

# Predication and information structure in Mandarin Chinese

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**Abstract** The purpose of this article is to show that long-established insights into the close relation between predicate structure and information structure in Mandarin Chinese can account for a number of concrete observations once they are formalized. In the course of the discussion, I will develop formal definitions of the principle I refer to as the Predicate-Comment Mapping Hypothesis and of the copula and comment marker *shi*. After discussing how they apply to simple assertive clauses, I will show that these definitions allow us to derive the correct predictions about the differences between three different types of polarity questions—the so-called *ma* questions, *shi-bu-shi* questions and A-neg-A questions.

**Keywords** Focus · Polarity questions · Topic comment · Information structure · Chinese · Contrastivity · Copula · Clefts

## Glosses

1 – first person	ADV – adverbializing particle
2 – second person	AL – attributive linker
3 – third person	BA – the particle <i>ba</i>
ACC – accusative	CL – classifier
CONT – continuous	NEG – negation
COS – change of state	PFV – perfective aspect
DAT – Dative	PL – plural
DE – sentence final particle <i>de</i>	Q – the question particle <i>ma</i>
EXP – experiential aspect	QP – a question particle other than <i>ma</i>

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FM – focus marker	RES – resultative
IP – interrogative particle	s – singular SHI – the copula <i>shi</i>
MASC – masculine	
NA – suffix in Konni	

## 1 Introduction

The close correspondence between predicate structure and information structure is an early and basic insight into the grammar of Mandarin Chinese, which has been summarized very concisely by Chao (1968, p. 69):

The grammatical meaning of subject and predicate in a Chinese sentence is topic and comment [...].

This intuitive insight has since informed several approaches to Chinese syntax and information structure, in particular in relation to the definiteness of noun phrases (Huang 1987; Tsai 1999).

Nevertheless, many recent treatments of phenomena related to information structure in Mandarin Chinese do not take this generalization into account. Among them are studies about polarity questions (Huang 1991; McCawley 1994; Ernst 1994; Schaffar and Chen 2001; Gasde 2004), focus particles (see e.g. Huang 1988 and Ernst 1995 for a treatment of the negation marker), (in-)definiteness of noun phrases (Cheng and Sybesma 1999; Simpson 2001; Sio 2006; Tham 2008), cleft-like structures (Cheng 2008; Paul and Whitman 2008; Li 2008) and others.

In this paper, I will give a formal semantic account of the mapping relations between syntactic structure and information structure. I will restate the claim quoted from Chao (1968) as the *Predicate-Comment Mapping Hypothesis* (PCMH), which essentially asserts that the predicate structure of a sentence determines its topic-comment structure.

Empirically, I will concentrate on the role of the copula and focus marker *shi* and on the different types of polarity questions. The goal of this paper is not to come up with new observations to challenge previous theories, but rather to show that a variety of well-known phenomena can be accounted for by the same small set of assumptions.

Three kinds of polarity questions can be distinguished in Mandarin Chinese: *ma* questions, *shi-bu-shi* questions and A-neg-A questions. The three question types differ in two respects: Their potential of hosting manner adverbs (Ernst 1994) and their adequacy in situations which require constituents other than the VP to belong to the comment (Schaffar and Chen 2001). While questions with the question particle *ma* and *shi-bu-shi* questions can host adverbs as in (1-a) and (1-b) respectively, the same does not hold for A-neg-A questions, as shown in example (1-c):

- (1) a. *Lǎobǎn yánlì de zéběi tā ma?*  
 boss sternly ADV reprove 2s Q  
 ‘Does the boss sternly reprove him?’

- b. *Lǎobǎn shì bu shì yánlì de zéběi tā?*  
 boss SHI NEG SHI sternly ADV reprove 3s  
 ‘Does the boss sternly reprove him?’
- c. \**Lǎobǎn yánlì de zé bù zéběi tā?*  
 boss sternly ADV reprove NEG reprove 3s  
 intended: ‘Does the boss sternly reprove him?’ (cf Ernst 1994, p. 248)

In a situation which, for example, requires the object within the question to be part of the comment, again only *ma* questions and *shi-bu-shi* questions fare well, as shown in (2-a) and (2-b) respectively. By contrast, the A-neg-A question in (2-c) is not felicitous in the given situation. In the following example, the proposition that Zhangsan kissed someone is given and B asks whether Xiaohong is the person in question. *Xiaohong* should therefore be new information in B’s question.

- (2) A says: *I think you should know that I saw Zhangsan kiss a girl last night.*  
 B asks:

- a. *Zhāngsān qīnwěn le [Xiǎohóng]<sub>F</sub> ma?*  
 Zhangsan kiss PFV Xiaohong Q  
 ‘Did Zhangsan kiss [Xiaohong]<sub>F</sub>?’
- b. *Zhāngsān shì-bu-shì qīnwěn le [Xiǎohóng]<sub>F</sub>?*  
 Zhangsan COP-NEG-COP kiss PFV Xiaohong  
 ‘Did Zhangsan kiss [Xiaohong]<sub>F</sub>?’
- c. #*Zhāngsān qīn méi qīnwén Xiǎohóng?*  
 Zhangsan kiss NEG.PFV kiss Xiaohong  
 ‘Did Zhangsan kiss Xiaohong?’

I will show that both phenomena are direct consequences of the PCMH, the definition of the copula *shì* and the definition of the question operator *Q* which I am going to introduce later in this paper (see Sects. 2, 3 and 4.2.1 respectively).

Furthermore, my findings lend support to the idea that being contrastive and being the comment of an utterance indeed belong to two independent categories and should not be collapsed into the notion of *focus* (cf. Vilkuņa and Vallduví 1998; Molnár 2001; Krifka 2007a). In the following discussion, I will therefore use the term *focus* only to refer to contrastivity.

The structure of the paper is as follows: In Sect. 2, I outline my assumptions about the relation between predication and information structure in Chinese. In Sect. 3, I discuss the meaning of the copula and of the comment marker *shì*. Along with some basic observations, I will develop a definition of both the copula and the comment marker which makes it possible to account for their semantic and information-structural effects in assertive sentences.

I will then explore the implications of these assumptions and definitions with regard to polarity questions. To that end, I will first give an overview of the three different types of polarity questions in Chinese in Sect. 4.1. Then, I will discuss some of the basic notions about the meanings of questions and the role of answers in diagnosing differences in question meanings, before applying these diagnostics to

the three different types of Chinese polarity questions. The related observations will allow me to define the question operator  $Q$ .

Finally, in Sect. 4.3, I will examine two cases for which the different question types show different behaviors and I will demonstrate how these differences can be derived from the basic assumptions and principles developed throughout the paper.

Unless indicated otherwise, the example sentences and judgements come from elicitation sessions with five speakers from Shandong and Liaoning. The choice of examples was greatly informed by corpus queries to the Lancaster Corpus of Mandarin Chinese (McEnery and Xiao 2004).

Following the suggestions of one reviewer, I have outsourced most of the formal calculations to Appendix B at the very end of the paper to make the text more readable. Appendix A is a primer for the terminology and notation conventions that I use.

I should also note that, in the literature, there are intricate discussions about the syntax of all the expressions treated in this paper. It would be impossible to do justice to them by mentioning them in passing, and a detailed discussion of how they relate to each other and to my own assumptions would be a research project of its own. I therefore largely remain agnostic about most details of the syntactic derivations involved and only comment on those aspects which are immediately relevant to my approach.

## 2 Mappings from predicate structure to information structure

In this section, I will frame the fundamental hypotheses on which this paper is based. As explained in the preceding chapter, my central claim is that in Mandarin Chinese predicate structure directly determines the topic-comment structure of a clause. During the course of this paper I am going to work with a hybrid approach to information structure along the lines of Krifka (2006), incorporating elements from both Structured Meanings and the framework of Alternative Semantics. Simultaneously, I am going to modify this approach in a way that allows for the distinction between topic-comment structure, on the one hand, and contrastivity on the other hand, which has been argued for by Vilkuina and Vallduví (1998), Molnár (2001), Krifka (2007a) and others.

I assume that meanings can be represented as an ordered pair  $\langle \text{TOPIC}, \text{COMMENT} \rangle$ , such that, if you apply the comment to the topic, you get a proposition. In the formal notations, the topic component will be represented by the Greek letter  $\alpha$ , the comment will be represented by  $\beta$ , and the ordered pair of topic and comment will accordingly be written as  $\langle \alpha, \beta \rangle$ .<sup>1</sup>

The divide between topic and comment can be defined in terms of *relational givenness-newness* as introduced by Gundel and Fretheim (2006, p. 177):

<sup>1</sup> In the original framework, which was optimized for dealing with constituent focus,  $\alpha$  was applied to  $\beta$  as in  $\alpha(\beta)$ . For the problems at hand, however, this way of putting it would unnecessarily inflate the formalism, which is why I reversed the order.

Relational givenness-newness, in contrast [to referential givenness-newness], involves a partition of the semantic/conceptual representation of a sentence into two complementary parts, X and Y, where X is what the sentence is about (the logical/psychological subject) and Y is what is predicated about X (the logical/psychological predicate).

A topic is therefore the part of the sentence which is *structurally marked as* what the sentence is about or the frame in which the sentence holds. A comment is the part of a sentence which is marked as the predicate which holds for the topic.

For the discussion at hand, I will largely restrict myself to sentences in which the topic and the comment of a clause form a simple proposition, such that the topic constituent exactly fills the argument positions of the comment constituent. There are of course other possibilities in Chinese; Chao (1968, p. 94) devotes a section to what he calls ‘full sentence (S-P) predicates’, where the comment alone represents an entire proposition and the topic is not an argument of the comment, as in the following example:

- (3) *diànyǐng wǒ kàn-bào le, měi-yǒu shénme hǎo de*  
 movie IS read-newspaper PFV, NEG.PFV-exist what good AL  
 ‘(As for) movies, I have looked over the papers, there aren’t any good ones.’  
 (Chao 1968, p. 96)

In other treatments, this type of construction has been described as containing a special type of topic rather than a special type of comment; such non-argument topics have been called (*Chinese-style*) *topics* by Chafe (1976) and *frame setters* by Krifka (2007a). They will not play a role in the discussion below.

To illustrate the principles developed above with English examples first, let us consider the sentence *Emma got married*, with phonological sentence stress falling on *married*. Assume that Emma is already a given participant in the discourse. A natural interpretation of the sentence would then be that *Emma* is the topic, and *got married* is the comment. According to the conventions just introduced, the structured meaning of the sentence would then be  $\langle \mathbf{emma}, \lambda x.\mathbf{get\ married}(x) \rangle$ . If we apply the comment  $\lambda x.\mathbf{get\ married}(x)$  to the topic **emma**, the result is the simple proposition *Emma got married*.

Independent from their being topics or comments, single constituents might bear a focus feature in the sense of Rooth (1985, 1992), which marks them as contrastive. This focus feature is spelled out phonologically by stressing (the head of) the contrastive constituent. If a constituent within the comment  $\beta$  is marked as contrastive, it gives rise to the set of alternatives to the contrastive comment,  $\text{ALT}(\beta)$ . If a constituent within  $\alpha$  is marked as contrastive, it generates the set of alternatives to the contrastive topic,  $\text{ALT}(\alpha)$ .

All elements within a set of alternatives are of the same type; thus, if the comment  $\beta$  is a predicate like  $\lambda x.\mathbf{play\ [FOOTBALL]}(x)$ , where *football* is contrastive, the set of alternatives  $\text{ALT}(\beta)$  could be  $\{\lambda x.\mathbf{play\ football}(x), \lambda x.\mathbf{play\ baseball}(x), \lambda x.\mathbf{play\ basketball}(x)\}$ .

Alternatively, if the entire  $\beta$  constituent is contrastive, the set of alternatives  $\text{ALT}(\beta)$  could be  $\{\lambda x.\mathbf{play\ football}(x), \lambda x.\mathbf{sing\ karaoke}(x), \lambda x.\mathbf{hunt\ caribous}(x)\}$ .

Both the topic and the comment can be contrastive, independent of each other. Thus, in the clause  $[MARK]_{\text{TOPIC}} [invited JUDY]_{\text{COMMENT}}$ , which could be an answer to the question *who invited whom?*, *Mark* would be a contrastive topic. The contrastive comment would be *invited Judy*. The set of alternatives to the contrastive topic might be (*Rudy, Lilja, Jonas*); The set of alternatives to the contrastive comment might be (*invited Helen, invited Jason, invited Philip*).

For a formal approach to determining  $ALT(x)$ , I refer the reader to Kratzer (1991). A less formal rule of thumb is given in (64) in the appendix.

When I am saying that “predicate structure determines the structured meaning of a phrase”, the meaning of the term *predicate* used here is by no means self-evident. In most cases, the constituent which is to be interpreted as the predicate of the clause in the sense of (4) is directly determined by the syntactic structure of the sentence: It is then simply the highest level of the V projection by the main verb.<sup>2</sup>

Furthermore, certain items such as the copula *shi* determine which constituent of a sentence is to be interpreted as the predicate, as will be seen later on.

Put more concisely, the assumptions on which I base my work are defined below, collectively labeled the *Predicate-Comment Mapping Hypothesis PCMH*.<sup>3</sup>

(5) Predicate-Comment Mapping Hypothesis:

- a. A clause can be split into a main predicate and its argument.
- b. The default main predicate of a clause is the VP.
- c. Let  $P$  be the main predicate of a clause, and  $a$  is its argument, such that  $P(a)$  gives a proposition. Then the structured meaning of  $P(a)$  is  $\langle a, P \rangle$ , where  $a$  is the topic and  $P$  is the comment.

Returning to the Chinese data, the representation below indicates the assumed structure of the clause by brackets. The calculation illustrates the mapping from predicate structure to background-comment structure as defined in (5).

- (6) a.  $[L\check{i} \ xi\check{a}nsheng]_{NP} \ [[z\grave{a}i \ Sh\grave{a}ng\check{h}\check{a}i]_{PP} \ [xu\acute{e}x\acute{i} \ f\check{a}w\acute{e}n.]_{\bar{V}}]_{VP}$   
 Li Mister at Shanghai study French  
 ‘Mr Li studies French in Shanghai.’  
 b.  $\langle \text{mr li}, \lambda x.\text{study french in shanghai}(x) \rangle$

<sup>2</sup> Regardless of the distinctions between adjectives and verbs in Chinese, adjectives are also taken to be of category V.

<sup>3</sup> Although this hypothesis has been arrived at independently and is designed specifically for the Chinese data, I have been advised of the obvious resemblance to the *Mapping Hypothesis* by Diesing (1992):

- (4) *Mapping Hypothesis:*  
*Material from VP is mapped onto the nuclear scope.*  
*Material from IP is mapped into a restrictive clause.*

Indeed, the notions of *nuclear scope* and *restrictive clause* correspond significantly to the notions of *topic* and *comment* used here. This correlation has already been noted by Partee (1991, 1999). Without going into further detail, these parallels strongly suggest that the PCMH is just one version of a much more universal principle.

So the VP [in Shanghai study French] is mapped to the comment of the clause, while [Mr Li] is mapped to the topic of the clause. This means that, by uttering (6), the speaker implies that *Mr. Li* is a given referent, while the fact that he studies French in Shanghai is new information to the listener.

### 3 *Shi* as copula and as focus marker

#### 3.1 Basic observations

In most treatments of *shi* as a focus marker, the identity of the information-structural particle *shi* with the copula *shi* is asserted, but no definition which covers both uses is given (e.g. Paul and Whitman 2008; Cheng 2008; Li 2008).

I will show that the semantic definition of the copula *shi* is indeed very close to the meaning of the comment marker *shi*, even though I suggest that they are two different lexemes.

The function of the comment marker *shi* is to interfere with the default predicate structure of a clause, overriding the PCMH according to which the comment is the VP. In addition to that, the comment marker *shi* also implies that the comment is contrastive. So, in all clauses containing non-copular *shi*, one constituent of the comment  $\beta$  will be interpreted as contrastive, giving rise to ALT( $\beta$ ) (this is also in line with Hole 2011). Note that *shi* does not determine which constituent of the comment is contrastive; instead, the contrastive constituent is picked out by intonational stress. This has already been noted in Cheng (2008).

I suggest that comment marking *shi* is an adjunct to the constituent which it takes as its first argument. The linear order of [*shi* X...X] is potentially ambiguous between two syntactic representations, since *shi* could either be adjoined to the first constituent X to its right or to the entire YP dominating this constituent X. In other words, in a sequence like [*shi* X], the two possible positions of *shi* would be [[*shi*][X]] and [[[*shi*][YP]] [X]].

For the phenomena discussed in this paper, the minimal assumption is that *shi* generally adjoins to the top-most projection of a phrase, except for when the left-most constituent in that phrase is the subject; in that case, *shi* can also directly adjoin to the subject constituent instead. This means that for sentence-medial *shi*, the only structure I am going to consider is [[[*shi*][YP]] [X]], whereas for sentence-initial *shi* preceding a subject, both the dominating XP and the subject constituent will be considered as potential sister nodes for *shi*:

- (7) a. In a sequence of [*shi* X], where X is an arbitrary constituent, *shi* is taken to adjoin to the highest projection YP dominating X.  
 b. If X is the subject of the clause, *shi* can also adjoin to the maximal projection XP of X directly.

As this assumption has considerable potential for controversy, I will discuss it briefly at the end of the next section, on Sect. 3.2.

The following sentences exemplify the range of positions *shi* can take within a clause and briefly illustrate the interdependence of *shi* and comment structure. In the

following example, *shi* is a genuine copula. Its use is obligatory and it does not mark its complement as contrastive:

- (8) *Aòbāmǎ \*(shì) [měiguó de zǒngtǒng].*  
 Obama SHI USA AL president  
 ‘Obama is the president of the United States of America.’

In the next example, *shi* adjoins to the verb phrase. Either *study* or *medicine* or *study medicine* can be interpreted as contrastive, depending on prosodic stress.

- (9) *Zhāngsān [shì [xuéxí yīxué]].*  
 Zhangsan SHI study medicine  
 ‘Zhangsan studies medicine.’

In (10), *shi* adjoins to the projection dominating both this adjunct and the rest of the verb phrase. Either *in Beijing* or *studies medicine in Beijing* can be contrastive, again also depending on prosodic marking. If the fact that Zhangsan studies in Beijing figures prominently in the Common Ground, *medicine* can also be interpreted as the contrastive constituent.

- (10) *Zhāngsān [shì [zài Běijīng xuéxí yīxué]].*  
 Zhangsan SHI in Beijing study medicine  
 ‘Zhangsan studies medicine in Beijing.’

Finally, consider (11):

- (11) *Shì Zhāngsān xuéxí yīxué.*  
 SHI Zhangsan study medicine  
 a. ‘It is Zhangsan who studies medicine.’  
 b. ‘It’s that Zhangsan studies medicine.’

In this example, *shi* either adjoins to the subject *Zhangsan*, or to the entire clause—the two parses would be  $[_{IP}[shi\ NP]\ [VP]]$  and  $[shi\ [IP]]$  respectively. Here we also see a significant difference in the two interpretations: In (11-a), Zhangsan is exhaustively identified as the only individual for which the predicate *studies medicine* holds (cf. Paul and Whitman, 2008, p. 426).

Example (11-b), by contrast, could figure in a conversation such as *Why don’t your family talk to each other?—It’s that Zhangsan studies medicine. His father wanted him to become a lawyer.* In this case, the entire sentence serves as a comment to a discourse topic, typically serving as an answer to a question for a reason. This type of sentence is probably best described as *inferentials* (cf. Delahunty 2001).

I should note that one anonymous reviewer has doubted the availability of this interpretation and the natural occurrence of such inferential clauses. I will therefore provide some more data on the phenomenon to give the debate more empirical substance. The two following examples come from a webpage and the Lancaster



Corpus of Mandarin Chinese respectively and have been accepted by four speakers from Liaoning and Beijing, as well as one speaker from Yunnan. They are both interpreted as giving a reason: the first sentence explains why people aren't so excited about New Year anymore, the second one explains why the addressee is so obstinate (as the subsequent phrase explicates). The second example can also be interpreted as a cleft—*it's your mother who pampered you too much*—both the inferential and the cleft interpretation were available to speakers.

- (12) a. *bù shì guò-nián wúliáo, [shì rénmen xiànzài shēnghuó*  
 NEG SHI celebrate-new.year boring SHI people now life  
*shǔipīng shàng-qu le], tiān-tiān dōu zài guò-nián*  
 level go.up-go COS day-day all CONT celebrate-new.year  
 'It's not that New Year is boring, it's that people's standard of living has improved, every day is [like] New Year.' (Duanwenxue 2011)
- b. *[shì mā tài jiàoguàn nǐ le], zhème rèn xìng.*  
 SHI mother too pamper 2S PFV thus obstinate  
 'It's that/ because your mother has pampered you too much, (that you are) such a pighead.' (LCMC\_F02.0098)

As should be expected from our previous observations about contrastivity in comments marked by *shì*, it is possible for subconstituents of an inferential clause to be contrastive. This is illustrated by the following two sentences which were judged by speakers in the context provided and with corresponding emphases:

- (13) A: Why is Xiaoli so upset? We all know that Xiaowang is often late.  
 B: *shì tā jīntiān lái de wán.*  
 SHI 3S today come RES late  
 'It's that he's late *today*.' (Today is Xiaoli's birthday.)
- (14) A: I can speak more languages than Xiaoli, why didn't the boss promote me?  
 B: *shì nǐ bù huì shuō déyǔ.*  
 SHI 2S NEG can speak German  
 'It's that you can't speak *German*.'  
 (Our most important partners are Germans.)

Inferential clauses are probably different from the type of 'full sentence comments' considered by Chao (1968): The topic to an inferential clause is not a typical frame-setting topic—it is typically a proposition which demands an explanation or a reason, whereas frame-setting topics cannot be given by a full clause. Conversely, I suggest it is impossible for a frame-setting topic to be followed by *shì*. I have to leave it to further research to fully explore the relation between these two constructions.

### 3.2 Defining *shì*

In principle, the meaning of *shì*, both copular and comment marking, can be paraphrased as 'apply predicate', just like the meaning of the English copula *be*

according to Partee (1987). In the simpler cases, the formalization of this meaning can indeed be rendered as  $\lambda P \lambda x.P(x)$ —‘take a one-place predicate and an individual and apply the predicate to the individual’.

During the following discussion, the constituent that *shi* adjoins to will be labeled as *C* for *comment*. The other constituent will be labeled *T* for *topic*.

The only contribution of *shi* to the meaning of the clause is, first, to define its meaning: It is always the *C* constituent which will be interpreted as the comment. Second, in non-copular use, *shi* implies that the *C* constituent is contrastive in the sense that there is a set of alternatives to the *C* constituent, where either the entire constituent is contrasted with expressions of the same semantic type, or one of its subconstituents.

In some uses of *shi* as a copula, it does not interfere greatly with the meaning of its arguments. For example in (15), the constituent marked as the information structural predicate of the clause by *shi* semantically already has the form of a predicate:  $(\lambda x.\text{foreigner}(x))$ ; and the constituent defined as the argument to this predicate, *Mister Zhang* already has the semantic form of an individual. So the predicate can be applied to its argument without much further ado; the copula is here semantically redundant.

- (15) [Wàn Mǎn [shì [wàiguórén.]]]  
 Wán Mǎn SHI foreigner  
 ‘Wan Man is a foreigner.’

In many cases, however, type-shifting has to be induced before the complement of *shi* can be interpreted as a predicate. Thus, *shi* might be used as a copula in a sentence where the designated predicate DP has the semantic form of an individual, without any open argument slots. In this case, the DP has to shift in order to become a predicate.

Consider the example in (17): Without a type shift, we would simply have two individual expressions of type *e*, that is *he* and *Yu Hua*. In order to interpret the latter expression as a predicate to the first one, it has to become an expression of type  $\langle e, t \rangle$  and it can do so by the operation *ident*:

- (16) *ident* shift:  $j \rightarrow \lambda x[x = j]$ (cf. Partee 1987, p. 362)

That is, the individual expression *Yu Hua* will shift to the predicate  $\lambda y.y = \mathbf{yu hua}$ , *y is Yu Hua*.

For the sake of simplicity, I will treat the third person pronoun here like a proper name. For detailed derivations of this and all following examples, see Appendix B.

- (17) a. Tā [shì [Yú Huá]].  
 3S SHI Yu Hua  
 ‘He is Yu Hua.’  
 b. *Yu Hua* shifts from denoting an individual to denoting the property of *being Yu Hua*;  $\lambda y y = \mathbf{yu hua}$   
 this property is then applied to *he*,  $\mathbf{he} = \mathbf{yu hua}$ .

So *shi* as a copula is semantically redundant if its *C* argument is a predicate; otherwise it forces its *C* argument to become a predicate.

For the comment marker *shi* however, not only the type of the *C* constituent might be forced to shift, but also the type of the *T* constituent. There are cases in which the constituent which *shi* defines as a predicate is an individual, while the one it defines as its argument is semantically a predicate. So *T* applied to *C* would actually yield a proposition, but in order to apply *C* as a predicate to *T*, type shifts are necessary and they do not come without certain semantic side-effects. Crucially,  $T(C) \neq C(T)$ .

In these cases, *C* will shift from an individual to a predicate as before, and *T* will shift from a predicate to an individual by the operation *iota*:

- (18) *iota* shift:  $P \rightarrow \iota x[P(x)]$ ; *P* becomes ‘the unique *x* such that *P(x)*’ (cf. Partee 1987, p. 362)

The *iota* shift makes a predicate into the one individual to which this predicate applies. So if your predicate *P* is for example *laugh*, the *iota* shift will change its meaning to *the unique x such that x laughs*. The combination of both type-shifts leads to the well-known effect of the exhaustive, cleft-like reading in cases like the following:

- (19) a. [*Shì* [*Roylott dàifu*]] *dǎ-sǐ* *le* *Zhūliyǎ*.  
 SHI Roylott doctor beat-dead PVF Julia  
 ‘It was Dr. Roylott who killed Julia.’
- b. (i) first shift: *Dr. Roylott* shifts from denoting an individual to denoting the predicate *to be Dr. Roylott*:  $\lambda x.x = \text{roylott}$ ; being the *C* argument of comment marking *shi*, this is defined as the comment of the clause.
- (ii) second shift: *kill Julia* shifts from denoting a predicate to denoting *the individual who killed Julia*:  $\iota y.\text{kill}(\text{julia})(y)$ ; this is the topic of the clause.
- (iii) result:  $\langle \iota y.\text{kill}(\text{julia})(y), \lambda x.x = \text{roylott} \rangle$

So *Roylott* shifts to the predicate *x is Roylott* and *y killed Julia* shifts to the individual expression *the unique y such that y killed Julia*. When we then apply the predicate to the individual, we get *the unique y such that y killed Julia is Roylott*. Furthermore, the information structure of the clause tells us that the information that someone has killed Julia is already given, while the new piece of information is that Roylott is the murderer.

Without the comment marker *shi* here, *Roylott* would be interpreted as the topic of the clause and *killed Julia* would be interpreted as the comment. The sentence would still be grammatical, but its information structure would match a different discursive background.

Summarizing the above, we arrive at the following definition of comment marker *shi* (a formal definition is given in Appendix B):

- (20) The first semantic argument  $C$  of *shi* is applied to its second argument  $T$  as a predicate.  $C$  is always interpreted as the comment of the clause. If  $C$  denotes an individual rather than a predicate, *shi* will force it to shift to become a predicate by the operation *ident*; then:
- a.  $T$  is either an individual expression, so that the shifted  $C$  can directly be applied as a predicate, or
  - b.  $T$  is a predicate; in that case, it shifts to an individual expression by the operation *iota*: a predicate shifts to denote the unique individual for which this predicate holds.

Before concluding this section, I return briefly to the syntactic behavior of *shi*: By adapting the assumption in (7), I am following the suggestion of one reviewer who pointed out that the subject is the only constituent for which it is clear that *shi* can trigger an interpretation of exhaustive identification of the type *it was y who did P*, or *the unique x such that P holds of x is y*. To derive this meaning, it is necessary to assume that *shi* can adjoin to the subject constituent directly, not only to the dominating YP. For constituents other than the subject, it is not clear that such syntactic sisterhood is also possible. I am however not sure whether this seemingly exceptional status of the subject is not in fact accidental.

Thus, the constellation in which *shi* exhaustively identifies the subject is one in which its first argument (the subject) is of type  $e$  and its second argument (the rest of the sentence) is of type  $\langle e, t \rangle$ . The same constellation can be seen when *shi* is a copula in a sentence like the following:

- (21) *Lǎoshī shì Sānmáo*  
 teacher SHI Sanmao  
 ‘The / \*A teacher is Sanmao.’ (cf. Tham 2008, p. 73)

Here, the first argument of *shi* is again of type  $e$ , its second argument is of type  $\langle e, t \rangle$  and the interpretation is also one of exhaustive identification: *the unique x such that x is a teacher is Sanmao*. The problem is, of course, that the definite interpretation of *lǎoshī* as ‘the teacher’ is probably independent from *shi* here. But that only proves that it’s hard to test whether *shi* triggers exhaustive identification in non-subject constituents, not that it can’t do it.

A similar point can be made about *shi* before local or temporal adverbs. Under the assumptions that (a) *shi* can directly adjoin to such adverbs, (b) they are predicates which take an event as their only argument and (c) events are of type  $e$ , one might expect that the application of *shi* to the adverbial phrase would lead to an exhaustive reading. Thus in a sentence as in (22), one would expect that the following interpretation should be available: *the unique event of Zhangsan meeting Lisi took place in Shanghai*. Not only is this interpretation intuitively reasonably close to the actual meaning of the sentence, it would in any case be very hard to prove that this interpretation is *not* available for speakers, in addition to the interpretation we get if *shi* adjoins to the entire dominating VP.

- (22) *Zhāngsān shì zài Shànghǎi pèngdào le Lǐsì*  
 Zhangsan SHI in Shanghai meet PFV Lisi  
 ‘Zhangsan met Lisi in Shanghai/ it was in Shanghai that Zhangsan met Lisi.’

In short, it is no trivial task to empirically determine whether the availability of an exhaustive reading for any one constituent is determined by its syntactic position, syntactic function, syntactic category, semantic type, or a combination of these factors. For the cases discussed in this study, the assumption in (7) is descriptively adequate, but some alternative hypotheses are also compatible with the observations.

### 3.3 Contrastivity

Additionally, I suggest that the comment marker *shi* not only defines what the comment of a sentence is, but that it also gives rise to a contrastive reading. The same is not true for the copula. In the following text, I will take *shi* to refer to the comment marker, not the copula.

- (23) If  $\llbracket \text{shi} \rrbracket (C)(T) = \langle \alpha, \beta \rangle$ , then  $\beta$  is contrasted with a set of contextually relevant alternatives  $\text{ALT}(\beta)$ .

Note that this definition only says that there has to be a set of alternatives to the comment. It does not say exactly how this set of alternatives has to look. It could be that the elements of the set differ from each other entirely or that they differ only in a subconstituent. Thus, if the comment is *plays baseball*, the set of alternatives could consist of elements like  $\{\textit{plays football}, \textit{plays basketball}\}$  and similar.

In this section, I will apply the definitions developed in the preceding section to the examples from which we started out. In each case, I will give a brief discussion of what it means for the comment to be contrastive.

- (24) a. *Zhāngsān shì xuéxí yīxué.*  
 Zhangsan SHI study medicine  
 ‘Zhangsan studies medicine.’  
 b. Zhangsan [SHI [study medicine]]:  $\langle \text{zhangsan}, \lambda x.\text{study}(x)(\text{medicine}) \rangle$

Here, Zhangsan figures as the topic of the clause, while the fact that he studies medicine is presented as new information. We said that in this clause, either *study* or *medicine* or *study medicine* can be the contrastive constituent. As the comment here is  $\lambda x.\text{study}(x)(\text{medicine})$  or  $\lambda x\lambda y.\text{study}(y)(x)$ , the requirement that the comment ( $\beta$ ) should contain—or be coextensive with—a contrastively focused constituent is satisfied (cf. (9) on p. 10):

Since the VP *study medicine* is the comment, either *study* or *medicine* or both could be contrastive. Thus, there are three possible kinds of sets of alternatives: if only *study* is contrastive, the set of alternatives might include the phrases

{*mistrusts medicine, is interested in medicine, . . .*}; if *medicine* is contrastive, the set of alternatives to the comment might include phrases like {*studies law, studies history, . . .*}; and if the entire phrase is contrastive, the set of alternatives might contain {*works as a journalist, travels around the world, is looking for a job*}.

Let us consider one further example:

- (25) *Shì Zhāngsān xuéxī yīxué.*  
 SHI Zhangsan study medicine
- a. (i) ‘It is Zhangsan who studies medicine.’  
 (ii) The topic is that there is exactly one person relevant for the discourse who studies medicine; the comment is that this person is Zhangsan:  
 $\langle \lambda x.\text{study}(x)(\text{medicine}), \lambda y.y = \text{zhangsan} \rangle$
- b. (i) ‘It’s that Zhangsan studies medicine.’  
 (ii) In this case, there is no sentence-internal topic. Instead, the topic of the utterance has to be recovered pragmatically from the discourse:  
 $\langle \emptyset, \text{study}(\text{zhangsan})(\text{medicine}) \rangle$

In (25-a), we get two type-shifts—one *iota* shift, turning *study medicine* into *the individual who studies medicine* and an *ident* shift, turning *Zhangsan* into *is Zhangsan*. The individual who studies medicine is thus presented as the topic of the clause and the identification of this individual as Zhangsan is presented as the comment. The result is the well known cleft-like interpretation of this type of clause.

For (25-b), the result is equally, if maybe less obviously, conforming to expectations. If you recall that these cases are restricted to a discursive environment which prompts the speaker to give a reason (see Sect. 3.1), the fact that there is no sentence-internal topic and that the entire proposition is the comment makes a lot of sense: A question for a reason requires a whole proposition as an answer. So, the fact that in (64-b-ii), the entire proposition constitutes the  $\beta$  part of the structured meaning is really what we should expect.

As shown by the examples in (13) and (14), constituents of the clause can be contrastive, so possible sets of alternatives to the comment in (25-b) would include {*Lisi studies medicine, Xiaohong studies medicine*}, {*Zhangsan likes medicine, Zhangsan isn’t good at medicine*} and {*Zhangsan studies law, Zhangsan studies art*}.

Interestingly, Mandarin Chinese is not the only language which uses the same structure to mark both exhaustive subject focus and sentence focus. The same is true for French clefts and the Hungarian focus position, as the examples below demonstrate (taken from Clech-Darbon et al. 1999, p. 84 and Kiss 1998, p. 264 respectively).

- (26) a. Q: *Did your daughter fall down the stairs?*  
 A: *Non, c’est le petit qui est tombé dans l’escalier.*  
 NEG it-is the small.MASC who is fallen in the.stairs  
 ‘No, it’s the little one who fell down the stairs.’

- b. Q: *You look worried. What happened?*  
 A: *C'est le petit qui est tombé dans l'escalier.*  
 it-is the small.MASC who is fallen in the.stairs  
 'The little one fell down the stairs.'

(27) Q: Who has won the Russian elections? or:

- Q: What's new?  
 A: [*spec-FP Jelcin*] *nyerte meg az orosz választásokat.*  
 Yeltsin won PFV the Russian elections  
 'It is Yeltsin who has won the Russian elections.'

In a similar vein, Fiedler et al. (2009, p. 251) write about the Gur languages that "utterances with focus on the whole sentence are expressed in the same way as *subject foci*". Thus in Konni, if the verb is followed by the suffix *nà*, either the subject is marked as focused or the entire sentence:

- (28) a. Q: Who hit Peter?  
 A: *Mary nígí-nà wà.*  
 Mary hit-NA 3SG  
 'MARY hit him.'
- b. Q: What happened?  
 A: *Mary nígí-nà Peter.*  
 Mary hit-NA Peter  
 'MARY HIT PETER.' (ex. (21) in Fiedler et al. 2009, p. 251)

It has been pointed out to me that one consequence of the PCMH and the definition of *shi* proposed here might provoke controversy: If my assumptions are right, it is virtually impossible for an object NP to be narrowly focused in the sense of being the only element mapped to the comment  $\beta$  in Mandarin Chinese. By default, the entire VP is mapped to the comment and *shi* cannot interfere between the verb and its object. Of course, objects can still be narrowly contrastive, but they cannot be the only constituent in the comment of a clause.

All I can add to this is that I simply regard this asymmetry between objects and subjects in Chinese to be an empirical fact. Maybe the clearest way to demonstrate this is to show that definite object NPs never receive the exhaustive identificational reading if preceded by *shi* the way subjects do, even if they are marked as contrastive prosodically. A standard procedure to show this is the test developed by Szabolcsi (1981):

- (29) If A, B is a pair of sentences, and in A, the focused element is a coordinated noun phrase whereas in B, one member of the coordination is dropped, then:  
 if  $A \rightarrow B$ , then A does not involve exhaustive identification of the focused NP; if  $A \nrightarrow B$ , then A is an instance of exhaustive identification.

In the following examples, if a constituent X is marked prosodically as contrastive, it will be written  $[X]_F$ .

- (30) a. *Shì [Zhāngsān hé Lǐsì]<sub>F</sub> qù guò Fǎguó.*  
 SHI Zhangsan and Lisi go EXP France  
 ‘It’s Zhangsan and Lisi who have been to France.’ →
- b. *Shì [Zhāngsān]<sub>F</sub> qù guò Fǎguó.*  
 SHI Zhangsan go EXP France  
 ‘It’s Zhangsan who has been to France.’
- (31) a. *Xiǎohóng shì pèngdào le [Zhāngsān hé Lǐsì]<sub>F</sub>.*  
 Xiaohong SHI bump.into PFV Zhangsan and Lisi  
 ‘Xiaohong has bumped into Zhangsan and Lisi.’ →
- b. *Xiǎohóng shì pèngdào le [Zhāngsān]<sub>F</sub>.*  
 Xiaohong SHI bump.into PFV Zhangsan  
 ‘Xiaohong has bumped into Zhangsan.’

So in (30), sentence (a) not only does not imply (b), but actually denies its presupposition, whereas in (31), sentence (a) does imply sentence (b).

The only way to exhaustively identify an object is by a more complex structure involving relativization, which is similar to English pseudo-clefts:

- (32) *Xiǎohóng zuì hèn de shì Lǐ lǎoshī.*  
 Xiaohong most hate AL SHI Li teacher  
 ‘The one Xiaohong hates most is teacher Li.’

Again, these observations are anything but new. As Chao (1968, p. 78) already points out:

In general, if in a sentence of the form S-V-O the object O is the logical predicate, it is often recast in the form S-V *de shi* [i.e. *shi*] O [. . .], thus putting O in the center of the predicate.

Having introduced the Predicate-Comment Mapping Hypothesis and the definition of *shi* as primary assumptions, I will now turn to some of the consequences of these assumptions.

## 4 Polarity questions

### 4.1 Preliminaries

In this section, I am going to introduce three different types of polarity questions in Mandarin Chinese. I will show that they are very similar in some respects and I will suggest definitions of their components which allow us to account for these similarities. At the same time, there are also interesting differences in their behavior, and I will show how these follow from previous definitions.



Polarity questions in Mandarin Chinese are traditionally distinguished into two major types: 1. Particle questions, or *ma* questions, which are structurally identical to simple assertions except for the sentence final particle *ma* which marks the clause as a polarity question:

- (33) *Zhāngsān qù guò Běijīng ma?*  
 Zhangsan go EXP Beijing Q  
 ‘Has Zhangsan ever been to Beijing?’

2. A-neg-A questions in which the lexical head of the VP or a higher V projection is repeated in its negated form.

- (34) a. *Lǐ xiānsheng zài Shànghǎi [xuéxí] bù [xuéxí] fǎwén?*  
 Li Mister at Shanghai study NEG study French  
 ‘Does Mr Li study French in Shanghai?’  
 b. *Lǐ xiānsheng zài Shànghǎi [xuéxí fǎwén] bù [xuéxí fǎwén]?*  
 Li Mister at Shanghai study French NEG study French  
 ‘Does Mr Li study French in Shanghai?’  
 c. *Lǐ xiānsheng [zài Shànghǎi xuéxí fǎwén] bù [zài Shànghǎi xuéxí fǎwén]?*  
 Li Mister at Shanghai study French NEG at Shanghai study French  
 ‘Does Mr Li study French in Shanghai?’

I should note, however, that long A elements containing several constituents as in (34-c) are strongly dispreferred and even felt to be ungrammatical by some speakers. By far the most frequent form of A-neg-A questions takes only the lexical verb itself as A element and I will therefore restrict myself to these cases.

Schaffar and Chen (2001) further distinguish *shi-bu-shi* questions from A-neg-A questions with predicates other than the copula serving as the A element. Indeed, there are a number of interesting differences between *shi-bu-shi* and other A-neg-A questions. For the sake of convenience I will therefore likewise distinguish between *shi-bu-shi* questions on the one hand, and A-neg-A questions, in which the repeated predicate is not the copula, on the other. Accordingly, I will from here on speak of three types of polarity questions: *ma* questions, A-neg-A questions and *shi-bu-shi* questions.

In a *shi-bu-shi* question, the *shi-bu-shi* part itself can occupy any position which would be open to *shi* in the corresponding assertive sentence. Some of the possible positions are illustrated below:

- (35) a. *Zhāngsān shì bu shì xuéxí yīxué?*  
 Zhangsan SHI NEG SHI study medicine  
 ‘Does Zhangsan study medicine?’  
 b. *Zhāngsān shì bu shì zài Běijīng xuéxí yīxué?*  
 Zhangsan SHI NEG shi in Beijing study medicine  
 ‘Does Zhangsan study medicine in Beijing?’

- c. *Shì bu shi Zhāngsān xuéxī yīxiué?*  
 SHI NEG SHI Zhangsan study medicine  
 (i) ‘Is it Zhangsan who studies medicine?’  
 (ii) ‘Is it that Zhangsan studies medicine?’

The contrastiveness conditions are exactly the same as in the assertive counterparts as described in (9) to (25): Put simply, one of the constituents following *shi-bu-shi* is interpreted as contrastive.

## 4.2 Structured meanings of polarity questions

### 4.2.1 Definitions

Semantically, questions are analyzed as sets of propositions.<sup>4</sup> In the framework assumed here, question meanings can be characterized more precisely as structured meanings of the form  $\langle \alpha, \beta \rangle$ , where  $\alpha$  is the function denoted by the question and  $\beta$  is the restriction to the set of congruent answers. The application of an element of  $\beta$  to  $\alpha$  results in a proposition (cf. Krifka 2007b, 2001; von Stechow and Zimmermann 1984).

To illustrate this, let us take the question *Who ate the chocolate?*: The unstructured meaning of this clause is a set of clauses, such as  $\{Kate\ ate\ the\ chocolate, John\ ate\ the\ chocolate, Pat\ ate\ the\ chocolate\}$ , in a context where it is clear that only Kate, John and Pat are potential suspects.

The structured meaning has two parts, one containing the given information that chocolate was eaten— $\lambda x.\text{eat the chocolate}(x)$ —the other one containing a set of individuals to whom this predicate could plausibly apply:  $\langle \lambda x.\text{eat the chocolate}(x), \{kate, john, pat\} \rangle$

Note that, as before, the first part of the structured meaning is the topic of the clause; the second part, the part which is being asked, is the comment. At the same time, the second part of the meaning defines which utterances would be felicitous as answers.

It follows that if two questions  $Q_1$  and  $Q_2$  can successfully be answered by exactly the same set of answers  $\{A_1 \dots A_n\}$  and if every application of  $Q_1$  to  $A_n$  yields the same proposition as the corresponding application of  $Q_2$  to  $A_n$ , the meanings of  $Q_1$  and  $Q_2$  should be identical. Although, as we will see, answers are not the only way to tell whether two questions are synonymous, I will take them as a starting point for initial observations about the polarity questions under discussion.

Generally speaking, polarity questions are questions for which the comment part of the structured meaning contains exactly two elements, and one element is the

<sup>4</sup> Different illocutions are here taken to be utterances of different semantic types which can contribute to different discourse components. Thus, assertions are of type  $t$  and they contribute to the Common Ground. Imperatives are predicates and contribute the To-Do-List of the addressee (cf. Portner 2007). Questions are sets of propositions and could be said to update a list of ‘what is under discussion’.

negated version of the other. The structured meaning of a polarity question has the form  $\langle \alpha, \{\beta, \neg\beta\} \rangle$ .

Considering the three types of polarity questions established before, there are substantial overlaps in the sets of answers. The following examples give an overview of the types of answers which apply to the different question types.

(36) Questions with sentence-final question particle *ma*:

Q: *Zhāngsān qù guò Běijīng ma?*  
 Zhangsan go EXP Beijing Q  
 ‘Has Zhangsan ever been to Beijing?’

A: (i) *qù guò; shì*  
 go EXP; SHI  
 ‘yes’

(ii) *méi qù guò; méi-yǒu; bú shì*  
 NEG.PFV go EXP NEG.PFV-have; NEG SHI  
 ‘no’

(37) A-neg-A questions:

Q: *Zhāngsān qù méi qù guò Běijīng?*  
 Zhangsan go NEG.PFV go EXP Beijing  
 ‘Has Zhangsan ever been to Beijing?’

A: (i) *qù guò; #shì*  
 go EXP; SHI  
 ‘yes’

(ii) *méi qù guò; méi-yǒu; #bú shì*  
 NEG.PFV go EXP; NEG.PFV-have; NEG SHI  
 ‘no’

(38) *Shi-bu-shi* questions:

Q: *Zhāngsān shì bu shì qù guò Běijīng?*  
 Zhangsan SHI NEG SHI go EXP Beijing  
 ‘Has Zhangsan ever been to Beijing?’

A: (i) *shì; shì qù guò; qù guò*  
 SHI; SHI go EXP; go EXP  
 ‘yes’

(ii) *bú shì; méi qù guò*  
 NEG SHI; NEG.PFV go EXP  
 ‘no’

Essentially, the only answer to A-neg-A questions which is always possible is the A element—or its negation—itsself. *Ma* questions can be answered by the verb or a

higher VP projection of the question. In principle they can also be answered by *shi*, but for some speakers, this is only acceptable if one of the constituents is interpreted as contrastive. In sentences like the following, some speakers only accept the answer *shi* if one of the bracketed constituents is prosodically marked as contrastively focused:

- (39) *Zhāngsān [zuótiān] [zài Běijīng] [[pèngdào le] [Lǐsì]] ma?*  
 Zhangsan yesterday in Beijing meet PFV Lisi Q  
 ‘Did Zhangsan meet Lisi in Beijing yesterday?’

If not for examples like this one, it would be tempting to assume that isolated *shi* means the same as English *yes*, which is  $\lambda p.p$  (cf. Krifka 2001). But cases like (39) rather suggest that bare *shi* is in fact an elliptic answer whose arguments can be anaphorically recovered. A further indication for taking *shi* as an elliptic answer is the fact that it can always be followed by the predicate of the sentence. In fact, some speakers only accept the more explicit answer to the question in (39):

- (40) *?#shì / shì pèngdào le tā.*  
 SHI / SHI meet PFV 3S  
 ‘Yes, he met him.’

*Shi-bu-shi* questions can always be answered by *shi*. This *shi* can optionally be followed by the *C* argument of the question. Only if *shi* directly precedes the verb as in (39) is there a third option: The question can be answered by the lexical verb, just as in the corresponding *ma* and A-neg-A questions. Table 1 gives a simplified overview comparing the kinds of answers applicable to the different question types.

The overlap of felicitous answers is always total between *shi-bu-shi* questions and corresponding *ma* questions involving the copula *shi*. Below, only positive answers are given in the examples, but the same applies to negative answers.

In the following examples, the (a) example is always the *shi-bu-shi* question, while the (b) example is the corresponding *ma* question containing *shi*. The translations for both question types, being identical, are only given once, below the *ma* question. Each [A:] part gives an exhaustive list of matching positive answers to both question types.

- (41) Q: a. *Zhāngsān shì bu shì xué le yīxué?*  
 Zhangsan SHI NEG SHI study PFV medicine

**Table 1** Summary of the types of answers applying to each of the three different polarity question types

Question Type	Answer Type		
	Default	Verb	<i>shi</i>
<i>ma</i>	verb or higher verbal projection	✓	✓
A-neg-A	the A element	✓	–
<i>shi-bu-shi</i>	the constituent after <i>shi-bu-shi</i>	if directly after <i>shi-bu-shi</i>	✓

- b. *Zhāngsān shì xué le yīxué ma?*  
 Zhangsan SHI study PFV medicine Q  
 ‘Has Zhangsan studied medicine?’
- A: *shì / shì xué le yīxué / shì xué le / xué le*  
 SHI / SHI study PFV medicine / SHI study PFV / study PFV  
 ‘yes’
- (42) Q: a. *Zhāngsān shì bu shì zài Běijīng xuéxí yīxué?*  
 Zhangsan SHI NEG SHI in Beijing study medicine  
 b. *Zhāngsān shì zài Běijīng xuéxí yīxué ma?*  
 Zhangsan SHI in Beijing study medicine Q  
 ‘Does Zhangsan study medicine in Beijing?’
- A: *shì / shì zài Běijīng*  
 SHI / SHI in Beijing  
 ‘yes’
- (43) Q: a. *shì bu shì Zhāngsān xuéxí yīxué?*  
 SHI NEG SHI Zhangsan study medicine  
 b. *shì Zhāngsān xuéxí yīxué ma?*  
 SHI Zhangsan study medicine Q  
 (i) ‘Is it Zhangsan who studies medicine?’  
 (ii) ‘Is it that Zhangsan studies medicine?’
- A: (i) *shì / shì Zhāngsān*  
 SHI / SHI Zhangsan  
 ‘yes’  
 (ii) *shì*  
 SHI  
 ‘yes’

Li and Thompson (1981, p. 549) note that *shì...ma* questions are not in every case identical to *shì-bu-shì* questions: In the situation in (44), B does not think he lost any weight. The question *shì ma?* is entirely acceptable in this situation, whereas *shì-bu-shì* is less so.

- (44) A: *nǐ hǎoxiàng shòu le yidiǎn.*  
 2S seem thin PFV a.little  
 ‘You seem to have lost some weight.’
- B: (i) *Shì ma?*  
 SHI Q  
 ‘Is that so?’
- (ii) *?#Shì bu shì?*  
 SHI NEG SHI  
 intended: ‘Is that so?’

This finding, however, could also be due to an idiosyncratic difference which specifies that *shi... ma* questions can occur without further material in isolation, while *shi-bu-shi* questions cannot. I have not found a single occurrence of an isolated *shi-bu-shi* question in the Lancaster Corpus of Mandarin, compared to thirteen isolated *shi ma* questions; and I haven't found an environment in which informants would accept an isolated *shi-bu-shi* question as a reaction by the second speaker (they do occur like question tags after a statement). More research would be needed to determine conclusively whether *shi-bu-shi* questions and *shi... ma* questions are in fact identical. For the time being, I will assume they are, based on the correspondences in meaning and answers above.

The overlaps between the different question types are probably due to the fact that the elements of their meanings are very similar. The question particle *ma* can very simply be defined as follows:

$$(45) \quad \llbracket Q \rrbracket (\langle \alpha, \beta \rangle) = \langle \alpha, \{ \beta, \neg \beta \} \rangle$$

This operator takes a structured proposition as its argument and turns the comment of this proposition into a set containing the comment and its negated form. This set represents the restriction of the set of matching answers to the question.

As discussed above, I take *shi-bu-shi* questions to be identical in meaning to corresponding *shi... ma* questions. This means that *shi-bu-shi* partitions a clause in exactly the same way that *shi* would, but in addition, the resulting structured meaning is then taken as the argument of the question operator:

$$(46) \quad \llbracket \text{XP } shi\text{-}bu\text{-}shi \text{ YP} \rrbracket: \llbracket Q \rrbracket (\langle \llbracket \text{XP } shi \text{ YP} \rrbracket \rangle)$$

A-neg-A questions, on the other hand, show an almost one-to-one correspondence between syntactic structure and structured meaning. Basically, the positive and the negated A element make up the comment part of the question, while the rest of the clause constitutes the topic:

$$(47) \quad \llbracket \text{XP A-neg-A YP} \rrbracket: \langle \langle \text{YP}, \text{XP} \rangle, \{ A, \neg A \} \rangle$$

#### 4.2.2 Applications

Let me first illustrate the application of the definition in (45) to *ma* questions. Remember that by the PCMH, the structured meaning of a clause is determined by its predicate structure.

- (48) a. *Zhāngsān qù guò Běijīng ma?*  
 Zhangsan go EXP Beijing Q  
 'Has Zhangsan ever been to Beijing?'
- b. (i) Structured meaning of proposition:  $\langle \text{zhangsan}, \lambda x. \text{go}(x)(\text{beijing}) \rangle$   
 (ii) Meaning of question, after application of question operator:  
 $\langle \text{zhangsan}, \{ \lambda x. \text{go}(x)(\text{beijing}), \lambda x. \neg \text{go}(x)(\text{beijing}) \} \rangle$

In prose: The question particle *ma* takes the structured meaning of the entire preceding phrase as its argument. The structured meaning of the phrase is determined by its predicate structure as defined by the PCMH: The phrase is split into a topic part  $\alpha$  and a comment part  $\beta$  yielding the form  $\langle \alpha, \beta \rangle$ . What  $Q$  then does is to transform  $\beta$  into a set of predicates which restricts the set of matching answers to the question, this set being of the form  $\{\beta, \neg\beta\}$ . The result in (48-b) means that it is part of the Common Ground that some predicate is true of Zhangsan and the question is whether this predicate is *has been to Beijing* or *has not been to Beijing*.

If you give one of the elements of  $\beta$  as an answer to the question, the resulting meaning is the proposition you get if you apply the answer to the meaning of  $\alpha$ . So if you answer the question in (48-b) negatively as indicated in (49), the meaning of that answer is correctly, if trivially, predicted to be ‘Zhangsan has not been to Beijing’.

- (49) a. *méi qù guò Běijīng*  
 NEG.PFV go EXP Beijing  
 ‘No, Zhangsan has not been to Beijing’ (=  $\lambda x. \neg \text{go}(x)(\text{beijing})$ )  
 b.  $[\lambda x. \neg \text{go}(x)(\text{beijing})](\text{zhangsan}) =$   
 $\neg \text{go}(\text{zhangsan})(\text{beijing})$

Let us next turn to *shi-bu-shi* questions. Here, if *shi-bu-shi* precedes the verb phrase, the interpretation is essentially the same as for the simple *ma* question in (48):

- (50) a. *Zhāngsān shì bu shi qù guò Běijīng?*  
 Zhangsan SHI NEG SHI go EXP Beijing  
 ‘Has Zhangsan ever been to Beijing?’  
 b.  $[\text{Zhangsan} [[\text{SHI NEG SHI} [\text{go EXP Beijing}]]]:$   
 $\langle \text{zhangsan}, \{\lambda x. \text{go}(x)(\text{beijing}), \lambda x. \neg \text{go}(x)(\text{beijing})\} \rangle$

So, the utterance indicates that *Zhangsan* is the topic of the clause and the question is whether he has been to Beijing or not, just as in the *ma*-question in (48).

In the next section we will see that this equivalence between the two question types only holds as long as *shi-bu-shi* directly precedes the verb.

Concluding this section, let us turn to A-neg-A questions. One crucial consequence of the definition in (47) is that, in contrast to *ma* questions, A-neg-A questions can take lower V projections as their information-structural predicate. If my assumptions are correct, the following A-neg-A question only contains the verb and its negation in the  $\beta$  part. The topic then consists of *Zhangsan* and *Beijing* and the question is whether the relation between the two is Zhangsan’s having been to Beijing or Zhangsan’s not having been to Beijing.

- (51) a. *Zhāngsān qù méi qù guò Běijīng?*  
 Zhangsan go NEG.PFV go EXP Beijing  
 ‘Has Zhangsan ever been to Beijing?’

- b. Topic: Zhangsan, Beijing;  
 Question:  $\{\lambda x \lambda y. \mathbf{go}(y)(x), \lambda x \lambda y. \neg \mathbf{go}(y)(x)\}$

We are now for the first time confronted with a topic consisting of more than one constituent. To take care of these cases, I extend the PCMH by the following principle:

- (5) d. For discontinuous topics (consisting of two or more separate constituents): let  $P$  be the main predicate of a clause, and  $a_1, \dots, a_n$  its arguments, such that  $P(a_1), \dots, (a_n)$  gives a proposition. Then the structured meaning of  $P(a_1 \dots a_n)$  is  $\langle (a_1, \dots, a_n), P \rangle$ , where  $(a_1, \dots, a_n)$  is an ordered set of topic constituents and  $P$  is the comment.

At this point, these subtle differences in meaning between the different question types only follow from my assumptions but can not be proven by the answer test: All three questions, (48), (50) and (51), can be answered pretty safely both by the lexical verb plus aspect marker *qu guo* ‘been to’ alone, as well as by the higher projection *qu guo Beijing* ‘been to Beijing’. This is not a big surprise as, in general, questions can be answered more or less successfully even by answers which are no total match to the question and omissions of previously uttered material are paramount.

The proof that the differences in meanings which my assumptions predict are real will have to come from other observations, which will be discussed in the following section.

### 4.3 Empirical consequences

#### 4.3.1 Evidence from manner adverbs

While the previous section was centered around the overlaps between the different question types, this section is about the differences between them.

The first such difference concerns manner adverbs. As Ernst (1994) has worked out in considerable detail, manner adverbs are banned from A-neg-A questions, as long as the A element is restricted to the lexical head of the predicate. The other two question types face no comparable restrictions. The example below is adapted from (Ernst 1994, p. 248).

- (52) a. *Lǎobǎn yánli de zébèi Zhāngsān ma?* (ma question)  
 boss sternly ADV reprove Zhangsan Q  
 ‘Does the boss sternly reprove Zhangsan?’
- b. *Lǎobǎn shì bu shì yánli de zébèi Zhāngsān?* (shi-bu-shi question)  
 boss SHI NEG SHI sternly ADV reprove  
 Zhangsan  
 ‘Does the boss sternly reprove Zhangsan?’



- c. \**Lǎobǎn yánlì de zé(bèi) bù zébèi Zhāngsān?* (A-neg-A question)  
 boss sternly ADV reprove NEG reprove Zhangsan  
 intended: ‘Does the boss sternly reprove Zhangsan?’

As it turns out, if we apply the principles established in this paper to the interpretation of the examples in (52), the observed differences in grammaticality find an almost banal explanation. To avoid the complications of event semantics, let us assume for the moment that the meaning of a manner adverb like *sternly* directly applies to a function, not the event this function denotes:

$$(53) \quad \llbracket \text{sternly} \rrbracket = \lambda f. \text{sternly}(f)$$

The meaning of the A-neg-A question would then be as follows:

- (54). a. \**Lǎobǎn yánlì de zé(bèi) bù zébèi Zhāngsān?*  
 boss sternly ADV reprove NEG reprove Zhangsan  
 intended: ‘Does the boss sternly reprove Zhangsan?’  
 b. The verb is the A element; so only the verb is in the comment part of the structured meaning of the proposition:  $\lambda x \lambda y. \text{reprove}(y)(x)$   
 The topic part contains the verb’s object, the adverb and the subject:  $(\text{zhangsan}, \lambda f. \text{sternly}(f), \text{iy. boss}(y))$   
 c. If we now apply the question operator, we get the structured meaning of the entire question:  
 $\langle (\text{zhangsan}, \lambda f. \text{sternly}(f), \text{iy. boss}(y)), \{ \lambda x \lambda y. \text{reprove}(y)(x), \lambda x \lambda y. \neg \text{reprove}(y)(x) \} \rangle$

So if someone were to ask this A-neg-A question, they would presuppose that there is something that the boss does sternly to Zhangsan; and the question would be whether that stern action is one of reprovng him or one of not reprovng him. This implies the possibility that ‘the boss sternly doesn’t reprove Zhangsan’. This sounds off in English and so does the Chinese version:<sup>5</sup>

- (55) \**Lǎobǎn yánlì de bù zébèi Zhāngsān.*  
 boss sternly ADV NEG reprove Zhangsan  
 \*?‘The boss sternly doesn’t reprove Zhangsan.’

Independent from the details of the derivation, the reason why the A-neg-A question sounds wrong is then the same reason for which a simple negated predicate cannot be modified by a manner adverb. In the scenario sketched out here, this reason is that such sentences require the listener to conceptualize an event characterized by the absence of a specific action, an ‘event of not reprovng’. The oddness of the sentence thus comes from a pragmatic markedness of such a requirement.

<sup>5</sup> In fact, the Chinese version is probably even less acceptable than the English one, possibly because only few languages are as happy to break linguistic conventions for stylistic effects as English.

This problem only arises because the adverb *sternly* is part of the topic of the question, while the verb *to reprove* constitutes the comment part. The same conditions do not apply for the two other questions under consideration.

Turning to the *shi-bu-shi* question, we get the following results:

- (56) a. *Lǎobǎn shì bu shì yánlì de zébèi Zhāngsān?*  
 boss SHI NEG SHI sternly ADV reprove Zhangsan  
 b. boss [SHI NEG SHI sternly ADV reprove Zhangsan]]:  
 Topic: the boss;  $\iota y.boss(y)$   
 Question: does he sternly reprove Zhangsan (or does he not sternly reprove Zhangsan)?  
 $\{\lambda x.sternly(reprove(x)(zhangsan)), \lambda x.\neg sternly(reprove(x)(zhangsan))\}$

Here, the assertion is that some predicate is true of the boss and asks whether ‘sternly reprovng Zhangsan’ is such a predicate. This interpretation is fine and does not run into the problems seen with *A-neg-A* questions.

The corresponding *ma* question yields the same interpretation as the *shi-bu-shi* question:

- (57) a.  $[[[Lǎobǎn] [yánlì de zébèi Zhāngsān]] ma]?$   
 boss sternly ADV reprove Zhangsan Q  
 ‘Does the boss sternly reprove Zhangsan?’  
 b. As *sternly* is an adjunct to the VP, according to the PCMH, this means that the phrase *sternly reprove Zhangsan* is mapped to the comment of the structured meaning, while *the boss* is mapped to the topic:  
 Topic: the boss;  $\iota y.boss(y)$   
 Question: does he sternly reprove Zhangsan (or does he not sternly reprove Zhangsan)?  
 $\{\lambda x.sternly(reprove(x)(zhangsan)), \lambda x.\neg sternly(reprove(x)(zhangsan))\}$

The question operator  $Q$  takes the structured meaning of the preceding phrase as its argument—the phrase is split into the topic *the boss* and the comment *sternly reproves Zhangsan* at VP level. The operator  $Q$  then transforms the comment part into a set of two elements by adding the negated version of ‘sternly reproves Zhangsan’.

This result can be confirmed independently if we take a look at appropriate answers: A felicitous answer to the question in (57) cannot consist of the bare verb, but must include the adverb as shown in (58):

- A:  $*(yánlì de) zébèi tā$   
 Sternly ADV reprove 3S  
 ‘yes’

The felicitous answer corresponds exactly to the positive element contained in the restriction of the set of answers as shown in (57).

To summarize this section, I have suggested that the apparent incompatibility of A-neg-A questions with manner adverbs can be reduced to the observation that manner adverbs do generally not apply to negated predicates. My previous assumptions have allowed me to derive that only in A-neg-A questions could the adverb be confronted with a negated predicate, which results in the rejection of such structures by native speakers. I have also shown that for the other types of polarity questions, the problem does not arise.

#### 4.3.2 Evidence from contrastivity and information structure within the question

Another observed difference between the three question types can equally be shown to fall out from the principles and definitions assumed in this paper. This difference concerns the ability to host a contrastive comment constituent other than the verb (cf. Schaffar and Chen 2001). The most remarkable effect of this phenomenon can be observed in cases like the following:

- (58) Context: *I think you should know that I saw Zhangsan kiss a girl last night.*
- a. *Zhāngsān shì-bu-shì qīnwěn le [Xiǎohóng]<sub>F</sub>?* (shi-bu-shi question)  
 Zhangsan COP-NEG-COP kiss PFV Xiaohong  
 ‘Did Zhangsan kiss [Xiaohong]<sub>F</sub>?’
  - b. *Zhāngsān qīnwěn le [Xiǎohóng]<sub>F</sub> ma?* (ma question)  
 Zhangsan kiss PFV Xiaohong Q  
 ‘Did Zhangsan kiss [Xiaohong]<sub>F</sub>?’
  - c. *#Zhāngsān qīn méi qīnwén Xiǎohóng?* (A-neg-A question)  
 Zhangsan kiss NEG.PFV kiss Xiaohong  
 ‘Did Zhangsan kiss Xiaohong?’

The given context suggests that the object of the question should be contrastive and belong to the comment, just as the *wh* word in the question *Who did Zhangsan kiss?* would. I suggest that the reason why (58-c) sounds odd here is that it does not allow for *Xiaohong* to be interpreted as a comment, only as a topic (contrastive or not).

This follows from the condition on the interpretation of A-neg-A questions in (47): According to the principle in (47), the A element of an A-neg-A question constitutes the comment part of its main proposition, the part which the question is about. In the example in (58-c), the phrase *Xiaohong* can therefore only be part of the topic, not the comment. But all the material in the topic part of a clause is supposed to be given, to be part of the Common Ground. In the given situation however, *Xiaohong* is the only piece of information which is not directly supplied by the previous statement and must therefore be expected to be the comment rather than part of the topic. I will briefly sketch the derivation of the question below (as always, a detailed derivation is given in Appendix B).

- (58-c) a. *Zhāngsān qīn méi qīnwén Xiǎohóng?*  
 Zhangsan kiss NEG.PFV kiss Xiaohong  
 ‘Did Zhangsan kiss Xiaohong?’

- b. Topic: Zhangsan and Xiaohong;  
 Question: did he kiss her?  $\{\lambda x\lambda y.\mathbf{kiss}(y)(x), \lambda x\lambda y.\mathbf{-kiss}(y)(x)\}$

In an A-neg-A question, only the A element, in this case the verb, enters into the comment part; so everything else is marked as given information. This means that, in (58), the object *Xiaohong* is automatically a topic, which is what makes (58) infelicitous in the given situation, even if *Xiaohong* is interpreted as contrastive. I suggest that this mismatch between the information structure of the question and the Common Ground is responsible for the infelicity of the question.

As a matter of fact, there is no general rule against A-neg-A questions with contrastive objects, as long as they are topics. In situations allowing for contrastive topic objects as in (59) and in sentences in which the contrastive object is overtly marked as topic by being preposed as in (60), A-neg-A questions are perfectly fine:

- (59) a. *Teacher Li has a lot of experience. He has been to many countries and has learned several languages.*  
*Tā qù méi qù guò [fǎguó]<sub>F</sub>?*  
 3S go NEG.PFV go EXP France  
 ‘Has he been to [France]<sub>F</sub>?’

The context of this example can be understood to give a list of countries teacher Li might have been to. France might be one of them. Whether or not the answer to this question is *yes*, it would be entirely natural to continue with a list of questions such as *Has he been to Korea, has he been to New Zealand?* and each time, the answer could be either *yes* or *no*. Compare this to the situation in (58): If the question *Did he kiss Xiaohong* is answered by *yes*, it would be odd to continue with a list of similar questions like *did he kiss Meilin, did he kiss Jiamin?*

Note also that for (58), it would be weird in the given context if *Xiaohong* was put into a topic position even with a particle question, while for (59), it would not:

- (60) a. #*Xiǎohóng tā qīnwén ma?*  
 Xiaohong 3S kiss Q  
 ‘What about Xiaohong, did he kiss her?’  
 b. *fǎguó tā qù guò ma?*  
 France 3S go EXP Q  
 ‘What about France, did he go there?’

The same principle is illustrated by the following example from a story published online (Feicui 2010):

- (61) a. *The topic under discussion is the relations between the male protagonist Mu Rongfu and the women surrounding him.*  
 b. *Àzhū’ābì tā xǐ bù xǐhuan ne?*  
 Azhuabi 3S like NEG like QP  
 ‘And Azhuabi, does he like her?’

The relevant difference with the example in (58) is that, in (61), the background contains a list of female characters and the protagonist’s relation to them is discussed case by case. The topical question is therefore *which relation does Mu Rongfu have with each of these characters?* and not *who does he like?* Thus, A-neg-A questions with the lexical verb as ‘A’ element are generally compatible with contrastive topicalized objects, but not with comment objects, contrastive or not.

By contrast, both the *shi-bu-shi* question and the *ma* question in (58) can be mapped to a structured meaning in which *Xiaohong* is part of the comment. For both question types, the comment part of the language consists of the verb phrase and its negative counterpart:  $\{\lambda x.\mathbf{kiss}(x)\mathbf{xiaohong}, \lambda x.\mathbf{-kiss}(x)(\mathbf{xiaohong})\}$ . In this meaning, *Xiaohong* is part of the comment and is therefore felicitous in the given situation. Furthermore, in the *shi-bu-shi* question,  $\lambda x.\mathbf{kiss}(x)(\mathbf{xiaohong})$  is automatically interpreted as contrastive because of the presence of *shi*, while in the *ma* question the same effect can be achieved by the appropriate prosodic marking.

There is one more prediction from the previous assumptions which I would like to comment on here: According to the definition of *shi* and the PCMH, there should be a certain asymmetry between comment subjects and objects in polarity questions.

To explore this prediction, I now briefly turn to contrastive subjects. Neither A-neg-A questions nor *ma* questions without *shi* are very good at hosting a comment subject, in contrast to *shi-bu-shi* questions, as long as *shi-bu-shi* directly precedes the subject. These *shi-bu-shi* questions receive a cleft-like reading, just like their declarative counterparts (as in (25))

The relevant examples are given below:

- (62) *Sherlock Holmes says: “I know who killed Julia.” Watson asks:*
- a. #*Roylott daifù dǎ-sǐ méi dǎ-sǐ*  
 Roylott doctor beat-dead NEG.PFV beat-dead  
*Zhūliyǎ?* (A-neg-A question)  
 Julia  
 ‘Did Dr. Roylott kill Julia?’
  - b. ?#*Roylott daifù dǎ-sǐ le Zhūliyǎ ma?* (*ma* question)  
 Roylott doctor beat-dead PFV Julia Q  
 ‘Did Dr. Roylott kill Julia?’
  - c. *Shì bu shi Roylott daifù dǎ-sǐ le*  
 SHI NEG SHI Roylott doctor beat-dead PVF  
*Zhūliyǎ?* (*shi-bu-shi* question)  
 Julia  
 ‘Was it Dr. Roylott who killed Julia?’

Again, these observations follow from the established assumptions: Given the context in (62), it is part of the Common Ground that someone killed Julia and common sense tells us that she was probably only killed once, most likely by only one person. So the question should be about who the murderer is. This means that the guessed culprit, *Roylott* has to be part of the comment of the question. However, the A-neg-A question only maps the bare verb to the question comment; the resulting impression is that there

is some kind of relation between Roylott and Julia and the question is whether this relation is one of him killing her. So in the given context, this is highly odd.

The *ma* sentence fares slightly better with informants. Here, the entire verb phrase constitutes the comment, while *Roylott* is still the topic. Thus, the impression is that the previous discourse revolved about Roylott and the new question is whether ‘killing Julia’ is something that he did.<sup>6</sup>

It is therefore expected that the *shi-bu-shi* question should be the most appropriate reaction to the linguistic situation—this expectation is borne out by speakers’ judgements.

In the *shi-bu-shi* question, *Roylott* is mapped to the comment part of the question, whereas the rest of the clause makes up the topic. At the same time, because of the requirement to apply the comment *Roylott* to the topic *killed Julia*, the familiar cleft-reading arises: *Roylott* has to shift from an individual expression to the predicate *is Roylott*, while the predicate *killed Julia* has to shift to the individual expression *the one who killed Julia*.

The respective structured meanings for each question are given in (62) in Appendix B.

Of the four different meanings available for the three questions, only the two meanings of the *shi-bu-shi* question satisfy the contextual requirement that the constituent *Dr. Roylott* be part of the comment, that is, contained in the  $\beta$  part of the meaning. Of these two, the first one is clearly the more appropriate, since it minimizes the given material in  $\beta$  (cf. the *Maximize Presupposition* principle by Heim 1991).

Summarizing this section, I have discussed two differences between the three types of polarity questions and I have shown how these differences can be derived from previously established principles.

## 5. Conclusion

In this paper, I have argued that in Mandarin Chinese, predicate structure determines the topic-comment structure of a clause. Furthermore, I have suggested that non-copular *shi* is a comment marker which determines the information structure of a clause.

I gave a definition for *shi* which takes into account all of its various applications to arguments of different types. This definition also accounts for the cleft-like interpretation of cases in which *shi* takes an individual expression as *C* argument and a predicate as *T* argument.

In order to account for overlaps in meaning and answer sets between the three different types of polarity questions—*ma* questions, A-neg-A questions and *shi-bu-shi* questions—I gave definitions for all three question types which make the underlying semantic parallels transparent.

<sup>6</sup> One should expect this question to be most acceptable if Sherlock and Watson have already established a list of suspects and Watson picks Roylott out of this list.

Then, I showed that the restrictions on manner adverbs in A-neg-A questions, as well as the absence of such restrictions in the other two question types, are a direct consequence of the previous assumptions. The same is true for the restrictions on contrastive comments in the various question types, including the asymmetry between commenting subjects and commenting objects. These observations lend support to the notion that contrastivity is independent from and orthogonal to topic-comment structure.

The implications of the assumptions made here go much further than this and I suspect they might play a crucial role in a wide range of phenomena such as negation and contrast sensitive particles. At the same time, the relation of my assumptions to similar approaches such as the Extended Mapping Hypothesis by Tsai (1999) deserves to be explored and discussed in detail.

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## Appendix A: Basic conventions

### Individuals and predicates

Linguistic expressions are either individual expressions or functions. Functions are also called *predicates*. Individual expressions may be simple, such as proper names, for example *Fred*; they can also be more complex such as *the cat that lives on the roof*. Predicates are expressions which take arguments and give a truth value. The argument of a predicate may be an individual expression or another function. For example, a verb like *sleep* is a function from an individual to a truth value. If you apply the function *sleep* to the individual expression *Fred*, you get the proposition *Fred sleeps*. This proposition is either true or false given a time and world of evaluation. So *sleep* takes an individual expression like *Fred* and gives a truth value—‘one’ if Fred does sleep and ‘zero’ if he doesn’t.

Regular nouns are also predicates. Thus, the expression *cat* is a predicate which can be applied to an individual expression such as *Fred* and give the truth value ‘one’ if Fred is a cat and ‘zero’ if he’s not.

A function can take more than one argument. A case in point is the set of transitive verbs like *love*. The verb *love* takes two individual expressions as arguments and turns out a truth value. The two individual expressions could be *Romeo* and *Juliet* and the truth value of the function *love* applied to these two arguments would be ‘one’ if Romeo does love Juliet and zero if he doesn’t.

Lastly, a function can also take another function as an argument, which is mostly the case with quantifiers. In this paper, I also assume an adverb like *sternly* to be a function which takes another function as an argument, namely the VP *reprove Zhangsan*. The more standard approach to adverbial meanings is that they take an event as an argument, which is denoted by a VP. I circumvent this approach here because there is a slightly involved discussion around the compositional derivation of events and because the details of this do not concern the discussion at hand, as far as I can see.

### Lambda calculus

Functions are represented as lambda expressions: argument variables which have not been filled by corresponding expressions, and have not been bound by other quantifiers or operators, are bound by the lambda operator  $\lambda$ . Lower case letters from the end of the alphabet such as  $x, y, z$  conventionally stand in for individual expressions.

The predicate *sleep* is thus represented as  $\lambda x.\mathbf{sleep}(x)$ . The meaning of *cat* is represented as  $\lambda x.\mathbf{cat}(x)$ ; you could also write  $\lambda x.x \mathbf{is a cat}$ . A dot separates the  $\lambda x$  part from the  $\mathbf{cat}(x)$  part. Before the dot, there is always a variable bound by an operator; after the dot, there is a declaration about what holds of the variable.

Some authors use square brackets instead of the dot:  $\lambda x[\mathbf{cat}(x)]$ .

Each open argument position is announced by a lambda operator at the beginning of the expression. A transitive expression like *love* therefore has the form  $\lambda x\lambda y.\mathbf{love}(y)(x)$ .

If a function is applied to a suitable argument, the argument variable is replaced by the argument expression; consequently, there is no longer a need for a lambda operator to bind a variable. For example, if you apply *sleep* to *Fred*, you get the following:

$$(63) \quad [\lambda x.\mathbf{sleep}(x)](\mathbf{fred}) = \mathbf{sleep}(\mathbf{fred})$$

### Semantic types

Linguistic expressions can be sorted into different types. For current purposes, the only two basic types which are of concern to us are  $e$  and  $t$ . Type  $e$  is for individual expressions. Type  $t$  is for truth values; propositions are of type  $t$ . Predicates are functions which result in a proposition if their argument variables are filled in. A predicate like *sleep*,  $\lambda x.\mathbf{sleep}(x)$  is of type  $\langle e, t \rangle$ : It takes an individual expression of type  $e$  as an argument and the result is a proposition, of type  $t$ . For example, *Fred* is of type  $e$ . If you apply *sleep* to *Fred*, the result is *Fred sleeps*, which is a proposition that can be true or false.

Transitive predicates such as *love* are of type  $\langle e, \langle e, t \rangle \rangle$ : They take an individual expression; then they take another individual expression and the result is a proposition.

In the main text, the main two types of interest to us are  $e$  and  $\langle e, t \rangle$ . There are ways to shift an expression from one type to another. If we want to use a predicate



like *cat* as an individual expression, as in *the cat*, for example, the definite article initiates a shift from the function  $\lambda x.\mathbf{cat}(x)$  to  $i x.\mathbf{cat}(x)$ . The only thing that has changed in the formalization is that the lambda ( $\lambda$ ) has been replaced by a *iota* ( $i$ ). Whereas the lambda operator announces that there are argument variables left which need to be filled or otherwise bound, the iota operator reads ‘the unique  $x$  such that...’. In the *cat* example,  $i x.\mathbf{cat}(x)$  means ‘the unique  $x$  such that  $x$  is a cat’. The shift from a predicate of type  $\langle e, t \rangle$  is called the *iota shift*.

The other type shift relevant for the main text is the shift from type  $e$  to type  $\langle e, t \rangle$ . If you want to use an individual expression like *Harold* as a predicate, for example in *The winner is Harold*, you need *Harold* to shift from type  $e$  to type  $\langle e, t \rangle$ . Otherwise you would be stuck with two individual expressions, *the winner* and *Harold* and couldn’t do much with them.

An individual expression is transformed into a predicate by the *ident* shift: The expression *Harold* shifts to  $x$  is *Harold*,  $\lambda x.x = \mathbf{harold}$ .

### Structured meanings

For most purposes, it is sufficient to give the meaning of an expression in terms of its truth functions. However, when dealing with certain information-structural categories such as topic and comment, it becomes necessary to represent these categories in the meaning of an expression too. One way to represent the partition of a phrase into a topic part and a comment part is to show them as an ordered pair. An ordered pair is something like a set consisting of two elements, but in contrast to a set, the two elements of a pair (which you could also call a 2-tuple) are fixed in their order. Ordered pairs are represented by round brackets  $()$  or angle brackets  $\langle \rangle$ . The same notation is used for complex types such as  $\langle e, t \rangle$  and other expressions for which the order of elements is crucial.

In the approach developed in the main text, the first element of such an ordered pair is the topic of a clause, while the second one is the comment. The topic element might consist of several ordered subelements, which are embraced by round brackets:  $\langle (\text{TOPIC}_1, \text{TOPIC}_2, \dots, \text{TOPIC}_n), \text{COMMENT} \rangle$ .

## Appendix B: Definitions and derivations

The numbered labels correspond to the labels in the main text.

(64) Contrastivity:

- a. If  $\alpha$  is of type  $\sigma$  and contains a contrastive constituent  $X$  of type  $\tau$ , then  $\text{ALT}(\alpha)$  is a set of expressions of type  $\sigma$ , which differ from each other in that  $X$  is replaced by contextually relevant alternatives to  $X$  of type  $\tau$ .
- b. If  $\beta$  is of type  $\sigma$  and contains a contrastive constituent  $X$  of type  $\tau$ , then  $\text{ALT}(\beta)$  is a set of expressions of type  $\sigma$ , which differ from each other in that  $X$  is replaced by contextually relevant alternatives to  $X$  of type  $\tau$ .
- c.  $\text{ALT}(\alpha)$  is the set of alternatives to a contrastive topic.  $\text{ALT}(\beta)$  is the set of alternatives to a contrastive comment.

- (6) a.  $[[L\check{i} \ xi\check{a}nsheng]_{NP} \ [[z\grave{a}i \ Sh\grave{a}ngh\check{a}i]_{PP} \ [xu\acute{e}x\acute{i} \ f\check{a}w\acute{e}n.]_{VP}]_{VP}]$   
 Li Mister at Shanghai study French  
 ‘Mr Li studies French in Shanghai.’  
 b.  $[[Li \ Mister \ at \ Shanghai \ study \ French]] =$   
 $[\lambda x \lambda e. \mathbf{study}(x)(\mathbf{french})(e) \wedge \mathbf{in \ shanghai}(e)](\mathbf{li}) =$   
 $\langle \mathbf{li}, \lambda x \lambda e. \mathbf{study}(x)(\mathbf{french})(e) \wedge \mathbf{in}(\mathbf{shanghai})(e) \rangle =$
- (15) If  $C \in D_{\langle e,t \rangle}$  and  $T \in D_e$ , then  $[[\mathbf{shi}]](C)(T) = C(T)$   
 a.  $[[W\grave{a}n \ M\grave{a}n \ [sh\grave{i} \ [w\grave{a}ig\acute{u}or\acute{e}n.]]]$   
 Wan Man SHI foreigner  
 ‘Wan Man is a foreigner.’  
 b.  $[[\mathbf{shi}]](\lambda x. \mathbf{foreigner}(x))(\mathbf{wan \ man}) =$   
 $(\lambda x. \mathbf{foreigner})(\mathbf{wan \ man}) =$   
 $\langle \mathbf{wan \ man}, \lambda x. \mathbf{foreigner}(x) \rangle$
- (17) If  $C \in D_e$  and  $T \in D_e$ , then  $C$  will shift to type  $\langle e, t \rangle$ :  
 a.  $T\bar{a} \ [sh\grave{i} \ [Y\acute{u} \ Hu\acute{a}]].$   
 3S SHI Yu Hua  
 ‘He is Yu Hua.’  
 b.  $[[\mathbf{shi}]](\mathbf{yu \ hua})([\mathbf{he}]) =$  here comes the *ident* shift  
 $[\lambda y. y = \mathbf{yu \ hua}](\mathbf{he}) =$   
 $\langle \mathbf{he}, \lambda y. y = \mathbf{yu \ hua} \rangle$
- (19) If  $C \in D_e$  and  $T \in D_{e,t}$ , then  $C$  will shift to type  $\langle e, t \rangle$  and  $T$  will shift to  $e$ .  
 a.  $[Sh\grave{i} \ [Roylott \ d\grave{a}ifu]] \ d\check{a}-s\check{i} \ le \ Zh\check{u}l\check{i}y\check{a}.$   
 SHI Roylott doctor beat-dead PVF Julia  
 ‘It was Dr. Roylott who killed Julia.’  
 b.  $[[\mathbf{shi}]](\mathbf{roylott})(\lambda y. \mathbf{kill}(\mathbf{julia})(y)) =$  both  $C$  and  $T$  shift  
 $[\lambda x. x = \mathbf{roylott}](\iota y. \mathbf{kill}(\mathbf{julia})(y)) =$   
 $\langle \iota y. \mathbf{kill}(\mathbf{julia})(y), \lambda x. x = \mathbf{roylott} \rangle =$   
 $(\iota y. \mathbf{kill}(\mathbf{julia})(y)) = \mathbf{roylott}$
- (20)  $[[\mathbf{shi}]](C)(T_{1\dots n}) = C(T_{1\dots n})$ .  $C$  is always interpreted as the main predicate in the sense of (5):  $C(T_{1\dots n}) = \langle T_{1\dots n}, \lambda x_1 \dots \lambda x_n. C(x_{1\dots n}) \rangle$ .  
 If  $C \in D_e$ , then  $C$  shifts to type  $\langle e, t \rangle$  by operation *ident*:  $j \rightarrow \lambda x[x = j]$  and  
 a.  $T$  is either of type  $e$  as in (8) or  
 b.  $T$  is of type  $\langle e, t \rangle$ ; in that case, it shifts to  $e$  by operation *iota*:  
 $P \rightarrow \iota x[P(x)]$  as in (19).
- (24) a.  $Zh\check{a}ngs\check{a}n \ sh\grave{i} \ xu\acute{e}x\acute{i} \ y\check{x}u\acute{e}.$   
 Zhangsan SHI study medicine  
 ‘Zhangsan studies medicine.’  
 b.  $[[\mathbf{shi}]](\lambda x. \mathbf{study}(x)(\mathbf{medicine}))(\mathbf{zhangsan}) =$  by (20)  
 $[\lambda x. \mathbf{study}(x)(\mathbf{medicine})](\mathbf{zhangsan}) =$  by (5)  
 $\langle \mathbf{zhangsan}, \lambda x. \mathbf{study}(x)(\mathbf{medicine}) \rangle$

- (25) *Shì Zhāngsān xuéxī yīxué.*  
 SHI Zhangsan study medicine  
 a. (i) ‘It is Zhangsan who studies medicine.’  
 (ii)  $\llbracket \text{shi} \rrbracket (\text{zhangsan}) (\lambda x. \text{study}(x)(\text{medicine})) =$  by (20)  
 $\langle \iota x. \text{study}(x)(\text{medicine}), \lambda y. y = \text{zhangsan} \rangle$   
 b. (i) ‘It’s that Zhangsan studies medicine.’  
 (ii) In this case, there is no sentence-internal topic. Instead, the topic of the utterance has to be recovered pragmatically from the discourse:  
 $\llbracket \text{shi} \rrbracket (\text{study}(\text{zhangsan})(\text{medicine})) (\emptyset) =$  by (20)  
 $\langle \emptyset, \text{study}(\text{zhangsan})(\text{medicine}) \rangle$
- (48) a. *Zhāngsān qù guò Běijīng ma?*  
 Zhangsan go EXP Beijing Q  
 ‘Has Zhangsan ever been to Beijing?’  
 b.  $\llbracket \text{Zhangsan go Beijing Q} \rrbracket =$   
 $\llbracket Q \rrbracket (\llbracket \text{Zhangsan} [\text{vp go Beijing}] \rrbracket) =$  by (5)  
 $\llbracket Q \rrbracket (\llbracket \text{zhangsan}, \lambda x. \text{go}(x)(\text{beijing}) \rrbracket) =$  by (45)  
 $\langle \text{zhangsan}, \{ \lambda x. \text{go}(x)(\text{beijing}), \lambda x. \neg \text{go}(x)(\text{beijing}) \} \rangle$
- (50) a. *Zhāngsān shì bu shì qù guò Běijīng?*  
 Zhangsan SHI NEG SHI go EXP Beijing  
 ‘Has Zhangsan ever been to Beijing?’  
 b.  $\llbracket \text{Zhangsan SHI NEG SHI go Beijing} \rrbracket =$  by (46)  
 (i)  $\llbracket Q \rrbracket (\llbracket \text{shi} \rrbracket (\lambda x \lambda y. \text{go}(y)(x))(\text{beijing})(\text{zhangsan})) =$  by (20)  
 $\llbracket Q \rrbracket (\langle \langle \text{beijing}, \text{zhangsan} \rangle, \lambda x \lambda y. \text{go}(y)(x) \rangle) =$  by (45)  
 $\langle \langle \text{beijing}, \text{zhangsan} \rangle, \{ \lambda x \lambda y. \text{go}(y)(x), \lambda x \lambda y. \neg \text{go}(y)(x) \} \rangle$   
 (ii)  $\llbracket Q \rrbracket (\llbracket \text{shi} \rrbracket (\lambda x. \text{go}(x)(\text{beijing}))(\text{zhangsan})) =$  by (20)  
 $\llbracket Q \rrbracket (\langle \text{zhangsan}, \lambda x. \text{go}(x)(\text{beijing}) \rangle) =$  by (45)  
 $\langle \text{zhangsan}, \{ \lambda x. \text{go}(x)(\text{beijing}), \lambda x. \neg \text{go}(x)(\text{beijing}) \} \rangle$
- (51) a. *Zhāngsān qù méi qù guò Běijīng?*  
 Zhangsan go NEG.PFV go EXP Beijing  
 ‘Has Zhangsan ever been to Beijing?’  
 b.  $\llbracket \text{Zhangsan} [\text{go NEG.PFV go}] \text{ Beijing} \rrbracket =$  by (47)  
 $\langle \langle \text{beijing}, \text{zhangsan} \rangle, \{ \lambda x \lambda y. \text{go}(y)(x), \lambda x \lambda y. \neg \text{go}(y)(x) \} \rangle$
- (54) a. \**Lǎobǎn yánlì de zé(bèi) bù zébèi Zhāngsān?*  
 boss sternly ADV reprove NEG reprove Zhangsan  
 intended: ‘Does the boss sternly reprove Zhangsan?’  
 b.  $\llbracket \text{boss sternly ADV reprove NEG reprove Zhangsan} \rrbracket =$  by (47)  
 $\langle \langle \text{zhangsan}, \lambda f. \text{sternly}(f), \iota y. \text{boss}(y) \rangle, \{ \lambda x \lambda y. \text{reprove}(y)(x), \lambda x \lambda y. \neg \text{reprove}(y)(x) \} \rangle$

- (56) a. *Lǎobǎn shì bu shì yánlì de zébèi Zhāngsān?*  
 boss SHI NEG SHI sternly ADV reprove Zhangsan  
 ‘Does the boss sternly reprove Zhangsan?’  
 b.  $\llbracket \llbracket \text{boss} [\text{SHI NEG SHI sternly ADV reprove Zhangsan}] \rrbracket \rrbracket =$  by (46)  
 $\llbracket \llbracket \llbracket \text{shi} \rrbracket (\lambda x. \text{sternly}(\text{reprove}(x)(\text{zhangsan})))(iy. \text{boss}(y)) \rrbracket \rrbracket =$  by (20)  
 $\llbracket \llbracket \llbracket iy. \text{boss}(y), \lambda x. \text{sternly}(\text{reprove}(x)(\text{zhangsan})) \rrbracket \rrbracket \rrbracket =$  by (45)  
 $\langle iy. \text{boss}(y), \{ \lambda x. \text{sternly}(\text{reprove}(x)(\text{zhangsan})) \},$   
 $\lambda x. \neg [\text{sternly}(\text{reprove}(x)(\text{zhangsan}))] \rangle$
- (57) a. *Lǎobǎn yánlì de zébèi Zhāngsān ma?*  
 boss sternly ADV reprove Zhangsan Q  
 ‘Does the boss sternly reprove Zhangsan?’  
 b.  $\llbracket \llbracket \llbracket \llbracket \text{Lǎobǎn} \rrbracket [\text{yánlì de zébèi Zhāngsān}] \text{ ma} \rrbracket \rrbracket =$  by (5)  
 $\llbracket \llbracket \llbracket \llbracket iy. \text{boss}(y), \lambda x. \text{sternly}(\text{reprove}(x)(\text{zhangsan})) \rrbracket \rrbracket \rrbracket \rrbracket =$  by (45)  
 $\langle iy. \text{boss}(y), \{ \lambda x. \text{sternly}(\text{reprove}(x)(\text{zhangsan})) \},$   
 $\lambda x. \neg \text{sternly}(\text{reprove}(x)(\text{zhangsan})) \rangle$
- (58-c) a. *Zhāngsān qīn méi qīnwén Xiǎohóng?*  
 Zhangsan kiss NEG.PFV kiss Xiaohong  
 ‘Did Zhangsan kiss Xiaohong?’  
 b.  $\llbracket \llbracket \text{Zhangsan kiss NEG kiss Xiaohong} \rrbracket \rrbracket =$  by (47)  
 $\langle \langle \text{xiaohong, zhangsan} \rangle, \{ \lambda x \lambda y. \text{kiss}(y)(x), \lambda x \lambda y. \neg \text{kiss}(y)(x) \} \rangle$
- (62) *Sherlock Holmes says: “I know who killed Julia.” Watson asks:*  
 a. (i) *#Roylott dàifù dǎ-sǐ méi dǎ-sǐ Zhūliànyǎ?*  
 SHI Roylott doctor beat-dead NEG.PFV beat-dead  
 (A-neg-A question)  
 Julia  
 ‘Did Dr. Roylott kill Julia?’  
 (ii)  $\# \langle \langle \text{julia, roylott} \rangle, \{ \lambda x \lambda y. \text{kill}(y)(x), \lambda x \lambda y. \neg \text{kill}(y)(x) \} \rangle$   
 b. (i) *?#Roylott dàifù dǎ-sǐ le Zhūliànyǎ ma? (ma question)*  
 Roylott doctor beat-dead PFV Julia Q  
 ‘Did Dr. Roylott kill Julia?’  
 (ii)  $\# \langle \langle \text{roylott}, \{ \lambda y. \text{kill}(y)(\text{julia}), \lambda y. \neg \text{kill}(y)(\text{julia}) \} \rangle \rangle$   
 c. (i) *Shì bu shì Roylott dàifù dǎ-sǐ le*  
 SHI NEG SHI Roylott doctor beat-dead PVF  
 Zhūliànyǎ? (shi-bu-shi question)  
 Julia  
 ‘Was it Dr. Roylott who killed Julia?’  
 (ii)  $\langle ix. \text{kill}(x)(\text{julia}), \{ \lambda y. y = \text{roylott}, \lambda y. \neg [y = \text{roylott}] \} \rangle$   
 (iii)  $\# \langle \langle \emptyset, \{ \text{kill}(\text{roylott})(\text{julia}), \neg \text{kill}(\text{roylott})(\text{julia}) \} \rangle \rangle$

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