Chinese Scope: An experimental investigation

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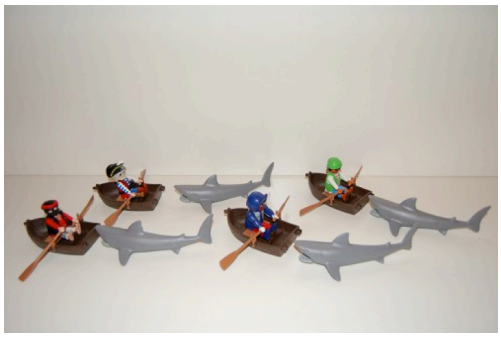
Background. English doubly-quantified sentences readily admit scope ambiguities wherein surface scope relations are optionally preserved at LF (May 1985, among others). Contrasting with English, Chinese is assumed to lack inverse scope (cf. the Isomorphic Principle; Huang 1982, Aoun & Li 1989). The sentence in Fig. 1 should therefore only describe a situation with a single shark. Note that sentence-initial numeral phrases require the existential predicate *you*. The status of Chinese inverse scope, both why and whether it is disallowed, has come under recent scrutiny. For example, Zhou & Gao [Z&G] (2009) tested speakers in Beijing on the interpretation of doubly-quantified sentences such as *mei-ge qiangdao dou qiang-le yi-ge yinhang* 'every robber robbed a bank'. Z&G conclude that despite its dispreferred status, an inverse scope interpretation is in fact available in Chinese. Their study and its results face a serious entailment problem, however, because their doubly-quantified sentences featuring *every* over *one/a* at surface structure felicitously describe the supposed inverse interpretation solely on the basis of surface scope: if one bank was robbed by every robber then it is trivially the case that for every robber there is a bank that he or she robbed; *one/a* > *every* entails *every* > *one/a*. Hence Z&G's conclusion that Chinese has inverse scope is not well founded. The current study tests the status of Chinese inverse scope by focusing on the interpretations available for sentences like in Fig. 1 where *one/a* scopes over *every* at surface structure, a feature that avoids the entailment problem inherent to Z&G's materials. By comparing the responses from native speakers of Chinese (N=72) and native speakers of English (N=144), we show that Chinese in fact does not allow inverse scope in these doubly-quantified sentences.

Experiment 1: Chinese. An auditory web-based experiment presented subjects with 16 sentence-picture pairs. One group of subjects judged whether the sentence was TRUE or FALSE in the scenario depicted; the other group rated on a 7-point scale how well the sentence described the image. Here we present only TRUE/FALSE results, but all patterns mentioned are replicated in the ratings data. Sentences were recorded by an adult male speaker of Chinese. Pictures came from the Scope Fieldwork Project. Critical items featured doubly-quantified transitive sentences with the quantifiers *mei* 'every' and *yi* 'one/a' in subject or object position. We manipulated two factors. The first, ORDER, corresponded to whether *every* preceded (EO) or followed (OE) *one/a* in the sentence. The second factor, INVERSE, corresponded to whether the picture co-occurring with the sentence matched an inverse or surface interpretation. For reasons mentioned above we focus on responses to the OE INVERSE condition (Fig. 1). Subjects saw one version of each of the 8 critical items, together with 8 fillers.



you yi-tiao-shayu gongji-le mei-ge-haidao.
have one-CL-shark attack-ASP every-CL-pirate
'One/a shark attacked every pirate.'

Fig. 1: Example OE INVERSE stimulus.

Results: Average responses by condition are presented in Table 1. A linear mixed effects model predicting response by our two factors revealed significant effects of ORDER (β=-0.27, t=-3.20, p<0.01) and INVERSE (β=-0.74, t=-8.95, p<0.01): OE sentences received fewer TRUE responses than EO, and inverse conditions received fewer TRUE responses than surface; the OE

Table 1: Percent TRUE answers averaged by condition for Expt. 1 (Chinese) & Expt. 2 (English)

ORDER	INVERSE	CHINESE	PLAIN	ONE	THERE	THERE+ONE
EO	SURFACE	1.0	.93	1.0		
OE	SURFACE	.76	1.0	.85	.87	.92
EO	INVERSE	.25	.88	.69		
OE	INVERSE	0.0	.56	.28	.50	.11

INVERSE condition received fewer TRUE responses than each of the other 3 conditions. In fact, no subject judged the critical OE INVERSE condition (Fig. 1) as true, which means that no subject demonstrated the ability for inverse scope in Chinese. To further confirm the current finding that inverse scope is disallowed in Chinese, and to better understand why that should be so, in Experiment 2 we test the same materials in a language uncontroversially claimed to allow inverse scope: English.

Experiment 2: English. We ran the English equivalent of Expt. 1 on speakers of American English. Subjects provided truth judgments or felicity ratings for auditory sentences-picture pairs (again, we report the truth judgment data, but all patterns are replicated in the ratings). English sentences were translations of the Chinese and featured ORDER and INVERSE manipulations. To evaluate the possible contribution of numeral semantics or a bi-clausal structure associated with existentials to the Chinese prohibition on inverse scope, we split Expt. 2 into 4 sub-experiments: English sentences featured either indefinite *a* (1a,c) or the numeral *one* (3b,d), and OE sentences optionally included existential constructions (1c,d).

(1)

	Sub-experiment	Example OE sentence
a.	PLAIN:	A shark attacked every pirate.
b.	ONE:	One shark attacked every pirate.
c.	THERE:	There is a shark that attacked every pirate
d.	THERE+ONE:	There is one shark that attacked every pirate.

Results: Average responses by condition are presented in Table 1. Consistent with previous findings on English scope (e.g., Anderson 2004), subjects demonstrated a dispreference for inverse interpretations, and OE INVERSE sentences were judged particularly poorly. However, whereas no Chinese subjects judged OE INVERSE trials true, in the corresponding English PLAIN condition (1a) subjects judged the sentence true 56% of the time. This 56% OE INVERSE acceptance rate characterizes the availability of inverse scope, a feature not present in Chinese. Crucially, planned comparisons between each of the four English OE INVERSE conditions and the corresponding Chinese condition demonstrate that in Chinese this prohibition does not emerge straightforwardly from numeral semantics or bi-clausal structure, but rather suggest a global prohibition on inverse scope such as the Isomorphic Principle: some languages simply prohibit inverse scope. Two other properties of the English data warrant further consideration. First, in the English ONE sub-experiment where the numeral *one* replaces *a* (1b), subjects were much more unwilling to judge an inverse sentence true than they were with indefinite *a*. This effect could signal that numerals induce scope freezing and therefore resist inverse scope. However, ongoing work investigating the possibility of English inverse scope with other numerals shows that this freezing effect is specific to *one*. We therefore conclude that *one* competes with *a* and engenders a specificity inference incompatible with inverse scope, i.e., incompatible with a situation in which *one* corresponds to many (as in Fig. 1). Second, in the English THERE sub-experiment where OE sentences enter into a bi-clausal existential construction (1c), subjects were as likely to accept inverse scope as they were in the PLAIN version without the relative clause necessitated by *there-be*. The possibility of LF extraction out of the relative clause in the THERE items aligns with previous judgments on similar extractions (cf. Aoun & Li 2003) and therefore supports a head-raising analysis of these constructions (over an operator movement analysis; Kayne 1994, Bianchi 2000). Under a head-raising analysis, the DP *a shark* reconstructs into the embedded clause where it scopally interacts with the other quantified expression (*every pirate*).

References. Anderson 2004. *The Structure and Real-Time Comprehension of Quantifier Scope Ambiguity*. Ph.D. Diss., Northwestern U. Aoun & Li 1989. Scope and constituency. *Linguistic Inquiry*. Aoun & Li 2003. *The Diversity of Wh-Constructions*. Bianchi 2000. The raising analysis of relative clauses. *Linguistic Inquiry*. Huang 1982. *Logical relations in Chinese and the theory of grammar*. MIT thesis. Kayne 1994. *The Antisymmetry of Syntax*. MIT Press. May 1985. *Logical Form: Its Structure and Derivation*. Scope Fieldwork Project. http://udel.edu/~bruening/scopeproject/materials.html. Zhou & Gao 2009. Scope Processing in Chinese. *J. of Psycholinguistic Research*.