

# POST-FOCUS COMPRESSION: CROSS-LINGUISTIC DISTRIBUTION AND HISTORICAL ORIGIN

Yi Xu

University College London, UK

yi.xu@ucl.ac.uk

## ABSTRACT

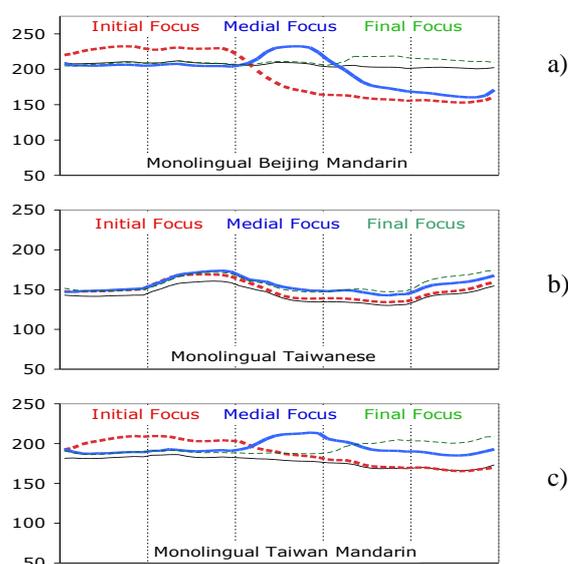
One of the most important acoustic correlates of prosodic focus is post-focus compression (PFC) — the reduction of pitch range and amplitude of all post-focus components in an utterance. PFC has been found in many Indo-European, Altaic languages, and interestingly, also in Mandarin Chinese. Meanwhile, there have also been reports that many other languages do not have PFC, or lack any clear prosodic marking of focus. This paper presents a brief review of the current state of the art in the investigation of PFC, and discusses a number of hypotheses in regard to this typological division among the world languages. In particular, the idea is explored that the distribution of PFC is related to the historical development of the world languages.

**Keywords:** prosodic focus, post-focus compression, PFC

## 1. INTRODUCTION

Prosodic focus has long been treated, explicitly or implicitly, as a core component of speech prosody. The traditional English school of intonation is almost entirely built around the notion of the nuclear tone, which is defined as the most prominent component of a sentence [25, 26]. The nuclear tone notion is also adopted into the AM theory of intonation, although no fundamental differences between the nuclear and pre-nuclear tones are assumed by the theory [30]. A major characterization of the nuclear tone is that it is the last major intonational movement in an utterance, and subsequent movements, known as the “tail” in the British tradition, are much reduced in magnitude. In the AM theory, the post-nuclear components are described as “deaccented”, because they lack apparent  $F_0$  movements. The present paper is mainly about the phenomenon of the tail or deaccenting, which will hitherto be referred to as post-focus compression (PFC), for reasons that will become clear later.

**Figure 1:** Time-normalized mean  $F_0$  contours produced by 4 speaker groups. Each curve is an average of 40 repetitions by 8 speakers. The vertical lines indicate syllable boundaries. The solid thin lines are from the no-focus condition.



In the nuclear tone concept, the primary concern is given to the  $F_0$  contour of the focused word, especially that of the stressed syllable, while what happens in the tail is viewed as less important. This is probably because the large pitch movements around the nucleus is more easily noticeable when describing intonational forms without systematically controlling their functional relevance. In experimental research, the *question-answer paradigm* has been developed to systematically control the presence as well as the location of what is now widely known as the focus of the sentence, and to examine the acoustic patterns that co-vary with focus. In this paradigm, the focused component of a sentence directly corresponds to what is asked in the question. Using the question-answer paradigm, it is found that in languages as diverse as Swedish [4], American English [10, 40] and Mandarin [39], the pitch range of the focused word is raised and expanded, that of the post-focus words substantially lowered

and narrowed, while that of the pre-focus words largely unchanged. An example is shown in Figure 1a in which mean  $F_0$  contours of the Mandarin sentence “mama mo maomi” [Mom strokes kitty] spoken with focus on the first, second, third or none of the words are overlaid in the same graph. The findings of these studies suggest that that post-focus lowering of  $F_0$  is just as consistent as  $F_0$  raising on the focused word, suggesting at least equal importance of the post-focus “tail” as the on-focus  $F_0$  movement. Also from Figure 1a it can be seen that the largest  $F_0$  movement actually consists of mostly a sharp drop from the on-focus component to the first post-focus component. Thus much of the nuclear tone is actually the  $F_0$  movement of PFC.

The importance of post-focus pitch compression is further demonstrated by findings about focus perception. It is shown that a non-final focus can be perceived only when later occurring  $F_0$  peaks are very small, otherwise listeners would hear an additional late focus or no focus [24, 32]. Furthermore, focus recognition is much better when PFC is applicable, i.e., when focus is not sentence-final, whereas sentence-final focus, for which PFC cannot apply, is often perceptually confused with no focus [3, 7, 23, 32].

## 2. NON-UNIVERSALITY OF PFC

Prosodic patterns suggestive of PFC has been reported for many other languages, including Dutch [32], Greek [3], French [11], Korean [22], Turkish [17], Nanchang [36], German [13], Japanese [18], Uyghur, Tibetan [36], Arabic [5, 16], Hindi [28], Persian [33] and Finnish [24]. For all these languages, there is observation of post-focus  $F_0$  lowering, deaccenting or pitch range compression. It may thus seem that PFC is quite wide spread across languages. However, there is also evidence that in many other languages PFC is absent. For example, Taiwanese and Cantonese, both Chinese languages closely related to Mandarin, are found to lack PFC [27, 38]. As can be seen in Figure 1b, the  $F_0$  contours of the same sentences as in Figure 1a but spoken in Taiwanese show no sign of PFC in  $F_0$ , and in fact very little difference can be seen across the four focus conditions. Also no PFC in intensity was found for either Taiwanese or Cantonese [7, 38]. Evidence of lack of PFC is also found for many other languages, including Yucatec Maya [19], Chichewa [41], Chitumbuka [41], Durban Zulu [41], Hausa [41],

Yi, Deang, Wa [36], Buli [41], Northern Sotho [41] and Wolof [31]. Thus it is clear that, despite its apparent benefit for focus perception [3, 7, 23, 32], PFC is not universal.

## 3. ORIGIN OF PFC

### 3.1. Possible linguistic factors

There are many conceivable factors that could determine the present of PFC in a language, but some of them can be already ruled out. First, all languages in the Chinese family are fully tonal, and thus the fact that PFC can be either present or absent across these languages means that lexical tone cannot be the determining factor for PFC. Second, PFC might have to do with the fact that Mandarin has the neutral tone, which shares many properties with unstressed syllables in languages like English and German [40], while Taiwanese and Cantonese both lack equivalent of the neutral tone. However, there are also PFC languages that lack lexical stress, such as Japanese, Korean, French and Yi. Thirdly, the Chinese languages examined so far all have morpho-syntactic means to indicate focus. In fact it is claimed that morpho-syntactic focus markers exist in various forms in every language that has been examined [41], and therefore they are unlikely to be responsible for PFC. Of course, these considerations are not the final word on these factors, as new light could be shed by further research.

### 3.2. Origin of PFC in Mandarin

One of the most intriguing findings of Chen, et al. [7] is that Taiwan Mandarin, just like Taiwanese, also lacks PFC, as can be seen in Figure 1c. Taiwan Mandarin is a variant of Mandarin spoken in Taiwan. Although once homogeneous with Standard Chinese, at least by definition, it now has noticeable differences in vocabulary, grammar [8] and pronunciation [14] from its mainland counterpart. Today, most people in Taiwan are bilinguals, fluent in both Taiwanese and Taiwan Mandarin. Thus it is possible that Taiwan Mandarin has lost PFC due to close contact with Taiwanese (or with other southern Chinese dialects as well) through pervasive bilingualism in Taiwan over several generations.

If this is the case, a natural question would be, how did PFC occur in Mandarin in the first place, given that it is absent from so many other tone languages? There could be at least three possible hypotheses: (a) independent genesis, i.e., emerging

locally in the language, (b) horizontal spreading, i.e., borrowed into the language through contact, and (c) vertical inheritance, i.e., passed on from a proto-language. Regarding local emergence, the fact that PFC did not arise automatically in so many other languages at least suggests that it might not easily emerge in a language. In regard to spreading, a further question would be, from which language could PFC have been spread into Mandarin?

Historically, northern China was in close contact with many non-Chinese speaking populations, in particular, Mongolian and Manchurian, who ruled China during the Yuan (1271-1368 AD) and Qing (1644-1912 AD) dynasties. As a result, there has been much influence of those languages on Mandarin [6, 21, 35]. Both Mongolian and Manchurian are Altaic, a hypothetic language family that includes Turkic, Mongolic and Tungusic languages [15], and Korean and Japanese according to some scholars [15]. Interestingly, all these languages have shown evidence of PFC [18, 17, 22, 36]. Thus it is possible that PFC in Mandarin came from Altaic languages via contact.

The difficulty with the spreading account, however, is that so far there is evidence only for the loss of PFC through language contact, but no case of a language gaining PFC through contact. This is true of native Mandarin-Taiwanese bilinguals [7], English-Cantonese bilinguals [37], Sotho speakers learning English as a second language [34], Cantonese [37], Deang, Wa and Yi [36] speakers learning Mandarin as a second language. What is not yet known is the case of a PFC language speakers learning a non-PFC language as a second language. Would these learners at least initially carry PFC into their non-proficient second language?

If it is indeed not easy for PFC to spread or automatically emerge, the inheritance hypothesis may have to be taken seriously. The implications of this hypothesis would be profound, however. First, it would mean that Mandarin is a descendant of an Altaic language, but has acquired, through language contact, a large amount of characteristics shared with other Chinese languages, including tone. This scenario would challenge the current assumption that all Chinese languages are derived from a single proto-Chinese language [1]. Interestingly, there is already evidence from population genetics that the southern and northern

populations in China are actually quite divided, suggesting rather different hereditary routes [9].

Secondly, vertical inheritance would mean that all cases of PFC can be traced back to an ancestral language where PFC first emerged. That is, there is a common ancestor to all modern PFC languages. This proto-language would have to be very ancient. From the distribution pattern that is currently emerging, the grouping of the PFC languages seem to be consistent with the hypothetical *Nostratic superfamily*, consisting of the Indo-European, Uralic, Altaic, Afroasiatic, Dravidian, Kartvelian and Eskimo-Aleut language families [2, 29]. Their common ancestor, the proto-Nostratic, could be dated back to the end of the last Ice Age, i.e., 15,000-12,000 BC, which was probably spoken along the Fertile Crescent [2]. However, three of the Nostratic families mentioned above — Dravidian, Kartvelian and Eskimo-Aleut languages — have not yet been studied for PFC. New research is therefore needed.

#### 4. CONCLUSION

A brief overview of the empirical findings about prosodic focus has shown that PFC, though an effective means of conveying focus through prosody, is present only in some of the world languages. The distribution of PFC suggests that its presence in a language is largely independent of factors such as lexical tone, lexical stress and availability of morphosyntactic markers of focus. The finding of its unspreadability through language contact suggests that PFC is most likely passed on to a language through inheritance rather than spreading. These findings may have profound implications for language typology, historical linguistics and human evolutionary history. There is therefore a need for increased collaborative research in all these directions.

#### 5. REFERENCES

- [1] Bodman, N.C. 1980. Proto-Chinese and Sino-Tibetan. In Coetsem, F.V., Waugh, L. (eds.), *Contributions to Historical Linguistics*. Leiden: Brill.
- [2] Bomhard, A.R. 2008. *Reconstructing Proto-Nostratic: Comparative Phonology, Morphology, and Vocabulary*. Leiden: Brill.
- [3] Botinis, A., Fourakis, M., Gawronska, B. 1999. Focus identification in English, Greek and Swedish. *Proceedings of the 14th International Congress of Phonetic Sciences* San Francisco. 1557-1560.
- [4] Bruce, G. 1982. Developing the Swedish intonation model. *Lund University, Dept. of Linguistics Working Papers* 22, 51-116.

- [5] Chahal, D. 2003. Phonetic cues to prominence in Lebanese Arabic. *Proceedings of the 15th International Congress of Phonetic Sciences* Barcelona, 2067-2070.
- [6] Chappell, H. 2001. Language contact and areal diffusion in Sinitic languages: Problems for typology and genetic affiliation. In Aikhenvald, A.Y., Dixon, R.M.W. (eds.), *Areal Diffusion and Genetic Inheritance: Problems in Comparative Linguistics*. 167-194.
- [7] Chen, S.-W., Wang, B., Xu, Y. 2009. Closely related languages, different ways of realizing focus. *Proceedings of Interspeech* Brighton, UK, 1007-1010.
- [8] Cheng, R.L. 1985. A comparison of Taiwanese, Taiwan Mandarin, and Peking Mandarin. *Language* 61, 352-377.
- [9] Chu, J.Y., Huang, W., et al. 1998. Genetic relationship of populations in China. *Proceedings of the National Academy of Sciences* 95(20), 11763-11768.
- [10] Cooper, W.E., Eady, S.J., Mueller, P.R. 1985. Acoustical aspects of contrastive stress in question-answer contexts. *Journal of the Acoustical Society of America* 77, 2142-2156.
- [11] Dohen, M., Lævenbruck, H. 2004. Pre-focal rephrasing, focal enhancement and post-focal deaccentuation in French. *Proceedings of the 8th International Conference on Spoken Language Processing* Jeju, Korea, 1313-1316.
- [12] Downing, L.J. 2008. Focus and prominence in Chichewa, Chitumbuka and Durban Zulu. *ZAS Papers in Linguistics (ZASPiL)* 49, 47-65.
- [13] Féry, C., Kügler, F. 2008. Pitch accent scaling on given, new and focused constituents in German. *Journal of Phonetics* 36(4), 680-703.
- [14] Fon, J., Chiang, W.Y., Cheung, C. 2004. Production and perception of two dipping tones (T2 and T3) in Taiwan Mandarin. *Journal of Chinese Linguistics* 32, 249-280.
- [15] Georg, S., Michalove, P.A., Ramer, A.M., Sidwell, P.J. 1999. Telling general linguists about Altaic. *Journal of Linguistics* 35(1), 65-98.
- [16] Hellmuth, S. 2006. Focus-related pitch range manipulation (and peak alignment effects) in Egyptian Arabic. *Proceedings of Speech Prosody 2006* Dresden, Germany, PS4-12-164.
- [17] Ipek, C. 2011. Phonetic realization of focus with no on-focus pitch range expansion in Turkish. *Proceedings of the 17th International Congress of Phonetic Sciences* Hong Kong.
- [18] Ishihara, S. 2002. Syntax-phonology interface of Wh-Constructions in Japanese. *Proceedings of Tokyo Conference on Psycholinguistics (TCP 2002)* Tokyo, 165-189.
- [19] Kügler, F., Skopeteas, S. 2007. On the universality of prosodic reflexes of contrast: The case of Yucatec Maya. *Proceedings of the 16th International Congress of Phonetic Sciences* Saarbrücken, Germany.
- [20] Ladd, D.R. 2008. *Intonational Phonology*. Cambridge: Cambridge University Press.
- [21] LaPolla, R.J. 2001. The role of migration and language contact in the development of the Sino-Tibetan language family. In Dixon, R.M.W., Aikhenvald, A.Y. (eds.), *Areal Diffusion and Genetic Inheritance: Case Studies in Language Change*. Oxford: Oxford University Press, 225-254.
- [22] Lee, Y.-C., Xu, Y. 2010. Phonetic realization of contrastive focus in Korean. *Proceedings of Speech Prosody 2010*, Chicago, 100033, 1-4.
- [23] Liu, F., Xu, Y., 2005. Parallel encoding of focus and interrogative meaning in Mandarin intonation. *Phonetica* 62, 70-87.
- [24] Mixdorff, H. 2004. Quantitative tone and intonation modeling across languages. *Proceedings of International Symposium on Tonal Aspects of Languages: With Emphasis on Tone Languages* Beijing, 137-142.
- [25] O'Connor, J.D., Arnold, G.F. 1961. *Intonation of Colloquial English*. London: Longmans.
- [26] Palmer, H.E. 1922. *English Intonation, with Systematic Exercises*. Cambridge: Heffer.
- [27] Pan, H. 2007. Focus and Taiwanese unchecked tones. In Lee, C., Gordon, M., Büring, D. (eds.), *Topic and Focus: Cross-linguistic Perspectives on Meaning and Intonation*. Springer, 195-213.
- [28] Patil, U., Kentner, G., Gollrad, A., Kügler, F., Féry, C., Vasisht, S. 2008. Focus, word order and intonation in Hindi. *Journal of South Asian Linguistics* 1, 55-72.
- [29] Pedersen, H. 1931. *The Discovery of Language: Linguistic Science in the Nineteenth Century*. English translation by Spargo, J.W. Bloomington: Indiana University Press.
- [30] Pierrehumbert, J. 1980. *The Phonology and Phonetics of English Intonation*. Ph.D. dissertation, MIT, Cambridge, MA. [Published in 1987 by Indiana University Linguistics Club, Bloomington].
- [31] Riialand, A., Robert, S. 2001. The intonational system of Wolof. *Linguistics* 39, 893-939.
- [32] Rump, H.H., Collier, R. 1996. Focus conditions and the prominence of pitch-accented syllables. *Language and Speech* 39, 1-17.
- [33] Sadat-Tehrani, N. 2008. The structure of Persian intonation. *Proceedings of Speech Prosody* Campinas, Brazil, 249-252.
- [34] Swerts, M., Zerbian, S. 2010. Prosodic transfer in Black South African English. *Proceedings of Speech Prosody* Chicago.
- [35] Wadley, S.A. 1996. Altaic influences on Beijing Dialect: The Manchu case. *Journal of the American Oriental Society* 116(1), 99-104.
- [36] Wang, B., Wang, L., Kadir, T. 2011. Prosodic encoding of focus in six languages in China. *Proceedings of the 17th International Congress of Phonetic Sciences* Hong Kong.
- [37] Wu, W.L., Chung, L. 2011. Post-focus compression in English-Cantonese bilingual speakers. *Proceedings of the 17th International Congress of Phonetic Sciences* Hong Kong. (To appear)
- [38] Wu, W.L., Xu, Y. 2010. Prosodic focus in Hong Kong Cantonese without post-focus compression. *Proceedings of Speech Prosody* Chicago.
- [39] Xu, Y. 1999. Effects of tone and focus on the formation and alignment of F0 contours. *Journal of Phonetics* 27, 55-105.
- [40] Xu, Y., Xu, C.X. 2005. Phonetic realization of focus in English declarative intonation. *Journal of Phonetics* 33, 159-197.
- [41] Zerbian, S., Genzel, S., Kügler, F. 2010. Experimental work on prosodically-marked information structure in selected African languages (Afroasiatic and Niger-Congo). *Proceedings of Speech Prosody* Chicago, 100976, 1-4.