

Biasing Context Facilitates the Processing of Aspectual Verbs in Mandarin Chinese

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Recent studies found that aspectual verbs such as *begin* taking an entity-denoting complement leads to ambiguity and processing costs in real time cross-linguistically (Lai et al., 2017; Ma et al., 2022). For example, in sentences like *John began the book*, multiple interpretations are acceptable including an agentive reading like *John began reading/writing the book* and a constitutive reading like *John is the first character in the book* (Piñango and Deo, 2016). To investigate how contexts affect the processing of aspectual verbs, Lai & Piñango (2019) conducted a sentence acceptability judgement task and found that biasing context disambiguated the interpretations, however, Lai et al. (2023) found no attenuation of processing costs in biasing context in an eye-tracking study. The mismatch of findings in offline versus online measurements raised questions about what counts as context and the time course of context effects. In the present study, we used grammatical contexts, different from the pragmatic contexts used in previous studies, in a self-paced reading study to examine context effects for sentences with aspectual verbs in Mandarin. Mental-attitude adverbs such as *reluctantly* were used as biasing context (towards agentive reading only) while speaker-oriented adverbs such as *surprisingly* were used as non-biasing context. In this study, we compared sentences with aspectual verbs and neutral verbs. More crucially, we compared sentences without adverbs, with mental-attitude adverbs, and with speaker-oriented adverbs (sample stimuli in Table 1).

Experiment 1. Sentence Interpretation Task

A sentence interpretation task (N=30, 3 lists of stimuli, each containing 30 sentences) was carried out to investigate the acceptability of interpretations of sentences with aspectual verbs in the biasing context (MA-adverb aspectual condition) and the two non-biasing contexts (No adverb aspectual and SO-adverb aspectual condition) in Mandarin Chinese. For each sentence, participants were asked to perform a forced choice task deciding whether they could accept an agentive reading, a constitutive reading, or both readings from the original sentences. Context effects were found that agentive readings were chosen more frequently for MA-adverb aspectual condition compared with No adverb aspectual condition ($z = -6.17$, $p < .0001$) and SO-adverb aspectual condition ($z = -6.24$, $p < .0001$).

Experiment 2. Self-paced Reading Experiment

A moving window self-paced reading experiment (N=65, 6 lists of stimuli, each containing 30 experimental stimuli and 60 fillers) was conducted to investigate how adverbs as context affected the real-time processing of aspectual verbs in Mandarin Chinese. Each sentence was divided into regions of interest (ROIs), as shown in Table 2. Reading time was recorded for each ROI. Model selections and Linear Mixed-Effects Models were used to analyze data by regions. A main effect ($F_{(1, 3476)} = 9.45$, $p = .0021$) and an interaction between verb type and adverb type ($F_{(2, 3479)} = 6.47$, $p = .0016$) were found in Post 2 region. Contrasts indicated that the reading time for the MA-adverb aspectual condition was significantly shorter than for the No adverb aspectual condition ($t_{(3478)} = -4.04$, $p = .0005$), suggesting a context effect that processing costs of sentences with aspectual verbs attenuated in a biasing context compared with that in a non-biasing context.

Experiment 3: Sentence Interpretation Post-test

A sentence interpretation post-test was conducted following the self-paced reading experiment to help interpret results of Experiment 2 (N = 65, 6 lists of stimuli, each containing 15 sentences). The same research design and data analysis were conducted as in Experiment 1. Context effects were found that agentive readings were chosen more frequently for MA-adverb aspectual condition compared with No adverb aspectual condition ($z = -13.65$, $p < .0001$) and SO-adverb aspectual condition ($z = -9.36$, $p < .0001$).

In conclusion, by finding context effects in both offline and online measurements, our results showed that biasing grammatical context facilitated the processing of aspectual verbs in Mandarin Chinese immediately in real time by predetermining the appropriate interpretation and suppressing other alternatives.

Table 1. Sample stimuli

Conditions	Examples
No adverb aspectual	shi Yuehan lai kaishi zhe bu wenxuezuopin keshi qingjie bingbu jingcai. SHI John PTCL begin the CL literature but story not interesting 'It is John who begins the literature but the story is not interesting'.
No adverb control	shi Yuehan lai zhuanxie zhe bu wenxuezuopin keshi qingjie bingbu jingcai. SHI John PTCL write the CL literature but story not interesting 'It is John who writes the literature but the story is not interesting'.
MA-adverb aspectual	shi Yuehan buqingbuyuande lai kaishi zhe bu wenxuezuopin keshi qingjie bingbu jingcai. SHI John reluctantly PTCL begin the CL literature but story not interesting 'It is John who reluctantly begins the literature but the story is not interesting'.
MA-adverb control	shi Yuehan buqingbuyuande lai zhuanxie zhe bu wenxuezuopin keshi qingjie bingbu jingcai. SHI John reluctantly PTCL write the CL literature but story not interesting 'It is John who reluctantly writes the literature but the story is not interesting'.
SO-adverb aspectual	shi Yuehan lingrenjingyade lai kaishi zhe bu wenxuezuopin keshi qingjie bingbu jingcai. SHI John surprisingly PTCL begin the CL literature but story not interesting 'It is John who surprisingly begins the literature but the story is not interesting'.
SO-adverb control	shi Yuehan lingrenjingyade lai zhuanxie zhe bu wenxuezuopin keshi qingjie bingbu jingcai. SHI John surprisingly PTCL write the CL literature but story not interesting 'It is John who surprisingly writes the literature but the story is not interesting'.

(SHI: *Shi* in Mandarin Chinese was classified as a verb or a focus marker (Liu & Kempson, 2018); PTCL: particle; CL: classifier)

Table 2. Examples of regions of interest (ROIs)

ROIs	Verb NP	Post1 Post2 Post3	
conditions without adverb	shi Yuehan lai kaishi zhe bu wenxuezuopin keshi qingjie bingbu jingcai. SHI John PTCL begin the CL literature but story not interesting 'It is John who begins the literature but the story is not interesting'.		
ROIs	Adverb	Verb NP	Post1 Post2 Post3
conditions with adverb	shi Yuehan buqingbuyuande lai kaishi zhe bu wenxuezuopin keshi qingjie bingbu jingcai. SHI John reluctantly PTCL begin the CL literature but story not interesting 'It is John who reluctantly begins the literature but the story is not interesting'.		

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