Processing of D-linked and non-D-linked wh-questions in Mandarin Chinese

This self-paced reading study on Mandarin aims to investigate the processing differences between in-situ wh-phrases and their declarative counterparts; further, we are also interested in the role D(iscourse)-linking plays in processing. Results showed that a) not all in-situ wh-questions are processed slower than their declarative counterparts; and b) that D-linked and non-D-linked questions are processed differently in Mandarin.

Mandarin is a wh-in-situ language in which question phrases remain at their base position (e.g., John bought what). Plenty of theoretical syntax studies have focused on the syntactic and/or semantic analysis of these questions (Huang 1982a; Aoun & Li, 1993a,b; a.o.). However, few studies have examined the processing of Mandarin in-situ questions. The few existing studies have mainly focused on the effect of dependency length and complexity on the interpretation of Mandarin wh-in-situ questions (Xiang et al., 2013; submitted).

Among wh-questions, the D-linked wh-phrase (which-x) is different from the non-D-linked one as the former "is supposed to be drawn from a set of individuals previously introduced into the discourse, or [...] part of the 'common ground' shared by speaker and hearer'' (Pesetsky, 2000, p. 16). In other words, the non-D-linked wh-phrase, like 'who', does not have a set of individuals previously introduced in the discourse. Previous processing work found D-linked wh-phrases involve more processing costs than non-D-linked ones in English and Dutch (Frazier & Clifton, 2002; Kaan et al., 2000; Donkers et al., 2011). For Mandarin, Xiang et al. (2013) conducted a Speed Accuracy Trade-off study and found that questions with D-linked wh-phrases incurred more processing costs than declaratives with definite noun phrases. Up to now, no study has investigated the processing of in-situ wh-questions with non-D-linked wh-phrases, let alone whether D-linking plays a role in processing in Mandarin. In addition, Xiang et al. (2013) didn't compare wh-questions with declaratives that contained indefinite noun phrases. Therefore, one of the aims of the present study was to investigate whether processing differences between questions and declaratives are dependent on the type of noun phrase within the declaratives (i.e., definite vs. indefinite).

We conducted two word-by-word self-paced reading experiments on a laptop PC running *Linger*. 24 sets of targets and 48 fillers were created for each experiment. Participants (Mandarin speakers from northern China) read each sentence and then answered a yes/no comprehension question.

Table 1. Experiment 1 (D-linked) exemplar stimuli exemplar stimuli

1a. D-linked condition
nage/ youyade/shenshi/ bangle/ **nǎge**/ nüshi/ jiu / liqule ?
the/gracious /gentleman/ helped/**which**/ lady/then/ left?
1b. Indefinite condition

Table 2. Experiment 2(non-D-linked)

2a. Non-D-linked condition
nage/ youyade/shenshi/bangle/ **shei**/ jiu / liqule ?
the/ gracious/ gentleman/ helped/ **who**/ then/ left?
2b. Indefinite condition

nage/ youyade/shenshi/ bangle/ **yige**/nüshi/ jiu / liqule.
the/ gracious/ gentleman/ helped/ **a**/ lady/ then/ left
1c. Definite condition
nage/ youyade/shenshi/ bangle/ **nàge**/nüshi/ jiu / liqule.
the/ gracious/ gentleman/ helped/ **the**/ lady/ and then/ left

nage/ youyade/shenshi/bangle/ **ren**/ jiu / liqule.
the/ gracious /gentleman/ helped/**someone**/then/left
2c. Definite condition
nage/ youyade/shenshi/bangle/ **Liujing**/ jiu / liqule.
the/ gracious/ gentleman/ helped/ **Liujing**/ and then/ left

Experiment 1 (n=41, Table 1) compared the D-linked questions in (1a) (*nǎge nüshi* 'which lady') with the declaratives with indefinite noun phrases in (1b) (*yige nüshi* 'a lady') and the declaratives with definite noun phrases in (1c) (*nàge nüshi* 'the lady'). Experiment 2 (n=41, Table 2) compared the non-D-linked questions in (2a) (*shei* 'who') with the declaratives containing a bare indefinite noun in (2b) (*ren* 'person') and the declaratives containing a definite proper name in (2c) (*LiuJing*).

Individual reading times (RTs) in each region were first log-transformed to correct for the heavily skewed distribution. Data points more than 3 times the standard deviation from the mean for each region were excluded, eliminating 1.3% (Experiment 1) and 0.9% (Experiment 2) of the data. A linear mixed effects model was run in R with condition as fixed-effects factor and item and subject as random factors. Figure 1 and 2 display the mean Log RTs per region across the three conditions for Experiment 1 (Fig.1) and 2 (Fig.2) respectively.
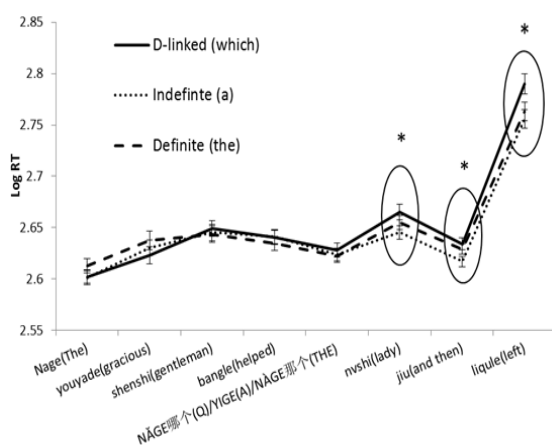

Fig. 1. Mean Log RTs of Experiment 1(D-linked)

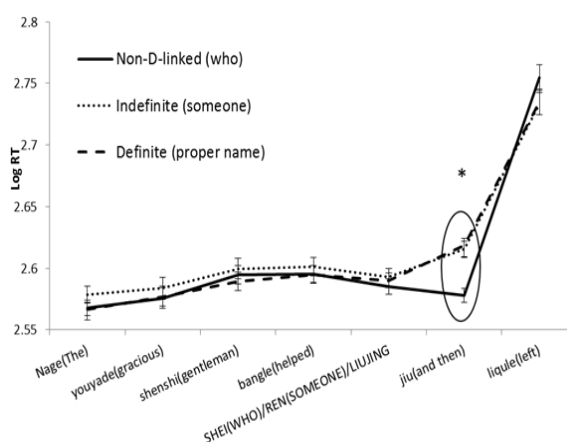Fig.2. Mean Log RTs of Experiment 2 (Non-D-linked)

Results showed that in Experiment 1 (Fig. 1, D-linked), questions were processed significantly slower than indefinite conditions at the region of the noun (*nüshi* 'lady')(Estimate = 0.02, SE = 0.01, *t* = 2.42, *p* < 0.05) and the conjunctor (*jiu* 'then') (Estimate = 0.02, SE = 0.01, *t* = 2.57, *p* = 0.01); whereas at the final verb region (liqu-*le* 'left'), questions were processed significantly slower than both indefinite (Estimate = 0.04, SE = 0.01, *t* = 3.05, *p* < 0.01) and definite conditions (Estimate = 0.03, SE = 0.01, *t* = 2.43, *p* < 0.05). In Experiment 2 (Fig. 2, non-D-linked), at the conjunctor region (*jiu* 'then'), questions were processed significantly faster than both indefinite (Estimate = -0.04, SE = 0.01, *t* = -5.73, *p* < 0.01) and definite conditions (Estimate = -0.04, SE = 0.01, *t* = -6.14, *p* < 0.01).

Figure 1 shows that D-linked wh-questions behave significantly differently from indefinites at the noun (*nüshi* 'lady') and the conjunctor (*jiu* 'then'), but the difference between questions and definites is not significant at these positions. This is possibly attributed to the fact that both D-linked wh-phrases and definites require drawing individuals from a given set, whereas indefinites do not have this requirement. Figures 1 & 2 show that overall non-D-linked and D-linked wh-phrases behave significantly differently from their declaratives counterparts, although this distinction goes in the opposite direction depending on the type of wh-phrase that is under consideration (i.e., facilitation in the case of non D-linked vs. slowdown in the D-linked). Further research is needed to explain the reason why non D-linked wh-questions are facilitated over their declarative counterparts.

Selected References: Aoun, J. & Li, Y.H.A. (1993a). *Syntax of scope*; Xiang, M., Dillon, B., Wagers, M., Liu, FQ. & Guo, T.M. (2014) Processing covert dependencies: An SAT study on Mandarin wh-in-situ questions. *JEAL*; Xiang, M., Wang, SP. & Cui, YL. (submitted) Constructing covert dependencies —the case of wh-in-situ processing; Pesetsky, D. (2000). *Phrasal movement and its kin*. Cambridge, MA: MIT Press.