Questions and anaphora in dynamic semantics:
Interrogativity, intensionality and compositionality of Mandarin Chinese "*wh*-relatives"
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Introduction While assertions update the context by eliminating possibilities, questions update the context by introducing new issues (Aloni et al., 2007). The current project constitutes one more attempt to model questions in the framework of dynamic semantics. Though the proposed system is based on equivalence relations between possibilities, it is nevertheless more expressive than a semantics of questions that treats them as partitions (Groenendijk & Stokhof, 1982), since possibilities also encode discourse references. Consequently, subsequent anaphoric links to the question expression are possible, and both incomplete knowledge and complete knowledge with respect to a question can be modeled.

Proposal To store information and to keep track of discourse referents (d-refs), possible worlds and assignment functions are bound into pairs (i.e., possibilities) (Beaver, 1993); to handle questions, the system works with equivalence relations (Groenendijk, 1999), and information states (info-states) are modeled as *sets of pairs of possible world–assignment function pairs* (i.e., sets of possibility pairs). Utterances are modeled as relations between info-states.

Assignment functions and possibility pairs are extended in two modes, one relativized to a d-ref with unspecified value and one relativized to a d-ref with a specified value. Importantly, two modes of d-ref introduction are defined, as in (1) and (2). Making use of the two modes of d-ref introduction, meanings are postulated for indefinites and *wh*-pronouns so that indefinites do not impose restrictions on each resulting pair of possibilities as to whether the two assignment functions assign the same value to the concerned d-ref, and *wh*-pronouns do require that two assignment functions from the same possibility pair assign the same value to the concerned d-ref. In other words, the equivalence relations between possibilities are not sensitive to values assigned to the d-ref associated with an indefinite, but they do reflect different values assigned to the d-ref introduced by a *wh*-pronoun.

(1) $\sigma[+d]\sigma' \Leftrightarrow \sigma'=\{p'|\exists p\in\sigma: p<_{[d]}p'\} \Leftrightarrow \sigma'=\{<wg', vh'>|\exists gh: <wg, vh>\in\sigma \wedge g<_{[d]}g' \wedge h<_{[d]}h'\}$
$\Leftrightarrow \sigma'=\{<wg', vh'>|\exists gh: <wg, vh>\in\sigma \wedge [g\neq g' \wedge \exists x\in D_e: g\cup\{d, x\}=g'] \wedge [h\neq h' \wedge \exists x\in D_e: h\cup\{d, x\}=h']\}$.

(2) $\sigma[\boxplus d]\sigma' \Leftrightarrow \sigma'=\{p'|\exists p\in\sigma: \exists x\in D_e: p<_{[d/x]}p'\} \Leftrightarrow \sigma'=\{<wg', vh'>|\exists gh: \exists x\in D_e: <wg, vh>\in\sigma \wedge g<_{[d/x]}g' \wedge h<_{[d/x]}h'\} \Leftrightarrow \sigma'=\{<wg', vh'>|\exists gh: \exists x\in D_e: <wg, vh>\in\sigma \wedge g\neq g' \wedge g\cup\{d, x\}=g' \wedge h\neq h' \wedge h\cup\{d, x\}=h'\}$.

The outcome is that different utterances update the context in different ways. Declaratives contribute information (the update is eliminative if no new d-refs are introduced) and interrogatives contribute issues (e.g., by breaking equivalent pairs). Though both indefinites and *wh*-expressions are associated with unspecified, varying values, only for the latter, the variations get expressed in equivalence relations.

Application The system sketched above is applied to handle Mandarin Chinese *wh*-relatives ((3)), for which a compositionality problem and an accessibility problem are identified.

(3) [*tā   (dàodǐ)   wèishénme   shībài*]   *de yuányīn,   méi rén   zhīdào*
    he   on earth   why   fail   DE   reason   no person   know
    Literal: 'The reason why on earth he failed, no one knows.'

First, it is argued that "Chinese *wh*-relatives" are in fact *wh*-interrogatives based on three types of evidence: (i) multiple *wh*-occurrences suggestive of multiple *wh*-questions, (ii) compatibility with adverbs that intensify interrogative force *dàodǐ* 'on earth' and *bìjìng* 'exactly' and (iii) "*wh*-relatives" formed with *zěnme* 'how come,' which is considered to lack non-interrogative uses (e.g., Tsai, 2008 analyzes it as an interrogative complementizer).

Second, it is shown for the first time that noun phrases modified by "Chinese *wh*-relatives" are far more likely to be used as a *concealed question* (i.e., as objects to question-embedding verbs like *zhīdào* 'know' and *xiǎng-zhīdào* 'want to know, wonder about,' e.g., (4)) compared

to noun phrases modified by Chinese non-*wh* relatives. This interaction between construction type and context type is illustrated for the reason-type head noun (e.g., *yuányīn* 'reason,' *lǐyóu* 'excuse') in Figure 1 and Figure 2 (the data are collected from the BLCU corpus center, under the literature genre) (the data are not balanced, since "Chinese *wh*-relatives" are used much less frequently than non-*wh* relatives).

(4) I know/want to know *the reason*. ≈ I know/want to know [what the reason is].

Based on these two discoveries, it is proposed that so-called "Chinese *wh*-relatives" are *wh*-questions embedded under an individual concept noun. The resulting noun phrase structure is named *the WH-IC construction* (an *individual concept* noun embedding a *wh-question*). However, there is a compositionality issue: According to the prevalent analysis of questions, a *wh*-question denotes a set of propositions, but how can a set of propositions be combined with a nominal? There is also an accessibility problem: Once a set of propositions is formed, the semantic contribution made by the *wh*-expression is no longer available, and how can one make sure that the *wh*-expression and the head noun match?

The dynamic system given above allows retrieving pairs of worlds and assignments, upon which an individual concept can be constructed. The *wh*-clause and the head noun of a WH-IC construction can thus be successfully combined. It is also possible to retrieve overlapping sets of worlds instead of partitions, which is useful when dealing with incomplete answers and deriving the set reading for concealed questions (e.g., when *John knows all the phone numbers* means "John knows which phone numbers are in use" instead of "John knows what everyone's phone number is") (an analysis in line with Frana, 2013 is developed).
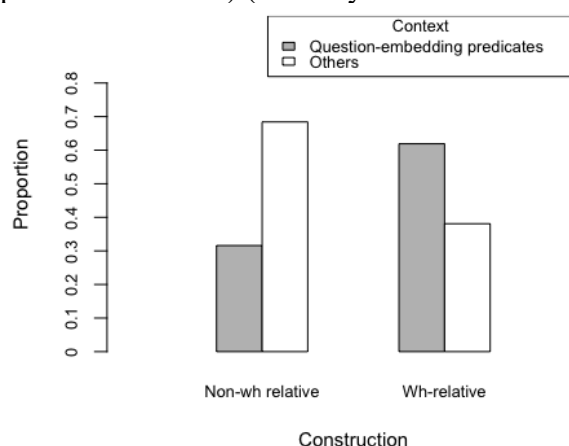

Figure 1. Proportions of contexts (Question-embedding predicates versus Others) for each type of construction (Noun phrases with non-*wh* relatives versus Noun phrases with *wh*-relatives)
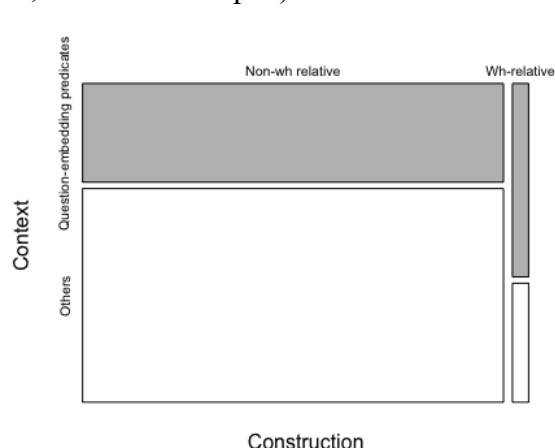
Figure 2. Mosaic plot by context types (Question-embedding predicates versus Others) and by construction types (Noun phrases with non-*wh* relatives versus Noun phrases with *wh*-relatives)

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