

The Effect of the Focus-to-prosodic Prominence Mapping on Speech Comprehension in Older Adults

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Communication is in part shaped by the mapping between prosody and information structure. Research on younger adults has shown that appropriate focus-to-prosodic prominence mapping facilitates comprehension; whereas inappropriate mapping slows it down [1]. Past research showed that appropriate mapping can facilitate older adults (> 60 years) in offline processing and recalling of the most important information in a sentence [2]. It remains to be investigated how the focus-to-prosodic prominence mapping influences online speech comprehension in older adults. Therefore, the present study examines whether cognitive decline alters older adults' use of the focus-to-prominence mapping during online speech comprehension. Given the top-down cognitive demands of prosody-context integration [3], we hypothesize that this interface is disrupted already in early neurodegenerative stages. Our prediction is that as cognitive ability declines, older adults show reduced processing facilitation from appropriate focus-to-prosodic prominence mapping.

Methodology: A total of 358 healthy older native speakers of Mandarin Chinese with normal hearing (age range: 55-85 years; $M = 68.43$, $SD = 6.70$) participated a reaction time (RT) experiment adapted from [4]. The stimuli consisted of 96 trials (48 experimental items; 48 fillers). All trials were constructed as Wh-question-SVO Answer pairs, in which the question established a specific constituent in the answer as the narrow focus. The answers were lexically correct in the experiment trials but prosodic prominence either correctly aligned with the focused constituent (Appropriate) or fell on an unfocused constituent (Inappropriate) (Table 1). The participants were presented with the stimuli via a headphone set and asked to judge on each trial whether the answer was correct or incorrect by pressing a key on a laptop keyboard as fast as possible. The experiments were administered using Zep [5]; RTs were measured from the end of each answer sentence. The participants' cognitive ability was assessed via the Montreal Cognitive Assessment (MoCA) [6] following the experiment.

Analysis: The RTs were log-transformed and analyzed using Linear Mixed-Effects Models in R, with PROSODIC CONGRUENCY (appropriateness vs. inappropriateness), FOCUS POSITION (subject, verb, or object), MOCA SCORE (continuous variable, 0–30, higher scores reflecting better cognitive ability), and AGE as covariate, and PARTICIPANT and TRIAL as random factors.

Results: The best-fit model revealed a significant effect of focus position ($p = .008$) and a significant interaction of MOCA SCORE by FOCUS POSITION ($p = .014$) (Fig.1). To further understand the interaction, we examined the main effect of MoCA score in each focus position. Higher MoCA scores were found to lead to shorter RTs or faster processing of verb focus, regardless of prosodic congruence.

Discussion: The absence of a main effect of PROSODIC CONGRUENCY and an interaction of PROSODIC CONGRUENCY by MOCA SCORE indicates that older adults are not sensitive to prosodic congruence in online speech comprehension, independent of their cognitive ability as measured by MoCA. Further, older adults with lower MoCA scores demonstrated greater delays when processing verb-focused information. This result is consistent with the finding that verb retrieval deficits is a sensitive marker of Mild Cognitive Impairment (MCI) [7] and extends it by showing that appropriate focus-to-prosodic prominence mapping may not mitigate the difficulty with verb retrieval in the case of MCI.

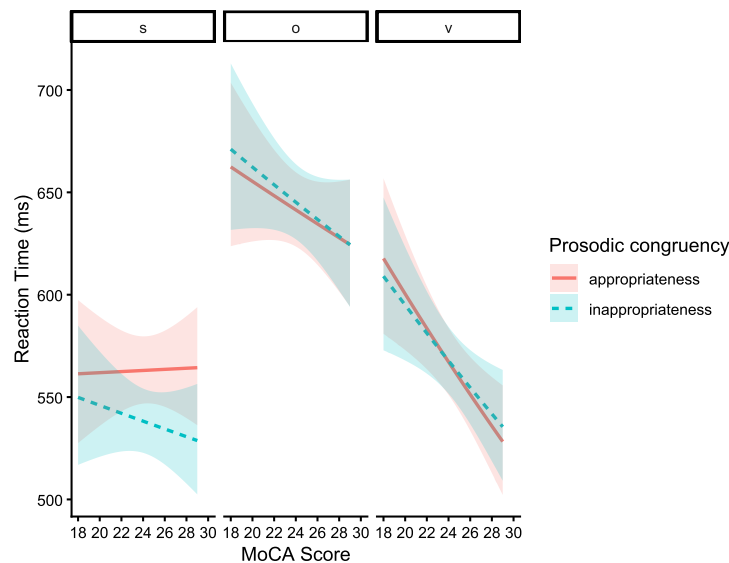
Conclusion: Our study shows no evidence that the focus-to-prosodic prominence mapping plays a role in older adults' online speech comprehension in Mandarin Chinese, regardless of cognitive ability, contra findings from studies on younger adults [4] (albeit from a West-Germanic language background). Future research on younger Mandarin-speaking adults and older adults with a West-Germanic language background is needed to separate potential influence of language background from a possible language-independent effect of aging on the use of the focus-to-prosodic prominence mapping in online speech comprehension.

Table 1. Example stimuli.

Focus Position	Context Question	Target Answer (Appropriate)	Target Answer (Inappropriate)
Subject	谁扔书？	[小猫]扔书。	小猫扔[书]。
Focus	Who throws the book?	[THE KITTEN] throws the book.	The kitten throws [THE BOOK].
Verb	小猫怎么弄书？	小猫[扔]书。	[小猫]扔书。
Focus	What does the kitten do to the book?	The kitten [THROWS] the book.	[THE KITTEN] throws the book.
Object	小猫扔什么？	小猫扔[书]。	小猫[扔]书。
Focus	What does the kitten throw?	The kitten throws [THE BOOK].	The kitten [THROWS] the book.

Table 2. Model summary for RT as a function of prosodic congruency, focus position and MoCA score.

Factor	Estimate	Std. Error	df	t value	Pr(> t)
Intercept					
(appropriate, object focus)	6.268	0.206	432.000	30.474	0.000***
inappropriate	0.027	0.080	296.000	0.339	0.735
subject focus	-0.243	0.092	493.500	-2.655	0.008**
verb focus	0.053	0.091	481.400	0.578	0.564
MoCA score	-0.004	0.005	503.200	-0.824	0.411
age	0.004	0.002	360.300	1.857	0.064
inappropriate:subject focus	-0.026	0.072	47.870	-0.363	0.718
inappropriate:verb focus	0.010	0.072	47.650	0.137	0.891
inappropriate:MoCA score	-0.001	0.003	13480.000	-0.578	0.563
subject focus:MoCA score	0.004	0.003	13490.000	1.278	0.201
verb focus:MoCA score	-0.008	0.003	13490.000	-2.450	0.014*

**Fig. 1. Interaction of MoCA score and prosodic congruency on reaction time by focus position.**

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