

DIFFERENCES IN ENGLISH INTONATION PERCEPTION BETWEEN MALE AND FEMALE BULGARIAN LEARNERS OF ENGLISH

Ralitsa Petrova Kuncheva
Paisii Hilendarski University of Plovdiv

Intonation is an important linguistic tool that people utilize to convey additional grammatical, focus-marking and attitudinal meaning at the suprasegmental level of language. The present study investigates the possible role of biological sex in the perception and comprehension of different intonation contours and their function by male and female Bulgarian learners of English.

Key words: intonation, intonation perception, intonation functions, biological sex

Introduction

The matter of potential differences in how male and female language learners perceive intonation lies at the crossroads of linguistics, cognitive studies, and language acquisition. It focuses on investigating how intonation patterns are perceived and interpreted by male and female learners, which is an important part of language comprehension and communication. In English, intonation – the varying pitches used in speech – is essential for expressing emphasis, attitudes, and meaning. It plays an important role in distinguishing questions from statements, indicating the speaker's attitude, and structuring information. The perception of intonation can significantly impact language comprehension and the ability to engage in natural, fluent conversations.

Linguistic and cognitive research has suggested that male and female language users may perceive and process linguistic stimuli differently. Such potential differences can be attributed to a range of factors, including biological, cognitive, and socio-cultural influences. Various studies have examined the neurobiological differences between the sexes in terms of language over the last thirty years, examining both the structure and

functions of the brain in different populations at various stages of life. The goal of the many reports on sex variations in language processing is to correlate potential differences in linguistic ability with differences in brain activity.

However, the available empirical data seems to be contradictory and its interpretation is debatable. According to meta-analyses, there is no concrete proof that sex influences linguistic ability, lateralization, or the underlying structures and functions of the brain (Kansaku and Kitazawa, 2000; Kaiser et al., 2009; Sommer et al., 2004, 2008; Wallentin, 2009). Nevertheless, a few EEG studies showed slight but consistent temporal differences between men and women in the auditory processing of phonetic cues during both speech perception and production, despite the fact that reported differences in cortical activity between men and women were not supported by neurobiological studies of higher order language processing. It is interesting to note that there was a rather high agreement for N1/P2 latency differences (the N1-P2 complex is a cortical auditory evoked potential) between the sexes in EEG experiments that used speaking and passive listening. In fact, compared to male participants, female individuals in all these investigations consistently showed an earlier latency of N1/P2 auditory evoked responses. It is well known that the N1 and P2 auditory evoked components, which are primarily derived from the supratemporal plane of the auditory cortex in response to spectral and temporal cues of an auditory stimulation, represent synchronous neural activation in the thalamic-cortical segment of the central nervous system (Näätänen and Picton, 1987; Woods, 1995). Given these recognized and proposed roles for N1 and P2 components, it is possible that sex differences exist in the auditory feedback control of speech production as well as in the early auditory processing of spectral and temporal phonetic cues, as indicated by the observed modulation of N1/P2 latency during speaking and listening. According to this later theory, it is interesting to note that sex variations in speech production under modified or delayed auditory feedback have also been shown in earlier behavioral studies in which male speakers exhibited more speech disturbances such as slower vocal responses, increased dysfluencies, decreased articulation accuracy, and decreased speech rate (Bachrach, 1964; Timmons, 1971; Corey and Cuddapah, 2008; Chen et al., 2010). While the reason behind women's faster N1/P2 auditory evoked responses remains unclear, there are a number of potential factors that could account for some of the observed sex differences. These include differences in phonemic articulatory and acoustic spaces, owing to the widely recognized differences between men and women in the physiology of the vocal tract and its effects

on speech behaviors, (Klatt and Klatt, 1990; Ladefoged, 2006; Simpson, 2009); in anatomical connectivity, with better within-hemispheric connectivity seen in men and better between-hemispheric connectivity in women (Ingalhalikar et al., 2014); in grey matter volume and tissue density (Ruigrock et al., 2014); and in hormonal influences, even though there is no compelling proof that sex hormones have an impact on neurobiological language processing (Wallentin, 2009).

When it comes to the specific research of intonation, there are few studies that look at possible differences in its perception and comprehension that may be due to biological sex and they focus largely on perception and production of emotions and attitude. Li et al. investigated how biological sex affected perception and production of emotional intonation denoting willingness and reluctance among native Mandarin speakers (Li, Wong & Tu, 2020). They found that female listeners were better at perceiving emotional intonation and their utterances tend to be perceived as willing attitude. Conversely, Lausen and Schacht found that “the mixed pattern for emotion-specific effects, however, indicates that, in the vocal channel, the reliability of emotion judgments is not systematically influenced by speakers' gender and the related stereotypes of emotional expressivity” (Lausen and Schacht, 2018).

The contradictory data on the matter of the influence of biological sex on intonation perception and production indicate a gap in scientific understanding and is a prerequisite for further studies in this direction. The present study aims to investigate whether biological sex is a factor for the perception and comprehension of intonation and its functions.

Design of the study

The purpose of the study is to investigate whether biological sex is an influential factor for the perception of English intonation by non-native female and male speakers (native Bulgarian speakers) and how it affects their understanding of sentence meaning, grammatical structure, and speaker attitude conveyed by different intonation patterns. The study involved 150 participants, all of whom were students in different undergraduate and graduate programs in the Faculty of Philology at Paisii Hilendarski University of Plovdiv. There were 114 female participants and 36 male participants. They were asked to respond to a questionnaire consisting of two parts.

The first part included 30 questions based on 30 English utterances, each one showcasing different intonation patterns that convey specific

meaning, grammatical structures or speaker attitudes. The participants were asked to listen to the recorded stimuli and then choose an answer that indicates the correct function of the intonation of the given spoken stimuli from a set of multiple choice answers. The recorded audio stimuli were spoken by native English speakers. Every sentence was recorded at least twice with different intonation patterns that serve a different grammatical, focus-marking or attitudinal function. The grammar and semantics of the stimuli were the same for each recording.

There were 3 tag questions, each recorded with a final rising intonation pattern and a final falling intonation pattern. They were used to test the participants' ability to perceive the degree of the speaker's certainty in what they are talking about based on the final intonation pattern of the tag.

There were 2 sentences, each recorded 3 times with different intonation patterns that marked the focus on different information units of the sentences. They were used to test the participants' ability to perceive the focus that the speaker placed on the information that they deemed important to convey.

There were 3 sentences with declarative grammatical structure which were recorded twice – once with final falling intonation pattern and once with final rising intonation pattern. They were used to test the participants' ability to perceive the grammatical function of intonation for indicating affirmative or interrogative sentences.

There were 3 sentences containing relative clauses which were recorded twice with different intonation patterns that indicated either a defining relative clause or a non-defining relative clause. They were used to test the participants' ability to perceive the grammatical function of intonation for marking a defining relative clause or a non-defining relative clause and their respective differences in meaning.

There were 3 sentences recorded twice with intonation patterns that expressed different attitudes or emotions. They were used to test the participants' ability to perceive the attitudinal function of intonation for expressing sarcasm, gratitude, interest, anger, and disbelief.

The second part of the questionnaire consisted of 30 additional questions which asked the participants to provide demographical data and other relevant information which may indicate possible factors that influence the perception of intonation by non-native speakers.

The questions pertaining to the audio stimuli were randomly asked and no two stimuli with the same sentence were presented one after the other. The participants' answers to the questions regarding the various stimuli were grouped according to the different functions of intonation that were tested

and were analyzed using descriptive statistics. The participants had to answer all of the questions for a given set of stimuli correctly in order for their answer regarding a given function of intonation to be counted as correct. Fisher's exact test was applied to explore whether there was an association between the biological sex (male or female) and the response (correct or wrong). Statistical significance was considered if the *p*-value was less than 0,05.

Results

1. Intonation of question tags

Regarding the first set of stimuli which tested the participants' ability to perceive the degree of the speaker's certainty in what they are saying based on the final intonation pattern of the tag, 52,6% of female participants gave the wrong answer to all the questions in the group and 47,4% answered correctly when asked to indicate whether the speaker was unsure in what they were saying based on the rising final intonation of the tags. This is similar to the results for the male participants with 66,7% wrong answers and only 33,3% correct answers (see Table 1). There was no statistically significant association between biological sex and the perception of the rising intonation pattern of the tags and its function ($p = 0,178$).

		Rising Intonation		Total	
		Wrong	Correct		
Sex	Female	Count	60	54	114
		% within Sex	52,6%	47,4%	100,0%
	Male	Count	24	12	36
		% within Sex	66,7%	33,3%	100,0%
Total		Count	84	66	150
		% within Sex	56,0%	44,0%	100,0%

Table 1. Results for the questions testing the rising intonation of tags and its function

Similar results were obtained for the set of stimuli testing the participants' ability to perceive and understand tags with falling final intonation and its function for expressing certainty on the speaker's part. The answers in both groups were predominantly wrong with 68,4% of female participants and 55,6% of male participants failing to give the correct answer (see Table 2). There was no statistically significant association between

biological sex and the perception of the falling intonation pattern of the tags and its function ($p = 0,166$).

		Falling Intonation		Total	
		Wrong	Correct		
Sex	Female	Count	78	36	114
		% within Sex	68,4%	31,6%	100,0%
	Male	Count	20	16	36
		% within Sex	55,6%	44,4%	100,0%
Total		Count	98	52	150
		% within Sex	65,3%	34,7%	100,0%

Table 2. Results for the questions testing the falling intonation of tags and its function

2. Focus-marking intonation patterns

Another set of stimuli tested the participants' ability to perceive the focus that the speaker placed on the information they deemed important to convey by producing the relevant focus-marking intonation patterns. The two sentences that were used for this purpose were recorded 3 times with 3 different intonation patterns. The results were statistically analyzed for each of the two subsets of stimuli.

As to the first subset of stimuli, most of both male and female participants gave the wrong answers – 77,2% and 83,3%, respectively (see Table 3). Once again, there was no statistically significant association between biological sex and the perception and comprehension of focus-marking intonation ($p = 0,493$).

		I've always been terrified of spiders		Total	
		Wrong	Correct		
Sex	Female	Count	88	26	114
		% within Sex	77,2%	22,8%	100,0%
	Male	Count	30	6	36
		% within Sex	83,3%	16,7%	100,0%
Total		Count	118	32	150
		% within Sex	78,7%	21,3%	100,0%

Table 3. Results for the questions regarding the sentence “I've always been terrified of spiders” which test the focus-marking function of intonation

Interestingly, with respect to the second subset of stimuli, a greater number of the participants in both groups provided correct answers – 57,0% of females and 52,8% of males, respectively (see Table 4). The calculated *p*-value of $p = 0,702$, however, is once again above the threshold under which a statistically significant association between the biological sex of the participants and the perception and comprehension of focus-marking intonation is indicated.

		Mary goes running in the park every Sunday			
			Wrong	Correct	Total
Sex	Female	Count	49	65	114
		% within Sex	43,0%	57,0%	100,0%
	Male	Count	17	19	36
		% within Sex	47,2%	52,8%	100,0%
Total		Count	66	84	150
		% within Sex	44,0%	56,0%	100,0%

Table 4. Results for the questions regarding the sentence “Mary goes running in the park every Sunday” which test the focus-marking function of intonation

3. Affirmative versus interrogative sentence intonation

With respect to the participants’ ability to differentiate between affirmative and interrogative sentences only based on the final falling or final rising intonation pattern of the utterance, the participants in both groups gave more correct answers. 86,0% of females and 86,1% of males were able to correctly identify the affirmative sentences (see Table 5), while 63,2% of females and 58,3% of males correctly identified the interrogative sentences (see Table 6).

		Affirmative			
			Wrong	Correct	Total
Sex	Female	Count	16	98	114
		% within Sex	14,0%	86,0%	100,0%
	Male	Count	5	31	36
		% within Sex	13,9%	86,1%	100,0%
Total		Count	21	129	150
		% within Sex	14,0%	86,0%	100,0%

Table 5. Results for the questions regarding affirmative sentence intonation

			Interrogative		Total
			Wrong	Correct	
Sex	Female	Count	42	72	114
		% within Sex	36,8%	63,2%	100,0%
	Male	Count	15	21	36
		% within Sex	41,7%	58,3%	100,0%
Total	Count	57	93	150	
	% within Sex	38,0%	62,0%	100,0%	

Table 6. Results for the questions regarding interrogative sentence intonation

Nevertheless, there was no statistically significant association between the sex of the participants and the ability of the participants to perceive and understand affirmative intonation ($p = 1,000$) and interrogative intonation ($p = 0,694$).

4. Defining versus non-defining relative clause intonation

The answers of the participants to the questions testing their ability to perceive and comprehend defining and non-defining relative clauses, based solely on their intonation contours, are overwhelmingly wrong. 71,9% of females and 63,9% of males were unable to correctly identify non-defining relative clauses (see Table 7), whereas the incorrect answers to the questions regarding the defining relative clauses were even more – 91,2% and 91,7%, respectively (see Table 8). There was no statistically significant association between the biological sex of the participants and their ability to perceive and understand the function of intonation for denoting defining ($p = 1.000$) and non-defining ($p = 0,406$) relative clauses.

			Non-defining relative clause		Total
			Wrong	Correct	
Sex	Female	Count	82	32	114
		% within Sex	71,9%	28,1%	100,0%
	Male	Count	23	13	36
		% within Sex	63,9%	36,1%	100,0%
Total	Count	105	45	150	
	% within Sex	70,0%	30,0%	100,0%	

Table 7. Results for the questions regarding non-defining relative clause intonation

		Defining relative clause		Total	
		Wrong	Correct		
Sex	Female	Count	104	10	114
		% within Sex	91,2%	8,8%	100,0%
	Male	Count	33	3	36
		% within Sex	91,7%	8,3%	100,0%
Total		Count	137	13	150
		% within Sex	91,3%	8,7%	100,0%

Table 8. Results for the questions regarding defining relative clause intonation

5. Perception of the attitudinal function of intonation

The last set of stimuli tested the ability of the participants to determine the attitude or the emotion of the speaker based on the intonation patterns of their utterances. They had to choose from a set of given answers after listening to each recording. The results indicated that the participants were mostly unable to identify sarcasm with 86,0% of females and 83,3% of males giving wrong answers ($p = 0,787$).

However, when it comes to the perception of the other tested attitudes and emotions, most of the participants in both groups were able to identify them. 67,5% of females and 80,6% of males were able to correctly identify gratitude ($p = 0,148$); 90,4% of females and 94,4% of males were able to correctly identify interest ($p = 0,735$); 64,9% of females and 75,0% of males were able to correctly identify anger ($p = 0,312$) and 83,3% of females and 75,0% of males were able to correctly identify disbelief ($p = 0,326$). There is no statistically significant association between the biological sex of the participants and their ability to perceive and identify the tested attitude or emotion based on the intonation contour of the utterances.

Discussion

The results of the study do not support a statistically significant association between the sex of the participants and their ability to perceive and understand the patterns associated with the different grammatical, focus-marking and attitudinal functions of intonation. This points to the conclusion that sex is not a factor for the proper perception and understanding of English intonation by Bulgarian learners of English and there may be other factors that are significant and can account for the differences in the responses of the participants, such as the participants' English language proficiency level,

the time they spent studying the language, and others. The results are in line with most studies which found that sex does not influence linguistic ability, however, they contradict the findings of the few studies that showed slight but consistent temporal differences between men and women in the auditory processing of phonetic cues during both speech perception and production. This may be due to the fact that the participants in most of these studies were native speakers of the studied language. The contradictory data calls for further in-depth investigation of the role of biological sex in intonation perception and comprehension.

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