How do structural predictions operate between languages for multilinguals? Evidence from cross-language structural priming in comprehension

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Many cross-language studies showed structural priming effects: in particular, speakers tended to re-use the prime structure in a target sentence after processing the prime in a different language. This suggests that multilinguals have a syntactic representation that is shared across their languages or separate but interacting representations for each language. However, it is unclear whether multilinguals can rely on such language non-specific representations to predict structure in language *comprehension*.

To answer this question, we conducted two visual-world eye-tracking priming experiments with multilinguals (Cantonese-L1, Mandarin-L2, English-L3). Participants were instructed to read prime sentences in either Cantonese, Mandarin, or English; then they heard a target sentence in Mandarin while looking at the corresponding target picture. The sentences either had a double object (DO) structure (e.g., "Gushou di **You**chai yizhang **You**piao", the drummer passed the mailman a stamp) or a prepositional object (PO) structure (e.g., "Gushou di **You**piao gei **You**chai", the drummer passed a stamp to the mailman); Note that in the DO, the verb is followed by the recipient ("Youchai", mailman), whereas in the PO, the verb is followed by the theme ("Youpiao", stamp). The priming effect is expressed as the proportion of looks to the predicted referent (i.e., the recipient after a DO-prime, the theme after a PO-prime), for two critical time windows during target sentence processing: the verb and the first syllable of the first post-verbal noun (which was identical in theme and recipient). In Experiment 1 (N=72), we used six prime verbs (see **Table1**) that differed in their bias for DO and PO (verb bias) in each language and four relatively unbiased target verbs in Mandarin. There was within-language structural priming only (from Mandarin to Mandarin, see **Figure1A**). There was no interaction between verb bias and prime structure. In Experiment 2 (N=72), we held the verb in prime and target constant (i.e., the verb was identical between prime and target within Mandarin, shared meaning, orthography and partly phonology in Cantonese and Mandarin, and shared meaning in English and Mandarin). Now there was not only within-language priming but also between-language priming, albeit only from Cantonese to Mandarin (see **Figure1B**).

These results indicated that the structure prediction system between languages in comprehension: 1) is independent, so that prediction errors within a specific language do not generalize to another language; 2) is interactive, so that cognate languages (e.g., Cantonese and Mandarin) show cross-linguistic priming whereas non-cognate languages (e.g., English and Mandarin[1]) do not; 3) is at least partly lexically-based, so that cross-linguistic structural priming only occurred with cognate verbs.

Table 1

*Structure bias of prime verb in Experiment 1*

Verb (E)	English Corpus (G&S, 2004)	English Norming	Verb (C/M)	Cantonese Norming	Mandarin Norming
grant	0.69	0.69	赏	-0.65	0.99
award	0.69	0.47	赐	-0.61	1.21
send	-0.56	-2.20	发	-2.71	-1.83
threw	*NA*	-3.69	丢	-3.09	-2.43
leave	-1.10	-2.08	留	-3.40	-1.54
bring	-2.34	-1.64	带	-3.04	-1.91

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[1] Age of acquisition (AOA) of Mandarin was earlier than English; and self-reported proficiency of Mandarin was higher than English.

Note. Structure bias was calculated as the log-odds for the DO responses following the verb divided by the PO responses (i.e., "log[(#DO+1)/(#PO+1)], Bernolet & Hartsuiker, 2010; Jaeger & Snider, 2008). Therefore, values larger than 0 indicate a DO-biased verb and values below 0 indicate a PO-biased verb. We chose 11 dative verbs which have the same structure preference in both English Corpus (Gries & Stefanowitsch, 2004) and Mandarin norming data (N=367, Chen et al., 2020). Then we performed a norming study of verb bias in Cantonese (40 native Cantonese speakers) and in English (51 high-proficient Mandarin-English bilinguals). We selected 6 verbs with similar structure bias in Mandarin, Cantonese and English (i.e., 11 dative verbs showed an overall preference of PO, so we selected two less PO-biased verbs; negative values correspond to PO-bias).

Figure 1

Difference in proportion of looks to recipient and theme for each time bin (50ms) from onset of target verb in three language blocks of Experiment 1 and 2
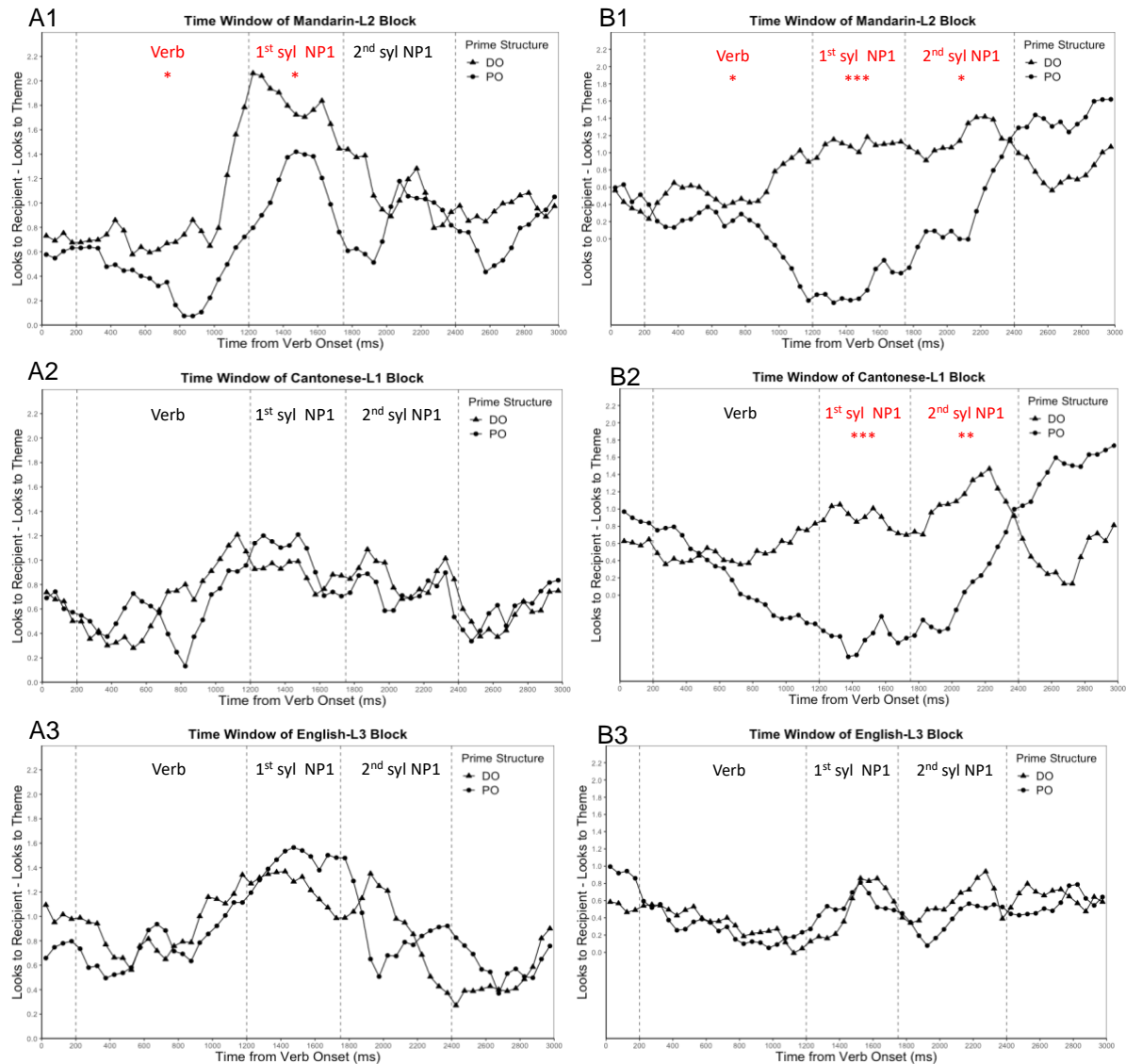
Note. The time window of verb is from 200ms to 1200ms and the time window of the first syllable of the first noun phrase is from 1200ms to 1750ms. The unambiguous time window of the second syllable of first noun phrase is from 1750ms to 3600ms. Six plots indicate the difference in the proportions of looks to recipient (predicting DO structure) and to theme (predicting PO structure) after prime sentences with different structure (DO vs. PO) in Experiment 1 when the prime and target have different verbs (A1, A2, A3 on the left) and in Experiment 2 when prime and target shared the translation-equivalent verbs (B1, B2, B3 on the right). The first two plots (A1, B1) suggest the priming effect for within-language block of Mandarin. The following four plots suggest the priming effect for between-languages blocks of Cantonese-to-Mandarin (A2, B2) and English-to-Mandarin (A3, B3). The red label of time window indicates significant priming effect (* p<.05; ** p<.01; *** p<.001).