0232
NATIONALITY	1	.338	.338	1.627	.2023
WORD * NATIONALITY	1	.162	.162	.780	.3773
DURATION * NATIONALITY	4	1.417	.354	1.705	.1461
WORD * DURATION * NATIONALITY	4	1.303	.326	1.568	.1802
F0 CURVE * NATIONALITY	4	3.182	.795	3.829	.0042
WORD * F0 CURVE * NATIONALITY	4	1.478	.370	1.779	.1304
DURATION * F0 CURVE * NATIONALITY	16	4.363	.273	1.313	.1799
WORD * DURATION * F0 * NATIONALITY	16	2.507	.157	.754	.7389
Residual	1900	394.700	.208		

was present in all the significant results; results were considered significant if p was less than 0.05. In other words, the fact that we had generated the stimuli from either W1 or W2 was a very important factor in influencing the subjects' choice. The fact that segmental cues were so important is an interesting result in itself, but in order to better understand the other factors at play, we recoded the results to eliminate the factor WORD. Henceforth, if a subject chose the first syllable for a stimulus created from W1 or the second syllable for a stimulus created from W2, we coded that answer R (for RIGHT) and W (WRONG) if not.

The significant results for the English are shaded on the ANOVA table (table 2).

These results may be summarised as follows:

1. The greater the modification of the duration of the vowel segments of the stimuli, the greater the effect on the stress judgements of both groups of subjects.
2. The same effect was observed for modifications of the F0 curve, but to a slightly more pronounced degree.
3. The English-speaking subjects were more strongly influenced by modifications of the F0 curve than were the French speaking subjects.

For the French test, the significant results from the ANOVA tests are shaded in table 3.

Table 3. French stimuli (recoded without WORD):
ANOVA Table for "right/wrong"

	DF	Sum of Squares	Mean Square	F-Value	P-Value
WORD	1	2.546	2.546	13.013	.0003
DURATION	4	20.253	5.063	25.879	<.0001
WORD * DURATION	4	1.827	.457	2.335	.0535
F0 CURVE	4	5.223	1.306	6.674	<.0001
WORD * F0 CURVE	4	6.456	1.614	8.250	<.0001
DURATION * F0 CURVE	16	8.747	.547	2.794	.0002
WORD * DURATION * F0 CURVE	16	3.602	.225	1.151	.3015
NATIONALITY	1	5.611	5.611	28.678	<.0001
WORD * NATIONALITY	1	.146	.146	.746	.3878
DURATION * NATIONALITY	4	.551	.138	.704	.5893
WORD * DURATION * NATIONALITY	4	1.097	.274	1.402	.2308
F0 CURVE * NATIONALITY	4	1.611	.403	2.058	.0839
WORD * F0 CURVE * NATIONALITY	4	.476	.119	.608	.6567
DURATION * F0 CURVE * NATIONALITY	16	3.519	.220	1.124	.3257
WORD * DURATION * F0 CURVE * NATIONALITY	16	2.562	.160	.819	.6654
Residual	1900	371.727	.196		

These results may be summarized as follows:

1. Both groups of subjects identified stimuli generated from W1 more often than stimuli created from W2, i.e. the segmental cues present

in W1 were a greater influence on subjects' stress judgements than those present in W2.

2. As for the English test, the greater the modification of the duration of the vowel segments of the syllables in the stimuli, the greater the effect on the stress-judgements of both subject groups.
3. Modifications to the F0 curve of the stimuli appeared to be significant, but no discernible pattern was perceived in relation to subjects' stress judgements.
4. English-speaking subjects were more influenced by modifications to the formant structure with the French stimuli than the French-speaking subjects.

Discussion

Insofar as the conditions of this study are concerned, the hypothesis that French and English native speakers listen to stress differently in English and in French was validated. The protocol of this study was not devised to prove or disprove the concept of "stress deafness", but clearly some linguistic transfer has occurred. The most evident result (at least before recoding the results) was the importance of segmental cues in identifying the stressed syllable, for both groups of subjects. It is, however, very likely that this result is an effect stemming from the protocol, perhaps from the words chosen, or perhaps from the way in which the stimuli were created.

The most interesting result, at least given the literature which we cited in the first part of this article, is the fact that the English subjects relied more on F0 than the French subjects for the English test (point 3 above). This holds with the view that English stress is a "pitch accent" and that, at least subjectively, the cue of pitch is relatively more important in English than in French, and perhaps the most important of all the cues.

The other result we would like to comment on is the fact that English-speaking subjects were more influenced by segmental cues for the French test than were the French native speakers (point 7 above). We suggest that a possible reason for this may be that the English subjects resorted to segmental cues in the absence of sufficiently salient cues in F0, in other words, the lack of a pitch accent in French.

Conclusion

We would firstly like to emphasise that although these results are interesting and support our hypothesis, we cannot realistically generalise any conclusions to all English and French speakers regarding the perception of stress in other contexts. In order for results of this sort of study to have a greater external validity, more subjects must be involved, a wider corpus using

a greater variety of stimuli must be used and sentence stress and contrastive stress must be targeted in addition to word stress. Having said that, we do think that the implications of this study for teaching English to French speakers could be important. We consider, along with others (Murphy, 2004), that stress perception and production should be focussed more on in teaching programmes, and that the separate cues should be explicitly targeted, especially the F0 curve. Where adult learners are concerned, we consider form-focused instruction (Doughty, 2001; Ellis, 2008) to be not only appropriate, but necessary for such difficult-to-master aspects of the English language as stress. Repeated targeted practice of judiciously chosen examples in isolation and in context, i.e. audio-active comparative work (AAC) would enable “graduated interval recall” to develop over time (Stenton et al., 2005). As MacWhinney argues, “The Unified Model argues that the success of this method can be attributed to its use of resonant neural connections between cortical areas.” (2008, pp. 359-360). Recent advances in technology make this sort of work much easier than it was even ten years ago (Chun, 2007). Indeed computer-mediated learning (CML) is a solution which is available to most teachers in France in secondary and tertiary education, not to mention the possibility of self-study via Internet connections in the home. It must not, however, be forgotten that stress is only one aspect of the extremely complex system which is the English language. Although CML and AAC constitute a pedagogically valid method for addressing the problems relating to “stress deafness” in France, this type of teaching must be integrated into a blended learning program (Chapelle, 2003) so as to integrate skills in the area of stress perception and production into the construction of communicative competence.

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