

The Principle of Distinctive and Contrastive Coherence of Prosody in Radio News: An Analysis of Perception and Recognition

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Abstract The prosodic features of a message are key factors in the transmission of information by radio. Some authors have demonstrated that perception and proper comprehension of radio news depend largely on the intonation, stress and speech rate used by the broadcaster. The aim of this study, therefore, is to determine the degrees of perception and recognition of information broadcast by radio when the prosodic features used in the transmission are modified. The main conclusion reached is that there is indeed a relationship between the prosodic combination employed and the way in which such information is perceived and recognized, and providing that the prosodic features observe the principle of distinctive and contrastive coherence, the information is perceived positively and recognition is highest.

Keywords Prosody · Radio · News · Intonation · Stress · Speech rate

Introduction

The voice is one of the radio news reader's most important resources when conveying messages. Controlling the voice, through the proper use of prosodic features as the main tool for transmitting the explicit content of a text, provides a referential framework. It is also instrumental in conveying the sense of the text as well as its affective dimension. Ultimately, therefore, it affects the impression forming process of the listener.

In this regard, some authors have demonstrated that content comprehension of a radio message is enhanced when this content is presented by vocally trained broadcasters

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(Beighley 1954; Nichols 1948). This is of particular importance in radio news programs, where the broadcaster's voice is the main medium of expression of a message. Therefore, the degree to which the broadcaster commands prosodic skills such as intonation, stress and speech rate may determine whether a discourse is conveyed sufficiently effectively to ensure that the listener assimilates the data presented.

Intonation may be defined as the set of pitch variations produced in a spoken text which characterizes different types of utterances, distinguishes syntactical units and defines the emotions and attitudes of the speaker. Stress refers to the emphasis applied to a particular syllable in order to highlight the importance of one word over the others. In this way, stress acts as a tool which the speaker may use to single out certain parts of a message for emphasis.

Linguistically, these two supra-segmental features fulfill two basic functions: distinctive, relating to meaning, and contrastive, at the level of expression. First, the distinctive function provides the utterance with a prosodic differentiation so as to imbue it with a specific meaning; that is, it distinguishes sentences, word classes and units of meaning by the intonation contour and stress employed. A descending contour with a low pitch and no stress indicates that the idea is closed, without continuity. In contrast, an ascending contour, with a high pitch and marked stress indicates that the message will continue. Accordingly, a distinction is made between central and secondary data in the meaning of the discourse.

The contrastive function establishes an acoustic contrast between the elements that form each of the prosodic features; that is, a contrast between high and low pitch and between ascending and descending contours, and which, by extension, leads to a distinction between stressed and unstressed syllables. This acoustic contrast guides and sustains the listener's attention thanks to the pitch variation with which the radio message is delivered. Thus, a high pitch and an ascending contour, resulting from tonal increase, operate to attract the listener's attention before the low pitch and descending contour convey the full extent of the message, according to Grosz and Sidner's (1986) attentional focus proposal.

Hence, the choice of prosodic combination is directly related to the content of the message, and consequently, depends on the extent to which the information being conveyed is novel or relevant. When part of a message needs to be highlighted, the speaker performs a focus projection, which relates the nuclear pitch stress or accent to the segment of the discourse that contains new or important information (De Kuthy and Meurers 2010). Thus, data deemed unknown to the listener, or which are particularly relevant in the message, are introduced using a rising intonation, with a high pitch and tonic, or nuclear, pitch accent. In contrast, known or secondary data are marked by a fall to a low pitch with unmarked stress (Halliday 1967). Brown (1983) found that speakers tend to place pitch accents on *new* information, while marking *given* information by deaccenting. Terken and Nootboom (1994) demonstrated that listeners expect *new* information to be pitch accented and *given* information to be deaccented. Also Pierrehumbert and Hirschberg (1990) consider that "given" information is marked with a stress with a starred low pitch, and "new" information by a stress with a starred high pitch. Lastly, Cruttenden (1997) has shown that in Spanish new information is always characterised by a pitch accent. There is a clear relationship between this distribution and comprehension of the message. Bock and Mazzella (1983), by using a comprehension time paradigm, found that comprehension times were shorter when focal or new information was accented, suggesting that appropriate accentuation facilitates comprehension in denial-counterassertion pairs of utterances.

As a result, in order to imbue a message with its intended sense, maintain the dynamism necessary to attract listener attention and to generally facilitate comprehension, the proper

prosodic configuration will be that which adheres to the principle of distinctive and contrastive coherence, applying the pitch, tonal contours and stress coherent to the message, on the linguistic concept of understanding a statement (Francuz 2010; Pierrehumbert and Hirschberg 1990). This explains why the participants in a study conducted by Rodero (2007), into the perception of information conveyed in radio format, rated more highly the type of intonation which performed the distinctive and contrastive functions of prosody.

Intonation and Stress in Radio News

Compared with the prosodic configuration described above, studies relating to intonation in media news programs, and particularly radio and television bulletins, reveal that broadcasters tend to use a circumflex intonation, which produces the sound that people commonly associate with news reading: a singsong (Brazil 1978; McGregor and Palethorpe 2008; Nihalani and Po Lin 1998; Taylor 1993; Tench 1990). The study conducted by De-la-Mota and Rodero (2010), which analyzed the news bulletins of the major Spanish radio stations, found that circumflex contours are prevalent, mainly at the end position of declarative statements. Rodero (2013) showed that the presentation of radio broadcasting news can be characterized by an abundance of circumflex contours, a regularity in the use of pitch contours and a constant emphatic stress. Kohler (1991) characterize this contour as an early peak roughly.

Repetition of this intonation contour occurs at regular intervals in radio news bulletins, thus generating a similar rhythm throughout a broadcast. This strain is independent of the content of the message conveyed. Price (2008) also describes this feature: “The analysis of the rising tunes has shown that they can be decomposed into the same contour types in very similar if not identical numbers” (p.12). In turn, this type of intonation produces an emphatic stress which regularly marks the syllables of the words according to the rises in pitch generated by the application of circumflex intonation. Price (2008) has found this “overall intonation template” in Australian radio news which is characterized by “a sharp rise in pitch to the highest of each speaker’s range, followed by a fall within the same word (...) resulting in the overuse of local prominence” (p. 308).

However, this prosodic pattern is not only found in radio; studies conducted into television have produced the same results. Rodero’s research (2006) confirms that the majority of pitch combinations used by Spanish television news broadcasters also employ circumflex intonation with emphatic stress at the beginning, in the middle and at the end of declarative statements. Strangert (1991) found that television news broadcasters employ a wider tonal range and make more frequent use of contrastive stress and Francuz (2010) concludes that “this mostly means that reporters sometimes have a natural tendency to over-use rhetoric accents and avoid logical accents” (p. 74).

The problem with this prosodic configuration is that it affects the distinctive and contrastive functions. The distinctive function is affected because the configuration is applied without regard to the message being conveyed. This means that, in so far as Spanish is concerned, it is a practice which deviates from the linguistic norm. In addition, the distinctive function is also affected because the number of stress peaks in a message is multiplied. Thus, Goldman et al. (2007) registered 10 % more peaks than occur in a normally read discourse and Van Leeuwen (1984) found that news readers stressed 95 % of the words in a message. Also De Kuthy and Meurers (2010) found many similar examples “with significantly more accents than are traditionally assumed by syntactic theories of focus projection, with some examples carrying pitch accents on almost all of the

words” (p. 3). Consequently, by modifying the distinctive function, meaning is also affected and, it may be assumed, so is the comprehension of the information, since no distinction is made between new and known data (Francuz 2010).

Secondly, this constant emphasis affects the contrastive function: since the rhythm is regular, the resulting lack of acoustic differentiation yields it ineffective. “It is the predictability of the vocal pattern which becomes boring” (McLeish 1995, p. 107). Furthermore, the effect acoustically is one of haltering speech, staccato and far from natural, when in fact it should have quite the opposite effect. Indeed, Price (2008), p. 291 states that the intention is to communicate the news in a way with which listeners can most easily identify, namely in a natural way, “the end result does not in fact reflect the way people actually speak” (p. 291).

In summary, the use of the same, recurrent intonation and stress structure leads to the elimination of the distinctive function of prosody, to the suppression of the nuances introduced by the various pitch movements and to the absence of acoustic and inflectional pitch contrast, thus contravening the principle of distinctive and contrastive coherence. These considerations give rise to the first hypothesis of this study:

H1 Participants will have a more positive perception of and will retain more data from bulletins which employ intonation and stress which observe the principle of distinctive and contrastive coherence, than when bulletins are presented with circumflex intonation and emphatic stress.

Speech Rate in Radio News

Speech rate is the other prosodic element important for the perception and comprehension of the radio news. If it is too fast, that is, with many words per minute (wpm), the listener cannot understand the message at the first hearing. Many words without pauses in a short time will be the reason why the listener loses important data as well as the sense of the story. Consequently, the correct use of this element depends on the audience paying attention to the message, then, understanding and assimilating it.

Investigations about the reading speed have demonstrated that the understanding begins to be difficult in 200 wpm. Most of the authors recommend a speech rate of 160–170 wpm. Hills (1987) establishes the most recommendable pace as 160 wpm, McLeish (1995) places this rate between 160 and 180 wpm, while Utterback (2000) places the rate between 145 and 180 wpm. Boyd (2003) establishes the rate between 140 and 220 wpm, although he considers 180 wpm as the most recommendable rate. Chantler and Stewart (2003) have the same opinion: “the usual speed for reading on radio is three words a second. That is the theoretical standard, but in practice your style has to fit with the overall station sound” (p. 87). Most authors agree that delivery speed should not exceed 200 wpm and that an acceptable rate stands around 175 wpm. Nevertheless, some studies have found that, in reality, news readers speak too quickly, which hinders comprehension of the message and gives the sensation of being rushed. For example, Van Leeuwen (1984) registered a speed of 4.59 syllables per second. In Spanish radio news, the investigations have also demonstrated a high speech rate, around 200 wpm, in all the national radio stations (Rodero 2007). These data are especially important since certain studies demonstrate that delivery speed in radio news broadcasts influences recognition. Goldstein (1940) found that a high speech rate affects comprehension of information, especially when the subject material is complex. Similarly, Nelson (1948), concluded that the poorest level of comprehension is

achieved at 225 wpm and that a satisfactory delivery rate is around 175 wpm. From these observations we formulate the second hypothesis of this study:

H2 Participants will have a more positive perception of and will retain more data from bulletins which have a moderate delivery speed, 175 wpm, than when bulletins are delivered at speeds above 200 wpm.

All in all, it may be deduced that the use of such a structure will affect both listener perception levels (attention) and the degree of listener comprehension. The main aim and contribution of this study is to demonstrate this aspect. Existing research points to this prosodic model as being the dominant one on radio news. But how does the audience perceive this and what level of comprehension does it achieve among listeners? There is hardly any research into these aspects however it is important to answer these questions because if the results are not positive journalists would not achieve their objectives and therefore the information which the public receives would, in turn, be adversely affected.

Therefore, the conclusions drawn in this research are of great interest for the audio industry and can be directly applicable to the teaching of sound, audio production and audio message complexity across platforms (e.g., radio, TV audio tracks, audio on the Web, podcasts or public and interpersonal communication). Lastly, although the main impact of this research can be recognized in its application to mass media messages, other potential areas could be benefited with the results. For example, areas in which the persuasive communication becomes in the essential objective, as the political communication, or educational activities or processes where the speech rate acquires a relevant function, as language learning.

Method

The methodology applied in this study is empirical, whereby a chosen sample population was made to listen to news bulletins which exhibited different prosodic models. The aim was to determine the degrees of perception and recognition of the information broadcasted.

Radio Bulletin Stimuli

The experiment used as its point of reference the analyses performed by Rodero (2007, 2013) of radio news bulletins taken from the major Spanish radio stations. The results, obtained with the use of Praat speech analysis software (Boersma and Weenink 2013), revealed a predominance of circumflex intonation with emphatic stress together with a fast delivery speed of 210 wpm. These features constitute the ‘real’ radio bulletin, since this represents the type of radio news bulletin habitually broadcast by radio stations. To make a contrast with this real bulletin, a model bulletin was created using the data obtained from the various studies cited above; a model which conserved the principle of distinctive and contrastive coherence in prosody. This model entailed less tonal variation with correct linguistic intonation, stress only on significant words and an appropriate delivery speed of 175 wpm. It should be noted that, in both cases, the resulting prosodic model was dynamic, since the literature contains numerous references to the fact that monotony produces negative effects on the listener while a lively delivery is always well perceived (Hincks 2004).

The bulletins were written in the usual way by the journalists. They contained five news items from the following categories: politics, economics, social affairs, culture and sport;

all of these were international stories in order to prevent any emotional response or any type of involvement on the part of the listeners. They were therefore as purely informative and as neutral as possible.

The combination of the different prosodic elements of the real bulletin and the model bulletin (two types of intonation/stress and two speech rates) yielded four different presentation models which were recorded by two professional broadcasters, one male and one female, so as to observe any differences in perception of the different types of presentation. Using the same text in all cases avoided any possible interference from the differences in subject matter, while employing the same broadcasters prevented any influence likely to arise from variations in voice types. In both cases, every attempt was made to ensure optimum tones of voice, which were all deep. This is the type of voice recommended in the literature as the most highly valued by listeners in news presentations since it is perceived as more appealing and conveying more credibility (Collins 2000; Forbes 2004; Zuckerman and Miyake 1993).

The broadcasters were made to follow strict instructions regarding intonation, stress and speech rate when producing both versions of the message. This meant that, to obtain the desired effect, the presentations had to be recorded several times. This process produced a sample of eight bulletins which reflected both the real and the desired models of presentation (see Table 1).

On continuation, the bulletins were once again analyzed using PRAAT speech analysis software to ensure that they conserved the established prosodic features.

Procedures

To conduct the experiment, once the bulletins had been recorded, individuals were selected to constitute the sample population for the study. The total sample consisted of 160 ($N = 160$) students of communication chosen at random from a class list: 82 women and 78 men with an overall average age of 21. This sample was randomly sub-divided into eight groups of 20 people each, who would listen to each bulletin. Each group retained the same male–female ratio as that of the total population. The criterion adopted for the distribution of the bulletins among the sample was to combine the bulletins' prosodic features with the gender of the broadcaster in the following manner:

- Group 1: RM (real male), with MM (model male)
- Group 2: RF (real female), with RM (real male)
- Group 3: MF (model female), with RF (real female)
- Group 4: RMM (real moderate male), with RMF (real moderate female)
- Group 5: FMM (model fast female), with RMM (real moderate male)
- Group 6: MFM (model fast male), with FMF (model fast female)
- Group 7: RMF (real moderate female), with MFM (model fast male)
- Group 8: MM (model male), with MF (model female)

To attain a balance in the evaluation, some groups combined model bulletins with real ones whilst others combined the variations in male and female voices. Each one of these groups was put in a separate room supplied with the necessary equipment to provide optimum listening conditions. The listening trials were conducted simultaneously so as to avoid interference and with a single opportunity to listen to each of the two bulletins assigned to each group. The instructions the participants received were intentionally vague so as to avoid individuals paying undue attention to specific aspects of the task and thus cause a bias. They were merely told that after listening to the programs they would be

Table 1 Characteristics of the bulletins

Bulletins	Broadcaster	Intonation	Stress	Speech rate
Real (R)	RM Male voice Pitch: 101 Hz	Pitch level: 104 Hz Pitch range: 103 Hz Circumflex intonation	8 random words accented by each 10 = 80 %	210 wpm
	RF Female voice Pitch: 190 Hz	Pitch level: 220 Hz Pitch range: 190 Hz Circumflex intonation		
Real moderate (MR)	MRM Male voice Pitch: 101 Hz	PL: 104 Hz PR: 103 Hz Circumflex intonation	8 random words accented by each 10 = 80 %	175 wpm
	MRF Female voice Pitch: 190 Hz	PL: 220 Hz PR: 190 Hz Circumflex intonation		
Fast model (FM)	FMM Male voice Pitch: 101 Hz	PL: 90 Hz PR: 85 Hz Correct	4 key words accented by each 10 = 40 %	210 wpm
	FMF Female voice Pitch: 190 Hz	PL: 190 Hz PR: 150 Hz Correct		
Model (M)	MM Male voice Pitch: 101 Hz	PL: 90 Hz PR: 85 Hz Correct	4 key words accented by each 10 = 40 %	175 wpm
	MF Female voice Pitch: 190 Hz	PL: 190 Hz PR: 150 Hz Correct		

asked to reply to some questions about what they had heard. Once the first broadcast was over, the participants received copies of the relevant questionnaire. Then they listened to the second broadcast and received the second questionnaire. The order of presentation was always counter-balanced. The duration of the test was 40 min.

Dependent Variables

The point of reference for the establishment of the dependent variables of this study was an earlier study conducted to determine the degree of perception of 126 participants with regard to the prosody applied in radio and television news programs. Responding to open questions, the participants were required to assess the news programs in both media with regard to intonation, stress and speech rate. The adjectives most used to describe what were considered to be the best programs, and thus registered values of .5 or higher, were: conventional, correct, natural, calm, appropriate, pleasant, cheerful, intelligible, moderate, sure, clear, dynamic, involved, simple, paused, and credible. These terms were subjected to factor analysis, which yielded three factors. First factor: calm, natural, moderate and dynamic. The second factor integrated the concepts: pleasant, credible, sure and correct. Last, the third factor comprised the adjectives: intelligible, clear and simple. The terms involved, conventional and cheerful could not clearly be attributed to the factors and so were discarded. Therefore, the scales were combined in accordance with the outcomes of the factor analysis.

The first factor appeared to classify perception in relation to the sensations transmitted from listening to the bulletin, the second concerned the broadcaster's competence, while the third factor tended more towards comprehension as, in order to be understood, a radio message has to be intelligible, clear and simple. Consequently, the measurement of perception of the bulletins comprised three variables: sensations, competence and comprehension, measured in all cases with a scale of opposing pairs ranging from 1 to 5, where the higher values corresponded to positive adjectives.

The question for the variable 'sensations' was: What sensations do you perceive from the broadcaster's presentation? The participants were required to state whether the presentation transmitted *calm* or *tension*, *naturalness* or *artificiality*, *moderation* or *emphasis* and *dynamism* or *monotony*. For the variable 'competence', the question was: How would you rate the broadcaster's presentation? The participants were required to choose from *pleasant* or *unpleasant*, *credible* or *not very credible*, *sure* or *unsure* and *correct* or *incorrect*. Finally, the question for the variable 'comprehension' was: How would you rate your understanding of the broadcaster's presentation? The participants were required to state whether their understanding of the news was *intelligible* or *not very intelligible*, *clear* or *not clear* and *simple* or *difficult*.

The second part of the study sought to ascertain whether retention of the information was affected by the prosodic configuration of the presentation. Accordingly, the next part of the questionnaire contained ten closed questions about the content of the bulletins listened to. First came ten questions about the content of the five news items which comprised each bulletin, two for each item, ensuring the same degree of complexity in all cases. Applying a forced choice recognition test, the participants were required to choose the correct answer from three options, only one of which was right. They had previously been told that there was only one right answer and that, in case of doubt, they should choose the 'don't know' option. An additional open question required the participants to supply the correct information. In no case did the answers to the questions require numerical data, such as the number of deaths in an accident, due to the added difficulty that

recognizing such details demands and because it was more important to determine the generic comprehension of the information. Therefore, the questions focused on determining the facts (What?), the causes and consequences (Why?) and on the circumstances (How?).

Since each group was to evaluate two bulletins, it was not possible to ask the same questions for each one of them. For this reason, two different sets of questions were distributed among the groups so that the participants in any one group evaluated each bulletin and responded to two different sets of questions with the same level of difficulty in each case.

To assure that the level of difficulty of the questionnaires was the same, a pretest was performed with a gender-balanced sample of 30 students of communication. Fifteen students assessed the level of difficulty of the first questionnaire and the other 15 evaluated the level of difficulty of the second questionnaire. The questionnaire was composed of a 5-item scale, where the value 1 represented the lowest level of difficulty and 5 the highest. The results showed no significant differences [$F(1, 28) = 3.04, p = .164$] between the level of difficulty of the questions for the first bulletin ($M = 3.46; SD = .41$) and for the second bulletin listened to by each group ($M = 3.17; SD = .66$).

The final recognition index quantified these answers according to the following formula: number of correct answers-number of errors between 3: $H-(E/3)$. The maximum score was 5.

Results

A two intonation/stress (circumflex vs. correct) by two speech rate (fast vs. moderate) factorial MANOVA of repeated measures was performed on the four dependent variables: sensations, competence, comprehension, and recognition, with two covariates: gender of the presenter, and gender of the participant. Using an alpha level of .001 to evaluate homogeneity assumptions, Box's M test of homogeneity of covariance was not significant ($p = .86$). Levene's homogeneity of variance test was statistically not significant (sensations: $p = .55$; competence: $p = .38$; comprehension: $p = .97$; and recognition: $p = .53$) making it possible to assume that the variations were the same and fell in line with the principle of homoscedasticity.

Hypothesis 1

The first hypothesis stated that participants would perceive more positively and would retain more data from bulletins that employed intonation and stress which adhered to the principle of distinctive and contrastive coherence, in both male- and female-voice versions, than would be the case where circumflex intonation and emphatic stress were employed.

The findings obtained confirm this hypothesis. Factorial ANOVAs were performed with intonation/stress (circumflex vs. correct) as the independent variable and two covariates (gender of the presenter and gender of the participant). The differences were significant for all four of the dependent variables studied: sensations [$F(1, 158) = 190.02, p < .001$], competence [$F(1, 158) = 292.54, p < .001$], comprehension [$F(1, 158) = 281.54, p < .001$], and recognition [$F(1, 158) = 140.45, p < .001$].

Examination of the means (see Table 1) show that the best perceived and remembered bulletins were those with proper intonation and stress as opposed to those with circumflex intonation and emphatic stress. An analysis of the internal variables which comprise each

Table 2 Means and SD for intonation/stress and speech rate

<i>N</i> = 160	Intonation/stress	Speech rate	Mean	SD	
Sensations	Real	210	2.33	.52	
		175	2.65	.45	
		Total	2.49	.51	
	Model	210	3.35	.40	
		175*	3.63	.41	
		Total	3.49	.43	
	Competence	Real	210	2.27	.50
			175	2.48	.32
			Total	2.38	.43
Model		210	3.23	.31	
		175*	3.69	.41	
		Total	3.46	.43	
Comprehension		Real	210	2.26	.47
			175	2.55	.44
			Total	2.40	.47
	Model	210	3.31	.40	
		175*	3.82	.45	
		Total	3.56	.50	
	Recognition	Real	210	2.10	.47
			175	2.49	.33
			Total	2.30	.45
Model		210	2.83	.40	
		175*	3.26	.35	
		Total	3.05	.43	

* The best perceived and retained bulletins

scale of perception reveals that the bulletins with proper intonation and stress were considered to be especially natural, credible, correct and intelligible while those with circumflex intonation and emphatic stress were deemed especially superficial, emphatic, unpleasant and not very intelligible.

These findings, therefore, confirm the first hypothesis of this study. The participants' perception and retention were greater when the bulletins were delivered with proper linguistic intonation in which only significant words were stressed than when they were delivered using circumflex intonation with emphatic stress. These findings are equally applicable to both male and female voices, no significant differences being found between them.

Hypothesis 2

Hypothesis 2 of this study stated that participants would have a more positive perception of and would retain more data from bulletins which have a moderate speech rate, 175 wpm, whether the voice be male or female, than from bulletins delivered at speeds above 200 wpm.

Factorial ANOVAs, with speech rate (fast vs. moderate) as the independent variable and two covariates (gender of the presenter and gender of the participant) were performed on the four dependent variables. Results showed that the differences were significant for all

four of the variables studied: sensations [$F(1, 158) = 16.67, p < .001$], competence [$F(1, 158) = 27.91, p < .001$], comprehension [$F(1, 158) = 32.91, p < .001$] and recognition [$F(1, 158) = 41.07, p < .001$]. The data (see Table 2) show that the best perceived and retained bulletins were those of moderate delivery speed: 175 wpm as opposed to a fast speed of 210 wpm. An analysis of the variables which comprise the scale shows that bulletins with moderate speech rate were considered to be more paused and calmer while those with high speed were seen as especially fast and tense.

The interaction between intonation/stress and speech rate was not significant [$F(1, 158) = 1.66, p < .161$, partial $\eta^2 = .04$], nor were the effects of the gender of the presenter or the gender of the participant significant.

In conclusion, the data demonstrate that bulletins read at a moderate speed of 175 wpm were better perceived and retained than those read at a high speed of 210 wpm. Therefore, the second hypothesis of this study is confirmed, albeit to a lesser extent than is the case with intonation and stress.

Discussion

The results of this study contribute to the enhancement of research into the use of prosodic features in radio news presentation and confirm that listener perception and recognition are influenced by the intonation, stress and speech rate employed by the broadcaster in the presentation.

The data show that the intonation/stress and the speech rate proposed in this study as a model do in fact configure the prosodic combination which obtains best results regarding perception and recognition and, thus, the principle of distinctive and contrastive coherence is upheld. When a linguistically correct intonation is employed, according to the content of the message, and this is combined with stress on the significant words, participants perceive this more positively and remember more details. The explanation for this appears obvious: first, this prosodic combination favors more positive listener perception because, by avoiding continual emphasis, the delivery sounds more natural. In fact, the naturalness is precisely one of the most salient factors in this study. Second, as it is linguistically correct, it conveys a greater sense of credibility, as the findings show. Last, this combination is deemed more comprehensible because it is more in keeping with the information content, stresses only significant words and favors the differentiation between relevant and accessory information. This is why the participants were evaluated as being especially intelligible. Consequently, these bulletins facilitate listener recognition of the information. These results concur with the findings of Rodero (2007), whose work also found this type of intonation and stress to be the best perceived, and with the statements of Francuz (2010), Bean et al. (1989). However, up until now no empirical results had been obtained in an experimental study on perception and recognition which allow the perceptual and cognitive effects of the various prosodic models to be examined.

In contrast, the prosodic combination used in real bulletins proved to be the least well perceived and recognized. This is also logical since it employs circumflex intonation, with regular pitch and emphatic stress, which occur independently of the message's content. These features, therefore, produce a prosodic incoherence, eliminating the distinctive and contrastive functions. Participants did not evaluate this combination positively because acoustically this combination produces the familiar news-reading pitch: a kind of chant, whose effect is heightened by its continued, emphatic stress. This leads participants to perceive it as superficial because it is unnatural for them. Its recurrent emphatic focus

makes it unpleasant to the ear; factors which concur with the statement of Evans (1977): “Reading out the phrases rather than concentrating on the sense is (...) the surest way to develop irritating vocal mannerisms, such as the piledriving thump which some newscasters bestow on the last words of every sentence, whether important or unimportant” (p. 50). Finally, in addition to the fact that the prosodic variation occurs independently of content and that word stress is not selective, this combination is not very comprehensible to participants. It clearly does not favor understanding of the information because it does not discriminate between basic data and secondary data. For this reason, it is rated as unclear, but also, and more importantly, as not very intelligible. As a result, the degree of recognition is affected and, as the findings show, so is the ability to understand. These conclusions coincide with the findings of several other authors (Bolinger 1982; Evans 1977; Van Leeuwen 1984; Wheatley 1949), including Rodero (2007), who also found that this prosodic configuration was the least well perceived, and Francuz (2010), although these results had not been empirically obtained in an ad hoc study on perception and recognition until now. The fact that this is the prosodic combination most commonly employed in radio news bulletins makes these data particularly significant.

Moreover, the findings show that the moderate speech rate of 175 wpm was the best perceived and retained. This is precisely the rate which is recommended by a number of other authors (Boyd 2003; Chantler and Stewart 2003; McLeish 1995; Utterback 2000). The explanation for this appears clear. First, this delivery speed conveys a sensation of moderation, which leads participants to perceive it as paused and calm. This perception, therefore, is positive and particularly pleasant. Second, it facilitates assimilation of data since it provides the listener with more time to process the information. As a result, participants are able to retain more of the message’s content.

In contrast, the bulletins with a high delivery speed, 210 wpm, produced worse results. This would appear to be related to the effect on comprehension of the message. A very rapid speech rate not only produces negative sensations, it also reduces the time available for processing the information, which makes comprehension more difficult; a fact demonstrated by several other authors (Goldstein 1940; Nelson 1948; Van Leeuwen 1984). Thus, these bulletins were perceived as accelerated and tense, a circumstance that does not favor assimilation of information. It also means that they were found not to be very intelligible, a factor that directly affects understanding of the message. The results for the degree of recognition reinforce the idea that high speech rate hinders participants’ ability to remember news items.

The study does not, however, reveal any significant differences between the bulletins presented using a male or female voice. Although the male voice was slightly better perceived and retained, while the female voice did better in perception of comprehension, these differences were too small to be taken into account. These results concur with those obtained in previous gender studies relating to voice, in which no differences between males and females were found (Collins 2000; Freiden 1984; McCollum and Spielman Research 1986; Rodero et al. 2013; Whipple and McManamon 2002; Whittaker and Whittaker 1976). Neither were there any differences between the evaluations made by the male and female participants of the sample.

It should be noted that these results are of great importance for the achievement of optimum processing of information in radio broadcasting. The radio news format in itself presents the listener with a complex coding task since it involves transmitting data-rich messages in a short space of time. It is, therefore, especially important that the way in which these data are presented should aid the listener in correctly assimilating the message. Consequently, the results of this study should prompt radio stations to reflect on the way in

which they currently present news in order to ensure that this form of radio communication is truly effective and comprehensible to listeners. But the findings of this study can also be applied to improve the processing of audio message complexity across platforms (e.g., radio, TV audio tracks, audio on the Web, podcasts or public and interpersonal communication). Last, other potential areas could be benefited with the results: the political communication, or educational activities or processes where the prosody acquires a relevant function, as language learning.

Future Research and Limitations

The results of the study also give rise to certain other interpretations and to various questions which might be answered through an on-going, deeper analysis.

For example, the reduction to only two prosodic configurations might be considered a significant limitation. Only two different models were analyzed in combination only with the delivery speed. In reality, there are various other possible prosodic combinations employed in a radio presentation. In this case, it was necessary to limit the sample and start with the models most commonly used. In this sense, the study constitutes an initial attempt to deal with this matter, which may later be complemented by other research into other prosodic models. Moreover, the fact that the delivery speed variable was not entirely isolated could also have had an effect on the results. The findings obtained appear to indicate that intonation and stress were more influential in listeners' final evaluation. However, this cannot be confirmed because this variable was not isolated.

Even though several combinations were used and the sample participants responded to two different models of questions in order to evaluate retention, an aspect that may have contaminated the results of the study is the fact that each group evaluated two different bulletins. Having answered the questions about the first bulletin, when faced with those of the second bulletin the participants would naturally tend to pay more attention to both the presentation and the content. In effect, and despite the fact that the questions were different and the order of the bulletins was altered among the groups, the listening conditions from one bulletin to the other must necessarily have been modified. This is a circumstance that should be taken into account when evaluating the results.

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