A Preliminary Study on the Emotional Tone in Exclamatory Sentences in Different Age Groups Based on Xi'an Dialect

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About emotional tone

Emotional tone： The vocal conveyance of emotions is marked by a deliberate and managed manifestation of the emotional quality in one's voice (Mullennix et al., 2002).

A speaker's variations in prosody, volume, pitch, syllable duration, and speech quality can all be indicators of their emotional state (Krestar & McLennan, 2013)

Emotions affect our perception, thinking and decision-making…emotions have an impact on how neutral words and sentences are processed by individuals (Vissers et al., 2010).

Previous studies about emotional tone

Emotional tone

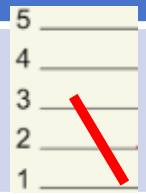
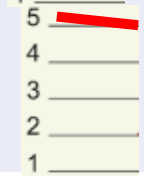
- The distribution pattern of **focus prosody** (Shi & Xia, 2022).
- 10 principles of **Mandarin intonation** (Shi & Yan, 2021).
- The **sound intensity** quantitatively influence its emotional meaning (Chen et al., 2012).
- Affect our global **level and range of F0 contours** (Bänziger & Scherer, 2005).

Aging

- **AD patients: significant deficits** in emotional processing ability, mainly in prosodic tasks (Bucks & Radford, 2004)
- **Patients with MCI: poorer performance** in facial expressions and vocalizations (Moreira et al., 2022).
- **Young subjects** tended to favor prosody**, older subjects** gave both prosody and semantic meaning equal importance feeling (Ben-David et al., 2019).

XI'AN Dialect (西安方言)

In Xi'an dialect(西安方言), the intonation characteristics of exclamatory sentences are obviously different from declarative sentences, especially in the expression of pitch and duration.

	Putonghua	Xi'an Dialect
天	阴平（first tone,55） 	阴平 middle-falling tone （first tone, 31） 
昨	阳平（second tone,35） 	阳平 rising tone （second tone, 24） 
马	上声（third tone, 214） 	上声 high-falling tone （fourth tone, 52） 
做	去声（fourth tone, 51） 	去声 high-level tone （fourth tone, 55,54） 

(Zhao, 2017) & (Gong, 1995)

Previous studies about XI'AN Dialect (西安方言)

Phonetic aspects of Chinese Shaanxi **Xi'an dialect**
L Czap, L Zhao - 2017 8th IEEE International Conference on ..., 2017 - ieeexplore.ieee.org
... **Xi'an dialect** talking head system. Shaanxi **dialect** translator is used to realize Shaanxi **Xi'an dialect** ... the consonants and vowels of Shaanxi **Xi'an dialect** are used to create visemes for ...
☆ Save 99 Cite Cited by 11 Related articles All 2 versions

[PDF] Visemes of Chinese Shaanxi **Xi'an Dialect** Talking Head [J]
L Zhao, L Czap - Acta Polytechnica Hungarica, 2019 - acta.uni-obuda.hu
... the consonants and vowels of the **dialect**. The viseme library also ... categorized the static visemes of the Shaanxi **Xi'an dialect** ... achieving a talking head for Chinese Shaanxi **Xi'an dialect**. ...
☆ Save 99 Cite Cited by 5 Related articles All 3 versions »

[PDF] Strong and weak **dialects** of China: How Cantonese succeeded whereas Shaan'Xi failed with the help of media
M Yu-Han, HY Lee - Asian Social Science, 2014 - epe.lac-bac.gc.ca
This research addresses an important set of social scientific issues—how language maintenance between dominant and vernacular varieties of speech—also known as **dialects**—are ...
☆ Save 99 Cite Cited by 5 Related articles All 5 versions »

Modelling the tongue movement of Chinese Shaanxi **Xi'an dialect** speech
Z Lu, L Czap - 2018 19th International Carpathian Control ..., 2018 - ieeexplore.ieee.org
... **Xi'an dialect**. This dynamic viseme system is used to create the fundamentals of a talking head – animated articulation model for Shaanxi **Xi'an dialect** ... in Shaanxi **Xi'an dialect** was also ...
☆ Save 99 Cite Cited by 5 Related articles

Phonemes of **Xi'an Dialect** and Statistic Study of Phonemic Combination Frequency
Y Li, H Wu - ... , Education Technology, Arts, Social Science and ..., 2016 - atlantis-press.com
... **Xi'an dialect** belongs to Guanzhong **dialect** of Shaanxi, is the representative of ... **dialect** of Guanzhong and that of Shaanxi **dialect**. **Xi'an dialect** is also one of the representative **dialects** in ...
☆ Save 99 Cite Related articles »

[PDF] A quantification of Chinese **dialect** affinity
CC Cheng - Studies in the Linguistic Sciences, 1982 - ideals.illinois.edu
... the question whether **Xi'an** is closer to Beijing or to Ji'nan. We look at line 4 of Table Ia and find **Xi'an** heading the row. Its correlation coefficients with the other **dialects** are listed across ...
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Study on Shaanxi Local **Dialect** and Its Cultural Representation
T Li - 8th International Conference on Social Network ..., 2018 - atlantis-press.com
... is the cornerstone of the development of Shaanxi **dialects**. Shaanxi has a long history, fully ... for the formation of Shaanxi **dialects**. Walking in today's capital city of **Xi'an** in Shaanxi, it is ...
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Dialect and Putonghua in **Xi'an** city: The case of Beishan Menkou urban village
Q Li, Y Wang - Journal of Asian Pacific Communication, 2020 - jbe-platform.com
... the **Xi'an dialect** of Beishan Menkou "urban village" and Mandarin Chinese. Data collection started with traditional **dialect** survey methodology which assumes the **dialect** ... **Xi'an dialect**'s ...
☆ Save 99 Cite Related articles All 3 versions

A research gap

Hypothesis: this study discussed the tonal features of exclamatory sentences in Xi'an dialect, focused on the expression of these features in different age groups. Hypothesized that there were significant age-related differences in the expression of tonal features in Xi'an dialect, and younger people showed more obvious tonal changes in the context of exclamatory sentences than older people

This study

Method- A. Participants

A total of 8 subjects participated in this experiment

Old group: 4 subjects (2 males and 2 females) were between 50 and 60 years old (average age: 56.8 years old), with an average education level of 10 years and the highest degree was high school. All of them had completed MoCA and MMSE tests.

Young group: 4 subjects (2 males and 2 females) are all 25 years old, were divided into the "Young group", all had completed their undergraduate studies.

All subjects were local residents of Xi' an and could fully communicate in Xi'an dialect with no literacy difficulties or dyslexia, and had no history of any mental or neurological diseases.

This study

Materials and methods:

A total of 8 Xi'an dialect sentences were designed in this experiment, and each group included two sentences. The first sentence in each group was a declarative sentence in Xi'an dialect, and the second sentence was the exclamatory corresponding.

The font presented to the participants was Song, size 40, and bold.

The subjects sat in a relatively comfortable position 30-40cm away from the computer screen.

请根据自己的感觉读出下面的句子

昨个买瘦肉鲤鱼焖得香。

昨个买瘦肉鲤鱼焖得香太太！

Practice only

昨天我看见老刘吃得美。

昨天我看见老刘吃得美太太！

……

This study

Procedure-Data Analysis

For both groups:

Each person read each sentence three times, and a total of **8×3×8=192 sample sentences were obtained**.

D1 昨天我看见老刘吃得美。

E1 昨天我看见老刘吃得美太太！

D2 前个你做菜洗碟整得好。

E2 前个你做菜洗碟整得好太太！

D3 晌午马上下雨虫飞得猛。

E3 晌午马上下雨虫飞得猛太太！

D4 人家考复试有题写得少。

E4 人家考复试有题写得少太太！

Focues words: The tenth word of every sentence

Which are: **美、好、猛、少**

Compared to declarative sentences, the intonation of the corresponding **word (the 10th word) in exclamatory sentences undergoes a noticeable change**, as it conveys the information focus of the sentence (Xie, 2017).

Result: **The averaged pitch variation of "Old group"**

O1

Less obvious changes

With higher MoCA and MMSE scores

O2

More obvious changes

With lower MoCA and MMSE scores

O3

Less obvious changes

With higher MoCA and MMSE scores

O4

More obvious changes

With lower MoCA and MMSE scores

MoCA: O1 M= 25, O2 M=19 / O3 F= 29, O4 F= 22

MMSE: O1 M= 30, O2 M=21 / O3 F= 29, O4 F= 26

O M	O F
−10.3392	−26.697

Discussion-Possible reasons: Old group

MOCA: O1 M= 25, O2 M=19 / O3 F= 29, O4 F= 22

MMSE: O1 M= 30, O2 M=21 / O3 F= 29, O4 F= 26

Why did these two MCI (potential) subjects show the significant pitch changes between the two types of sentences?

A possible explanation was that in order to **hide their perceived insecurity about cognitive decline** (Aramaki et al., 2016).

The language difficulties in the aMCI (amnestic type MCI) participants were **probably can be seen in the semantic level, similar to the early stages of AD** (Tsantali, Economidis, & Tsolaki, 2013).

The expression “language performance deficit” should **refer to the impairment of cognitive abilities** (such as memory and word retrieval ability) rather than the loss of fundamental language knowledge (McCullough et al., 2019).

Result: **The averaged pitch variation of “Young group”**

Y1

Y2

Y M	Y F
-18.8277	-14.1924

Y3

Y4

In the young group, we can see that the pitch variation of males was more obvious than that of females

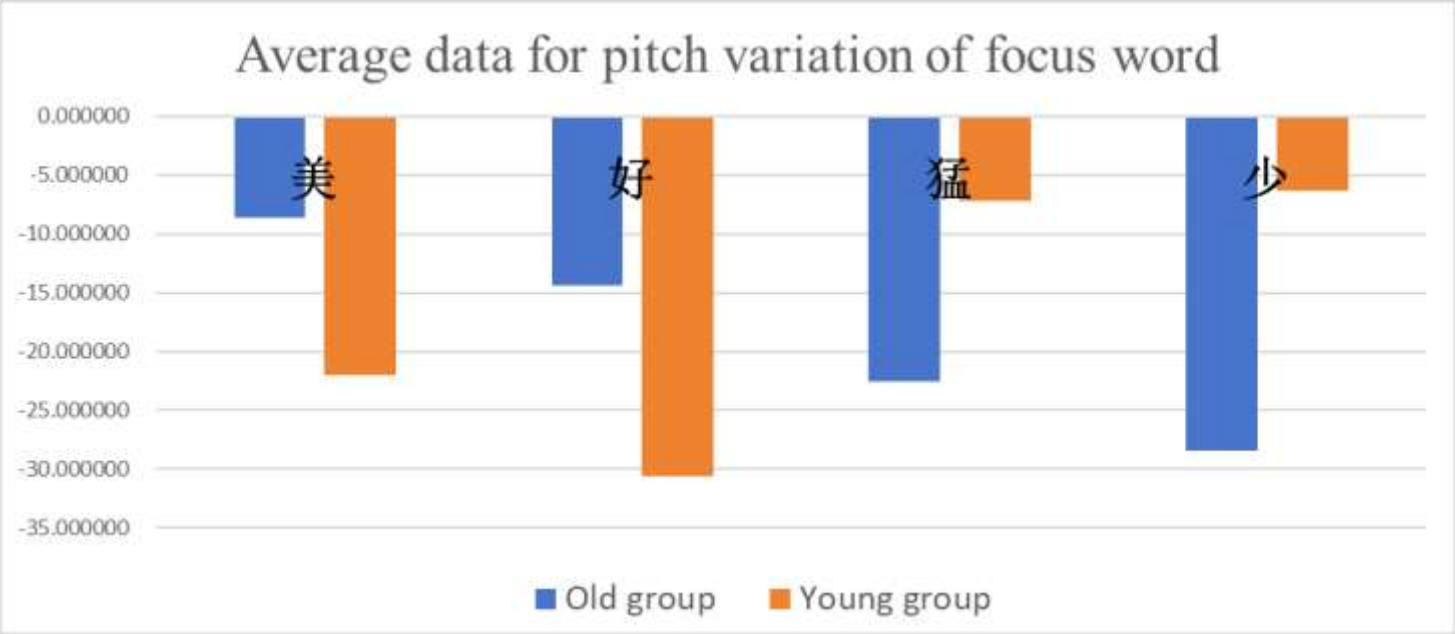
However, the individual differences did not appear to be significant……

Result-pitch variation of the focus word between groups

t-TEST between group of pitch variation

	美	好	猛	少
O:Y	t=3.21, p <0.01	t=3.7, p <0.01	t=-4.03, p <0.01	t=-4.11, p <0.01

The pitch variation between 2 groups showed the significant differences.



"猛" and "少": The average variation of these 2 focus words in the **old group** is more significant than that in the **young group**.

?

	美	好	猛	少
Word frequency	1496.48	7331.88	76.95	603.97

Sun et al., 2018

Word frequency and predictability may influence the early and late stages of word processing independently, may also interact in the later stages of word processing (Huizeling et al., 2022).

Further analysis

ANOTHER possible explanation:

Theory of Lexical Diffusion

The change in sound is lexically gradual, passing word by word across one speaker to another and so on; while phonetically abrupt, the pronunciation of a particular word is changed instantaneously by a particular person (Wang & Minett, 2005)

A "snowball" effect: in language, phonological changes may start out randomly before solidifying and become frequent but conditional (Wang, 1969).

Look at each factor involved in **sound, including physical, organizational, social, and more, one by one .** (Wang, 1969).

Further analysis

ANOTHER possible explanation:

With the development of time and changes in the social environment **(the increase in dialect types due to the increased number of people around the city, the promotion of the status of Mandarin, and the different degrees of understanding of the exclamation tone among young generations),** the pronunciation of certain words in the Xi'an dialect has also changed, especially when compared with the dialect of several decades ago.

"猛" "少"	Young group	Less emphasis on the emotional aspects
"猛" "少"	old group	Get used to the emphatic tone and emotional tone of such focus words in spite of their differences in frequency

Conclusion- Preliminary Results

Emotional tone of the elderly is significantly affected by (potential) MCI.

Difference in focus word pitch between the old group and the young group also depended on the specific focus words.

New insights into the tonal characteristics of Xi'an dialect.

Important evidence for exploring the influence of age on dialect perception and expression.

1. Interfering factors in the recording environment and equipment conditions, which affected the audio quality and, in turn, the data analysis and collation.

2. To examine the specific dialect language changes, a large number of sample data are required in future studies.

Reference

Aramaki, E., Shikata, S., Miyabe, M., & Kinoshita, A. 2016. Vocabulary Size in Speech May Be an Early Indicator of Cognitive Impairment. *PLOS ONE*, vol. 11, no. 5, pp. 1-13.

Bänziger, T., & Scherer, K. R. 2005. The role of intonation in emotional expressions. *Speech Communication*, vol. 46, no. 3-4, pp. 252-267.

Ben-David, B., Gal-Rosenblum, S., Van Lieshout, P., & Shakuf, V. 2019. Age-Related Differences in the Perception of Emotion in Spoken Language: The Relative Roles of Prosody and Semantics. *Journal of Speech, Language, and Hearing Research*, vol. 62, pp. 1188–1202.

Bucks, R. S., & Radford, S. A. 2004. Emotion processing in Alzheimer's disease. *Aging & Mental Health*, vol. 8, no. 3, pp. 222–232.

Cai, Q., & Brysbaert, M. J. P. o. 2010. SUBTLEX-CH: Chinese word and character frequencies based on film subtitles, vol.5, no. 6, pp. 1-8.

Chang H.-S., Lee C.-Y., Wang X., Young S.-T., Li C.-H., & Chu W.-C. 2023. Emotional tones of voice affect the acoustics and perception of Mandarin tones. *PLOS ONE*, vol. 18, no. 4, pp. 1-26.

Chen X., Yang J., Gan S., & Yang Y. 2012. The Contribution of Sound Intensity in Vocal Emotion Perception: Behavioral and Electrophysiological Evidence. *PLOS ONE*, vol. 7, no. 1, pp.1-11.

Gandour, J., Wong, D., Dzemidzic, M., Lowe, M., Tong, Y., & Li, X. 2003. A cross-linguistic fMRI study of perception of intonation and emotion in Chinese. *Human Brain Mapping*, vol. 18, no. 2, pp. 149-157.

Gong, Q. [龚群虎]. 1995. 关中方言的变调和变音 [Tonal changes and sound changes in Guanzhong dialect]. *语文研究 [Language Research]*, vol. 4, no. 57, pp. 55-58.

Huizeling, E., Arana, S., Hagoort, P., & Schoffelen, J.-M. 2022. Lexical Frequency and Sentence Context Influence the Brain's Response to Single Words. *Neurobiology of Language*, vol. 3, no. 1, pp. 149–179.

Krestar, M. L., & McLennan, C. T. 2013. Examining the Effects of Variation in Emotional Tone of Voice on Spoken Word Recognition. *Quarterly Journal of Experimental Psychology*, vol. *66*, no. 9, pp. 1793–1802.

Liu, F., & Xu, Y. 2005. Parallel Encoding of Focus and Interrogative Meaning in Mandarin Intonation. *Phonetica*, vol. 62, pp. 70–87.

McCullough, K. C., Bayles, K. A., & Bouldin, E. D. 2019. Language Performance of Individuals at Risk for Mild Cognitive Impairment. *Journal of Speech, Language, and Hearing Research*, vol. 62, no. 3, pp. 706–722.

Mullennix, J. W., Bihon, T., Bricklemyer, J., Gaston, J., & Keener, J. M. 2002. Effects of Variation in Emotional Tone of Voice on Speech Perception. *Language and Speech*, vol. 45, no. 3, pp. 255–283.

Moreira H. S., Costa A. S., Machado Á., Castro S. L., Vicente S. G., & Lima C. F. 2022. Impaired Recognition of Facial and Vocal Emotions in Mild Cognitive Impairment. *Journal of the International Neuropsychological Society*, vol. 28, no.1, pp. 48–61.

Shi, F., & Xia, Q. [石锋, 夏全胜]. 2022. The principles of sentence focus in Mandarin Chinese [试论汉语普通话语句的焦点原理]. *Linguistic Sciences[语言科学]*, vol. 21, no. 6, pp. 580-594.

Shi, F., & Yan, J. [石锋, 阎锦婷]. 2021. A Preliminary Analysis of the Principles of Mandarin Intonation [试论普通话语调原理]. *Nankai Linguistics[南开语言学刊]*, vol. 2, pp. 39-51.

Sun, C. C., et al. 2018. Chinese lexical database (CLD). *Behavior Research Methods*, vol. 50, no. 6, pp. 2606-2629.

Tsantali, E., Economidis, D., & Tsolaki, M. 2013. Could language deficits really differentiate Mild Cognitive Impairment (MCI) from mild Alzheimer's disease? *Archives of Gerontology and Geriatrics*, vol. 57, no. 3, pp. 263-270.

Tsang, Y.-K., et al. 2018. MELD-SCH: A megastudy of lexical decision in simplified Chinese. *Behavior Research Methods*, vol. 50, no. 5, pp. 1763-1777.

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Tsang, Y.-K., et al. 2018. MELD-SCH: A megastudy of lexical decision in simplified Chinese. *Behavior Research Methods*, vol. 50, no. 5, pp. 1763-1777.

Vissers, C. Th. W. M., Virgillito, D., Fitzgerald, D. A., Speckens, A. E. M., Tendolkar, I., Van Oostrom, I., & Chwilla, D. J. 2010. The influence of mood on the processing of syntactic anomalies: Evidence from P600. *Neuropsychologia*, vol. 48, no. 12, pp. 3521–3531.

Wang, W. S.-Y. 1969. Competing Changes as a Cause of Residue. *Language*, vol. 45, no. 1, 9-25.

Wang, R., et al. 2020. Chinese character handwriting: A large-scale behavioral study and a database. *Behavior Research Methods*, vol. 52, no. 1, pp. 82-96.

Wang, W. S. Y. 2019. Language and the brain in the sunset years. In C.-R. Huang, Z. Jing-Schmidt, & B. Meisterernst (Eds.), *The Routledge handbook of Chinese applied linguistics*. Routledge, pp. 605-623

Wang, W. S.-Y., & Minett, J. W. 2005. The invasion of language: Emergence, change and death. *Trends in Ecology & Evolution*, vol. 20, no. 5, pp. 263–269.

Xie, C. [谢郴伟]. 2017. “被” 字句和 “把” 字句中处置义的差异——韵律分布模式的证据[The differences on disposal between Bei-construction and Ba-construction—evidence from prosodic distribution pattern]. *南开语言学刊 [Nankai Linguistics]*, vol. 2, pp. 92-101.

Xu, X., & Li, J. 2020. Concreteness/abstractness ratings for two-character Chinese words in MELD-SCH. *PloS one*, vol. *15*, no. 6, pp. 1-16.

Xu, X., et al. 2021. Age of acquisition ratings for 19,716 simplified Chinese words. *Behavior Research Methods*, vol. 53, no. 2, pp. 558-573.

Xu, X., et al. 2022. Valence and arousal ratings for 11,310 simplified Chinese words. *Behavior Research Methods*, vol. 54, no. 1, pp. 26-41.

Zhao, Y. [赵永刚]. 2017. 汉语的连读变调与陕西方言单字调的区域性差异 [Regional differences in Chinese connected speech tone sandhi and tonal variations of single characters in Shaanxi dialect]. *外国语文研究 [Foreign Language and Literature Research]*, vol. 3, no. 4, pp. 2-13.

Thanks for your attention!

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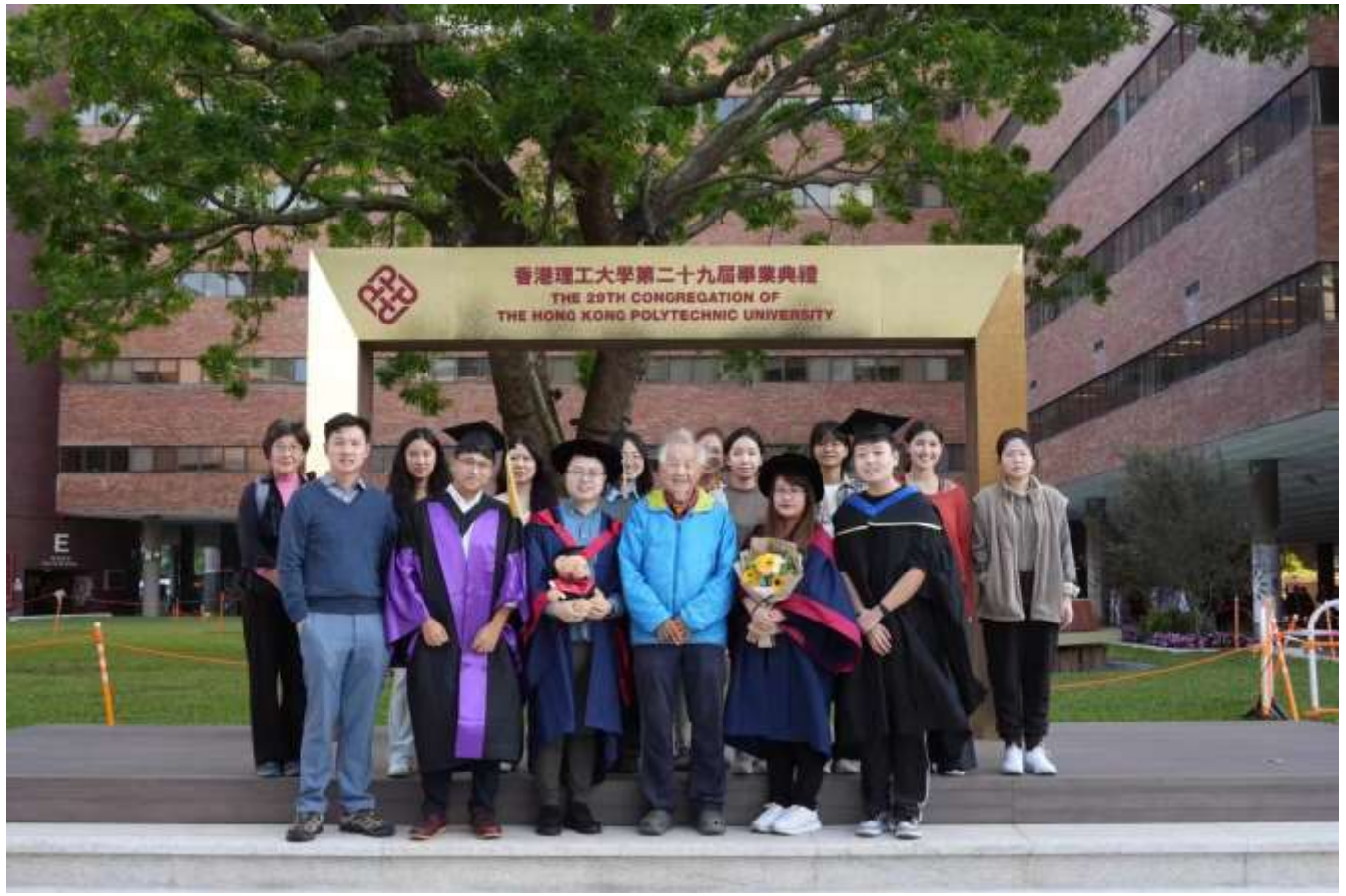

Back Up

In Xi'an dialect(西安方言), the intonation characteristics of exclamatory sentences are obviously different from declarative sentences, especially in the expression of pitch and duration.

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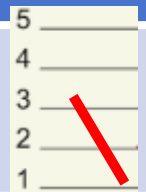
天	阴平（first tone,55） 	阴平 middle-falling tone （first tone, 31） 
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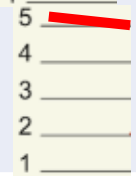
做	去声（fourth tone, 51） 	去声 high-level tone （fourth tone, 55,54） 

(Zhao, 2017) & (Gong, 1995)

It should be noted that this is only a change in the tone of a single sinogram in Xi'an dialect, if it is in a two-sinogram word or a complete sentence, the tone pattern of this syllable will be changed totally (regarded as tone sandhi)

做（去声高平，55,54）菜　　做（阴平降调，31）作业

Back up

Procedure-Data Analysis

For both Old and young group:

Each person reads each sentence three times, and a total of **8×3×8=192 sample sentences are obtained**.

D1 昨天我看见老刘吃得美。

E1 昨天我看见老刘吃得美太太！

D2 前个你做菜洗碟整得好。

E2 前个你做菜洗碟整得好太太！

D3 晌午马上下雨虫飞得猛。

E3 晌午马上下雨虫飞得猛太太！

D4 人家考复试有题写得少。

E4 人家考复试有题写得少太太！

My focus words: The tenth word of every sentence

Which are: **美、好、猛、少**

Compared to declarative sentences, the intonation of the corresponding word (the 10th word) in exclamatory sentences undergoes a noticeable change, as it conveys the information focus of the sentence (Xie, 2017).

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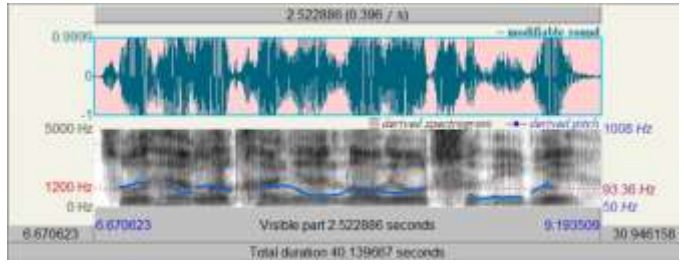
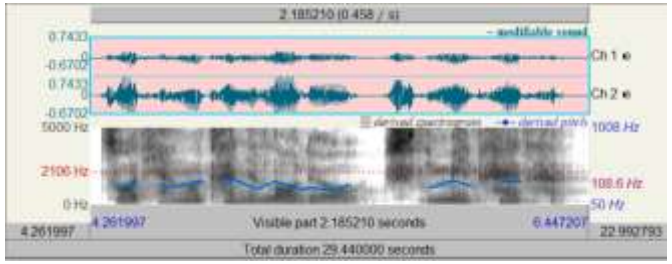


昨天我看见老刘吃得美太太！



Result Data Analysis

A

	1	2	3	4	5	6	7	8	9	10
Old group D	151.74	156.90	161.18	160.57	156.07	147.04	136.59	126.27	118.08	112.90
Old group E	176.33	179.38	181.38	179.51	174.10	165.43	154.57	141.69	132.51	127.64

B

	1	2	3	4	5	6	7	8	9	10
Young group D	167.18	169.10	169.46	168.81	165.45	159.54	153.75	150.14	149.10	149.08
Young group E	183.32	185.82	187.10	187.64	185.86	181.09	173.55	165.56	159.62	157.16

Average pitch of focus words in all D and E sentences in "Old group" and in "Young group" respectively.

t-test: "Old group" exhibited significant differences ($t = -2.13$, $p < 0.05$), which is also found in "Young group" ($t = -3.53$, $p < 0.01$).

The pitch value of the focus words of declarative sentences and exclamatory sentences in both "Old group" and "Young group" changed significantly.

Between groups:

Declarative sentences: $t = -2.74$, $p < 0.05$

significant differences of pitch changes among the two groups

Exclamatory sentences: $t = -2.04$, $p = 0.06$

marginally significant or near significant difference between two groups

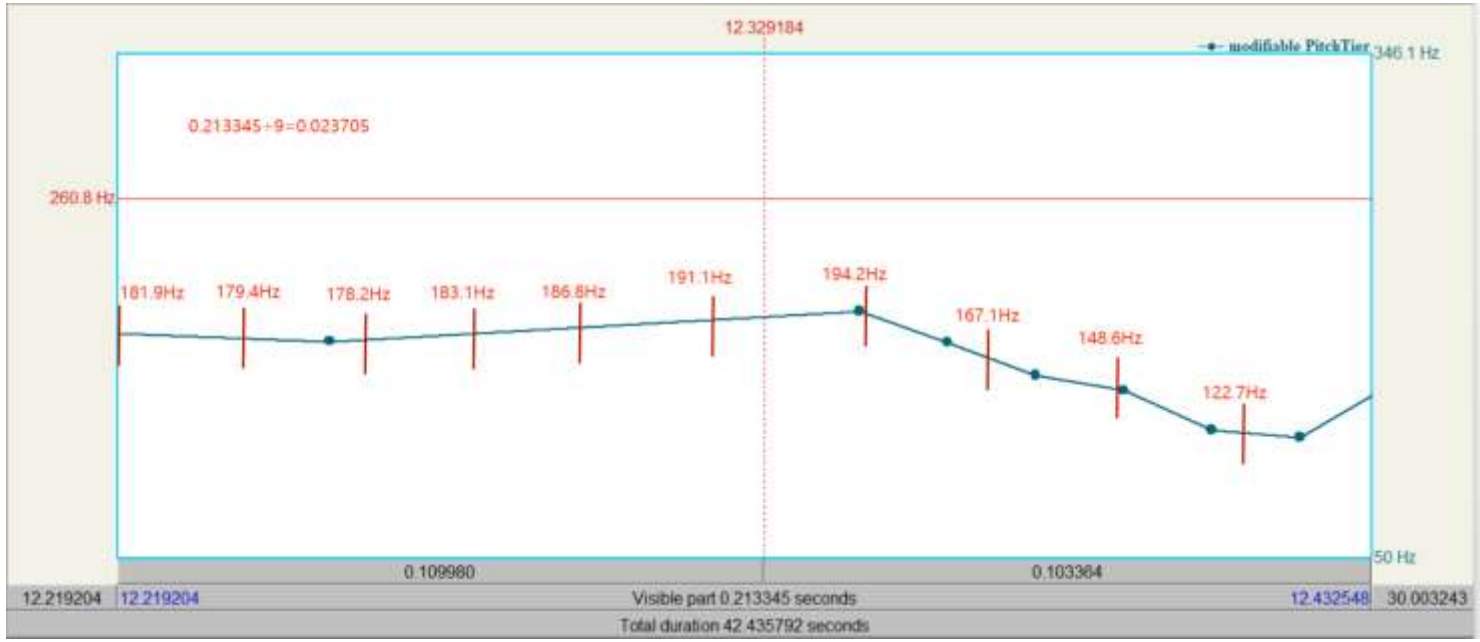
Back Up

Procedure-Data Analysis

昨	天	我	看	见	老	刘	吃	得	美	太	太	！
192.7	231.3	187.32	234.07	180.4	187.6	157.28	181.9	181.14	211.17	162.78	185.92	
188.76	231.09	203.9	220.16	178.5	198.48	160.69	179.4	177.69	208.94	178.03	183.36	
191.77	227.45	215.59	207.36	165.2	206.23	160.98	178.2	167.94	202.15	196.41	179.65	
200.74	221.7	221.64	201.39	152.89	200.8	160.28	183.1	164.44	190.06	205.92	172.73	
212.36	211.53	221.21	201.99	145.18	193.16	163.13	186.8	165.34	176.63	204.54	162.74	
225.3	194.1	212.9	203.26	144.48	184.1	173.29	191.1	170.68	167.35	199.25	148.86	
236.66	179.4	201.81	202.89	146.86	175.15	182.54	194.2	179.7	159.94	196.29	136.12	
242.8	170.79	192.54	202.39	150.97	167.01	184.36	167.1	188.31	156.37	191.95	125.94	
240.25	171.94	185.46	197.95	159.82	158.76	178.16	148.6	195.04	158.27	186.04	121.09	
233.39	178.19	172.69	187.87	174.32	156.35	180.17	122.7	200.63	164.03	187.01	119.42	

For every word in all sentences, this study conducted a data analysis using Praat to obtain 10 pitch values for each character.

10 pitch：This is used to interpret the average pitch distribution of a word, to obtain a range of pitches, including maximum and minimum values



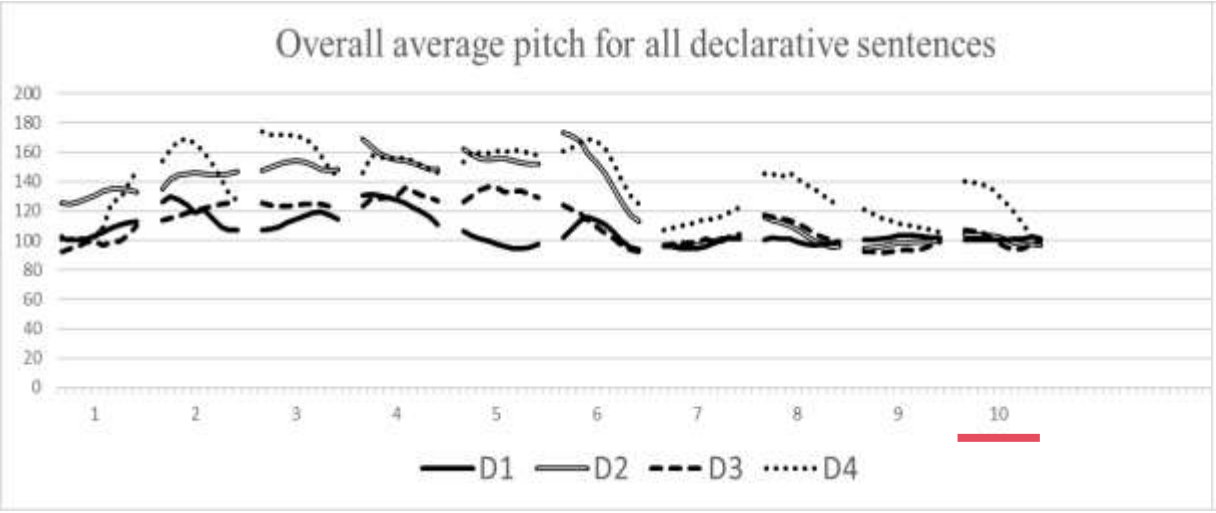
In cases where data were missing due to recording damage, this study manually recalculated these values using the modifiable PitchTier feature in Praat.

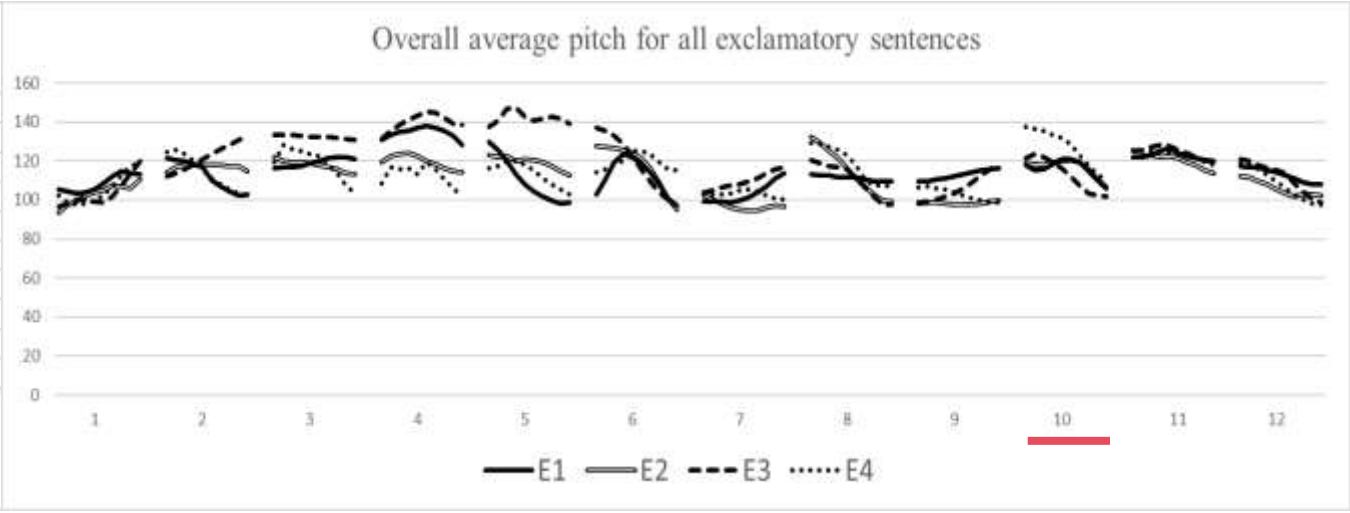
Back Up

Data Analysis

時	1	2	3	4	5	6	7	8	9	10
First	106.75	105.71	106.05	108.37	112.29	116.71	122.9	128.89	132.55	132.9
Second	101.65	100.73	99.69	100.15	101.37	103.35	105.63	107.75	108.99	109.52
Third	95.88	95.7	95.32	95.24	95.5	95.75	96.01	95.99	95.68	95.36
					時					
Average	101.43	100.713	100.353	101.253	103.053	105.27	108.18	110.877	112.407	112.593

To ensure the best possible recording quality, each sentence was read three times, resulting in three sets of pitch values for each word. After completing the data analysis, this study calculated **the average pitch for every word to determine its mean value**

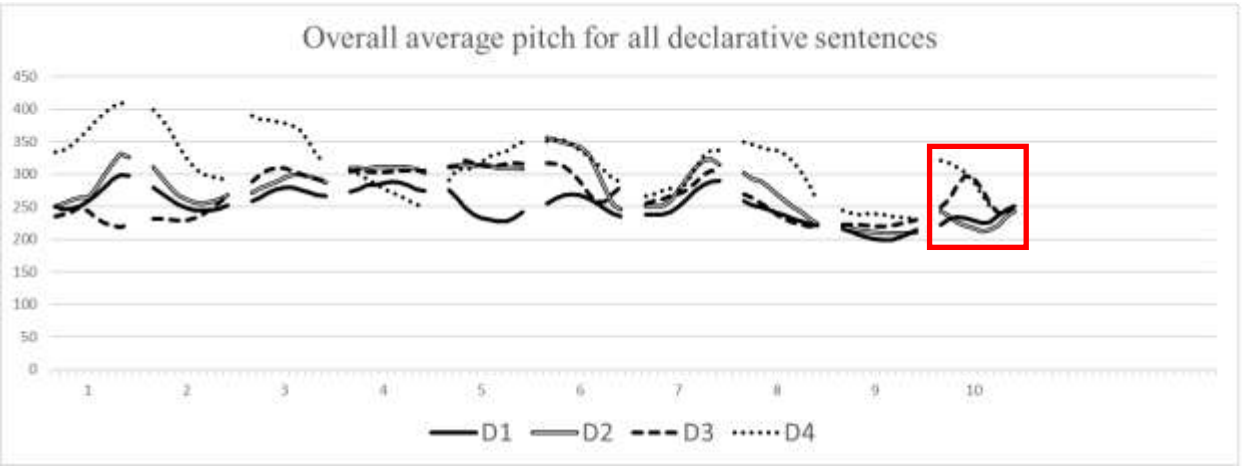


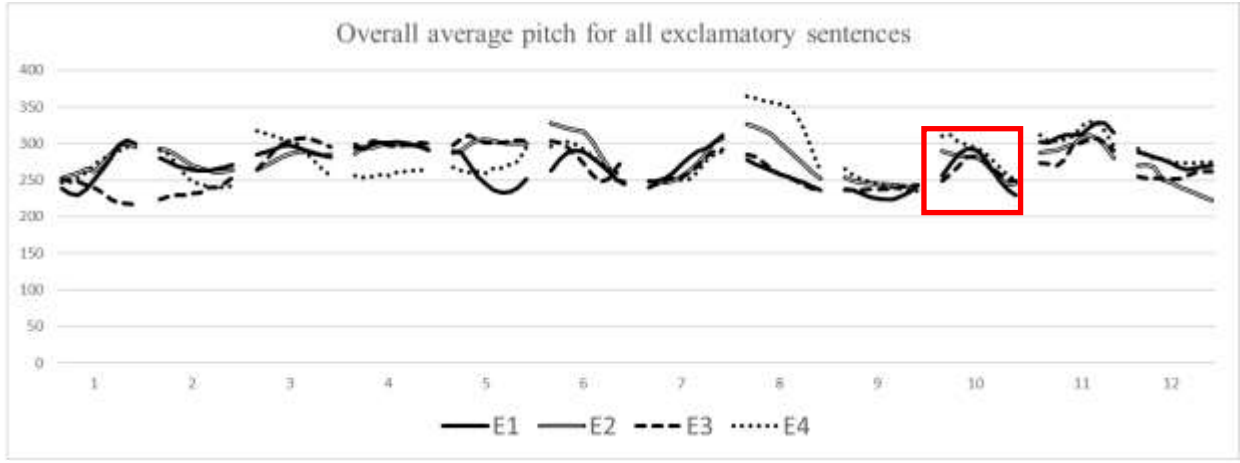


Y1 M: First subject in the Young group, male, same as O1 M, O2 M…

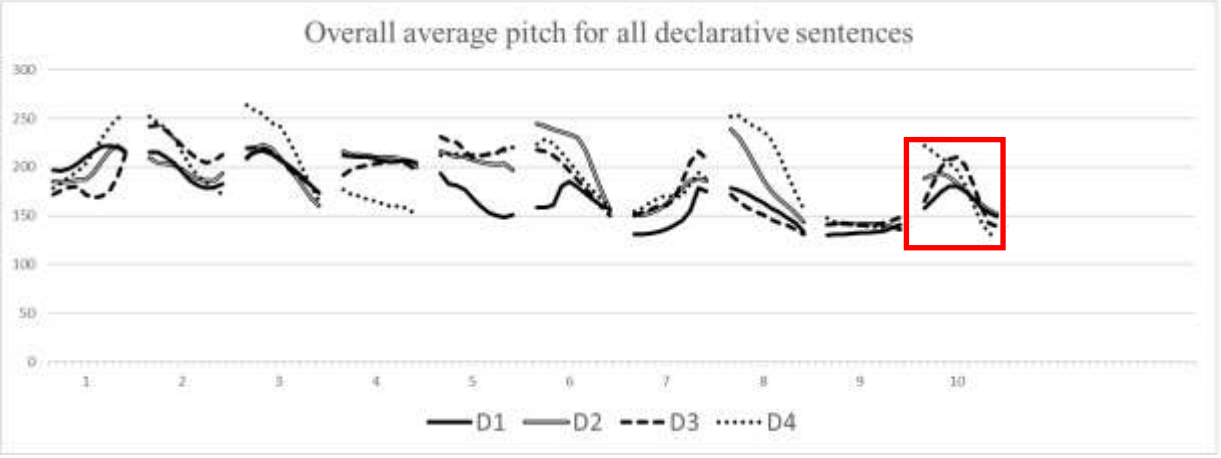
D: declarative sentence / E: exclamatory sentence

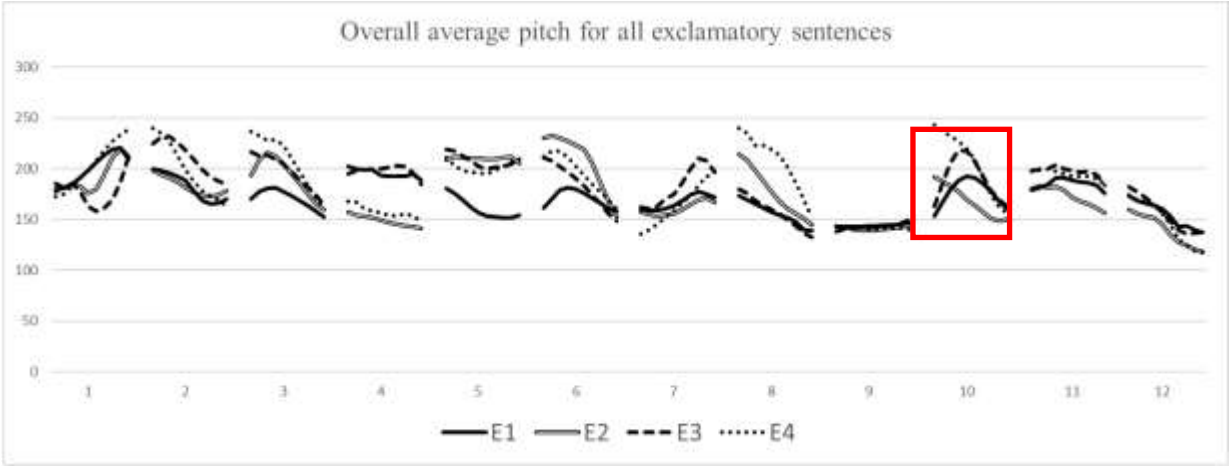
Back Up





Y3 F





O3 F

The preliminary charts and data did not readily reveal significant differences in pitch values of the focus word between declarative and exclamatory sentences for the young and old groups, so **this study proceeded to further analysis the data.**

Back Up

Because all tones for focus words are 上声in Putonghua and Xi'an dialect(52), in this experiment, 10 pitch averages of all focus words in 4 declarative sentences and 4 exclamatory sentences were calculated respectively

美, 好, 猛, 少 in D

美, 好, 猛, 少 in E

$$\frac{美1\ \text{pitch in D1} + 好1\ \text{pitch in D2} + 猛1\ \text{pitch in D3} + 少1\ \text{pitch in D4}}{4}$$

$$\frac{美2\ \text{pitch in D1} + 好2\ \text{pitch in D2} + 猛2\ \text{pitch in D3} + 少2\ \text{pitch in D4}}{4} \Big/ \ldots\ldots$$

3 & 4

= Average pitch of focus words in all D sentence for XX subject

		1	2	3	4	5	6	7	8	9	10
01	Focus word in D	116.16	121.63	124.94	125.73	122.25	113.73	106.11	100.00	95.60	91.84
	Focus word in E	124.37	127.20	129.10	128.42	125.83	121.19	112.92	103.03	96.18	92.32

Back Up

Analysis of data between groups

Keep calculating the average of the total number of the corresponding 10 pitch in focus words in D and E sentences for all subjects in both groups, and then the average was calculated

$$\frac{\textbf{O1}\ 1 \text{ pitch in D} + \textbf{O2}\ 1 \text{ pitch in D} + \textbf{O3}\ 1 \text{ pitch in D} + \textbf{O4}\ 1 \text{ pitch in D}}{4}$$

$$\frac{\textbf{O1}\ 2 \text{ pitch in D} + \textbf{O2}\ 2 \text{ pitch in D} + \textbf{O3}\ 2 \text{ pitch in D} + \textbf{O4}\ 2 \text{ pitch in D}}{4} \quad / \ \ldots\ldots$$

3 & 4

= Average pitch of focus words in **all D sentence in Old group**

	1	2	3	4	5	6	7	8	9	10
Old group D	151.74	156.90	161.18	160.57	156.07	147.04	136.59	126.27	118.08	112.90
Old group E	176.33	179.38	181.38	179.51	174.10	165.43	154.57	141.69	132.51	127.64

O: t= -2.13, p < 0.05

It is proved that the pitch value of the focus words of declarative sentences and exclamatory sentences in old group changes significantly.

Back Up-for specific analysis

The pitch variation for each focus word across the two sentence types

D1（美）
192. 1267
204. 44
209. 58
201. 7833
183. 06
164. 2067
151. 33
147. 0567
139. 8933
131. 9467

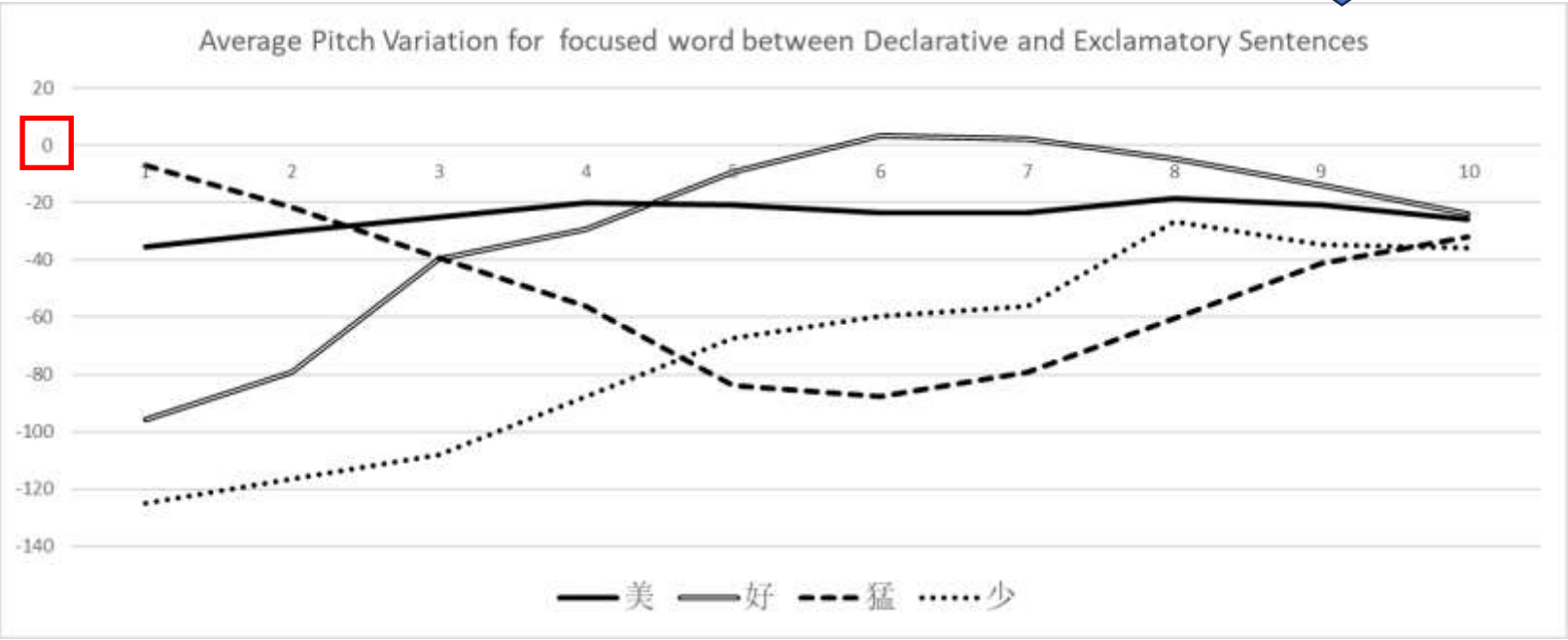
—

E1（美）
227. 5267
234. 71
234. 51
221. 84
204. 07
187. 8067
174. 7167
165. 68
160. 6867
157. 6533

=

−35. 4
−30. 27
−24. 93
−20. 0567
−21. 01
−23. 6
−23. 3867
−18. 6233
−20. 7933
−25. 7067

Minus the averaged 10 pitch values of the focus word in declarative sentences from the corresponding 10 averaged pitch values of the focus word in exclamatory sentences, **the resulting data represent the pitch variation for each focus word across the two sentence types.**

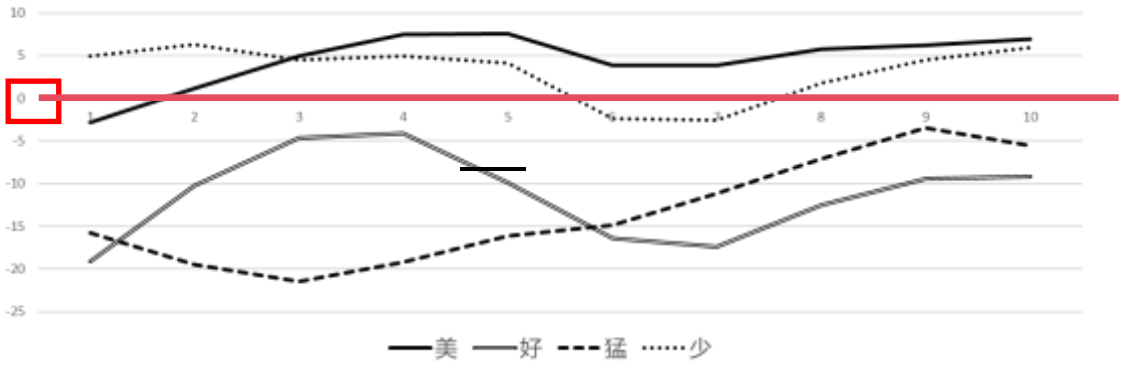


+:the pitch of the focus word in **declarative sentences is higher than in exclamatory sentences**

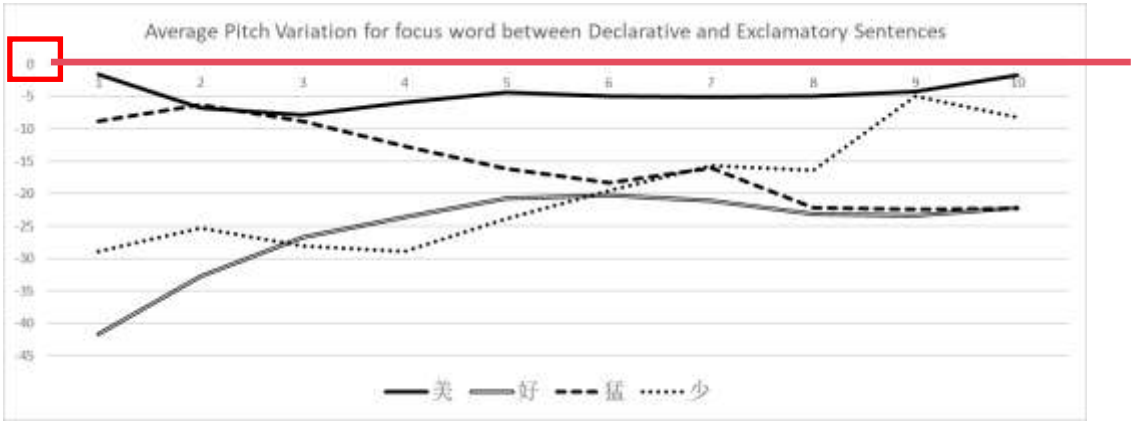
-: the pitch of the focus word in **exclamatory sentences is higher than in declarative sentences**

Result: The averaged pitch variation of “Old group”

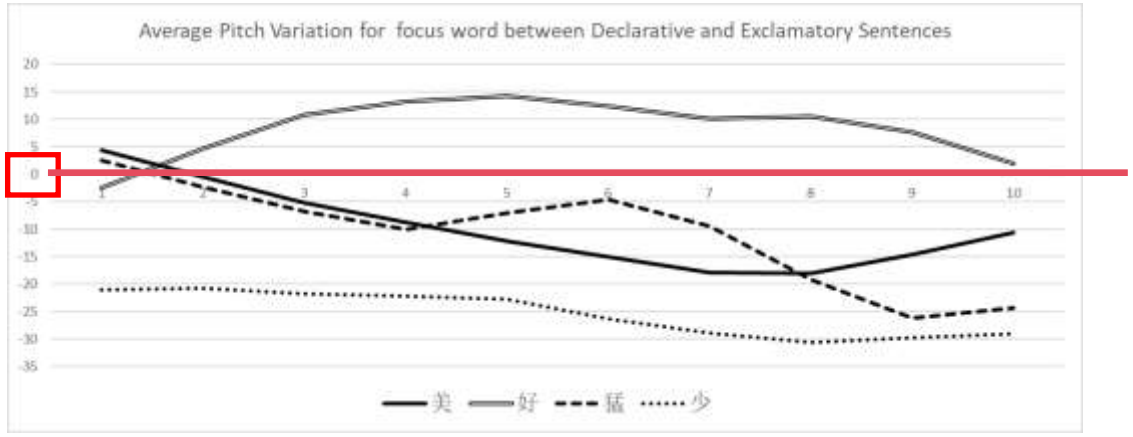
O1



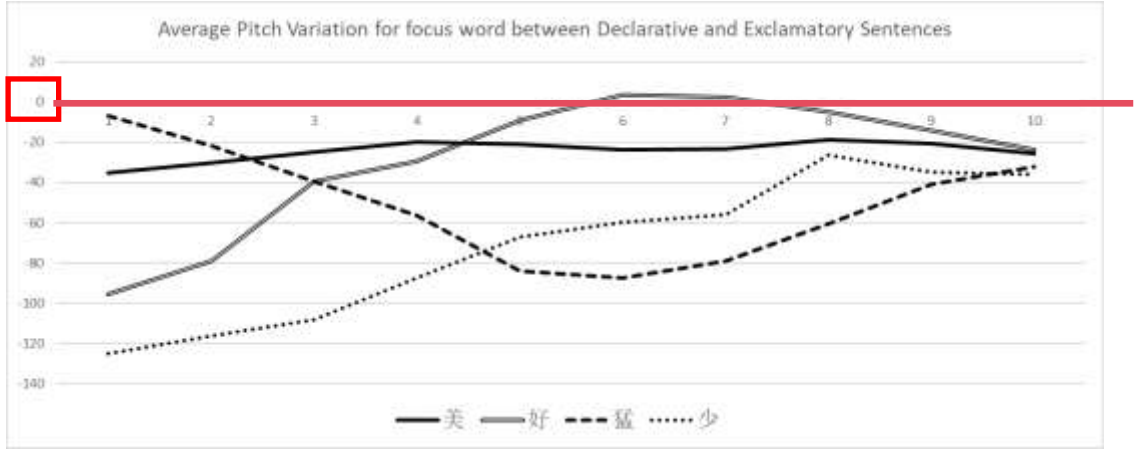
O2



O3



O4



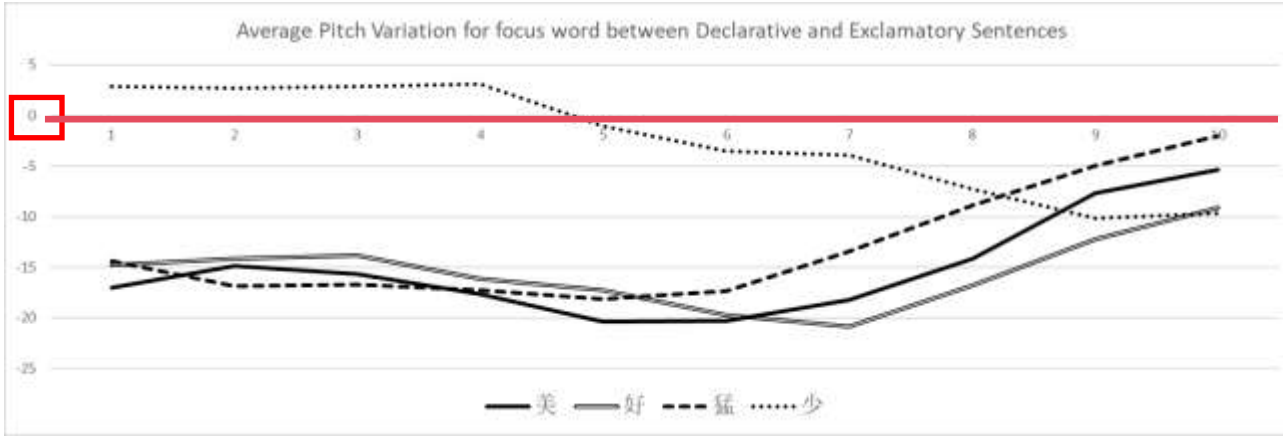
MOCA: O1 M= 25, O2 M=19 / O3 F= 29, O4 F= 22

MMSE: O1 M= 30, O2 M=21 / O3 F= 29, O4 F= 26

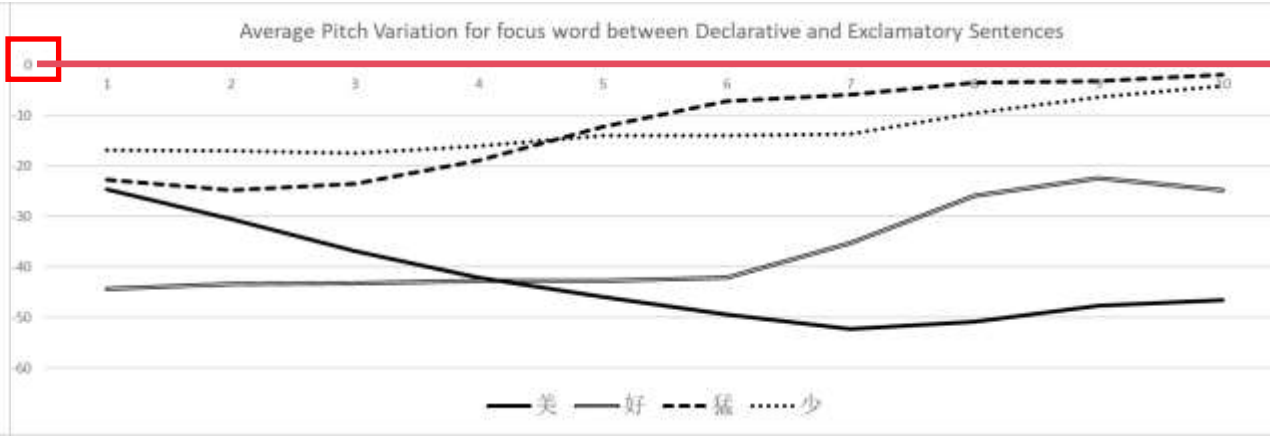
O M	O F
−10. 3392	−26. 697

Result: The averaged pitch variation of "Young group"

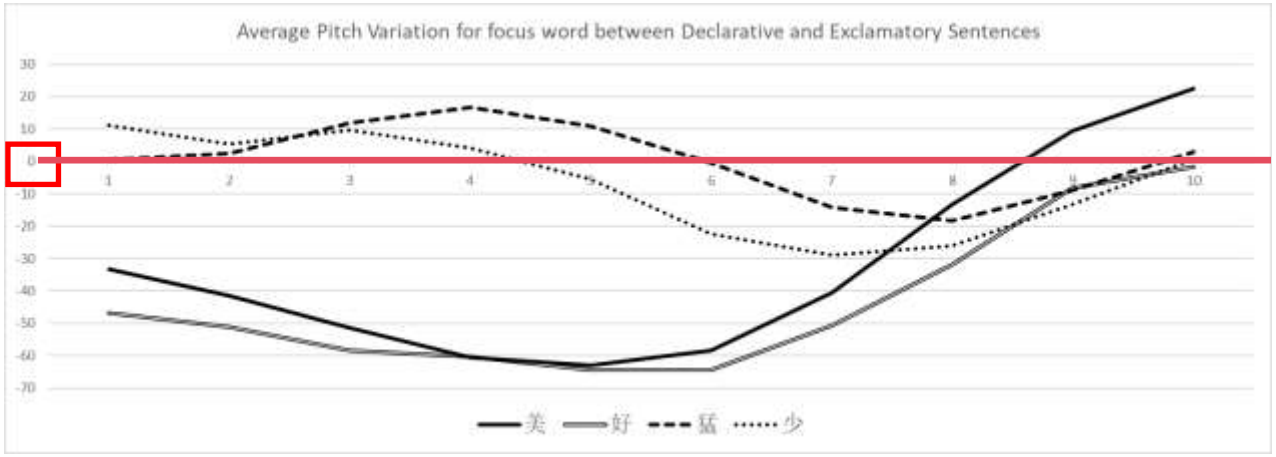
Y1



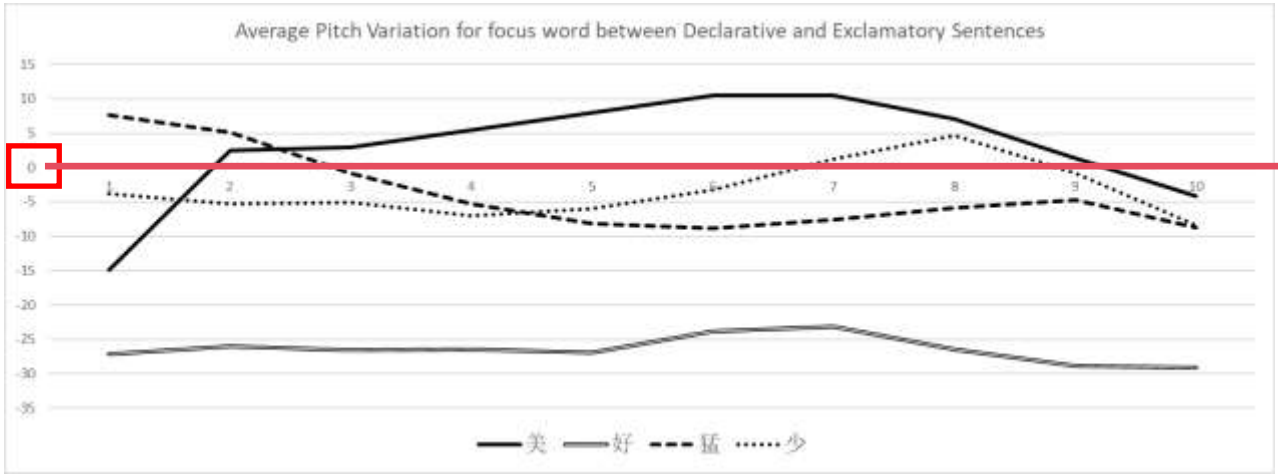
Y2



Y3



Y4



In the young group, we can see that the pitch variation of males was more obvious than that of females

Y M	Y F
-18.8277	-14.1924