



The role of prosody in foreign accent perception and intelligibility

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The role of prosody in foreign accent perception and intelligibility



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Didactique des Langues*
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ABSTRACT

The present study is a theoretical and empirical study on foreign accent and intelligibility perception (Munro, 2008) of L2 English utterances produced by L1 French speakers. A small corpus of learner recordings was collected and prosodically annotated using the Momel algorithm and the Intsint alphabet (Hirst & Espesser, 1993). Recordings were then used to create an accentedness rating survey which was answered by English L1 speakers and French L1 speakers. Descriptive prosodic analyses show that some intonational and rhythmic features of L1 French are transferred onto learners' L2 English oral production. Survey results show that English native speakers rate accentedness higher than French L1 speakers, and that French L1 speakers perceive a higher intelligibility of utterances produced by French L1 learners of English. Although L1 English listeners rely primarily on segmental cues for accent detection, French listeners rely more on prosodic cues, intonation particularly.

1. INTRODUCTION

When we listen to someone speak, we pay attention to more than the content of what is being said. Several linguistic and paralinguistic cues can provide us with information about a speaker's education, social class, or geographical/cultural origins. This is what is commonly called an *accent*. In the current study, we will focus on one particular type of accent, foreign accent, which can be defined as "the effect of the contact of two phonological systems, one being from a native language (L1) and the other from a non-native, second language (L2)" (Boula de Mareüil & Vieru-Dimulescu, 2006). It does not take training in linguistics to be able to perceive the foreign accent of a nonnative speaker talking in our mother tongue; in fact, even their specific L1 background can be easily recognized depending on certain phonological features of their pronunciation.

The linguistic phenomenon of foreign accent can have different consequences in communication. From a sociolinguistic perspective, it has been proven that speakers who have a foreign accent are more prone to be subject to discrimination based on overgeneralization and stereotypes of their cultural origins (Eisenschlas & Tsurutani, 2011). From a communicative perspective, if the listener is not used to a particular variety of a foreign accent or if there are too many phonological elements of the speaker's L1 in his/her L2 production, it can affect comprehension and therefore obstruct communication.

Although current schools of thought do not regard foreign accent as negative, as it used to be the case in the past (Munro, 2008), and the teaching of a neutral English used as a *lingua franca* among non-native speakers is promoted (Jenkins, 2007), the fact that accented speech can be a hurdle for communication has motivated a series of studies on the origins of foreign accent, its perception by listeners and its relationship to intelligibility.

The present study relies on three pivotal models for foreign accent research, which explain the causes of accent from a perceptive point of view (Kuhl & Iverson, 1991; Best, 1995; Flege, 1995). Like most of the research in this field, however, these studies focus on segmental features. Only recently has research started to focus on the suprasegmental dimension of foreign accent (Kamiyama, 2004; Boula de Mareüil & Vieru-Dimulescu, 2006; Jun & Li, 2009; Winters & Grantham O'Brien, 2013), thanks to the development of acoustic analysis and phonological transcription techniques for suprasegmental features, like the MOMEL algorithm for pitch stylization (Hirst & Espesser, 1993) and INTSINT transcription (Hirst & Di Cristo, 1998).

In the light of these recent scientific developments and to address the problem that accentedness can represent for L2 English learners in the French higher education system. The questions that will drive our study are the following: do native speakers perceive accentedness differently from French learners of English? Which aspects of prosody are the most influential in the perception of a foreign accent? Does accentedness obstruct communication?

In order to answer these questions, we will first present a bibliographical review of studies dealing with the principles of prosody, with the description of intonation in English and French and with accentedness perception. We will then explain our methodology, where we will describe the creation of a corpus of recordings of French-accented English, and the design and implementation of an accentedness perception survey with the recorded utterances. Finally, we will present and analyze the results of the accentedness perception survey in search of similarities or differences in the way native speakers of English and French learners of English perceive French accent. Furthermore, we will carry out acoustic analyses of the fundamental frequency (F_0) of the utterances rated as most accented to determine if they present recurrent atypical intonation patterns.

2. THEORETICAL FRAMEWORK

2.1 THE ANALYSIS OF SPOKEN LANGUAGE

In the current study, we seek to analyze certain aspects of the prosody of L1 French learners of English as a second language (L2). For this purpose, in the following pages, we will identify and define the concepts that are relevant for our analysis. In this first part, we will begin by giving a clear definition of what we will consider as prosody and by establishing the difference between the segmental and suprasegmental features of spoken language.

Segments are the smallest components of speech, “any discreet unit that can be identified either physically or auditorily in the stream of speech” (Crystal, 2003:408). They are discrete as they can be identified individually, and they correspond to the vocal rendition of consonants and vowels or, in other words, phonemes. The word *insult* in English, for example, is composed of the phonemes or segments [ɪ], [n], [s], [ʌ], [l] and [t].

Now, the six phonemes that make up this word can be uttered in several different manners. We can shout or whisper them. We can produce them as a high-pitched squeal or in a deep, low voice. We can pronounce them very quickly or very slowly. We can even decide to put the stress in the first syllable [ˈɪnsʌlt] or in the second one [ɪnˈsʌlt] to make the difference between a noun and a verb. All of these layers of speech, which are above the segmental level, fall into the suprasegmental level of spoken language.

2.1.2 PROSODY OR INTONATION?

Here we face a terminological dilemma identified by Hirst and Di Cristo (1998). The terms *prosody* and *intonation* are often used indistinctly by authors to refer to the whole of suprasegmental features. Yet, sometimes, they are used with different meanings, but this difference is not explicitly stated. This leads to ambiguity. Since these concepts will be systematically used throughout the present study, we deem it crucial to present Hirst and Di Cristo's in order to set a clearly defined classification of terms and to understand in what way they relate to one another.

Hirst and Di Cristo first define two types of usage of the word intonation in the scientific literature. In a broad sense, the term intonation is used as comprising factors such as word-stress, tone and quantity, all of which participate in the configuration of the lexical meaning of words. In a narrow sense, the term is used in a non-lexical way (i.e.

excluding the aforementioned factors), only to represent the pitch patterns of complete utterances.

At a first stage of analysis, they propose to use the term **prosody** as an equivalent of intonation in its broad sense and the term **intonation proper** as an equivalent of intonation in its narrow sense. They summarize this first categorization in the following diagram:

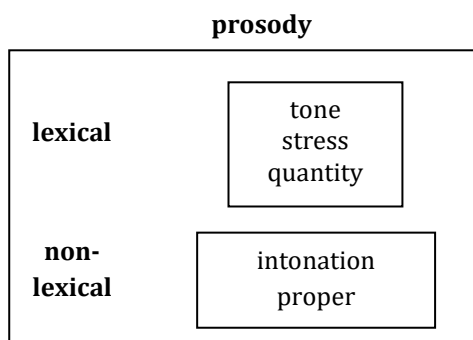


Fig. 1 (Hirst & Di Cristo, 1998:4)

At a second stage of their analysis, they make a distinction between the physical and linguistic levels of prosody. At the physical level of prosody, we find measurable acoustic parameters such as **fundamental frequency (F₀)**, **intensity** and **duration**. At the linguistic level, we find formal, more abstract concepts which are observable in a speaker's performance, i.e. tone, stress, quantity and intonation proper.

To illustrate this complex, multi-layered distinction between the physical and linguistic levels in suprasegmental phonology, they describe the same distinction at a segmental level. The acoustic data obtained from spectrographic analyses would correspond to the physical level, whereas phonological transcriptions of these data would correspond to the linguistic level.

They organize the relationship between the lexical/non-lexical categories and the physical/linguistic levels in the following scheme:

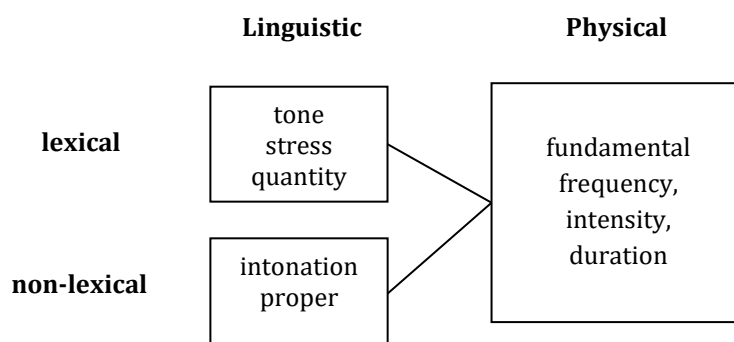


Fig. 2, adapted from Hirst & Di Cristo (1998:5)

However, they specify that the linguistic/physical dichotomy is not categorical. Quite the opposite: many definitions of intonation fall somewhere in between these two extremes and tend to be based on the speaker's or listener's impression of physical characteristics. In what they call a "no-man's land between the formal and the physical", hybrid terms such as pitch, loudness and length appear to convey fundamental frequency, intensity and duration respectively, but from the point of view of the speaker's linguistic knowledge (e.g. Roach, 1983; Cruttenden, 1986).

Therefore, they put forward the idea of having an interface between both categories. Similarly to how phonetics work as an interface between phonology (cognitive level) and the acoustics of segments, the term intonation can serve as a bridge connecting both poles:

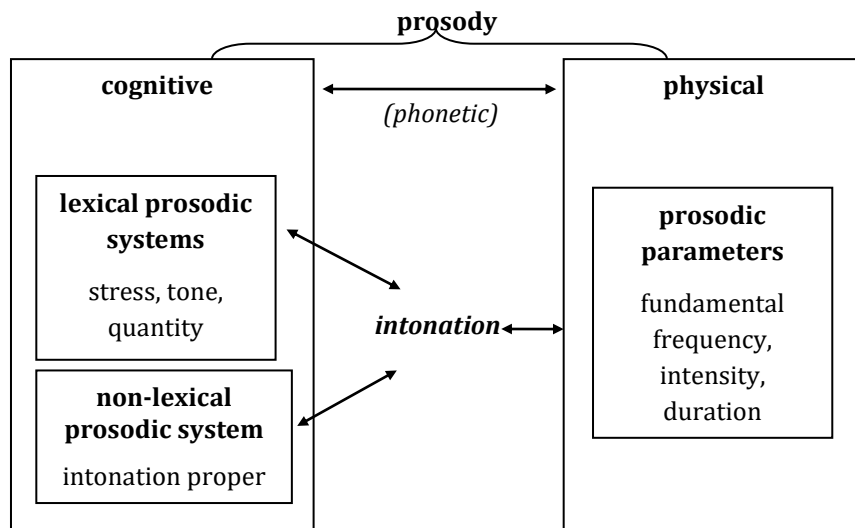


Fig. 3, adapted from Hirst & Di Cristo (1998:7)

To sum up, Hirst and Di Cristo propose the following denominations, which we have adopted throughout the present study:

- **Prosody** refers to both the abstract cognitive system and the physical parameters upon which this system is based.
- Specifically at a cognitive level, prosody is composed of lexical systems –stress, tone and quantity– and one non-lexical system: **intonation** (proper).
- **Intonation**, in a broader sense, also refers to any type of phonetic representation of the cognitive systems that relates them to their corresponding prosodic parameters at a physical level.

Furthermore, in the present study we will also use the phonological (and therefore cognitive) terms **pitch** and **tone** as synonyms, as well as **quantity** and **speed**, since the literature we have based our research upon uses them interchangeably.

2.2 RHYTHM

All prosodic parameters are present and can be measured in every language. The different ways in which these parameters organize themselves is what makes the prosody of every language unique. The perception and imitation of these organized parameters is one of the main challenges for the learners of a language as an L2 when it comes to oral production. In this part, we will focus on rhythm, understood as the interaction of F_0 , duration and intensity.

Abercrombie (1967), in a long-time leading study in the differences of rhythm between languages, postulated that languages could be classified into two types: stress-timed languages and syllable-timed languages¹. His stress- and syllable-timed hypotheses (SSH) can be organized in the following manner (Cauldwell, 2002:3):

- (a) *all languages fall into one of two mutually exclusive categories: stress-timed or syllable timed*
- (b) *in stress-timed languages, stresses occur at equal time-intervals (stress-isochrony)*
- (c) *in syllable-timed languages, syllables occur at equal time-intervals (syllable-isochrony)*
- (d) *syllable-length varies in stress-timed languages, but not in syllable-timed languages*
- (e) *inter-stress intervals vary in length in syllable-timed languages, but not in stress-timed languages.*

According to his study, English, along with other languages such as Russian and Arabic, are stress-timed languages; and French, along with Yoruba and Telugu, are syllable-timed languages.

This theory has served as base for many studies on rhythm and stress, but it has also been widely contested. Authors criticize that this classification on languages is subjective, as it relies mainly on listener perception and not on the measurement of acoustic parameters associated with stress (Roach 1982; Di Cristo, 2013). This

¹ *As far as is known, every language in the world is spoken with one kind of rhythm or with the other. In the one kind, known as a syllable-timed rhythm, the periodic recurrence of movement is supplied by the syllable-producing process: [...] syllables recur at equal intervals of time – they are isochronous [...] In the other kind, known as a stress-timed rhythm, the periodic recurrence is supplied by the stress-producing process: the stress-pulses, and hence the stressed syllables, are isochronous. [...] There is considerable variation in syllable-length in a language spoken with a stress-timed rhythm, whereas in a language spoken with a syllable-timed rhythm the syllables tend to be equal in length. (Abercrombie 1967:97-98)*

measurement would be a very complicated task to fulfill to compare several languages, since the elements that play part in stress vary widely from one language to another. English, for example, distinguishes between reduced and full vowels, and only the latter can be found in stressed syllables. In other words, spectral characteristics, which are yet another measureable acoustic parameter, also play an important role in stressing in English, which is not the case in other languages like French or Spanish.

Roach also discusses that syllable duration is bound to vary in spontaneous speech due to hesitations and tempo variations, both of which are characteristic of non-prepared speech. He carried out measurements of syllables in the languages mentioned by Abercrombie (1967) by using spontaneous, unscripted speech. The experiment revealed that the duration of syllables in syllable-timed languages was not isochronous, and that the intervals between stressed syllables in syllable-timed languages are not consistent either. This confirms the claim that, if isochronicity does exist, it remains at a perceptive level.

Syllable and stress isochronicity would only appear during prepared speech—reading out loud, repetition and other types of what David Brazil calls the “oblique orientation” of intonation and rhythm (1997:133). Ultimately, this type of speech is not the most common or natural manifestation of language.

Cauldwell (2002) asserts that SSH cannot be valid due to the aforementioned factors, but that still nowadays many authors end up classifying languages, to a certain degree, according to these two categories in the absence of a better classification, and because of its “deceptively bewitching power” (2002:1). He admits that this power comes from there being some truth in Abercrombie’s theories, and so he uses them as a base to make a distinction between SSH production and SSH perception. His hypotheses are based on spontaneous speech, and on the premise that this type of speech is irrhythmic, occurring in bursts too short to trigger perceptions of rhythm in the listener.

Thus, he refutes isochronicity, stating that if speech was produced in an evenly rhythmical manner for every syllable, it would come out as mechanical and it would distract the hearer from understanding it as a “connected set of units of meaning”. Therefore, he argues that the “irrhythmicality” of spontaneous speech is functional, as the constantly changing stress and rhythmic patterns make the listener pay attention to the content of what is being said.

In light of the above, and since no empirical methods for comparison have yet been invented for all languages, we will establish, for the present study, that certain languages are more “stress-based”, rather than stress-timed. Dauer (1983) (in Cauldwell, 2002:6 and Tortel, 2009:33) proposes this denomination rejecting the concept of timing, in order to describe languages, such as English, in which “stress plays a large role in word-stress, syllable structure and vowel reduction”. Languages could then be placed in a stress-based/syllable-based continuum, depending on which type of rhythm is predominant. Thus, in the following diagram, the arrow indicates the degree of importance stress has in a language. English is placed towards the stress-based extreme of the continuum, whereas French is farther to the left. Other languages could also be organized accordingly:

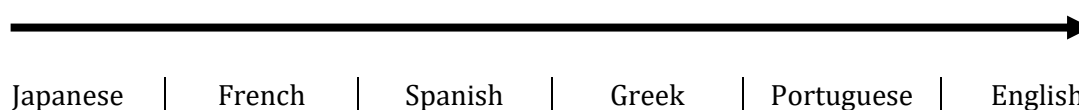


Fig. 4, Degree of importance stress has in a language
(adapted from Dauer, 1983 in Tortel, 2009)

In the present study, we will refer to the ensemble of rhythmical parameters (F_0 , intensity and duration) and their cognitive representations as **stress**.

2.2.1 STRESS IN ENGLISH AND FRENCH

In this section, we will give a brief description of the rhythmical systems of English and French. This description is based on Hirst and Di Cristo’s descriptions in *Intonation Systems: A Survey of Twenty Languages*.

2.2.1.1 French

In French, stress has no lexical significance in words or morphemes. A fixed, single rhythmic stress is assigned to the final syllable of the last lexical item of a stress group. In other terms, it is a “trailer-timed language” (Wenk & Wioland, 1982).

The primary accent of a stress group is defined by three principles (Hirst & Di Cristo, 1998):

- **Stressability** (accentogénéité), which selects what elements are stressable lexical items in the group (e.g. content words).
- **Grouping**, which specifies the elements that make up stress groups (e.g. stressable lexical item and its adjacent pro/en-clitics)
- **Right-heading principle**, which assigns stress to the final full syllable (i.e. not containing a schwa as in prendre [ˈprɑ̃.drə], être [ˈɛ.trə]) of the construction responding to the two previous principles.

Primary rhythmic stress is expressed mainly through lengthening. As a result, the final syllable of a stress group is longer than the ones preceding and following it.

French also presents full vowels in both accented and non accented syllables, as opposed to English, where unstressed syllables contain reduced vowels. Observation has been made that this constant vowel quality might be the reason why French is perceived as a syllable-timed language (Bolinger D., 1981 in Tortel, A., 2009:33).

2.2.1.2 English

In English, rhythm is expressed, in decreasing importance, by a rising F_0 , higher intensity and longer duration. As opposed to French, the distribution of stress in English can fall on any syllable of a word, rather than just towards the end of stress-groups, but most commonly at the beginning of a stress unit. Therefore, it is said that English is a “leader-timed” language (Wenk & Wioland, 1982).

At a word level, stress holds a lexical value and it can even mark the difference between certain words (*de'crease*, a verb, and '*decrease*', a noun). This change in stress comes along with a change in the spectral properties of vowels, turning a reduced or short vowel in an unstressed syllable into a full or long vowel in a stressed syllable ([dɪ'kri:s] and ['di:kri:s]). Longer words can have primary and secondary accents. Primary accent is more prominent than secondary accent, i.e. marked by a longer duration, and higher pitch and intensity, but both are more prominent than unstressed syllables and possess full vowels. If we take the example of the word *organization* [ɔ:gənɪ'zeɪʃən], primary accent falls on the fourth syllable and secondary accent falls on the first one, as shown by the phonetic transcription marks , and '.

At a broader, stress-group level, stress tends to fall on the syllables of lexical words –proper and common nouns, adjectives, verbs, adverbs and demonstrative pronouns. Grammatical words –articles, conjunctions, relative pronouns and auxiliary verbs– are usually unstressed, unless special emphasis wants to be made, in which case their reduced vowels are executed in their full form: *the* [ðə] becomes [ði:], *a* [ə] becomes [eɪ], etc.

2.3 INTONATION

We have established above that languages configure themselves differently in spoken language when it comes to rhythm, syllables and stress. The same thing happens for other suprasegmental features such as pitch.

From this perspective, we can identify certain languages which rely on tone, aside from consonants and vowels, to convey lexical meaning. These languages are common in East Asia and sub-Saharan Africa: Mandarin and Cantonese Chinese, Vietnamese, Thai and Bantu languages are common examples of these languages, known as tonal languages. Thus, a same syllable in Mandarin Chinese, pronounced with the four different tones of the language, will acquire completely different meanings, as in the commonly quoted example of [ma] (Roach, 1983:136):

媽 mā (high level pitch) means *mother*.
麻 má (rising pitch) means *hemp*.
馬 mǎ (falling-rising pitch) means *horse*.
罵 mà (falling pitch) means *to scold*.²

European languages like English and French are “non tonal” or “intonation languages” (Roach, 1991), and do not use this dimension of spoken language to express lexical differences between words, which makes the role of tone and intonation in them much harder to define.

It should be noted that both tonal and non-tonal languages can make use of intonation at a suprasegmental level to convey paralinguistic information such as emotion, intention or emphasis. Tonal languages will adapt differently to this “superimposed intonation” in order to keep the word-level lexical tones (Cruttenden, 1986:9).

We will proceed to review a number of theoretical proposals dealing with how intonation configures itself in spoken language and we will show two types of graphic representations of these configurations.

2.3.1 REPRESENTATIONS OF INTONATION

Multiple models of representation of intonation exist, conveying different aspects of spoken language at different analytical levels. For the aims of our research, we have chosen to present two types of transcription models. One of them is a phonological representation of tones and rhythm and the other one is based in the phonetic analysis of sound waves.

2.3.1.1 The tonetic model and the intonational phrase

When we described the stress systems of English and French we mentioned rhythmical structures that assemble several stressed and unstressed syllables. We called

² The diacritic marks used on top of the vowels of all four words to represent tones are part of the official transcription of Chinese pronunciation called *Pinyin*—an example of a visual representation of tone applied to syllables.

these groups “stress groups”. A similar model has been proposed, based on perception to represent intonation and rhythm of segments in English, called the “interlinear tonetic model” – initially conceived by Crystal (in Bolinger, 1972) but further developed by Roach (1983) and Cruttenden (1994), among others. This model, preferred by British scholars of prosody, divides speech into “intonational phrases” (IP). The transcription is done in three steps (Wells, 2006), similar to the ones mentioned in 2.4.1. for the delimitation of the stress group in French.

First, the intonational phrase has to be delimited or “chunked”. IPs usually correspond to syntactical phrases, but they can be shorter segments if the speaker pauses, hesitates or purposely decides to produce his/her utterances in a separate manner for emphasis. They are marked by an intonation break or a pause.

Then, we have to decide what syllables hold stress. Unstressed syllables are represented by small dots and stressed syllables are represented by big ones. The most stressed syllable in the IP is called the nucleus. If a less-stressed syllable precedes the nucleus, it marks the beginning of the “head”. All unstressed syllables preceding the head are part of the “pre-head”, and all unstressed syllables succeeding the nucleus are called the “tail”. The nucleus is the only part of the IP that is always present.

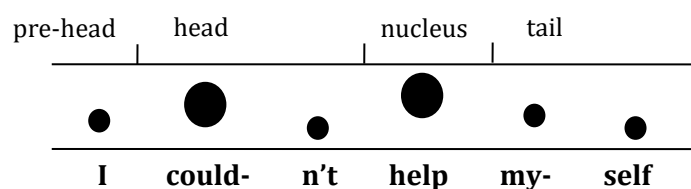


Fig. 5, Example of the interlinear tonetic model

Finally, the type of pitch movement (or “tone”) that occurs in the nucleus has to be defined. Cruttenden (1994) identifies seven kinds of tones. There are basic tones, which can be rising, falling or level. Depending on their starting point, rises and falls can be high or low. Two types of complex tones also exist: rise-fall and fall-rise.

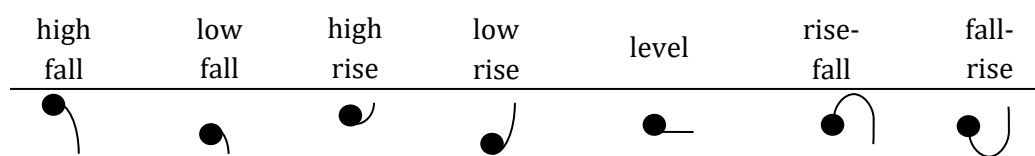


Fig. 6, Types of tones in the tonetic model

This transcription model, originally developed for English, is more suitable to visually represent stress-based languages. However, adaptations can be made to describe other languages. One of the main advantages of this system is the fact that it integrates

both rhythm and pitch contours, as well as the range of these contours, through the use of the concepts of high and low rises and falls.

2.3.1.2 INTSINT

INTSINT (International Transcription System for Intonation) belongs to the French school of phonetics and was developed by Daniel Hirst in 1987. It was proposed as a phonetic analysis of intonation, based on the data obtained through the acoustic analysis carried out by software like PRAAT and, more precisely, by an algorithm called MOMEL. This algorithm divides WAV files into segments depending on the pauses found in the speech; it then takes the F_0 data obtained with PRAAT and models it to create a continuous curve with important pitch changes marked by dots or “target points”. MOMEL can codify these points into a series of symbols and/or letters that convey the way in which they are organized for a single utterance between two pauses. This second part of the transcription results in a “surface phonological representation” in which a continuous phenomenon can be represented in discrete entities (Di Cristo, 2013:114). These entities can be organized as shown in Fig. 7:

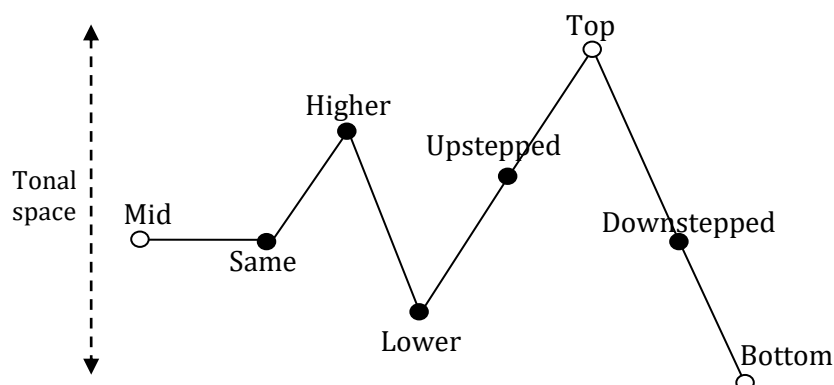


Fig. 7, INTSINT Alphabet
(modified from Di Cristo, 2013, and Louw & Barnard, 2004)

Three of these values designate absolute values: **T**(op) and **B**(ottom) mark the highest and lowest F_0 values, respectively, for the whole utterance. **M**(id) marks the starting point of an utterance, unless this point is already marked as **B** or **T**.

The five other values represent relative tones, which are calculated in relation to the target points surrounding them. A tone can be **S**(ame) if it has the same F_0 value as the one preceding it, **H**(igher) if it has a higher value than its adjacent tones and **L**(ower) if it has a lower value than its adjacent tones. **U**(pstepped) designates a point higher than the one preceding it but lower than the one succeeding it and, inversely, **D**(ownstepped) designates a point lower than the one preceding it but higher than the one succeeding it. All of these letters have symbol equivalences:

T: ↑	H: ↑
B: ↓	L: ↓
M: <i>(not specified)</i>	U: <
S: →	D: >

Table 1, INTSINT transcription

Fig. 8 shows an example of the utterance “I couldn’t help myself”, produced by a male speaker, analyzed by the MOMEL algorithm and transcribed with INTSINT. Note the equivalences of the target points with their respective INTSINT symbols.

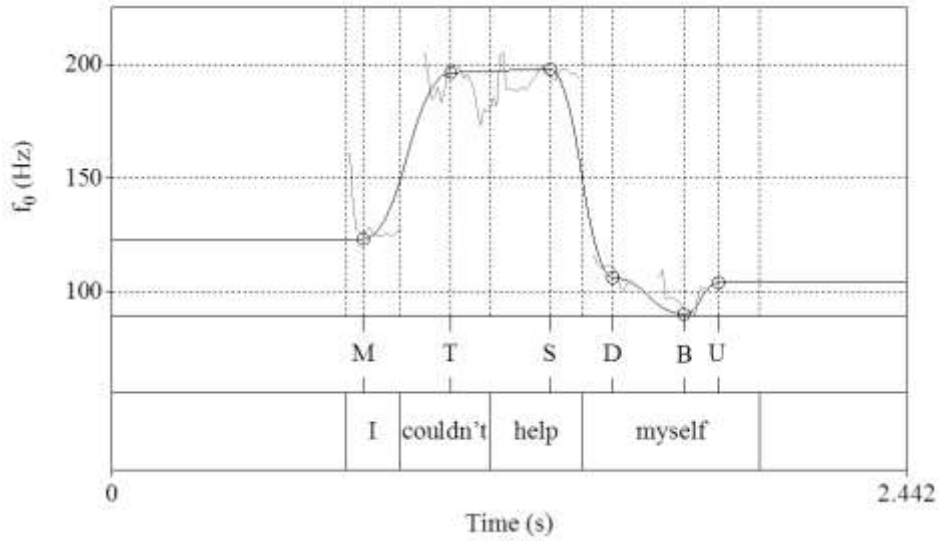


Fig. 8, MOMEL and INTSINT representations of an utterance

The sequence **MTSDBU** could otherwise be represented like this:

I COULdn't HELP myself
[↑ → > ↓ <]

The opening bracket ([) marks the beginning of the utterance and the closing bracket (]) marks its end. **M** is not specified in this type of transcription.

2.3.2 FUNCTIONS OF INTONATION

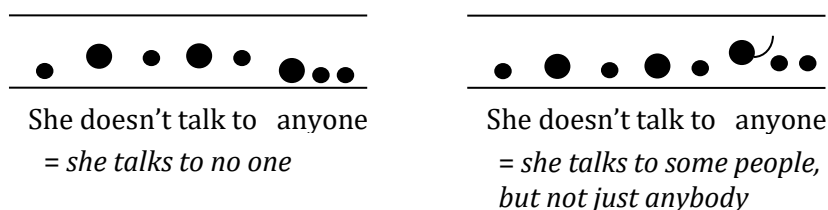
Now that we have the tools to describe and graphically represent intonation, we will briefly discuss the role that intonation plays in spoken language. The value of intonation has been discussed, described and classified many a time by researchers. Di Cristo (2013: 174), for example, gives a very detailed explanation and makes a distinction between general and specific functions of intonation. Among these categories we can find interesting functions, including the importance intonation has in the acquisition of language by infants, who are able to imitate the rhythm and pitch of utterances long before they are able to articulate vowels and consonants; or the role that intonation plays in understanding speech in a noisy environment (the *cocktail party effect*).

For this study, we will follow the simpler, clear-cut classification of the functions of intonation into four types proposed by Peter Roach (1983).

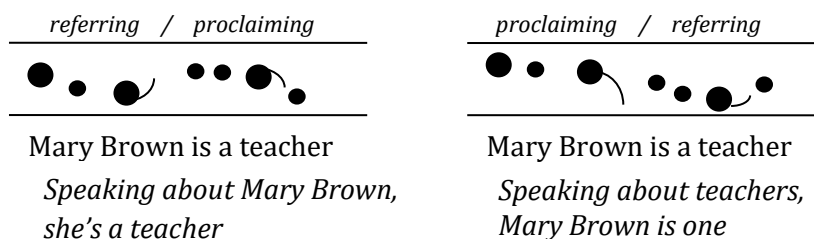
He begins by identifying an **attitudinal function**, through which intonation allows us to express emotion and attitude in our speech. Languages employ intonation in different ways to express emotion. Because of this, Roach insists on the importance of learners knowing how to express their attitude through intonation when learning a new language, to prevent listeners from misinterpreting their intentions. This function works closely with other paralinguistic resources of language, such as facial expression and body movements.

Roach qualifies the remaining three functions as **syntagmatic** functions, as they indicate a relationship between linguistic elements and the context in which they occur.

The **accentual function** of intonation allows the speaker to insist on certain syllables of words through the means of stress in order to change the importance they have within the IP. This function can completely change the meaning of an utterance, having either a contrastive or emphatic effect. For example, the sentence *she doesn't talk to anyone* can have two different meanings:



The **discourse function** of intonation allows the speaker to associate a particular communicative value to intonation, distinguishing old information from new information. This deictic function of intonation has also been mentioned by David Brazil, who proposes a model of intonation with only two tones: a fall-rise, or referring tone (R), that marks the IP as common, shared information between the speaker and the listener; and a falling tone, or proclaiming tone (P) that introduces new information. Thus, the P/R relationship can be analyzed in the following sentence (Brazil, 1997:68), composed by two IPs:



Finally, the **grammatical function** of intonation –the word *grammatical* used in a broad sense- refers to the use of intonation to represent different grammatical marks (i.e. punctuation marks, mostly). In certain cases, this intonation is essential in order to avoid ambiguity or misinterpretations, as in the example proposed by Pierre Delattre (in Bolinger, 1972):

i.	<table><tr><td colspan="5">Qu'est-ce qu'on a pour le dîner, maman?</td></tr><tr><td>[</td><td>↑</td><td>></td><td>></td><td>↓]</td></tr></table>	Qu'est-ce qu'on a pour le dîner, maman?					[↑	>	>	↓]	ii.	<table><tr><td colspan="5">Qu'est-ce qu'on a pour le dîner ? Maman ?</td></tr><tr><td>[</td><td>↑</td><td>></td><td>↓]</td><td>[↓ ↑]</td></tr></table>	Qu'est-ce qu'on a pour le dîner ? Maman ?					[↑	>	↓]	[↓ ↑]
Qu'est-ce qu'on a pour le dîner, maman?																							
[↑	>	>	↓]																			
Qu'est-ce qu'on a pour le dîner ? Maman ?																							
[↑	>	↓]	[↓ ↑]																			
iii.	<table><tr><td colspan="5">Qu'est-ce qu'on a pour le dîner ? Maman.</td></tr><tr><td>[</td><td>↑</td><td>></td><td>↓]</td><td>[↑ ↓]</td></tr></table>	Qu'est-ce qu'on a pour le dîner ? Maman.					[↑	>	↓]	[↑ ↓]												
Qu'est-ce qu'on a pour le dîner ? Maman.																							
[↑	>	↓]	[↑ ↓]																			

In these examples, pauses and diverse intonation patterns conjugate to transform the same sequence of words into three possible and quite different utterances. These changes in intonation are expressed in writing through commas, question marks and stops. Slight changes can turn a question directed at *maman* (i) into two separate questions (ii) or into a question and a ghastly answer.

The present study will analyze one of the acts of speech that results from this last grammatical function: questions. We have decided to focus on this function because it is more easily identifiable than attitude or discourse features. We will proceed to describe the intonation patterns commonly associated to questions in French and English.

2.3.3 THE INTONATION OF QUESTIONS IN FRENCH AND ENGLISH

The tonal patterns of this modality of speech have certain characteristics that allow the listener to differentiate it from other types of utterances. But, since the syntactical structures of questions differ between French and English, it follows that the intonational strategies used in each language are different as well. In this part, we will analyze the literature's description of intonation patterns in questions in both languages, in order to establish the differences and similarities between both languages. These descriptions apply to generalizations of questions, and they do not consider contrast, emphasis or other accentual functions that might affect the intonation of these utterances.

2.3.3.1 French

Di Cristo in Hirst & Di Cristo (1998:201) decides to divide questions in French into two big categories: total and partial questions.

Total questions are also known as *polar* or *yes/no* questions. They can either be syntactically unmarked or introduced by the formula *est-ce que*. The author puts emphasis

on unmarked questions, as he judges that they present an interesting intonational behavior and, also, because they are more frequent in current spoken French.

They are first and foremost characterized by a final rise. The rest of their intonation is similar to that of declarative sentences, which have a “continuative intonation”, or *continuation majeure* and *mineure*, as proposed by Delattre (1966): they present a first important rise in the first intonation group of the utterance (the formula *est-ce que* adopts this position in grammatically marked questions), and a subsequent fall until the final rise. If there are several intonation groups after the first one, their final syllables tend to have lesser rises than the first one. These constant rises are characteristic of French intonation, and they delimitate ‘sense groups’ within the sentence (Post, 2002; Vaissière, 2002).

At the final syllable of the utterance comes the interrogative rise, characterized for being greater in range than the previous rises, having steeper slope and a higher final pitch. In other words, it corresponds to **T** (↑). This would give yes/no questions in French what Delattre (1966) calls a “concave pitch pattern”. Di Cristo (1998:203) illustrates this through the following example:

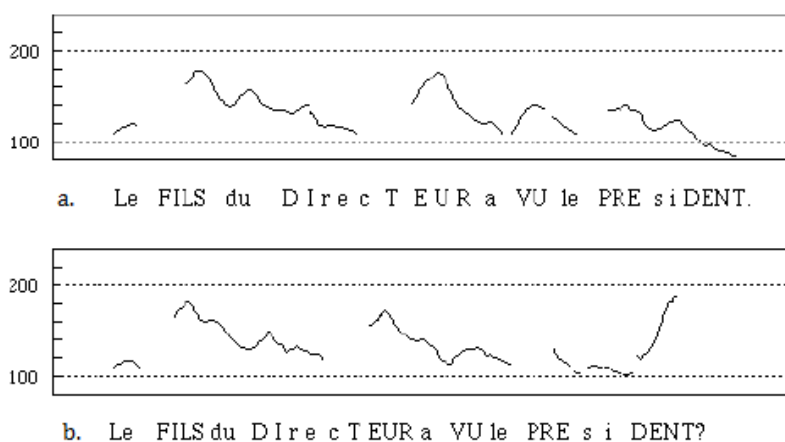


Fig 9. from Di Cristo, 1998:203

The dotted lines mark the referential frequencies of 100 and 200 Hz. Here, *a*, the affirmative version of the utterance, would phonologically correspond to:

Le fils du directeur a vu le président				
[↑	>	>	↓]

Whereas *b*, its question form, would be:

Le fils du directeur a vu le président ?				
[↑	>	>	↑]

Partial questions are characterized by the presence of an interrogative adverb: *qui, quand, où, pourquoi, comment*, etc. They present a pitch accent on the stressed syllable of the interrogative adverb. Pitch then drops until the end of the utterance, the final syllable of which represents the absolute bottom pitch (**B**).

Pourquoi tu n'es pas venue ?
[> > ↓]

Tag questions in French end in terminators such as *oui? non? si? n'est-ce pas?* or *hein?* They present a falling intonation, followed by a **T** rise accompanying the final syllable:

Tu n'es pas venue, si ?
[> ↓ ↑]

An interesting fact about French is that it has the syntactical flexibility to move interrogative adverbs within the sentence. Thus, the following question can be formulated in different ways, placing the adverb *où* in different positions (Déprez, Syrett, & Kawahara, 2013):

- i) *Où est-ce que tu vas?*
- ii) *Où vas-tu ?*
- iii) *Où tu vas ?*
- iv) *Tu vas où ?*

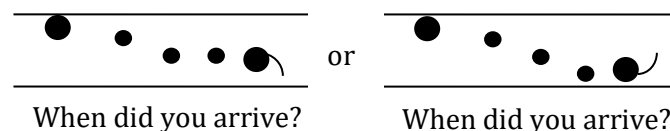
Number *iv* belongs to another type of question – wh-in-situ questions. Although intonation tends to rise where the interrogative adverb is located, there is no consensus over a clear intonation pattern for these questions in particular. Certain authors claim that a final rise would be obligatory for these structures to be grammatical (Cheng & Rooryck, 2000), whereas others say that there is no proof for this to be true. Indeed, authors like Léon (1992:131) say that –and this applies to qu-in-situ or any other type of question– when the interrogation is grammatically marked, by either *est-ce que* or an interrogative adverb, intonation is redundant and can therefore be completely neutralized.

2.3.3.2 English

Questions in English can be divided into three main groups: Wh-questions, yes/no questions and question tags. Syntactically, questions are usually marked by the auxiliary verb *do* or by a subject-verb inversion.

Wells (2006) assigns “default tones” to the different types of questions that exist in English, i.e. the tones that are most commonly associated to them.

Wh-questions exist in English as well and, as in French, they are characterized by a rise in the interrogative adverb and a subsequent falling final tone. However, other final tones are possible, such as a rise or a fall-rise. To illustrate this, the question *when did you arrive?* can present either of the two following tone patterns:



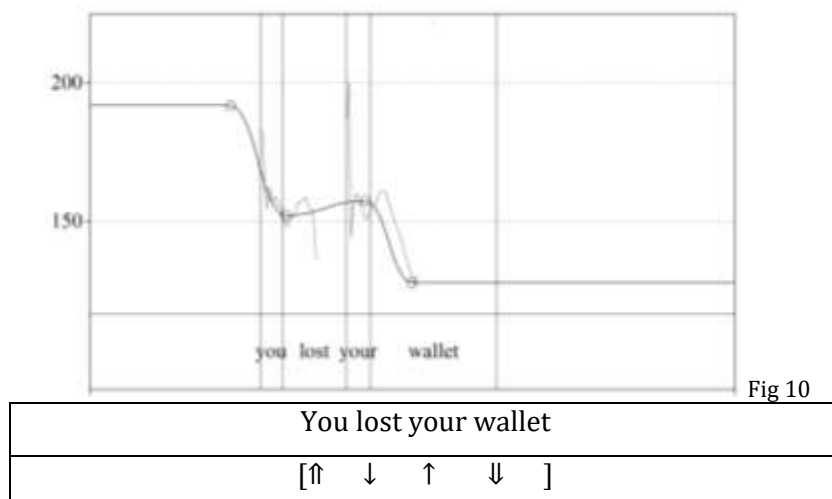
The prevalence of these patterns has been confirmed by later studies. Moore Mauroux (2009) carried out an analysis of the intonation of different types of utterances, using as a corpus an episode of a television show. Her study revealed that 78% of Wh-questions ended in a falling tone.

The default tone for **yes/no questions** in English, according to Well's description, is a constant rise. Moore Mauroux's study corroborates this claim, with 74% of rising tones in yes/no questions in her corpus. Yet, when analyzed at a syntactical level, we see that yes/no questions can present an interrogative element such as the auxiliary verb *do* or the subject-verb inversion, but they can also be syntactically presented as an assertion. The latter are called declarative questions:

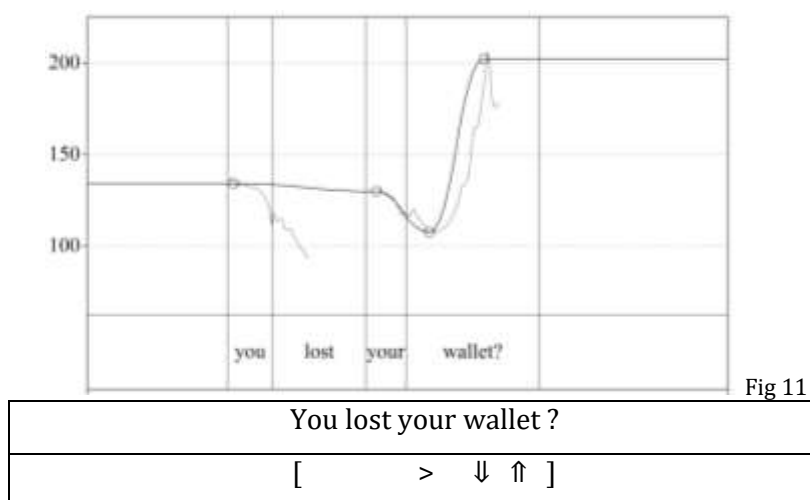
Yes/no question: *Did you lose your wallet?*
 Declarative question: *You lost your wallet?*

Declarative questions depend on intonation and context in order to be interpreted as questions. Therefore, rising intonation is even more prevalent in them, as confirmed by Moore Mauroux's measurements: 86% of occurrences presented a final rising tone. Figures 10 and 11 show the intonational contrast between declarative questions and yes/no questions in English in a similar way as Di Cristo's comparison above for the case of French:

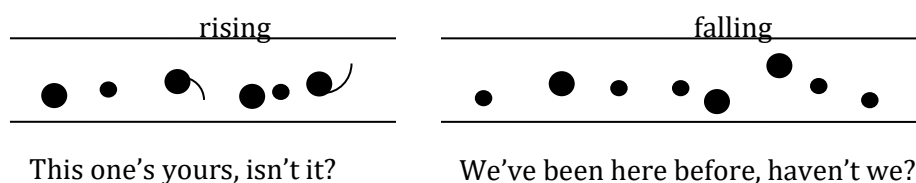
Affirmation:



Question:



And finally, **question tags** in English, as in French, are short yes/no questions tagged at the end of a statement. They can be produced with either a fall or a rise (Wells, 2006:48). When they present a falling intonation, they are genuinely asking for confirmation from the listener, whereas when they present a falling intonation they seek to insist, “appealing the listener for agreement”.



It should be noted that all of the above are merely descriptions –not prescriptions– of the most commonly observed intonation patterns in questions. The fact that a rising intonation is the most common intonation pattern found in yes/no question does not mean that all yes/no questions follow this scheme. And the same applies inversely: not all of the utterances ending with a final rising intonation are yes/no questions or even questions at all.

The following table summarizes the intonation patterns associated to questions in both languages:

	English	French
Yes/no questions	Rising overall	Rising in the final syllable
Declarative questions	Rising	Rising
Wh-questions	Falling Falling-rising	Falling Rising (wh-in-situ)
Tag questions	Falling Rising	Falling-rising

Table 2, intonation patterns of questions in English and French

Another important factor that distinguishes the distribution of intonation patterns in both questions and assertions is the presence of word stress in English, which enables it to have a more varied intonation than French (Vaissière, 2002).

2.4 PROSODY AND LANGUAGE LEARNING

2.4.1 PHONOLOGICAL “DEAFNESS”?

David Brazil illustrates the information exchange between a speaker and a listener as shown in Fig. 12. The shaded area represents their common knowledge, which depends on their common experience and on the communication context. In other words, the center part of the diagram stands for the portion of information from the speaker’s original message (its intentions, nuances and content altogether) that is actually understood by the listener. The rest of the circles represent the speaker and the listeners’s world views.

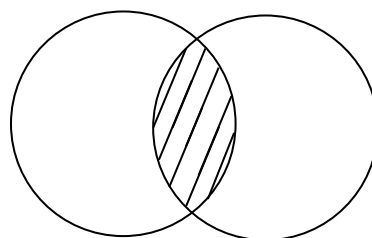


Fig 12, Brazil’s diagram for knowledge exchange in oral interaction.

For the aims of our study, we propose that the two circles are pulled farther apart when the speaker or the listener is a non-native speaker (NNS) of the language being used for the interaction. As we have established in the previous pages, there is a clear dissimilarity in the prosodic features of languages, such as those of English and French, and this can be evidenced in the interlanguage (IL) of learners (Swan & Smith, 2001:55), in the appearance of sounds and intonation patterns foreign to English in the speech of the NNS, which might affect the intelligibility of the speaker’s message. This phenomenon is known as **negative transfer** or **interference** from the learner’s L1.

But this process is first of all a perceptive phenomenon, and being confronted to new phonemes a learner can experience a phenomenon similar to a phonological “deafness”. This happens because the degree of perception of the sounds of a foreign language is determined by the listener’s mother tongue, as proposed in 1939 by Trubetzkoy. He postulated that learners possess a phonological filter based on their native language, and that phonemes which do not exist in the repertory of sounds of the learner’s native language are unconsciously associated to the closest ones that do exist. As a result, the distinctions between sounds that do not exist in the learner’s language are hard to

perceive and, therefore, to reproduce. Several comparative and cross-linguistic studies have analyzed the difficulties in perception and reproduction of phonemes in non native speakers of a foreign language, such as Best & Strange, 1992, or Swan & Smith, 2001.

Theoretical models have also been developed, based on Trubetzkoy's initial findings. Among these is the Perceptual Assimilation Model (PAM) (Best, 1995), which posits that the perceptive difficulty of a foreign language lies in the phonetic-articulatory similarities and differences between one's mother tongue and the language in question. It also stipulates that learners classify foreign languages into different categories, depending on the degree of similarity they hold with L1 phonemes.

The Speech Learning Model (SLM) proposed by Flege, (1995) tries to dismantle the Critical Period theory that claims that, after a certain age, acquiring the phonemes of an L2 becomes impossible. He proposes that the cognitive mechanisms used to learn sounds in the L1 remain intact throughout the learner's life. Adults would only be less likely to create new cognitive categories ("dissimilating" an L1 category from the new L2 category, to create contrast) when learning new sounds, and would instead be more prone to associating them to the categories already existing in their L1 ("merging" them into a single phoneme category).

A third and very interesting model is the Language Magnet Effect by Kuhl & Iverson (1991). Their theory proposes that exposure to a particular language distorts the perceptive capacities of a learner, reducing or "warp[ing] the acoustic space underlying phonetic perception" (Kuhl, 1991:122). Therefore, someone who has been exposed all their life to one language might perceive an enormous difference between two sounds that, for a listener exposed to a completely different language, would sound exactly the same.

All of these models define and explain the origins and the mechanics of a set of phonological characteristics that are common to the speakers of a same L1 who begin to learn an L2. These features are commonly known as a **foreign accent** or **accentedness**. The study of how listeners perceive accentedness and of the impact it has on communication is a relatively new research field. We will proceed to present an overview of the scope of this field scope and the different dimensions that are relevant for our research.

2.4.2 FOREIGN ACCENT

Sociolinguistic research on accent has highlighted the importance of accent in L1 speakers as well as L2 learners. Studies on language attitude have shown that foreign accent is often perceived as negative and that the expectations on the performance of speakers of an accented variety of a language –be it diatopic or diastratic– are low and can lead to discrimination (Eisenclas & Tsurutani, 2011:218). Another negative consequence of accented speech can be diminished intelligibility. But not all reactions to foreign accent are negative. In certain social interactions it can warn interlocutors to adapt their speech in order to ease comprehension, thus enhancing communication (Munro, 2008:195).

A widely-accepted definition of the concept of foreign accent is yet to be established, especially with the rising importance of “nativized varieties of English [which] will likely continue to blur the distinction between what is called a ‘native’ accent and what is considered ‘foreign’” (Munro, 2008:193). For our research, we will consider foreign accent as **the effect produced by the contact of the phonological system of an L1 and an L2 in a learner’s speech.**

An interesting quality about foreign accent is that it is such a salient cue in speech that it can be easily perceived not only by specialists, but by native speakers and learners as well. Linguists have exploited this quality to explore the reactions of listeners to accentuation in different contexts to see the role it plays in communication. The term **accentedness rating** has been conceived to represent the degree of foreign accent an utterance has. It is measured through scales in which listeners have to place utterances in a continuum of accentedness between the poles “not accented at all” and “very accented”.

Most studies deal with the pronunciation of vowels and consonants as the main factor in the perception of accentedness. We will review three recent studies that focus on the prosodic dimension of accent to examine their methodological approach to measuring how foreign accent is perceived.

Boula de Mareüil et al. (2006) ask themselves what characterizes an accent physiologically, acoustically and perceptually. They recorded native speakers of Spanish and Italian uttering a series of short sentences made up of words that are segmentally very close in both languages. Intonation, however, was different in both languages. They made listeners discriminate whether the speaker was Spanish or Italian. Afterwards, they resynthesized utterances, giving them the intonation of the other language, and discovered that listeners then identified them as more accented. This proves that prosody and other suprasegmental features play an important part in the perception of a foreign accent.

Jun & Li (2010) measured the factors that raters consider when rating an utterance as accented, as well as the intelligibility of foreign accented English. Two groups of listeners –native speakers of English and learners of English as L2– were exposed to foreign accented utterances of English. The factors intervening in their perception of accent were recorded by asking them to vocalize their thought process when listening to the recordings. Findings showed that native speakers and learners of English focus on different cues when judging an accent, but that the most common features considered by both groups are the same: consonants and vowels. They also discovered that native speakers display higher unintelligibility of accented English than learners.

Finally, Winters & Grantham O'Brien (2013) measured intelligibility and accentedness by using a 0-to-6 rating scale. They focused on F_0 and duration by manipulating samples of English and German speech. They transferred native intonation contours from English and German to non-native recordings of both languages. Results showed that unintelligibility and accentedness rating increased when they were manipulated.

3. METHODOLOGY

3.1 RESEARCH QUESTIONS AND OBJECTIVES

We have seen that prosody plays a very important lexical and pragmatic role in oral communication. We have also established that, since intonation and rhythm patterns differ greatly from one language to another, students of a second language cannot get by without learning how these suprasegmental features configure themselves in order to be able to convey clearly what they mean. However, our experience and observation in teaching English as a foreign language in France has taught us that students display a negative transfer of the prosodic features of French when they speak. The resulting foreign accent can be hard to understand if the listener is not familiarized with it, and can lead to misinterpretations both in the meaning and the intention of utterances. This has led us to ask ourselves the following questions, which will drive the present study:

- 1) Do native speakers perceive accentedness differently from French learners of English?
- 2) Which aspects of prosody are the most influential in the perception of a foreign accent?
- 3) Does accentedness obstruct communication?

Through our research, we seek to answer these questions by achieving three objectives:

- **Main objective:** Determining if native speakers of English and French learners of English perceive foreign accent in the same way.
- **Specific objective 1:** Evaluating the influence of intonation and other suprasegmental and segmental features in the perception of accentedness by native speakers of English and by French learners of English.
- **Specific objective 2:** Determining if accent affects intelligibility for native speakers of English and French learners of English alike.

To achieve the above stated objectives, we have carried out a two-part experiment. The first part consisted of the collection and analysis of a corpus of recordings, and the second part consisted in the creation and conduction of an accentedness rating survey based on the recorded data.

3.2 PROCEDURES

3.2.1 CORPUS COLLECTION

We compiled a set of recordings during an English-for-specific-purposes class activity with students from the University of Rennes 1 in France. The activity consisted in students preparing and playing an American-style trial. For this study, we concentrated on

the prosody of questions asked by the students playing the prosecutor and defendant attorneys in the activity. We decided to analyze this specific activity as we sought to examine the prosody of questions in a genuine –yet controlled– communicative context, in order to avoid the influence of read text. During the representation of the trials, students presented texts they had previously written and memorized, but they also had to resort to improvisation.

The students that appear in the recording range from ages 19 to 25. They are third-year students of law, non-specialists in English. Since the examinations at the end of high school studies in France demand that students have achieved a minimum level of B2 in their first option as a foreign language, and a B1 in their second option³, it has been established that the students recorded have an intermediate level of proficiency.

Six trials were recorded with a Roland Edirol R-09HR 24 bit/96kHz. Audio files were analyzed and questions were extracted into separate WAV files by means of the open source audio editor Audacity. In total, 235 questions were extracted, 20 of which had to be discarded as it was later discovered that one of the students was not a native speaker of French. The remaining 215 questions were classified into the four categories of questions we have identified above: **WH-questions**, **yes/no questions**, **declarative questions** and **question tags**.

WH-questions	78
yes/no questions	124
question tags	2
declarative questions	11
Total	125

Table 3, categorization of the questions found in the recordings

The recordings were used with the participants' consent, which they expressed by signing an authorization form (cf. Appendices 7.1).

3.2.2 CORPUS ANALYSIS

This classification was done in order to verify whether the students' productions presented either the intonational patterns that characterize each of these types of questions or different intonation contours.

³ Article D. 312-16 of the *Code de l'éducation*,
http://www.education.gouv.fr/pid25535/bulletin_officiel.html?cid_bo=58313

A word-by-word transcription of the content of the questions was carried out, and F₀ contours of the WAV files were obtained using the acoustic analysis software PRAAT⁴, and applying the MOMEL algorithm (Hirst & Espesser, 1993). The frequency curves obtained were then transformed into INTSINT notation.

The aim of the acoustic analyses was to examine if there is a relationship between divergent intonation contours and the perception of accentedness by two types of listeners.

3.2.3 SURVEY

For this experimental study, an accentedness rating survey was created to measure the perception of accentedness in some of these questions by English NS and French NS learners of English. The survey was applied to:

- i) 10 native speakers of English (NS GROUP): 8 female, 2 male, average age = 24.9 years old. All of them can speak French and have lived/are currently living in France.
- ii) 10 native speakers of French learners of English (NNS GROUP): 5 female, 5 male, average age = 20.3 years old, average number of years studying English = 9.8.

In total, the survey contained **28 questions**: 9 Wh-questions, 11 yes/no questions, 7 declarative questions and 1 question tag (see Appendices 7.2). These questions were selected because they were representative of the entirety of the questions and because of their better sound quality, higher volume and absence of background noise.

Subjects were given instructions at the beginning of the survey briefing them on the structure of the survey, telling them to wear headphones and giving them the necessary information to understand how to rate the questions (see Appendices 7.3). They were asked to rate questions according to a 5-point scale:

How accented is the following question?

1	2	3	4	5
no accent at all	slight accent	noticeable accent	strong accent	very strong accent

If they rated a question with any value higher than 1, they were prompted with two additional questions.

⁴ Created by Paul Boersma and David Weenink, available at <http://www.fon.hum.uva.nl/praat/>

- 1) **What aspect(s) of his/her speech make(s) this accent noticeable?** To answer this question, they could choose between four options, which represent different features of speech: **intonation, rhythm, speed** (suprasegmental) and **consonants and vowels** (segmental). Subjects were previously explained the meaning of these terms in the introduction to the survey, in case they were not familiar with them. They were given a fifth option '**other**' where they could add their own words in case none of the aforementioned categories matched their judgment.
- 2) **Does the accent render the question incomprehensible?** A simple yes/no question in case they could not understand what was being said on account of the speaker's accent.

Results were then analyzed and contrasted with the acoustic analysis data.

3.3 VARIABLES

We are confronted to several variables, two of which will be analyzed in this study: the **intonation of the recorded questions** and the **accentedness ratings obtained from the survey**.

The intonation found in the recordings is an independent variable. It can either match what theory identifies as the most common intonation of English or not. Accentedness rating is a dependant variable, as it will vary depending on how the NS group and the NNS group react to these different types of intonation found in the questions.

Other factors that will be considered in this study, as they might have an influence on accentedness rating, are the ones that were proposed to subjects in the survey: intonation, rhythm, speed, and consonants and vowels. Finally, intelligibility -or the lack thereof- will be considered as a consequence of the perception of accentedness.

3.4 HYPOTHESES

The hypotheses that we formulated in response to our research questions were the following:

Do native speakers perceive accentedness differently from French learners of English?

- **Hypothesis 1:** Subjects in the NS GROUP will rate utterances as more accented than those in the NNS GROUP.

Which aspects of prosody are the most influential in the perception of a foreign accent?

- **Hypothesis 2:** Listeners in the NS GROUP will consider intonation as the main cause of accentedness.
- **Hypothesis 3:** The utterances rated as accented by the NS GROUP will be those that present a predominant negative transfer of intonation patterns from French.

Does accentedness obstruct communication?

- **Hypothesis 4:** The NS GROUP will find utterances unintelligible more often than the NNS GROUP.

We will proceed to confirm or disprove these hypotheses by analyzing the data obtained.

4. RESULTS AND ANALYSES

In this section we will begin by presenting the survey results for both groups. We will then study the acoustic analyses for the questions that were rated as most accented or that presented remarkably different ratings from both groups. All the acoustic analyses, visual representations of F_0 produced with the MOMEL algorithm and survey results of each individual question can be found in the Appendices 7.4 section for reference.

4.1 ACCENTEDNESS RATING

Table 4 shows the rating averages given by the NS group and the NNS group. The scale, as shown in the methodology section, went from 1 to 5. Averages in green mark the lowest ratings (1.0-2.5), those in yellow mark medium ratings (2.6-3.6) and those in red mark the highest ratings (3.7-5.0). A higher rating (yellow or red) means a more perceptible accent.

























































	NS	NNS		NS	NNS
Q01	 4.5	 3.3	Q15	 3.2	 2.7
Q02	 3.9	 4.0	Q16	 3.8	 2.7
Q03	 3.0	 3.0	Q17	 3.5	 3.3
Q04	 3.6	 3.3	Q18	 2.0	 2.2
Q05	 2.8	 2.6	Q19	 3.7	 3.4
Q06	 4.0	 3.5	Q20	 3.0	 2.5
Q07	 2.1	 2.5	Q21	 4.2	 3.9
Q08	 3.5	 3.1	Q22	 3.4	 2.5
Q09	 3.4	 2.9	Q23	 3.3	 3.6
Q10	 1.9	 1.7	Q24	 3.7	 3.5
Q11	 4.3	 2.4	Q25	 3.1	 3.3
Q12	 2.1	 2.2	Q26	 3.2	 3.4
Q13	 3.5	 3.1	Q27	 2.8	 2.4
Q14	 3.8	 4.2	Q28	 3.8	 3.2

Table 4, average accented ratings of NS group and NNS group

At a first glance, native speakers consistently give the recordings a higher accentedness rating (19 higher average ratings out of 28 questions). This difference, however, is higher than 0.5 points only in questions 6, 9, 11, 15, 16, 20, 22 and 28 for the NS group.

Figure 13 shows the data set up in a different presentation, to appreciate differences between both groups:

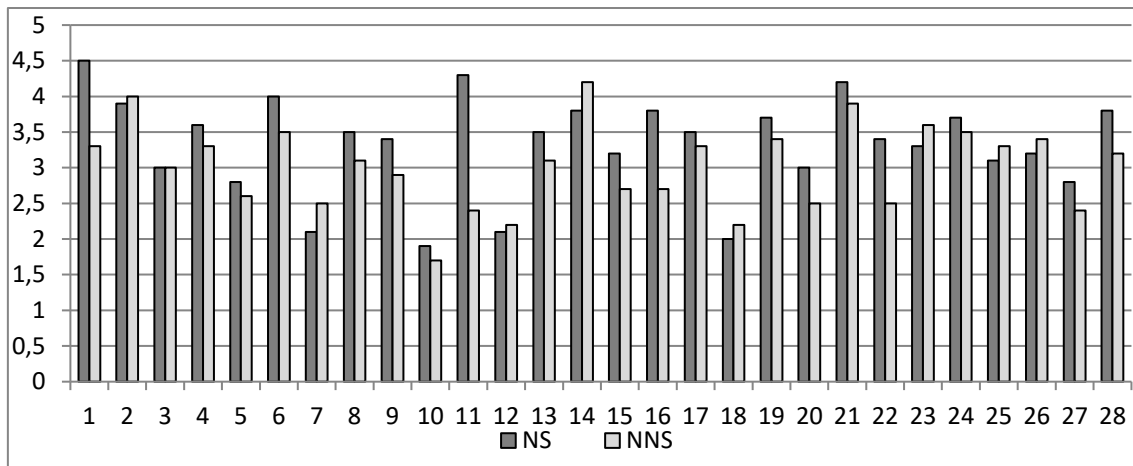


Fig. 13, average accentedness rating of NS group and NNS group

These differences between both groups hint at a difference in the way that native speakers and French learners of English perceive language. Here, the listeners' native tongue does seem to play part in the perception of sounds (Trubetzkoy, 1939; Flege, 1983; Best & Strange, 1992) and, by extension, in the perception of a foreign accent. The acoustic cues that prompt NS to judge these utterances as accented are either not perceived by NNS or, at least, not judged as foreign.

This could imply a link between accent perception and production, and would explain the difficulty that learners of L2 English experience to overcome certain aspects of their own accent. In other words, the fossilization of the French accent might stem from the fact that most French learners of English –in the same way as any other person who learns L2 English in their home country– are surrounded predominantly by a French accent throughout their years of schooling. The constant exposure to this accent –be it their teachers' or their peers' accent– rather than to a native accent or a different foreign accent of English may be a reason why they are less critical than native speakers when rating.

The differences in ratings also confirm Kuhl and Iverson's Language Magnet Effect theory (1991), by demonstrating that native speakers, who are evidently exposed more intensively to English than L2 learners throughout their lives, can perceive more subtly the distance between sounds and intonation patterns than French speakers. As predicted by the Speech Learning Model (Flege, 1995) and the Perceptual Assimilation Model (Best, 1995), learners are likely to group divergent segments and suprasegments in a same cognitive category, whereas native speakers immediately perceive sounds as different because they do not belong to the repertoire of sounds they are accustomed to hearing.

If we analyze the rating averages given to questions according to their category, the results are the following:

Question type	NS average	NNS average
WH-questions	3.27	3.01
Yes/no questions	3.21	2.91
Declarative questions	3.43	3.27

Table 5, rating averages by question type

Both groups display similar lower ratings for WH and yes/no questions –that is, questions that are grammatically marked as questions– and higher ratings for declarative questions, which depend solely on intonation to be understood as interrogative sentences instead of affirmative sentences. In order to observe if there is a link between intonation and accentedness and to understand how listeners assessed the recordings, we will proceed to analyze the factors that they considered important when rating foreign accent.

4.2 FACTORS INVOLVED IN ACCENTEDNESS PERCEPTION

Not only did NS and NNS give different ratings to the recordings, but the factors involved in their evaluation also differed. Table 6 shows the total number of times each factor was selected by NS and NNS for all 28 questions:

		NS	NNS
Aspects that make accent noticeable	Intonation	156	148
	Rhythm	159	124
	Speed	97	91
	Consonants and vowels	203	131

Table 6, aspects making accent noticeable - totals

NS gave significantly more importance to segmental features of speech than NNS. This goes against the results obtained in Jun and Li (2010), where NNS detected segmental more often than NS. This can be explained by the different nationalities of their NNS raters. In our study, all NNS raters were French as well as the speakers in the recording. Therefore, they are more oblivious to French-accented segmentals than NS.

Intonation and speed were mentioned in similar proportions by both groups. The latter was the least mentioned, probably because the speakers did not hesitate much, and their speech debit was natural-like since they had studied their lines for the class activity, but were not reciting or reading them out loud.

Finally, there is a difference in the perception of rhythm as a cause of accentedness. The reason behind this phenomenon is most likely the “absence” of word-stress in French. At a word-level, words in French are stressed in the final full syllable. It has been proven that, because of this structural feature of spoken French, French NS have difficulties in perceiving and placing word stress in languages like English or Spanish (Dupoux et al., 2008). Because of this, some of the stress misplacements that can be found in the recordings and which were perceived by the NS group were not perceived by NNS, or simply not considered as a cause of a foreign accent.

One of our hypotheses was that there would be a link between accentedness and intonation. Table 6 combines several parameters: it takes the ratings presented in Table 4 and associates them with the factors mentioned by listeners. As a visual aid, higher occurrences of a factor have been emphasized in darkening grey tones. Furthermore, questions have been grouped to determine if there is a relationship between question types and segmental/suprasegmental features associated to accent:

Question type	Q #	NS							NNS						
		Avrg	U.R.	Int	Rhy	Spd	C&V		Avrg	U.R.	Int	Rhy	Spd	C&V	
WH	Q01	4.5	80%	5	6	4	9		3.3	30%	8	1	3	6	
	Q05	2.8	10%	2	3	3	7		2.6	0%	4	1	4	4	
	Q06	4.0	40%	3	7	2	9		3.5	10%	7	7	2	8	
	Q07	2.1	0%	1	2	0	8		2.5	0%	3	5	0	5	
	Q18	2.0	0%	4	5	0	1		2.2	0%	3	2	4	1	
	Q19	3.7	30%	6	6	9	8		3.4	40%	6	4	8	4	
	Q22	3.4	40%	8	6	4	8		2.5	10%	5	5	2	4	
	Q23	3.3	30%	7	7	4	6		3.6	30%	6	5	8	3	
	Q24	3.7	50%	9	8	3	8		3.5	0%	6	4	5	6	
Yes/no	Q03	3.0	10%	8	7	2	3		3.0	40%	6	5	1	2	
	Q04	3.6	40%	8	6	2	9		3.3	40%	8	4	2	6	
	Q08	3.5	30%	6	6	3	9		3.1	20%	5	7	2	6	
	Q09	3.4	10%	6	7	4	8		2.9	0%	4	5	4	6	
	Q10	1.9	0%	4	3	2	6		1.7	0%	0	2	2	1	
	Q13	3.5	20%	5	7	3	9		3.1	0%	6	8	2	7	
	Q15	3.2	30%	5	7	2	8		2.7	20%	5	5	0	6	
	Q17	3.5	40%	6	7	3	8		3.3	30%	6	6	2	6	
	Q25	3.1	40%	9	7	5	8		3.3	20%	8	3	5	5	
	Q27	2.8	0%	3	4	3	6		2.4	0%	3	2	3	4	
Declarative	Q02	3.9	60%	9	6	2	8		4.0	30%	6	8	3	4	
	Q12	2.1	0%	6	2	3	3		2.2	0%	2	3	5	2	
	Q14	3.8	30%	7	5	5	7		4.2	20%	7	7	4	8	
	Q16	3.8	40%	5	3	8	7		2.7	10%	5	5	5	3	
	Q20	3.0	20%	4	6	2	8		2.5	20%	6	3	1	3	
	Q21	4.2	100%	4	7	4	9		3.9	70%	7	5	0	7	
	Q26	3.2	0%	6	6	4	7		3.4	0%	8	6	7	8	
Question tag	Q11	4.3	80%	5	6	7	7		2.4	30%	2	0	5	1	

Table 6, question types, accentedness averages (Avrg), Unintelligibility rate (U.R.) and factors that cause accent (Int, Rhy, Spd, C&V)

We notice that NS mention more factors than NNS in general, the most noticeable being vowels and consonants. Rhythm and intonation are also frequent in the NS group, especially when accentedness ratings are high. There does not seem to be a relationship between a type of question and a specific factor, for neither NS nor NNS.

The NNS group presents a more even distribution of factors, with a less marked tendency for consonants and vowels. Although both groups sometimes mention the same factors for accentuation in certain questions, in other questions they give completely different answers. A clear tendency cannot be distinguished from these answers. An individual analysis of questions might prove revealing.

4.3 INTELLIGIBILITY

There is a relationship between higher accentedness ratings and less intelligibility among the members of the NS group. The three questions with the highest unintelligibility rate, questions 1, 11, and 21, are a good example of this relationship (see Table 6 above). For a global idea of unintelligibility, Table 8 shows the total answers concerning unintelligibility for all 28 recordings:

<i>Is the question incomprehensible?</i>			
NS		NNS	
Yes	No	Yes	No
87	181	46	234

Table 8, global answers to *is the question incomprehensible?*

The NS group could not understand the content of the recordings on account of foreign accent almost twice as many times as the NNS group. This means that not only do NNS perceive less of a foreign accent, but they can also understand accented utterances better than NS. Once again, we are led to think that this would further fossilize a foreign accent among French learners, since they can perfectly understand each other through their accents and, therefore, they do not feel the need to improve their pronunciation. Additionally, even though all of the subjects in the NS group knew the phonological system of French, and all of them spoke French at different proficiency levels, they still displayed less comprehension. These findings do match those of Jun and Li (2010).

If we analyze these results focusing on individual questions, 5 of them (number 1, 2, 11, 21 and 24) were qualified as incomprehensible by more than 50% of listeners in the NS group, whereas only one question (number 21) was deemed unintelligible by the NNS group. For the NS group, unintelligibility seems to be related primarily to segmental

features (consonants and vowels), which shows up as the predominant factor of accentedness in all 4 questions. However, intonation was also identified as a factor of accentedness in these questions, yet to a lesser extent.

4.4 ANALYSIS OF INDIVIDUAL QUESTIONS

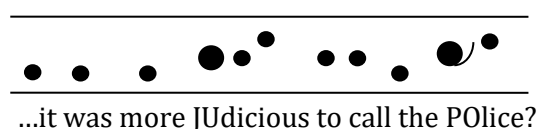
In this final part of our analysis, we will only focus on the answers given by the NS group. We will analyze seven highly rated utterances (questions number 2, 3, 4, 19, 24, 25 and 28) containing high occurrences for intonation. We will describe the intonation patterns in them in search of intonation transfers from French or other unusual contours which might have prompted these high ratings.

Q02 – Declarative | 3.9 rating | 9 occurrences signaling intonation | 60% unintelligible

You didn't think it was more judicious to call the police?										
[↓	↑	↓	<	→	→	<	↑	>	↓
										↑
MLHBUSS <u>U</u> HDLT										

This declarative question begins with a low, flat F_0 (~250 Hz, female speaker), displaying a few Lower and Higher target points that stay close to the Bottom in its first half. F_0 then rises towards the end, in the words *judicious* ($H \cong 400$ Hz) and *police* ($T \cong 500$ Hz). Strictly speaking, this question shows a final rise and therefore meets the intonation criteria of declarative questions (Wells, 2006). However, the sudden double rising in the final portion of the question might be the reason why NS listeners considered that intonation sounded foreign. We will see that, generally speaking, utterances rated as more accented tend to display a higher frequency range than those rated as less accented. Listeners might regard this as an exaggeration of English intonation. The same final sequence UHDLT (underlined) can also be found in question 21, another declarative question which also received a high accentedness rating (see Appendices 7.4 – Q21).

Furthermore, there is a stress misplacement in the two final, high-pitched words, which might also contribute to the high accented rating given by the NS group. This phenomenon, signaled by 6 out of 10 listeners who selected rhythm as a cause of accentedness, affects the tonal structure of the intonational phrase by turning what should be the nucleus (poLICE) into the tail (POlice), resulting in a 60% of unintelligibility:



Q03 – Yes/no | 3.0 rating | 8 occurrences signaling intonation | 10% unintelligible

Did you call immediately the police?									
[↓	↓	<	↑		→	>	→]
MDBUTSDS									

This question is an interesting case of syntactic negative transfer from French, which has incidence at a phonological level. The position of the adverb *immediately* before the object of the verb is characteristic in French syntax. This emphatic placing of the adverb is accompanied by stress in the first syllable and, by extension, of a rising intonation that is deemed unnatural by NS. This, along with a falling intonation instead of the distinctive rising intonation of yes/no questions in English, results in 8 listeners out of 10 associating accent to intonation.

Two listeners also marked *other* as a cause for accentedness and specifically mentioned “word order” and identified it as a “very [F]rench way to speak”. Nevertheless, although evident, this negative transfer from French intonation has no repercussions in intelligibility.

Q04 – Yes/no | 3.6 rating | 8 occurrences signaling intonation | 40% unintelligible

Do you think that she inform you enough about the risks of the operation?															
[<	↑	↓	↑	>	>	>	↓	↑	>	>	>		↑ ↓]
MUTLHDDDBHDDDBH															

In this case, the divergent question intonation pattern is likely to be the reason why listeners linked intonation to accentedness. The falling intonation contour in this utterance does not match the characteristic intonation of yes/no questions in English, which tend to show a constantly rising intonation. After an initial rise in *think*, intonation downsteps slowly, reaching a very low bottom intonation (100Hz, male speaker). This, however, cannot be attributed to an influence of French intonation, since yes/no questions in French are characterized by a final rise in the final syllable.

Other factors that prompted listeners to give a high rating to this question were consonants and vowels (9 out of 10) and rhythm (6 out of 10), probably due to the word *enough* being pronounced as [ˈɛ.nœf], with a misplaced stress in the first syllable and a full initial vowel.

Q19 – WH | 3.7 rating | 6 occurrences signaling intonation | 30% unintelligible

What er was your husband's behave with Heather's boyfriend in general?																	
[↑	>↓	↑	>→	↓	<↑	>	>	↓↑	>↓	→	<	<	↑	>	↓	↑ ↓]
MTDLHDSBUHDDDBHDBSUHDBHD																	

At a first glance, there seem to be excessive shifts in intonation in this utterance. It is a particular case where duration and F_0 work together to produce a foreign accent. The utterance lasts approximately 7.29 seconds and presents hesitations that caused that 9 out of 10 listeners chose speed as a cause of accentedness. The hesitations and the lengthening of words that the speaker used –most likely as a resource to cover up silence while thinking of what to say next– were accompanied by a highly ranging intonation ($T \cong 500\text{Hz}$, $B \cong 100\text{Hz}$, female speaker).

Contour-wise, the utterance begins with a high pitch placed on the interrogative adverb, as expected for this type of questions. However, this is followed by a series of steep higher and lower target points. High-pitched target points appear every time a new adverbial is added to the utterance and Bottom target points (underlined) appear at the end of each one of these adverbials. These successive falling contours give the listener the false impression that the sentence is coming to an end, only to be resumed with new information, twice. This results in what seems to be three separate utterances:

What er was your husband's behave / with Heather's boyfriend / in general?

Two listeners who selected the field *other* gave additional input mentioning grammar –probably referring to the use of *behave* instead of *behavior*– and saying that it “influences [the] rhythm / flow of [E]nglish”, but that it “[doesn’t] affect how the question is understood”. Indeed, this is confirmed by the relatively low rate of unintelligibility (30%).

Q24 – WH | 3.7 rating | 9 occurrences signaling intonation | 50% unintelligible

What can be the evolution of this face surgery?											
[↑	↓	↑	↓	↑	↓	↑	↓	↑	>	↓]
MTLHLHBHLHDB											

This WH-question contains the main features of a WH-question in English: the Top target point is located at the very beginning on the interrogative adverb; then, intonation drops until the end of the utterance, where it reaches its bottom. Yet 9 out of 10 listeners said its intonation sounds foreign. This is due to the contours occurring between these two extreme points. The H-L succession is reminiscent of the French intonational phenomenon of continuative intonation. The H nodes mark sense groups within the whole intonational phrase, similarly to the contours shown in the example of Fig. 9 (above).

This negative interference of French intonation is perceived by NS listeners, 50% of which even declared not understanding the content of the utterance. It is interesting to

note that, although NNS also associated intonation to foreign accent (6 out of 10), contrary to the NS group, they group had a 100% comprehension rate. This proves that French continuative intonation does not obstruct communication at all for NNS.

Q25 – Yes/no | 3.1 rating | 9 occurrences signaling intonation | 40% unintelligible

Is it possible that Pete Bronson view changed since two-thousand and ten?											
[↑	>	↓	↑	↓	↑	↓	↑	>	>	↓]

This question shows a similar phenomenon to the one we just analyzed in Q24, which proves that the transposing of continuative intonation from French to English would not be restricted exclusively to WH-questions. This is visible in the successions of H and L points.

In this question, like in Q19, there are pauses that might have also played part in accent perception. The only difference here is that, at the end of every small group between pauses, there is a rising intonation that lets us know that the utterance is still not complete, and that more information is about to be presented:

Is it possible ↑ / *that Pete Bronson view* ↑ / *changed since two-thousand-and-ten?* ↓

Because of these characteristics, we can affirm that there is a clear transfer of intonation patterns from French in this question. When we look at the F_0 graph rendered by the MOMEL algorithm (see Appendices 7.4 – Q19), the result resembles the example of Fig. 9 for declarative intonation in French: there is an initial very high first rise followed by lower rises until the end of the utterance. Contrary to Fig. 9, however, since this question is grammatically marked by a subject-verb inversion at the beginning, a final rise is not vital for it to be understood as a question.

Finally, it should be observed that the utterance also presents a high F_0 range (from **T** \cong 450 to **B** \cong 170, female speaker) which, as we mentioned in Q02, is probably associated to affected intonation and regarded as foreign accent.

Q28 – Yes/no | 3.8 rating | 5 occurrences signaling intonation | 40% unintelligible

Do your husband take care of you and your daughter?									
[↑	↓	↑	↓	↑	↓	↑	↓]
MHLTLHLHB									

The last question in the survey was primarily rated as accented because of its segmental features (9 out of 10). However, intonation was also signaled as relevant by 50% of raters. Once again, traces of *continuation majeure* are present in the series of ups-

and-downs visible in the transcription. The distribution of H target points, however, is at unusual places, as they do not seem to be delimitating groups of sense: for example, a low F0 in *take care*, the main verb of the sentence, followed by a higher intonation in *you*, a pronoun which is not generally prominent unless special emphasis wants to be made. This irregular distribution of pitch might also explain the fact that 7 raters out of 10 also indicated rhythm, since one of the factors involved in stress is an increased F₀.

5. CONCLUSIONS AND DISCUSSION

In this study, we tried to confirm if there exists a relationship between accentedness perception and intonation. Through our analyses, we were able to better understand the intricate ways in which accent is perceived by native speakers and francophone learners of English as a foreign language. We will first answer our research questions and present our most important findings, then we will discuss the limitations of our methodology and finally we will discuss the possible projections and practical applications of our results.

Do native speakers perceive accentedness differently from French learners of English?

There is convincing evidence that native speakers perceive French accent at a higher extent than French learners. This is reflected in L1 English speakers' constantly assigning higher accentedness ratings than L2 learners. NS also mention more factors intervening in accent than NNS, which proves that they have a more developed perception of sounds and prosodic features that diverge from those of native English. These findings confirm previous discoveries in language learning (Kuhl & Iverson, 1991; Flege, 1995; Best, 1995). Our hypothesis 1 is therefore confirmed.

Which aspects of prosody are the most influential in the perception of a foreign accent?

Our hypothesis 2 resulted to be negative, as the most cited factor by the NS group was decidedly consonants and vowels. Rhythm and intonation followed and speed was in the final place. The NNS group, on the other hand, presented different, more evenly distributed results, with intonation in the first place, followed closely by segmentals and rhythm, and speed in the final position as well. Native speakers tended to consider more factors at a time than learners.

Does accentedness obstruct communication?

Hypothesis 4 was partially confirmed. Higher unintelligibility rates always occur in questions with high accentedness ratings, but the opposite is not always true. In other words, unintelligible speech is always considered as heavily accented, but speech rated as very accented is not necessarily unintelligible.

It is interesting to note that unintelligibility rates are much higher in the NS group than in the NNS group, which suggests once more that French-accented utterances are more easily understood by native French speakers.

Unintelligibility appears to depend primarily on the pronunciation of segments, as this factor was the most mentioned in all utterances graded as incomprehensible.

Hypothesis 3 is a more complex hypothesis to confirm or reject, because it is hard to determine whether an uncommon intonation pattern is necessarily caused by an influence of French intonation. After our analysis of the seven highly accented utterances, we can conclude that two phenomena are recurrent, one of which is distinctive of French intonation.

First, utterances containing highly ranging F_0 contours with steep H and L nodes are usually graded as more accented on account of intonation. The placement of these steep rises and falls seems to be important as well, as the analyzed accented utterances tended to present rises in grammatical words –which are usually less prominent– and falls in content words –which are usually more prominent and present higher pitch. Falls occurring along with pauses also contribute to foreign accent perception, giving an impression of completeness before the utterance is actually over.

A second and very important feature found in the analyzed utterances was the transference of French intonation patterns and, more precisely, continuative intonation (Vaissière, 2002). The grouping of words into sense groups with risings at the end of each group are perceived as foreign accent by listeners, as English does not arrange words in rising intonational groups in the same way as French. These groups, reflected in the transcription of L-H target point sequences, prompted NS listeners to grade accentedness on account of intonation on the three utterances that present evident transfers. Nevertheless, the data we collected did not show conclusive evidence that this type of transfer is directly related to reduced intelligibility.

A difficulty faced during this study was the use of categories labeled as *intonation*, *rhythm*, *speed* and *consonants and vowels* to denominate the factors intervening in the perception of accent. Since listeners are not specialists, and although explanations were given to clarify what each of these terms meant, they might have had trouble fully understanding what these words mean in linguistics and how they manifest themselves in speech. It should be noted that F_0 , and therefore its perceptual manifestation, intonation proper, does not present itself isolated from other suprasegmental features. Quite the opposite: it often appears in intricate interactions with duration and intensity which makes the task of assigning accentedness to a specific factor even harder for the untrained ear. This is why a different approach, such as that of Jun & Li (2010), might have proven more accurate. However, their methodology would have required significantly more time,

as it consists on the listeners vocalizing their thought process as they answer the survey and therefore demands that the linguist pay individual attention to every rater. By doing so, it is not listeners who have to deal with classifying what they perceive; instead, the linguist takes notes on their comments and then carries out a more accurate classification.

Another difficulty which is also related to the listeners' comprehension of the concept of foreign accent is that other factors, such as errors in grammar and syntax, might make them grade utterances as more accented, even when segmental and suprasegmentals are similar to native speech. Although listeners were instructed to rate exclusively the accent of the recorded speakers (see survey instructions, Appendices 7.3), it is inevitable to perceive an utterance as more "foreign" if it contains grammar or vocabulary mistakes. This is one of the risks of working with spontaneous speech samples, and it can be overcome or complemented by contrasting our results with the perception of recordings of students reading out loud previously formulated utterances which are grammatically and syntactically correct.

Further research

Further research on the behavior of continuative intonation of both languages is required to corroborate the existence of a link between French continuative intonation transfer in English and unintelligibility. Furthermore, to confirm the fact that French accent is actually an obstacle for communication, which would make it a relevant subject for further study, it would be interesting to examine how learners of English with L1s other than French react to French accentedness, and to measure their intelligibility.

The identification of recurrent prosodic transfers that has been carried out in this research also serves as a starting point for the development of didactic tools to help students acquire native-like prosody to achieve better intelligibility. Previous research has shown that speech visualization technology can be beneficial for students both at a sentence and at a discourse level (Chun, 1998; Levis & Pickering, 2004). Commercial programs like *VisiPitch* and *SpeechViewer* have been created for these purposes, and freely downloadable software such as *WASP* and *PRAAT* can be used to analyze raw data which can be modified didactically to show students how their production differs from native production and how this can be an obstacle for communication. Other studies have further developed this idea and propose techniques of F_0 resynthesis that can be used to transpose native intonation into students' recordings (Felps, Bortfeld, & Gutiérrez-Osuna, 2009; Arias, Becerra Yoma, & Vivanco, 2010).

6. BIBLIOGRAPHY

- Abercrombie, D. (1967). *Elements of General Phonetics*. Edinburgh: Edinburgh University Press.
- Arias, J. P., Becerra Yoma, N., & Vivanco, H. (2010). "Automatic intonation assessment for computer aided language learning". *Speech Communication* , 52, 254-267.
- Best, C. (1995). "A direct realist view of cross-language speech". In W.Strange (Ed.), *Speech perception and linguistic experience*, 171-204. Baltimore: York Press
- Best, C., & Strange, W. (1992). "Effects of Phonological and Phonetic Factors on Cross-Language Perception of Approximants". *Haskins Laboratory Status Report on Speech Research* , 110, 89-108.
- Bolinger, D. (1972). *Intonation*. Middlesex: Penguin.
- Boula de Mareüil, P., & Vieru-Dimulescu, B. (2006). "The contribution of prosody to the perception of foreign accent". *Phonetica, International Journal of Phonetic Science* , 63, 4, 247-267.
- Brazil, D. (1997). *The Communicative Value of Intonation*. Cambridge: Cambridge University Press.
- Cauldwell, R. (2002). "The functional irrhythmicality of spontaneous speech: A discourse view of speech rhythms". *Apples - Journal of Applied Language Studies* , 2, 1, 1-24.
- Cheng, L. L.-S., & Rooryck, J. (2000). "Licensing Wh-in-situ". *Syntax* , 3, 1-19.
- Chun, D. (1998). "Signal analysis software for teaching discourse intonation". *Language Learning & Technology* , 2, 1, 74-93.
- Cruttenden, A. (Ed.) (1994). *Gimson's Pronunciation of English*. London: Arnold.
- Cruttenden, A. (1986). *Intonation*. Cambridge: Cambridge University Press.
- Crystal, D. (1969). *Prosodic Systems and Intonation in English*. Cambridge: Cambridge University Press.
- Dauer, R. (1983) "Stress-timing and syllable-timing reanalyzed". *Journal of Phonetics*, 11 1, 51-62.
- Delattre, P. (1966). "Les dix intonations de base du français". *French Review* , 40, 1, 1-14.

- Déprez, V., Syrett, K., & Kawahara, S. (2013). "The interaction of syntax, prosody, and discourse in licensing French wh-in-situ questions". *Lingua* , 124, 4-19.
- Di Cristo, A. (2013). *La prosodie de la parole*. Brussels: De Boeck.
- Dupoux, E., Núria, S.-G., Navarrete, E., & Peperkamp, S. (2008). "Persistent stress 'deafness': the case of French learners of Spanish". *Cognition* , 106, 682-706.
- Eisenclas, S., & Tsurutani, C. (2011). "You sound attractive! Perceptions of Accented English in a Multi-Lingual Environment". *Australian Review of Applied Linguistics* , 34, 2, 216-236.
- Felps, D., Bortfeld, H., & Gutiérrez-Osuna, R. (2009). "Foreign accent conversion in computer assisted pronunciation training". *Speech Communication* , 51, 920-932.
- Flege, J. E. (1986). "The production and perception of foreign language speech sounds". In Winitz, H (Ed.). *Human communication and its disorders*, 2, 224-401. Norwood, NJ: Ablex.
- Hirst, D., & Di Cristo, A. (Eds.) (1998). *Intonation Systems : A Survey of Twenty Languages*. Cambridge: Cambridge University Press.
- Hirst, D., & Espesser, R. (1993). "Automatic modelling of fundamental frequency using a quadratic spline function". *Travaux de l'Institut de Phonétique d'Aix* , 15, 71-85.
- Jenkins, J. (2007). *English as a Lingua Franca: Attitude and Identity*. Oxford: Oxford University Press.
- Jun, H. G., & Li, J. (2009). "Factors in Raters' Perception of Comprehensibility and Accentedness". *Proceedings of the 1st Pronunciation in Second Language Learning and Teaching Conference* (pp. 53-66). Ames, Iowa: Iowa State University.
- Kamiyama, T. (2004). "Perception of Foreign Accentedness in L2 Prosody and Segments: L1 Japanese Speakers Learning L2 French". *Speech Prosody 2004 International Conference*, 721-724. Nara, Japan.
- Kuhl, P & Iverson, P. (1995). "Linguistic experience and the 'perceptual magnet effect'". In W. Strange (Ed.) *Speech Perception and Linguistic Experience: Issues in cross-language research*. Baltimore: York Press.
- Léon, P. (1992). *Phonétisme et prononciation du français*. Paris: Nathan.
- Levis, J., & Pickering, L. (2004). "Teaching intonation in discourse using speech visualization technology". *System* , 32, 505-524.

- Louw, J. A., & Barnard, E. (2004). "Automatic intonation modeling with INTSINT". *Proceedings of the 15th Annual Symposium of the Pattern Recognition Association of South Africa*, (pp. 107-111). Grabouw, South Africa.
- Moore Mauroux, S. (2009). "L'interrogation en anglais : structures syntaxiques et contours intonatifs". *Grammaire et prosodie*, 2, 117-128.
- Munro, M. (2008). "Foreign accent and speech intelligibility". In J. Hansen Edwards, & M. Zampini, *Phonology and Second Language Acquisition*, 193-218. Philadelphia: Benjamins.
- Post, Brechtje (2002). "French tonal structures". In Bel, B. & Marlien, I. (Eds.), *Proceedings of the Speech Prosody 2002 conference*. Aix-en-Provence: Laboratoire Parole et Langage, 583-586.
- Roach, P. (1983). *English Phonetics and Phonology: a practical course*. Cambridge: Cambridge University Press.
- Roach, Peter (1982) "On the distinction between 'stress-timed' and 'syllable-timed' languages", In Crystal, D. (Ed.) *Linguistic Controversies*, 73-79. London: Edward Arnold.
- Swan, M., & Smith, B. (2001). *Learner English*. Cambridge: Cambridge University Press.
- Trubetzkoy, N. S. (1939/1969). *Principles of Phonology*. Berkeley: University of California Press.
- Vaissière, J. (2002) "Cross-linguistic prosodic transcription: French vs. English". In Volskaya, N., Svetozarova, N. & Skrelin, P. (Eds.) *Problems and methods of experimental phonetics. In honour of the 70th anniversary of Pr. L.V. Bondarko*, 147-164. St Petersburg: St Petersburg State University Press.
- Wells, J. (2006). *English Intonation: an Introduction*. Cambridge: Cambridge University Press.
- Wenk, B., & Wioland, F. (1982). "Is French really syllable timed?". *Journal of Phonetics*, 10, 193-216.
- Winters, S., & Grantham O'Brien, M. (2013). "Perceived accentedness and intelligibility: The relative contributions of F0 and duration". *Speech Communication*, 55, 486-507.

7. APPENDICES

7.1 AUTHORIZATION FORM

AUTORISATION POUR L'ENREGISTREMENT AUDIO/VIDEO ET L'EXPLOITATION DES DONNEES ENREGISTREES

Présentation

Cette enquête est réalisée dans le cadre du Master 2 Linguistique et Didactique des Langues de l'Université Rennes 2. L'enquête porte sur l'intonation des apprenants francophones de l'anglais. Cette recherche est menée par Leonardo CONTRERAS ROA.

Elle n'est néanmoins possible que grâce au consentement des personnes qui acceptent d'être enregistrées, à qui nous demandons par conséquent une autorisation écrite.

Autorisation

Je soussigné(e) _____

- autorise par la présente à enregistrer en audio/vidéo les activités de production orale en cours d'anglais à l'Université Rennes 1 entre le 3/02/2014 et le 20/02/2014.

- autorise l'utilisation de ces données, sous leur forme enregistrée aussi bien que sous leur forme transcrite et anonymisée (cf. infra) :

a) à des fins de recherche scientifique (mémoires ou thèses, articles scientifiques, exposés à des congrès, séminaires).

b) à des fins d'enseignement universitaire (cours et séminaires donnés à des étudiants avancés, à partir du niveau M1)

- prends acte que pour toutes ces utilisations scientifiques les données ainsi enregistrées seront *anonymisées* : ceci signifie

a) que les transcriptions de ces données utiliseront des pseudonymes et remplaceront toute information pouvant porter à l'identification des participants ;

b) que les bandes audio qui seront présentées à des conférences ou des cours (généralement sous forme de très courts extraits ne dépassant pas la minute) seront « beepées » lors de la mention d'un nom, d'une adresse ou d'un numéro de téléphone identifiables (qui seront donc remplacés par un « bruit » qui les effacera) ;

Lieu et date: _____

Signature :

7.2 SURVEY QUESTIONS

Question 1	what might have been the reason why Miguel made contact with your husband?
Question 2	you didn't think it was more judicious to call the police?
Question 3	did you call immediately the police?
Question 4	do you think that she informed you enough about the risks of the operation?
Question 5	and when did you start to buy drugs?
Question 6	why have you asked her to be your open complice?
Question 7	so how do you define friendship?
Question 8	could you explain how you saw the weapon of Mr. Django without seeing his face?
Question 9	do you know that other pupils made fun of Madison?
Question 10	have you ever practice that kind of surgery?
Question 11	it was the night, isn't it?
Question 12	so you didn't suspect anything at all?
Question 13	do you ever have suspicious about your granddaughter's activities?
Question 14	the neighborhood where Mr. McCornick lives?
Question 15	yes, and do you think that Madison was the only child who was subject to mockeries?
Question 16	and it doesn't shock you?
Question 17	has she already been violent in the past with her comrades?
Question 18	and how did you react?
Question 19	what was your husband's behave with Heather's boyfriend in general?
Question 20	so by saying that you recognize your part of responsibility in disfigure?
Question 21	so the intruder threatened Mr. McCornick?
Question 22	so what went wrong according to this surgery?
Question 23	where were you last june and the two years before?
Question 24	what can be the evolution of this face surgery?
Question 25	is it possible that Pete Bronson's view changed since 2010?
Question 26	you don't think you are responsible for what happened to this patient?
Question 27	did you had any problem before?
Question 28	do your husband take care of you and your daughter?

Color key			
WH-questions	Yes/no questions	declarative questions	question tags

7.3 SURVEY INSTRUCTIONS

Thank you for taking the time to answer this survey!

You are going to listen to several recordings of English students asking questions. Please **use headphones or earphones** to listen to the audio excerpts in this survey. You can replay the files as many times as necessary.

We will ask you to rate the foreign **accent** of students by using a 1-to-5-point scale. **You can interpret the values in the following way:**

- 1 - no accent at all
- 2 - slight accent
- 3 - noticeable accent
- 4 - strong accent
- 5 - very strong accent

We will also ask you to specify what about the way they speak makes you identify this accent. We provide you with some options, but if they do not correspond to what you perceive, feel free to add your own words by checking the option **Other**. You can check more than one option.

Remember that you are rating their **accent**, not their grammar or their syntax. However, if you feel like they do play part in their accent, you can add them in the field Other.

These questions might help you understand the options we propose:

Intonation refers to the pitch or "melody" of their speech - does it sound like a question? is it too flat? does it go up or down in the wrong places?

Rhythm refers to word stress - do they place the emphasis on the right syllable? (e.g. **CON**tent or con**TENT**?)

Speed - do they talk too slowly? too fast? do they hesitate a lot?

Consonants and vowels - are they properly pronounced?

That's it! Click on *Next* to get started.

A note on privacy

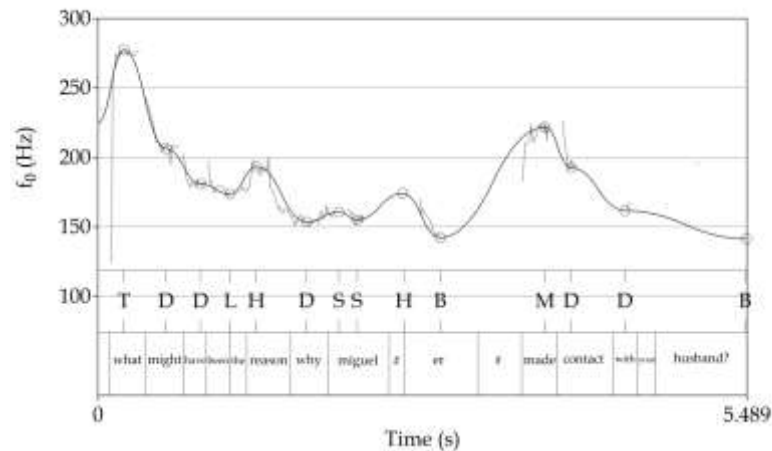
This survey is anonymous.

The record of your survey responses does not contain any identifying information about you. If you used an identifying token to access this survey, please rest assured that this token will not be stored together with your responses. It is managed in a separate database and will only be updated to indicate whether you did (or did not) complete this survey. There is no way of matching identification tokens with survey responses.

7.4 MOMEL MODELING DATA AND SURVEY ANSWERS

Q01

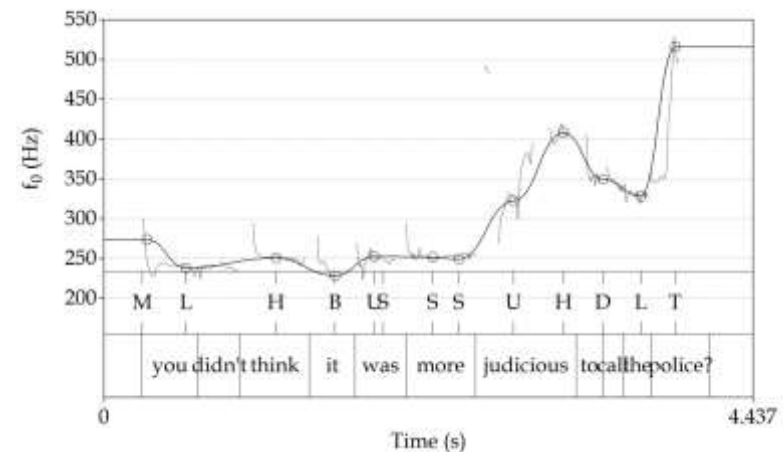
What might have been the reason why Miguel made contact with your husband?



		NS group		NNS group	
Accentedness average		4.5		3.3	
Aspects making accent noticeable	Intonation	5		8	
	Rhythm	6		1	
	Speed	4		3	
	Consonants and vowels	9		6	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		8	2	3	7

Q02

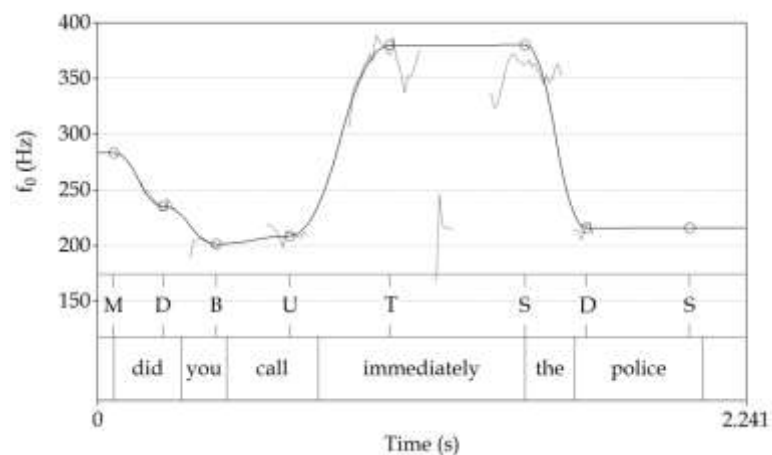
You didn't think it was more judicious to call the police?



		NS group		NNS group	
Accentedness average		3.9		4.0	
Aspects making accent noticeable	Intonation	9		6	
	Rhythm	6		8	
	Speed	2		3	
	Consonants and vowels	8		4	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		6	4	3	7

Q03

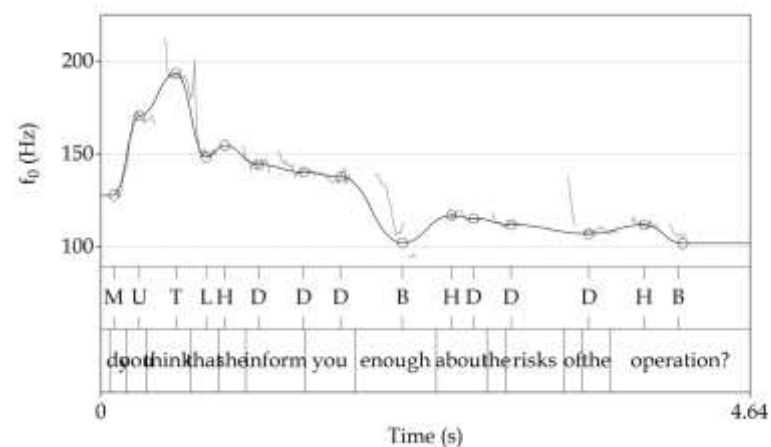
Did you call immediately the police?



		NS group		NNS group	
Accentedness average		3.0		3.0	
Aspects making accent noticeable	Intonation	8		6	
	Rhythm	7		5	
	Speed	2		1	
	Consonants and vowels	3		2	
	Other	2		0	
		- it's a very french way to speak - Word order			
Unintelligible?		Yes	No	Yes	No
		1	9	1	8

Q04

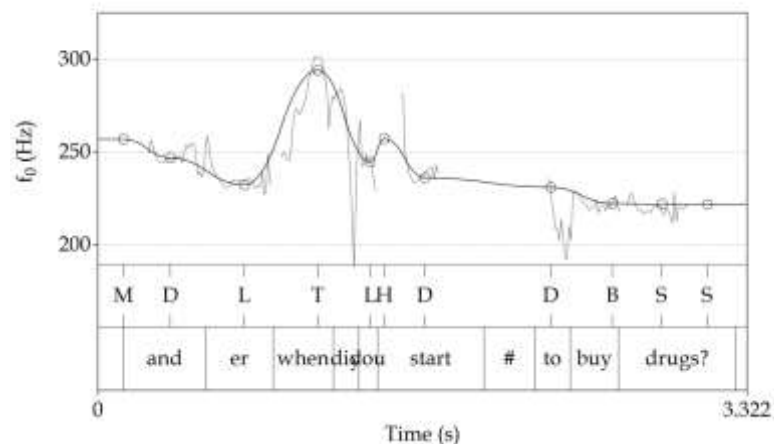
Do you think that she inform you enough about the risks of the operation?



		NS group		NNS group	
Accentedness average		3.6		3.3	
Aspects making accent noticeable	Intonation	8		8	
	Rhythm	6		4	
	Speed	2		2	
	Consonants and vowels	9		6	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		4	6	4	5

Q05

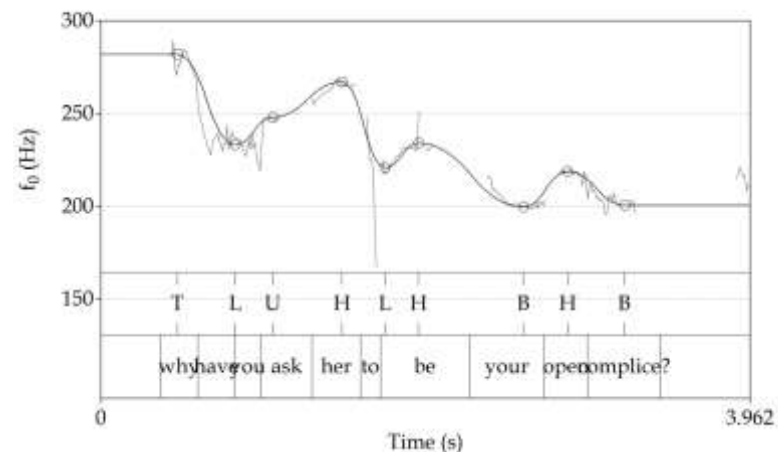
And when did you start to buy drugs?



		NS group		NNS group	
Accentedness average		2.8		2.6	
Aspects making accent noticeable	Intonation	2		4	
	Rhythm	3		1	
	Speed	3		4	
	Consonants and vowels	7		4	
	Other	1		1	
		Pronunciation is fine, but it sounds like there are other sounds trying to come naturally that aren't English sounds! ilt sounds like she's making an effort to speak rather than it coming naturally.			
Unintelligible?		Yes	No	Yes	No
		1	8	0	9

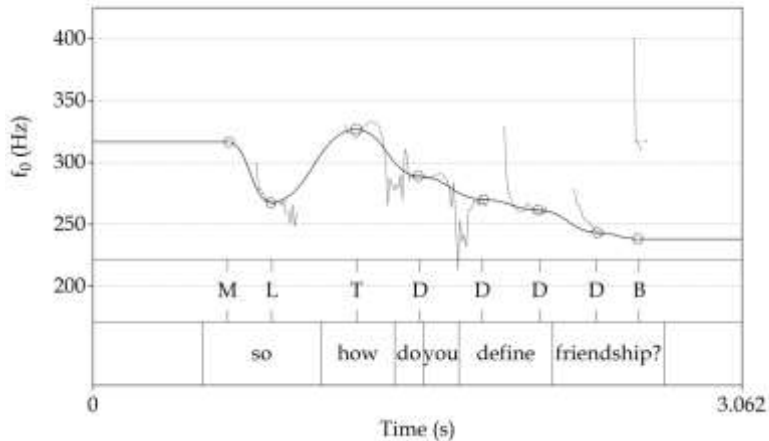
Q06

Why have you ask her to be your open complice?



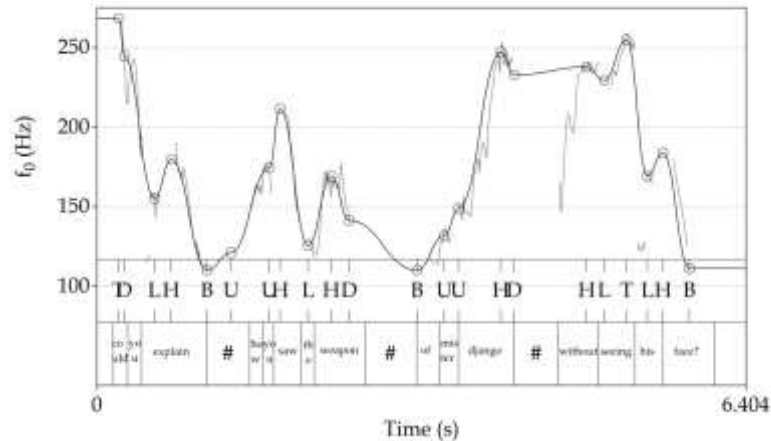
		NS group		NNS group	
Accentedness average		4.0		3.5	
Aspects making accent noticeable	Intonation	3		7	
	Rhythm	7		7	
	Speed	2		2	
	Consonants and vowels	9		8	
	Other	0		1	
		The presence of the "H" before ask I think			
Unintelligible?		Yes	No	Yes	No
		4	6	1	8

Q07
So how do you define friendship?



		NS group		NNS group	
Accentedness average		2.1		2.5	
Aspects making accent noticeable	Intonation	1		3	
	Rhythm	2		5	
	Speed	0		0	
	Consonants and vowels	8		5	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		0	8	0	9

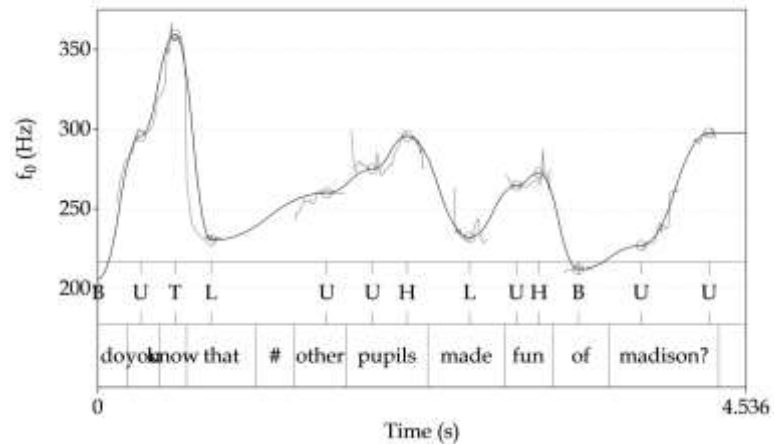
Q08
Could you explain how you saw the weapon of Mr. Django without seeing his face?



		NS group		NNS group	
Accentedness average		3.5		3.1	
Aspects making accent noticeable	Intonation	6		5	
	Rhythm	6		7	
	Speed	3		2	
	Consonants and vowels	9		6	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		3	7	2	7

Q09

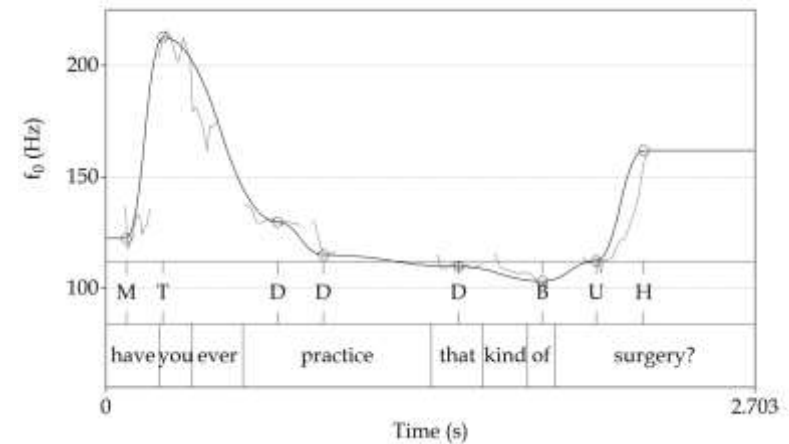
Do you know that other pupils made fun of Madison?



		NS group		NNS group	
Accentedness average		3.4		2.9	
Aspects making accent noticeable	Intonation	6		4	
	Rhythm	7		5	
	Speed	4		4	
	Consonants and vowels	8		6	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		1	9	0	9

Q10

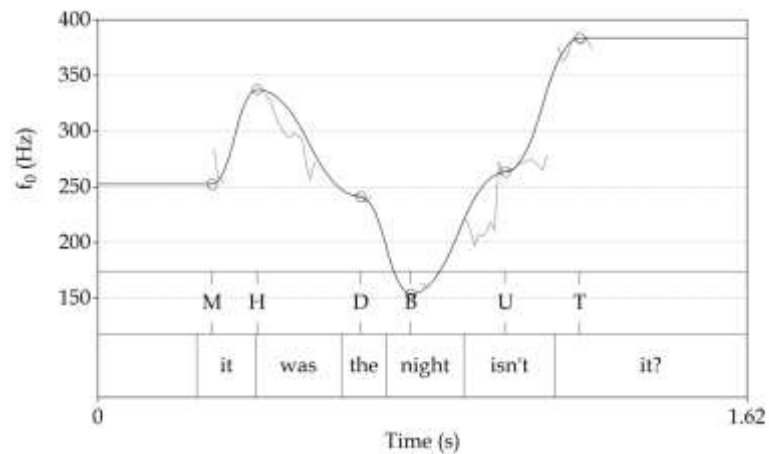
Have you ever practice that kind of surgery?



		NS group		NNS group	
Accentedness average		1.9		1.7	
Aspects making accent noticeable	Intonation	4		0	
	Rhythm	3		2	
	Speed	2		2	
	Consonants and vowels	6		1	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		0	8	0	5

Q11

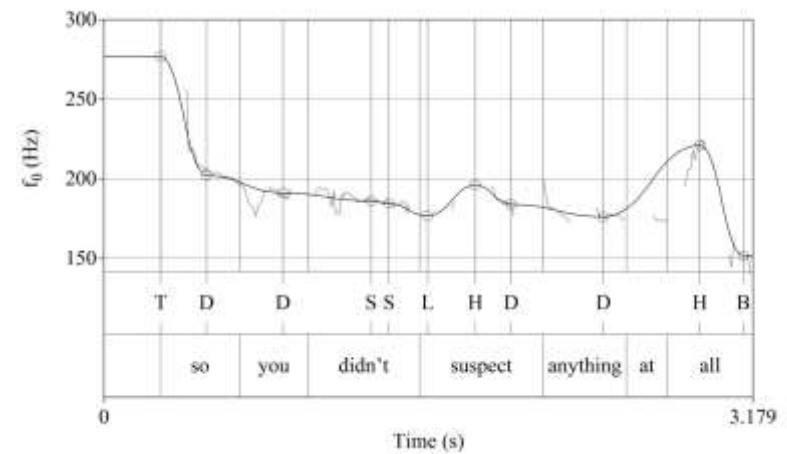
It was the night, isn't it?



		NS group		NNS group	
Accentedness average		4.3		2.4	
Aspects making accent noticeable	Intonation	5		2	
	Rhythm	6		0	
	Speed	7		5	
	Consonants and vowels	7		1	
	Other	2 - word choice - Grammar - it sounds as though she says 'was' and then 'isn't', but it's also too fast for me to be sure what is being said, so it's all incomprehensible as a result.		0	
Unintelligible?		Yes	No	Yes	No
		8	2	3	4

Q12

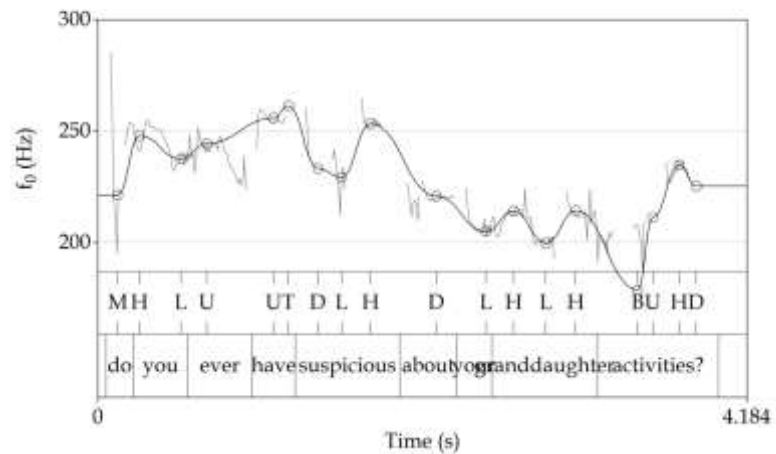
So you didn't suspect anything at all?



		NS group		NNS group	
Accentedness average		2.1		2.2	
Aspects making accent noticeable	Intonation	6		2	
	Rhythm	2		3	
	Speed	3		5	
	Consonants and vowels	3		2	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		0	8	0	8

Q13

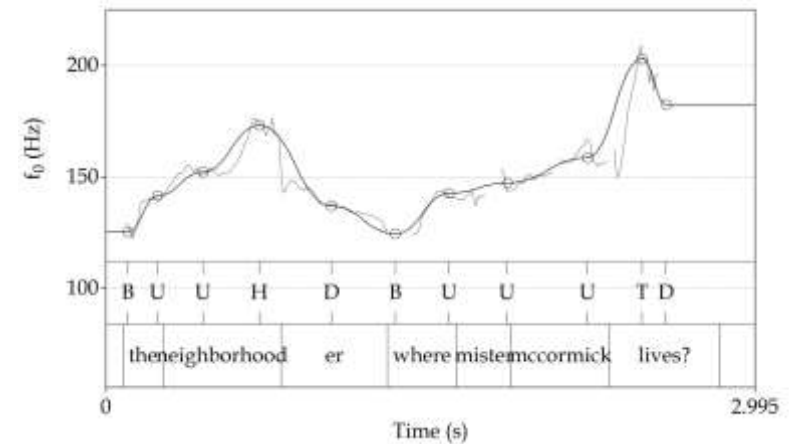
Do you ever have suspicious about your granddaughter activities?



		NS group		NNS group	
Accentedness average		3.5		3.1	
Aspects making accent noticeable	Intonation	5		6	
	Rhythm	7		8	
	Speed	3		2	
	Consonants and vowels	9		7	
	Other	1		1	
		- Word choice		- vocab/grammar	
Unintelligible?		Yes	No	Yes	No
		2	8	0	10

Q14

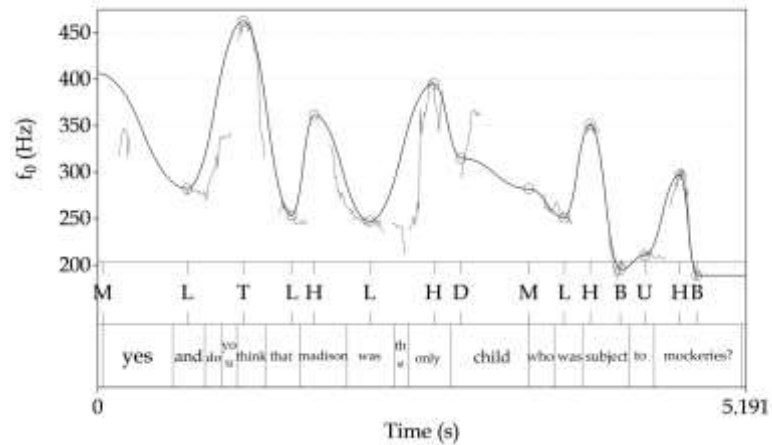
The neighborhood where Mr. McCormick lives?



		NS group		NNS group	
Accentedness average		3.8		4.2	
Aspects making accent noticeable	Intonation	7		7	
	Rhythm	5		7	
	Speed	5		4	
	Consonants and vowels	7		8	
	Other	0		2	
				- "the neighborhood" - syntax	
Unintelligible?		Yes	No	Yes	No
		3	7	2	8

Q15

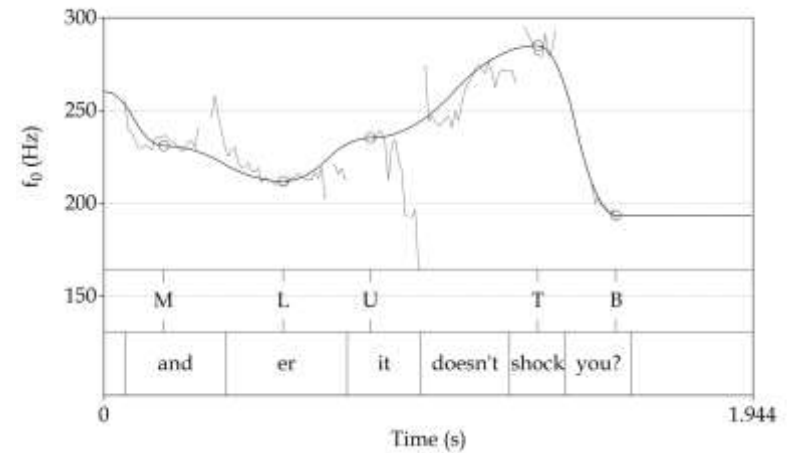
Yes, and do you think that Madison was the only child who was subject to mockeries?



		NS group		NNS group	
Accentedness average		3.2		2.7	
Aspects making accent noticeable	Intonation	5		5	
	Rhythm	7		5	
	Speed	2		0	
	Consonants and vowels	8		6	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		3	7	2	6

Q16

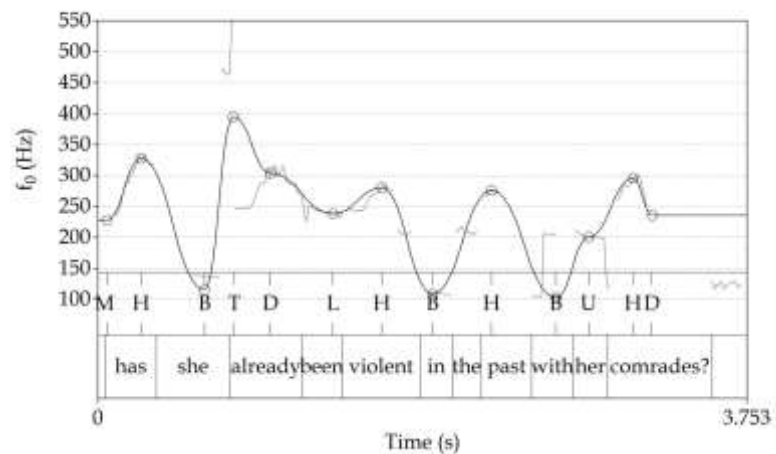
And it doesn't shock you?



		NS group		NNS group	
Accentedness average		3.8		2.7	
Aspects making accent noticeable	Intonation	5		5	
	Rhythm	3		5	
	Speed	8		5	
	Consonants and vowels	7		3	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		4	6	1	8

Q17

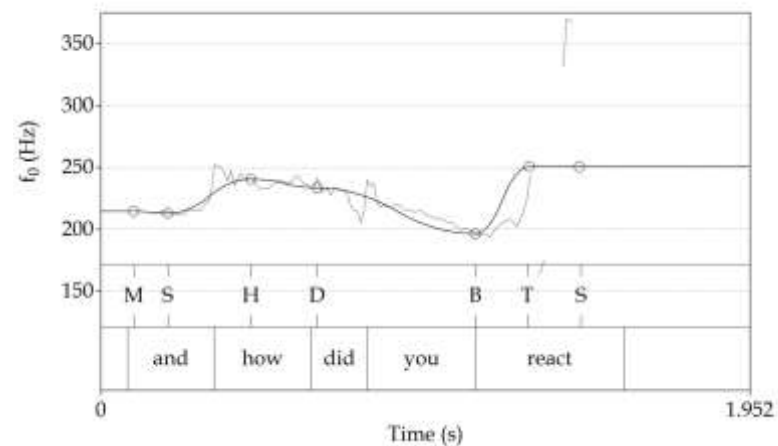
Has she already been violent in the past with her comrades?



		NS group		NNS group	
Accentedness average		3.5		3.3	
Aspects making accent noticeable	Intonation	6		6	
	Rhythm	7		6	
	Speed	3		2	
	Consonants and vowels	8		6	
	Other	0		1	
Unintelligible?		Yes	No	Yes	No
		4	6	3	6

Q18

And how did you react?

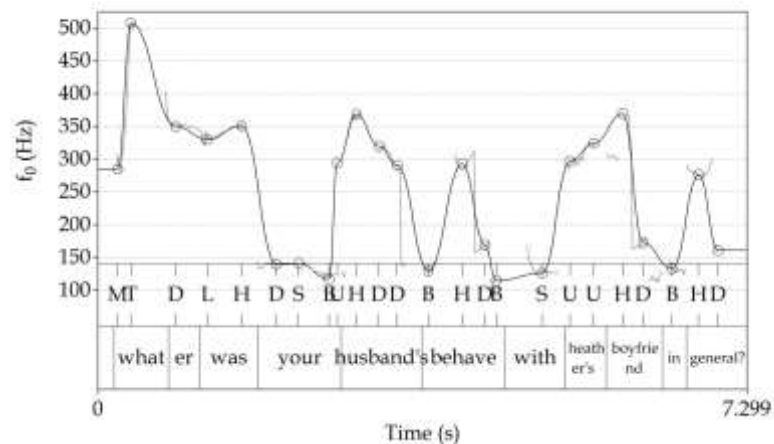


		NS group		NNS group	
Accentedness average		2.0		2.2	
Aspects making accent noticeable	Intonation	4		3	
	Rhythm	5		2	
	Speed	0		4	
	Consonants and vowels	1		1	
	Other	1		0	
Unintelligible?		Yes	No	Yes	No
		0	7	0	7

Words not formed fully
e.g. 'react' sounds like
'ract' (not enough
syllables).

Q19

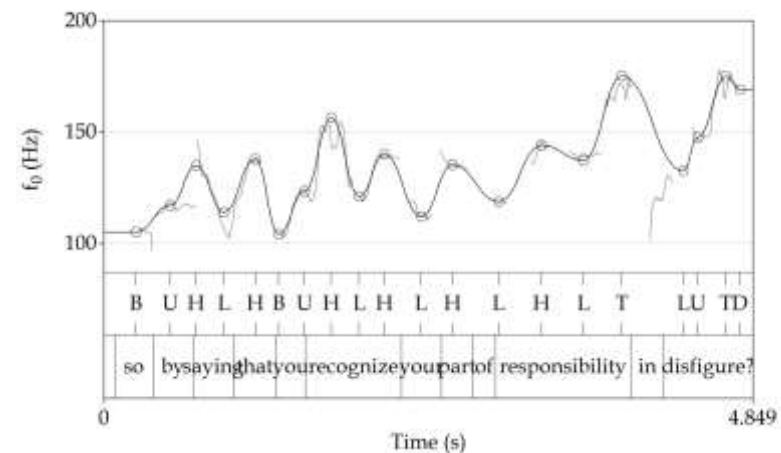
What was your husband's behave with Heather's boyfriend in general?



		NS group		NNS group	
Accentedness average		3.7		3.4	
Aspects making accent noticeable	Intonation	6		6	
	Rhythm	6		4	
	Speed	9		8	
	Consonants and vowels	8		4	
	Other	2		1	
		- Grammar mistakes make accent more noticeable, although they don't affect how the question is understood. - grammar influences rhythm /flow of english		- syntax	
Unintelligible?		Yes	No	Yes	No
		3	7	4	5

Q20

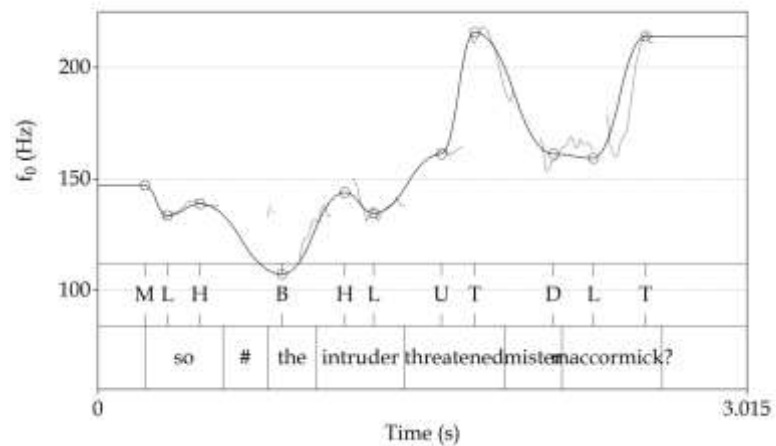
So by saying that you recognize your part of responsibility in disfigure?



		NS group		NNS group	
Accentedness average		3.0		2.5	
Aspects making accent noticeable	Intonation	4		6	
	Rhythm	6		3	
	Speed	2		1	
	Consonants and vowels	8		3	
	Other	0		1	
				- syntax	
Unintelligible?		Yes	No	Yes	No
		2	7	2	6

Q21

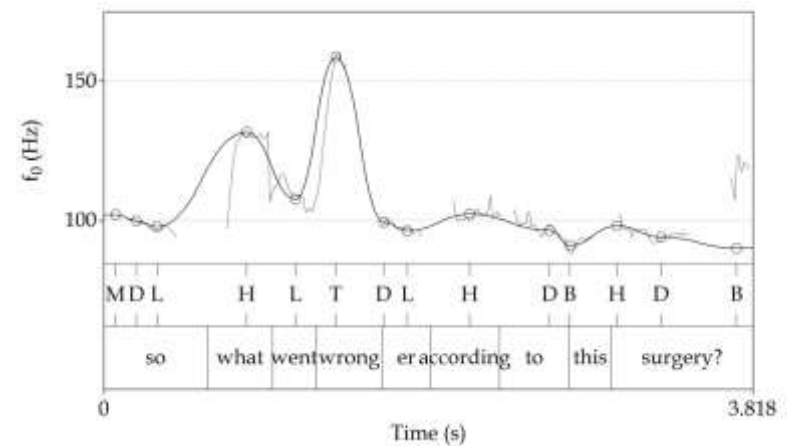
So the intruder threatened Mr. McCormick?



		NS group		NNS group	
Accentedness average		4.2		3.9	
Aspects making accent noticeable	Intonation	4		7	
	Rhythm	7		5	
	Speed	4		0	
	Consonants and vowels	9		7	
	Other	0		2	
Unintelligible?		Yes		No	
		10		0	
		Yes		No	
		7		2	

Q22

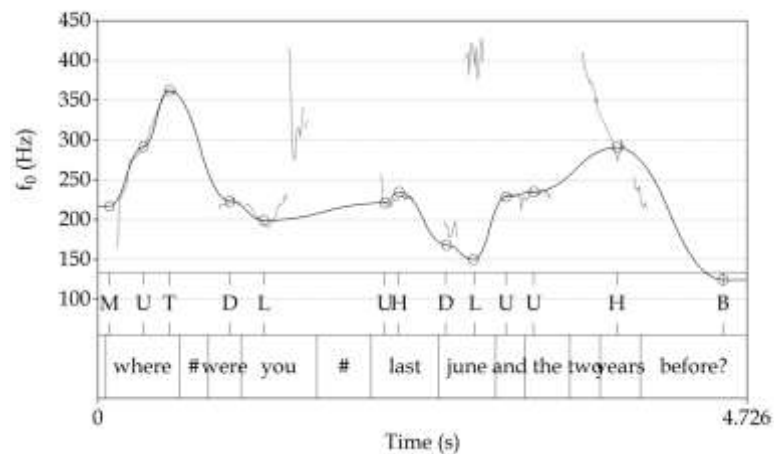
So what went wrong according to this surgery?



		NS group		NNS group	
Accentedness average		3.4		2.5	
Aspects making accent noticeable	Intonation	8		5	
	Rhythm	6		5	
	Speed	4		2	
	Consonants and vowels	8		4	
	Other	0		1	
Unintelligible?		Yes		No	
		4		6	
		Yes		No	
		1		6	

Q23

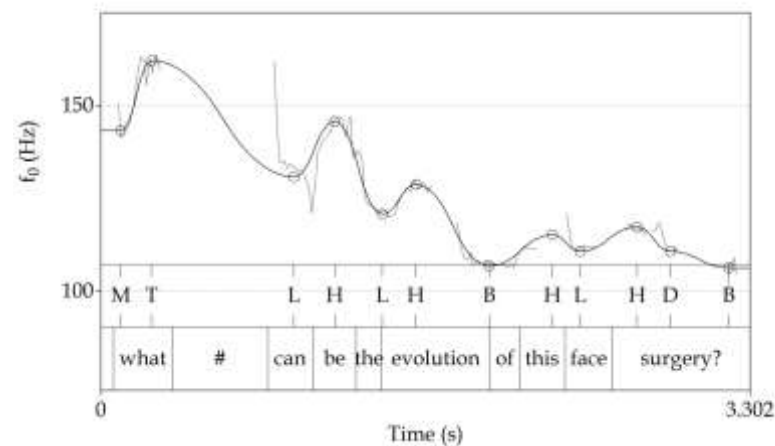
Where were you last June and the two years before?



		NS group		NNS group	
Accentedness average		3.3		3.6	
Aspects making accent noticeable	Intonation	7		6	
	Rhythm	7		5	
	Speed	4		8	
	Consonants and vowels	6		3	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		3	7	3	6

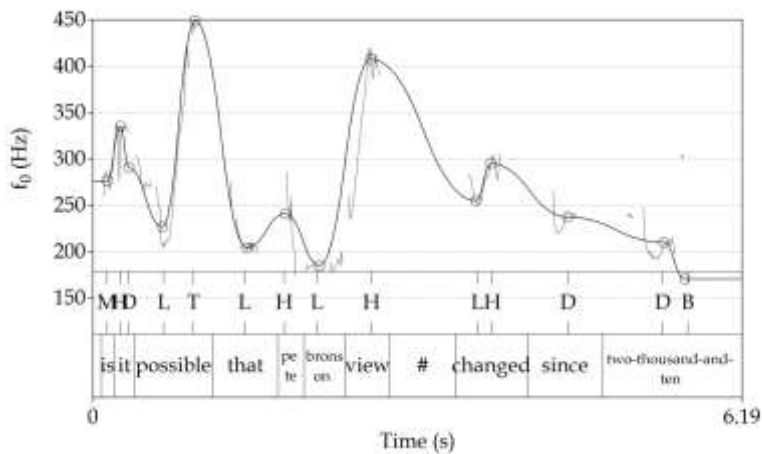
Q24

What can be the evolution of this face surgery?



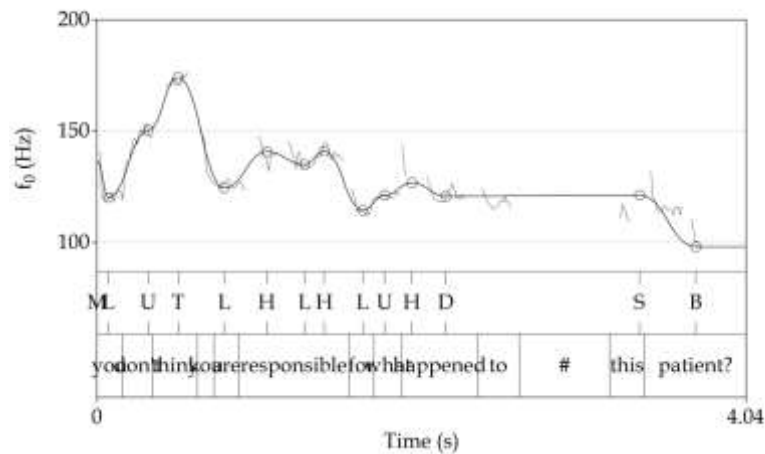
		NS group		NNS group	
Accentedness average		3.7		3.5	
Aspects making accent noticeable	Intonation	9		6	
	Rhythm	8		4	
	Speed	3		5	
	Consonants and vowels	8		6	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		5	5	0	9

Q25
Is it possible that Peter Bronson view changed since 2010?



		NS group		NNS group	
Accentedness average		3.1		3.3	
Aspects making accent noticeable	Intonation	9		8	
	Rhythm	7		3	
	Speed	5		5	
	Consonants and vowels	8		5	
	Other	0		1	
		- Syntax/grammar			
Unintelligible?		Yes	No	Yes	No
		4	6	2	8

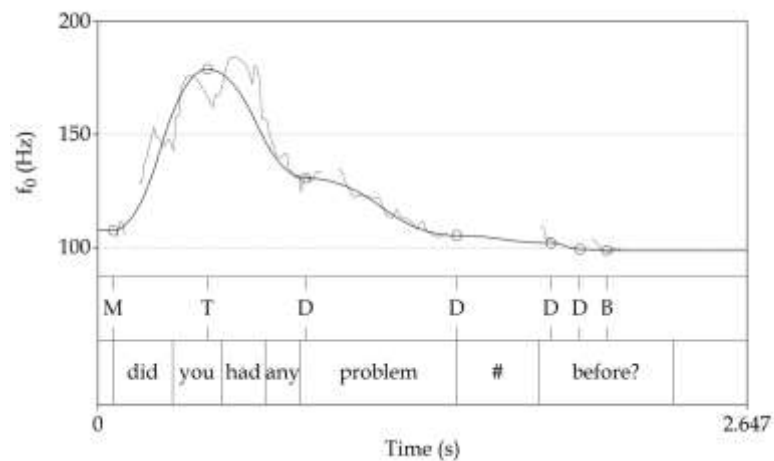
Q26
You don't think you are responsible for what happened to this patient?



		NS group		NNS group	
Accentedness average		3.2		3.4	
Aspects making accent noticeable	Intonation	6		8	
	Rhythm	6		6	
	Speed	4		7	
	Consonants and vowels	7		8	
	Other	0		0	
Unintelligible?		Yes	No	Yes	No
		0	10	0	10

Q27

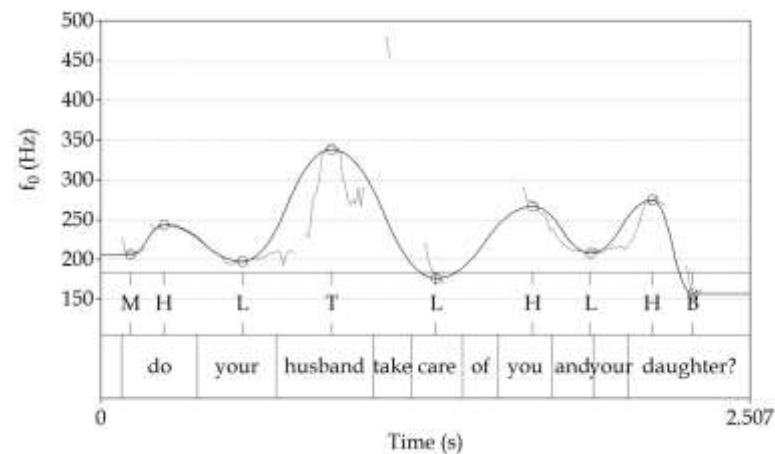
Did you had any problem before?



		NS group		NNS group	
Accentedness average		2.8		2.4	
Aspects making accent noticeable	Intonation	3		3	
	Rhythm	4		2	
	Speed	3		3	
	Consonants and vowels	6		4	
	Other	0		1	
Unintelligible?				- syntax	
		Yes	No	Yes	No
		0	9	0	8

Q28

Do your husband take care of you and your daughter?



		NS group		NNS group	
Accentedness average		3.8		3.2	
Aspects making accent noticeable	Intonation	5		6	
	Rhythm	7		6	
	Speed	4		2	
	Consonants and vowels	9		5	
	Other	0		2	
Unintelligible?				- Do/Does - Grammar	
		Yes	No	Yes	No
		4	6	2	6