Disjunctions in Mandarin Chinese

MSc Thesis *(Afstudeerscriptie)*

written by

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Abstract

Whereas classical logic treats disjunction as a simple truth-functional connective, its expression in natural language is significantly more complex and polyfunctional. This thesis addresses this complexity by developing a novel functional classification for disjunctive expressions, based on an analysis of three distinct disjunctions in Mandarin Chinese: 或者 *huòzhě*, 还是 *háishì*, and 要么…要么 *yàome…yàome*.

We propose seven functions, distinguishing between *core functions* (Inclusive, Exclusive, Alternative), *associated functions* (List-marker, Dual-under-negation, Exhaustive), and an *off-map function*, the Possibility-marker, which exhibits modal-like properties. Our empirical analysis demonstrates that *huòzhě* acts as a standard declarative disjunction, *háishì* as an obligatorily interrogative disjunction, and *yàome…yàome* as a marker of exhaustive choice.

On the formal side, we demonstrate that Inquisitive Logic effectively models the interrogative semantics of *háishì*. However, to explain the Free Choice inferences associated with these disjunctions, we adopt an alternative framework, namely Bilateral State-based Modal Logic (BSML). Ultimately, this work provides a novel analytical map for the functional spectrum of disjunction, contributing to a deeper understanding of cross-linguistic variation.

Acknowledgments

I first encountered the topic of *disjunction* in Maria's course *The Structure of Semantics*, which explored whether *or* in natural language is exclusive. That small linguistic puzzle sparked my curiosity. When translating the examples into Mandarin, I noticed for the first time that Mandarin uses several distinct disjunctive expressions. It was then that I realized how rich and subtle our everyday language is.

Later, in Floris's *Logic and Conversation* course, I was introduced to *Inquisitive Logic* and saw how elegantly it could capture the semantics of *háishì*. That was when I realized how flexible and creative formal methods can be. At the end of that semester, I attended the Amsterdam Colloquium and met scholars from around the world. When I shared my thoughts on Chinese disjunction and negation, one of them said, "Why not study both?"—and that became the seed of this thesis.

The completion of this work feels like a natural and seamless process, not only because of the intellectual journey itself, but also because of the incredible kindness and support I received throughout. It was this that made the entire experience so enjoyable.

My deepest gratitude goes to Maria Aloni and Tomasz Klochowicz. Your patience, generosity, and encouragement have meant more than I can express. Without your guidance, this work would not have been possible. Thank you, Maria, for your insightful guidance throughout this project. Thank you, Tom, for your kindness and endless patience in discussing every idea—no matter how small.

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To my parents—thank you for your unconditional love and support. Mom, thank you for teaching me to face life with optimism. Dad, thank you for teaching me to pursue my dreams with courage.

I used to see language diversity as a barrier to communication, but this journey has changed my views. I now see it as a source of richness and wonder. The Tower of Babel, therefore, feels not like a curse, but a gift that gave us a more colorful tapestry of human expression. And semantics serves as a key—it allows us to see beyond the differences of language and uncover the shared cognitive mechanisms that unite us all.

Thank you, semantics, for bringing me to all these wonderful people and all these wonderful things.

Contents

Chapter 1

Introduction

In classical logic, disjunction is one of the most fundamental logical connectives. A disjunctive statement is considered true if at least one of its constituent propositions holds true. In natural language, however, disjunctive expressions frequently extend beyond this basic truth-functional role.

This thesis proposes an original classification of disjunctive functions in natural language, based on a detailed analysis of Mandarin disjunctive expressions and supported by cross-linguistic data. This framework identifies seven distinct functions: Inclusive (`INCL`), Exclusive (`EXCL`), Alternative (`ALT`), List-making (`LIST`), Dual-under-negation (`DUAL`), Exhaustive (`EXHA`), and Possibility-maker (`POSS`).

Among these, `INCL`, `EXCL`, and `ALT` are defined as *core functions* of disjunction. Any lexical item that encodes at least one of these three functions is treated as a disjunctive expression in this study. By contrast, the functions of `LIST`, `DUAL`, and `EXHA` are identified as *associated functions*. While frequently co-occurring with disjunctive items, they are not exclusive to disjunction and can be realized by other, non-disjunctive lexical items.

Furthermore, this thesis introduces an *off-map function*, `POSS`. A function is defined as *off-map* in the domain of disjunction if it is realized by disjunctive morphology but its semantic contribution falls outside the canonical scope of disjunction—namely, `INCL`, `EXCL`, and `ALT`. The `POSS` function, attested in languages such as Mandarin 或 *huò* and Japanese あるいは *aruiwa*[1] , is a case in point. Although morphologically disjunctive, its semantic contribution is more akin to an modal particle (e.g., *perhaps*) than disjunction.

In Mandarin, no single disjunctive expression lexicalizes the full set of seven functions identified, whereas English *or* can express all but the Possibility-marker (`POSS`) function.[2] Based on functional distinctions, this thesis proposes a novel function map for three disjunctive expressions in Mandarin, indicating which functions are expressed by each. This mapping method can also be extended to other languages.

Chapter 2 empirically investigates the three Mandarin disjunctions, highlighting their distinct semantic profiles. 还是 *Háishì* is shown to be dedicated to forming alternative questions, whereas 或者 *huòzhě* serves as a declarative disjunction that can combine with the question particle 吗 *ma* to form polar questions. Furthermore, 要么 *yàome* is shown to encode an exhaustive meaning, as evidenced by its unique behavior under negation.

[1]For cross-linguistic lexical items such as those from Mandarin and Japanese, we use the format of Romanized pronunciation followed by the original script. This convention will be followed throughout the paper. We may omit the original script and use only the pronunciation occasionally.

[2]It is theoretically plausible that a language could possess a single disjunction encompassing the entire functional spectrum.

Chapter 3 employs Inquisitive Propositional Logic (InqB) to provide formal definitions for the seven functions and to formulate semantic entries for the Mandarin disjunctives and the particle *ma*. Through detailed examples, this chapter showcases the explanatory power of InqB, particularly its ability to model the interrogative nature of *háishì*.

Chapter 4 addresses the phenomenon of Free Choice (FC) inferences. It begins by examining the FC behavior of Mandarin disjunctives and their associated ignorance inferences. We then assess the capacity of inquisitive logic to account for these phenomena, concluding that existing definitions are insufficient to capture the FC inferences exhibited by *huòzhě*. In response, the chapter introduces Bilateral State-based Modal Logic (BSML), presenting formal definitions within this framework and showing that it effectively explains the full range of FC data.

Finally, Chapter 5 explores broader research avenues emerging from this work. It suggests a historical trajectory for disjunctives based on Classical Chinese evidence and extends the empirical domain to novel behaviors of conjunctions and negations, presenting a largely unexplored space for future investigation.

Chapter 1 will first summarize the key findings, present the functional maps for the various disjunctive expressions in Mandarin Chinese.

1.1 The Functional Spectrum of Disjunction

This section presents a classification of disjunctive functions in natural language. The first three—`INCL`, `EXCL`, and `ALT`—are considered *core disjunctive functions*, in that they are sufficient to identify a lexical item as disjunctive. Whether natural language ever lexicalizes a purely exclusive disjunction (i.e., an expression that encodes `EXCL` but not `INCL`) remains a matter of ongoing debate, see Jennings (1994):pages 239–251 and Nicolae et al. (2024) for more discussions. The remaining functions are considered *associated functions*, which often co-occur with disjunction but may also be expressed by non-disjunctive lexical items.

Notably, disjunctive expressions are often polyfunctional. English *or*, for example, can realize six of the seven functions depending on context. The rest of this section illustrates these functions using English *or* as a primary example, before turning to a detailed analysis of Mandarin in the chapters that follow.

1. Inclusive function (INCL)

The Inclusive function corresponds to classical logical disjunction, as captured by the truth-functional operator $\vee$ in propositional logic. Under this interpretation, a disjunctive statement is true if at least one of its disjuncts is true. Importantly, this reading allows for the possibility that both disjuncts hold simultaneously, and thus aligns with the default truth conditions of disjunction in classical logic.

Truth Conditions:

p	q	$p \vee q$ `(INCL)`	Truth Value
T	T	T	True
T	F	T	True
F	T	T	True
F	F	F	False

Example:

(1) *Jane speaks German or Chinese (or both).*
This utterance is interpreted as true in all situations where Jane speaks German, Chinese, or both. No exclusivity is implied.

Logical Form:[3]

$$\texttt{INCL}(p, q) \;:=\; p \vee q \tag{1.1}$$

Here, p and q are proposition letters denoting the two disjuncts, and $\vee$ represents inclusive disjunction.

2. Exclusive function (EXCL)

The exclusive function indicates that exactly one of the alternatives is true. Unlike inclusive disjunction, which allows both disjuncts to hold, exclusive disjunction explicitly excludes this possibility.

Example:

(2) *Jane speaks German or Chinese (but not both).*

Logical formalization:

$$\texttt{EXCL}(p, q) := (p \vee q) \wedge \neg(p \wedge q) \tag{1.2}$$

Alternatively, we can define a exclusive disjunction operator, denoted here as ∞.[4] The function can then be written simply as $p \infty q$. Its truth conditions are given in the table below.

p	q	$p \infty q$	Truth Value
T	T	F	False
T	F	T	True
F	T	T	True
F	F	F	False

3. Alternative function (ALT)

This function is characteristic of disjunction in interrogative sentences, where it serves to pose a choice between two or more alternatives. Semantically, this usage must be distinguished from a standard *polar (yes/no) question.*

A polar question, such as "*Is it true that she speaks English or French?*", asks for confirmation of the entire disjunctive proposition and can be answered with *yes* or *no*. An alternative question, however, does not ask if the disjunction is true, but rather which of the disjuncts is true.

Example:

[3]This is not our final definition, but merely an example for the case where there are only two disjuncts, since a disjunction can, of course, connect three or more disjuncts. The same applies to the following examples.
[4]Cf. Stanford Encyclopedia of Philosophy, "Disjunction"Aloni (2025).

(3) *Does she speak English or French?* [5]
(An alternative question asking which language she speaks. The expected answer is *'English'* or *'French'*. A *'Yes'* or *'No'* answer is infelicitous.)

Classical logic, which models disjunction as a single truth-functional proposition ($p \vee q$), cannot formulate a *question*. To account for this, We adopt the framework of *inquisitive semantics* (Ciardelli, Groenendijk, et al., 2019), in which disjunction can encode alternative questions.

Logical formalization:

$$\texttt{ALT}(p, q) := p \mathbin{\mathbb{V}} q \tag{1.3}$$

Here, $\mathbb{V}$ denotes *inquisitive disjunction*, which triggers an issue by presenting a set of alternatives.[6]

4. List-marker function (LIST)

The LIST function captures the use of disjunction in open-ended enumerations. This interpretation treats the explicitly mentioned disjuncts as mere examples from a larger set of possibilities, rather than an exhaustive list, signaling that other contextually salient alternatives are left unspecified.

Example:

(4) *Jane speaks German or Chinese, (or other languages).*[7]

Logical formalization:

$$\texttt{LIST}(p, q) := p \vee q \vee r \tag{1.4}$$

Here, r denotes an underspecified, contextually inferred alternative not explicitly mentioned.

5. Dual-under-negation function (DUAL)

The DUAL function captures the inferential behavior of disjunction under negation, as governed by one of De Morgan's laws. Specifically, the negation of a disjunction is logically equivalent to the conjunction of the negations of its disjuncts.

Logical Equivalence (De Morgan's Law):

$$\neg(p \vee q) \;\equiv\; \neg p \wedge \neg q \tag{1.5}$$

Truth Table:

[5] In English, this sentence is ambiguous. Its interpretation as an alternative question versus a polar question depends crucially on its context. For the purpose of the discussion here, we are concerned with the alternative question reading.

[6] A more detailed discussion of inquisitive disjunction, including its unique semantic properties and its role in the interpretation of alternative questions, is provided in Chapter 3.

[7] This open-list reading is typically signaled prosodically in spoken language. It is often accompanied by a rising intonation on the final item, which indicates that the list is incomplete and more examples could follow.

p	q	$p \vee q$	$\neg(p \vee q)$	$\neg p \wedge \neg q$
T	T	T	F	F
T	F	T	F	F
F	T	T	F	F
F	F	F	T	T

In natural language, this equivalence is reflected in sentences where a negated disjunction entails the falsity of each individual alternative. This function does not constitute a distinct lexical meaning of disjunction but reflects a derived interpretive pattern that arises when disjunction scopes under negation.

Example:

(5) *Anna was not in Paris or London.*
(Implicates: Anna was not in Paris *and* not in London.)

Formal Representation:

$$\texttt{DUAL}(p, q) \;:=\; \neg(p \vee q) \tag{1.6}$$

Here, $\neg$ represents sentential negation and $\vee$ represents classical disjunction, such that when it is placed under negation, it becomes equivalent to the conjunction of the negated propositions $\neg p \wedge \neg q$.

6. Exhaustive function (EXHA)

The EXHA function captures a interpretation in which the disjunction is exhaustive of the relevant contextually available alternatives.

Example:

(6) *Music class is on Monday or Tuesday.*[8]
(Implication: Music class is not on any other day.)

Formal Representation:

$$\texttt{EXHA}(p \vee q) := (p \vee q) \wedge \neg r \tag{1.7}$$

Here, r denotes a contextually inferred alternative that is not explicitly mentioned.

7. Possibility-marker function (POSS)

The POSS function arises in contexts where disjunctive term are used not to express choice or contrast between alternatives, but rather to signal uncertainty or possibility.

This type of use is attested in Mandarin 或者 *huòzhě*, Japanese あるいは *aruiwa*. Unlike standard disjunction, which requires at least two alternatives, POSS can apply to a single alternative to mark it as uncertain or possible.

Example:

[8] In English, this sentence can have different interpretations depending on the context. Here, we are concerned only with the exhaustive interpretation.

(7) “你为什么不走动走动？**或者 (huòzhě)/or**[1] 他还念旧，有些好处，也未可知。”
——《红楼梦·贾宝玉初试云雨情·刘姥姥一进荣国府》[9]

“*Why not go and see him?* ***Perhaps/or***[1] *he still remembers the past and even offer you something good —you never know.*”
– *Dream of the Red Chamber*, Chapter 6

In this case, *huòzhě* functions not as a disjunction of two explicit alternatives, but as a modal particle introducing an epistemically possible state of affairs.

Formal Representation:

$$\texttt{POSS}(p) \coloneqq \Diamond p \tag{1.8}$$

Here, $\Diamond$ is the standard modal operator in modal logic, interpreted as *it is possible that*. [10]

Summary of Functions:

Based on the preceding discussion, and generalizing each function to accommodate an arbitrary number of disjuncts, we arrive at the following table[11]:

Function	Classical Definition	Description
INCL	$\texttt{INCL}(p_1, \ldots, p_n) := p_1 \vee \cdots \vee p_n$	Inclusive *or*
EXCL	$\texttt{EXCL}(p_1, \ldots, p_n) := p_1 \infty \ldots \infty p_n$	Exclusive *or*
ALT	$\texttt{ALT}(p_1, \ldots, p_n) := p_1 \Vbar \cdots \Vbar p_n$	Alternative question
LIST	$\texttt{LIST}(p_1, \ldots, p_n) := p_1 \vee \cdots \vee p_n \vee \gamma$	Open list
DUAL	$\texttt{DUAL}(p_1, \ldots, p_n) := \neg(p_1 \vee \cdots \vee p_n)$	Under negation
EXHA	$\texttt{EXHA}(p_1, \ldots, p_n) := (p_1 \vee \cdots \vee p_n) \wedge \neg\gamma$	Exhaustive reading
POSS	$\texttt{POSS}(p_1, \ldots, p_n) := \Diamond p_1 \vee \cdots \vee \Diamond p_n$	Possibility

Note: The γ represents other available options in the context.

Table 1.1: Functional Definitions

1.2 Disjunctions in Mandarin

While English primarily employs the term *or* to express disjunction, many other languages have a greater variety of disjunctive terms. Mandarin Chinese, for example, has several such expressions.

[9] https://ctext.org/hongloumeng/ch6/zhs?searchu=%E6%88%96%E8%80%85&searchmode=showall

[10] The emergence of POSS from disjunctive forms raises important questions about grammaticalization pathways and semantic bleaching. It also motivates cross-linguistic investigations into whether epistemic modality and disjunction are historically or structurally related. Chapter 5 will provide more analysis about this in classical Chinese.

[11] Another way to define EXCL function is by using classical logic disjunction: $\texttt{EXCL}(p_1, \ldots, p_n) := \bigvee_{i=1}^{n} p_i \wedge \bigwedge_{1 \le i < j \le n} \neg(p_i \wedge p_j)$.

Building on the aforementioned classification of functions, this section will delineate the functional scope of three disjunctive terms in Mandarin.

This section presents an original classification of Mandarin disjunctive expressions. This analysis identifies three primary classes of disjunctive expressions in Mandarin[12] , distinguished by the core and associated functions they fulfill:

1. 或者 huòzhě

The first disjunctive expression, 或者 *huòzhě*, designated hereafter as **or**^{1}, is the most commonly used form in declarative contexts. It exhibits broad functional flexibility, supporting Inclusive (`INCL`), Exclusive (`EXCL`), List-making (`LIST`), Dual-under-negation (`DUAL`), and Possibility-maker (`POSS`) interpretations.

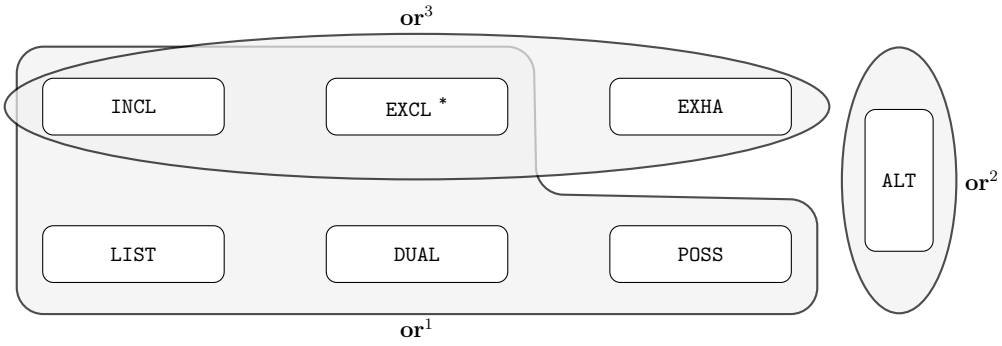
2. 还是 háishi

The second disjunctive expression, 还是 *háishi*, designated hereafter as **or**^{2}, is specialized for forming questions—both direct and embedded—through its Alternatives (`ALT`) function.

3. 要么…要么 yàome…yàome

The third disjunctive expression, 要么…要么 *yàome…yàome*, designated hereafter as **or**^{3}, is a correlative construction that structures a clear contrast between alternatives. It allows for both Inclusive (`INCL`) and Exclusive (`EXCL`) interpretations, but its most distinctive feature is the Exhaustive (`EXHA`) reading, which explicitly excludes all other possibilities.

This functional distribution for the Mandarin disjunctives is visualized in Figure 1.1.



*Note: The existence of `EXCL` (Exclusive) disjunctive function is debated.

Figure 1.1: Functional Scope of Disjunctive Connectors

This functional diversity, evident in the Mandarin inventory, could also be found in other languages such as Japanese (e.g., ～か *-ka*, あるいは *aruiwa*, それとも *soretomo*). English, in contrast, employs a single, highly polyfunctional operator, *or*, which covers nearly the entire functional spectrum except for the modal POSS function. The mapping framework developed here for Mandarin can thus be extended to analyze cross-linguistic distinctions.

[12]Other Mandarin disjunctives, such as the monosyllabic 或 huò and reduplicated correlatives (e.g., 或…或 *huò…huò* and 或者…或者 *huòzhě…huòzhě*), fall outside the scope of this primary analysis. While functionally related to the operators discussed here, a full investigation into their subtle semantic and stylistic distinctions is left for future research. See Chapter 2 for a brief discussion of these related issues.

1.3 Free Choice Disjunction

Disjunctive expressions often exhibit intricate interactions with modal operators, giving rise to what is known as the *Free Choice* (FC) effect, which refers to a phenomenon whereby a disjunction within the scope of a modal gives rise to a conjunctive interpretation.

Under a classical logical system, a sentence of the form $\Diamond(p \vee q)$ is expected to entail that at least one of p or q is possible, but not necessarily both. However, natural language permits the inferences $\Diamond p \wedge \Diamond q$. This phenomenon has been extensively discussed, as it challenges the expected interaction between disjunction and modality under classical logic.

We can primarily classify free choice into two types: epistemic and deontic. The distinction is based on the type of modal verb involved, which can sometimes lead to differences.

Epistemic Free Choice (`FC-E`)

In epistemic contexts—where the modal expresses the speaker's knowledge or belief—Free Choice arises as an inference that each disjunct is epistemically possible.

(8) *Example (Zimmermann (2000)):*
Mr. X might be in Victoria or in Brixton.
$\rightsquigarrow$ *Mr. X might be in Victoria and Mr. X might be in Brixton.*

Here, the sentence asserts that Mr. X is in one of the two places, but the inference supports that both locations are individually consistent with the speaker's knowledge.

Deontic Free Choice (`FC-D`)

In deontic contexts—where the modal expresses permission, obligation—Free Choice is often more robust.

(9) *Example (Kamp (1974)):*
You may go to the beach or to the cinema.
$\rightsquigarrow$ *You may go to the beach and you may go to the cinema.*

This inference pattern has drawn particular attention in dynamic semantics, alternatives semantics, and modal logic. For a comprehensive overview, see Meyer (2020).

Notably, these inferences are often cancellable or context-sensitive, and may not be preserved under negation or embedding. Nevertheless, the availability of FC readings across languages provides valuable evidence about how disjunction and modality interact in natural language semantics.

Free Choice in Mandarin

Mandarin Chinese licenses both **epistemic** (`FC-E`) and **deontic** (`FC-D`) Free Choice inferences, though these inferences vary across disjunctive expressions.

Among the three core disjunctive terms identified in this study, 或者 *huòzhě* (**or^{1}**) most robustly supports both `FC-E` and `FC-D` readings. The correlative form 要么…要么 *yàome…yàome* (**or^{3}**) can also license `FC-D`, but its behavior under epistemic modals remains less clear and may depend on context. In contrast, 还是 *háishi* (**or^{2}**), being a primarily interrogative, does not give rise to Free Choice inferences.

1.4 Summary

Based on the above discussion, we have identified seven distinct functions exhibited by disjunction in natural language. These include three core functions, three associated functions, one off-map function, and the phenomenon of free choice related to disjunction. We also briefly introduced the three primary disjunctive terms in Mandarin Chinese and outlined their functional map.

The functional scope of the primary Mandarin disjunctive terms, encompassing both core and off-map functions, is summarized as follows:

Term	INCL	EXCL	ALT	LIST	DUAL	EXHA	POSS	FC-D	FC-E
或者 *(huòzhě)* / or[1]	✓	✓	✗	✓	✓	✗	✓	✓	✓
还是 *(háishi)* / or[2]	✗	✗	✓	✗	✗	✗	✗	✗	✗
要么 *(yàome)* / or[3]	✓	✓	✗	✗	✗	✓	✗	✓	?

Table 1.2: Functional Distribution of Mandarin Disjunctive Terms

Chapter 2

Disjunction in Mandarin: A Data-Driven Analysis

This chapter provides a systematic, data-oriented investigation of the three primary disjunctive expressions in Mandarin Chinese: 或者 *huòzhě or*[1], 还是 *háishi or*[1], and 要么…要么 *yàome…yàome or*[1]. It explores the range of functions they encode, with a primary focus on their semantics and the necessary syntactic contexts that govern their use.

2.1 Functional Profile of *huòzhě*

The disjunctive 或者 *huòzhě*, hereafter referred to as **or**[1], is semantically versatile, encompassing five distinct functions: Inclusive (`INCL`), Exclusive (`EXCL`), List-marker (`LIST`), Dual-under-negation (`DUAL`), and Possibility-marker (`POSS`).

2.1.1 Inclusive (`INCL`) and Exclusive Function (`EXCL`)

The inclusive use of disjunction corresponds to the standard truth conditions of classical logic: a disjunction $p \vee q$ is true if p, q, or both are true. In contrast, the exclusive interpretation requires that only one of the disjuncts holds, but not both.

Although a disjunctive expression, such as English *or*, may support both inclusive and exclusive readings across different contexts, the inclusive (`INCL`) and exclusive (`EXCL`) functions are mutually incompatible within a single context.

A central assumption is that the basic meaning of simple disjunctions like English *or* and Mandarin *huòzhě or*[1] is inclusive, and that exclusive interpretations arise as a pragmatic enrichment in specific contexts. Consider the following example:[1]

(10)

tā	shuō	yīng yǔ	**huòzhě**	fǎ yǔ
她	说	英语	**或者**	法语。
She	speak	English	**or**[1]	French

"She speaks English or French."

[1]All Mandarin examples in this thesis will follow this four-line interlinear glossing convention. From top to bottom, the lines represent: (1) Pinyin romanization, (2) the original sentence in Chinese characters, (3) a morpheme-by-morpheme English gloss, and (4) the free English translation.

In (10), the most accessible interpretation is that she speaks at least one of the two languages. There is no compelling intuition that the sentence is exclusive. Thus, *huòzhě* here appears to encode a straightforward inclusive disjunction.

However, similar forms can support exclusive readings in specific contexts. For instance:

(11)

tā	shuō	yīng yǔ	**huòzhě**	fǎ yǔ,	wǒ	jì bù qǐ	shì	nǎ ge le
她	说	英语	**或者**	法语,	我	记不起	是	哪个了。
She	speak	English	**or**[1]	French,	I	don't remember	is	which.

"She speaks English or French—I don't remember which."

Here, the clause "*I don't remember which*" triggers an exclusive reading. This inference arises not from the semantics of *huòzhě* but from the pragmatic and epistemic context. The exclusive inference is thus cancellable.

This observation aligns with a broader debate in the field: whether any natural language possesses a dedicated, purely exclusive disjunction remains an open question. Recent work Nicolae et al. (2024), through a series of cross-linguistic experimental studies, showed that many disjunctions previously described as inherently exclusive do not yield robustly exclusive interpretations across languages.

A common cross-linguistic strategy for strengthening an exclusive reading is the use of morphologically complex or reduplicated disjunctive terms, such as French *soit …soit*, Russian *ili …ili* , and Greek *i…i*. Mandarin exhibits a similar pattern with the reduplicated form *huòzhě…huòzhě*. A sentence like (12) may carry a stronger exclusive intuition than its simplex counterpart in (10).[2]

(12)

tā	**huòzhě**	shuō yīngyǔ,	**huòzhě**	shuō fǎyǔ
她	**或者**	说英语,	**或者**	说法语。
she	**or**[1]	speaks English,	**or**[1]	speaks French.

"She speaks either English or French."

However, this intuition is not robust, as the reduplicated structure does not necessarily result in an exclusive reading. This is demonstrated in example (13), which can express a range of alternative activities:

(13)

rén men	**huòzhě**	sàn bù,	**huòzhě**	pāi zhào,	**huòzhě**	zuò yùn dòng
人们	**或者**	散步,	**或者**	拍照,	**或者**	做运动。
people	**or**[1]	walk,	**or**[1]	take photos,	**or**[1]	exercise.

"People take a walk, take photos, or exercise."

In (13), it is clearly possible for people to be walking while taking photos. This suggests that the number of times *huòzhě* is repeated might has a subtle effect on its interpretation.

Given this ambiguity, this thesis will not analyze the reduplicated form separately. Both the simplex and reduplicated forms of huòzhě will be treated as manifestations of or[1].

A parallel treatment applies to the monosyllabic disjunctive particle *huò*, as well as its reduplicated counterpart *huò…huò*. While these forms are functionally comparable to *huòzhě*, a detailed examination of their stylistic and semantic nuances falls beyond the scope of this thesis. Accordingly, all four expressions—*huòzhě*, *huòzhě…huòzhě*, *huò*, and *huò…huò*—are analyzed as members of a unified disjunctive class, denoted by or^1.

[2]Empirical testing would be required to determine whether this pattern reliably strengthens exclusivity.

2.1.2 List-marker Function (LIST)

In certain contexts, the Mandarin disjunction *huòzhě* acts as an open-list marker, presenting a set of alternatives understood as non-exhaustive. This can be illustrated with the following dialogue:

(14) 李：她说英语**或者**说法语。
Li: She speaks English ***or***[1] *French.*
王：我确定她不会说英语。
Wang: I know for sure she doesn't speak English.
李：?? 那么她肯定说法语。
Li: ??Then she must speak French.[3]
李：那她应该是说法语。
Li: Then she probably speaks French.

The infelicity of "*Then she must speak French*" suggests that the initial disjunctive statement "*She speaks English or French*" does not license a robust inference to the truth of the second disjunct when the first is rejected. This inference is context-sensitive but generally weak, pointing to a open-list interpretation of the disjunction. In such contexts, *huòzhě* appears to introduce options without asserting that exactly one must be true. [4]

Moreover, this open-list behavior is consistent with cross-linguistic patterns and aligns with the semantic framework proposed by Ciardelli, Groenendijk, et al. (2019):Chapter 6. According to this approach, the interpretation of disjunctions is shaped by clause type (e.g., declarative vs. interrogative) and prosodic features such as final pitch. Specifically, a disjunctive sentence may be interpreted as introducing a list. The list is perceived as *open* when the sentence ends in a rising intonation, and as *closed* when followed by a falling intonation.

For example, consider the English utterance:

(15) "Anna speaks English or French ↑."

Compared to its counterpart with final falling intonation "*Anna speaks English or French* ↓", (15) conveys uncertainty. (15) suggests that Anna speak English or French—or another language. Westera (2017) provides a comprehensive discussion on the semantics of prosody in disjunctive contexts.

While Mandarin Chinese exhibits similar patterns[5], its status as a tonal language means that intonation interacts intricately with lexical tones. A rising pitch contour may not always occur on the sentence-final syllable but might instead affect a key word or co-occur with prosodic breaks. Nevertheless, pitch variation systematically encodes meaning differences.

In this paper, we adopt the following convention for prosodic annotation: ↓ denotes unmarked declarative prosody, while ↑ indicates a special pitch contour (e.g., marked rising intonation), regardless of its precise position in the sentence.

Consider the following sentence:

[3]This inference may be acceptable in some contexts but not in others. By comparison, the inference from the *yàome…yàome or*[3] construction is significantly stronger.

[4]By contrast, a structurally similar example with the Mandarin exclusive disjunction *yàome…yàome…* ("either...or") yields a much stronger inference pattern, indicating a semantically richer, and more exhaustively specified, alternative structure. This contrast will be explored in more detail in Section 2.3.

[5]See Yuan (2011) for more discussion.

(16) tā shuō yīng yǔ **huò zhě** fǎ yǔ
她 说 英语 **或者** 法语 ↓
She speak English **or**[1] French ↓
"She speaks English or French ↓."

(16) is a canonical declarative sentence. Compare with:

(17) tā shuō yīng yǔ **huòzhě** fǎ yǔ ↑
她 说 英语 **或者** 法语 ↑。
She speak English **or**[1] French↑
"She speaks English or French ↑"
Marked Polar (Yes/No) Question

Here, the rising final intonation in (17) suggests the speaker is uncertain and invites confirmation. This directly corresponds to an *open list* reading: the speaker is entertaining the possibility that the subject speaks English, French, or perhaps another language. This exemplifies the list-marking function of *huòzhě*.

It is important to note that questions formed with *huòzhě* always yield polar (yes/no) readings. Mandarin uses a different disjunctive term, *háishì or*[2], to form canonical alternative questions.

Polar Questions

If we analyze the question being asked as a proposition, then for a *polar question*, the expected answer is about the truth-value of this proposition, i.e., yes or no. For example:

Consider a context where an office needs an assistant for a project requiring knowledge of either English or Italian. When interviewing a candidate, the hiring manager might ask:

(18) "Does she speak English or Italian?"

In this scenario, the expected answer is: *Yes* (if she speaks either) or *No* (if she speaks neither).

Alternative Questions

By contrast, *alternative questions* expect the addressee to choose one from among the disjuncts. For instance:

Consider a scenario after a marathon, where participants can choose either a trophy or a T-shirt as a prize. An organizer at the distribution booth might ask a finisher:

(19) "Do you want a trophy or a T-shirt?"

Here, a *Yes*/*No* response would be infelicitous. The expected answer is *the trophy* or *the T-shirt*.

Ambiguity in English

In English, such questions may be ambiguous. For example:

(20) "Is the meeting in Amsterdam or Brussels?"

This sentence allows two readings:

- *Alternative Question*: Which city? (Expected answer: *Amsterdam* or *Brussels*)
- *Polar Question*: Is it in either of those cities? (Expected answer: *Yes* or *No*)

Mandarin

However, in Mandarin, this ambiguity is avoided via distinct disjunctive terms:

- *háishì or*[2] is used in alternative questions.
- *huòzhě or*[1] cannot be used to form alternative questions and instead polar questions.

huòzhě in Interrogatives

We now turn to a more detailed examination of the behavior of *huòzhě* in interrogative contexts. The disjunctive word *háishì*, which carries an alternative reading, will be addressed in the next section.

Although *Huòzhě* can occur in interrogative constructions, it does not contribute alternative question force but rather helps form a polar question. This indicates it lacks an `ALT` function.

The most common strategy for forming a polar question in Mandarin is by appending the sentence-final particle *ma* (吗).

(21)

tā	shuō	yīng yǔ	**huò zhě**	fǎ yǔ	ma?
她	说	英语	**或者**	法语	吗？
She	speak	English	**or**[1]	French	Q

"Does she speak English or French?"

Polar (Yes/No) Question

In (21), responses like *'English'* or *'French'* are inappropriate.

In Mandarin, the sentence-final particle 吗 *ma* can generally be appended to a declarative sentence to form a polar question. This also applies to sentences that might otherwise be wh-questions. Consider the example of a simple declarative and its polar question counterpart:

(22)

tā	lái	le.
他	来	了。
He	arrive	PERF

"He arrived."

Declarative Statement

(23)

tā	lái	le	ma?
他	来	了	吗？
He	arrive	PERF	Q

"Did he arrive?"

Polar Question

Notably, adding *ma* to a wh-question transforms its into a yes/no question. This contrast, illustrated in (24) and (25). [6]

(24) nǐ xiǎng chī diǎn shénme?
你 想 吃 点 什么？
You want eat a-little what
"What would you like to eat?"
Wh-Question

(25) nǐ xiǎng chī diǎn shénme ma?
你 想 吃 点 什么 吗？
You want eat a-little anything Q
"Would you like to eat something?"
Polar Question

Other polar question strategies in Mandarin involving *huòzhě* include the A-not-A construction[7] and colloquial sentence-final negation 不 *bù*.

(26) tā **huì-bù-huì** shuō yīng yǔ **huòzhě** fǎ yǔ
她 **会不会** 说 英语 **或者** 法语
She **can-not-can** speak English **or**[1] French
"Does she speak English or French?"
Polar (Yes/No) Question

(27) tā shuō yīng yǔ **huòzhě** fǎ yǔ **bu**?
她 说 英语 **或者** 法语 **不**？
She speak English **or**[1] French **no**
"Does she speak English or French?"
Polar (Yes/No) Question

In marked cases[8], polar questions involving *huòzhě* may also be formed by adding a sentence-final rising intonation (↑), as previously discussed.

Deriving Alternative Readings: A Challenge for *huòzhě*

Given that *huòzhě* lacks the (ALT) function, speakers must employ periphrastic strategies to force such a reading. A common method involves wh-question, as illustrated in (28).

[6] This behavior is not universal for sentence-final interrogative particles. By contrast, Japanese also employs a sentence-final particle, か *ka*, to mark interrogativity. However, *ka* does not uniformly convert a sentence into a polar question. When *ka* appears at the end of a wh-question—e.g., 誰が来たか？"*Who came?*"—the sentence retains its wh-question status. In Japanese, the presence of *ka* is generally obligatory in interrogative contexts.

[7] The A-not-A structure is productive and commonly used in Mandarin for yes-no inquiries.

[8] We use "marked"here to refer to interrogative interpretations derived from declarative syntax, such as rising intonation questions.

(28) píjiǔ **huòzhě** kělè, nǐ xiǎng yào nǎ yí gè?
啤酒 **或者** 可乐, 你 想要 哪一个？
beer **or**[1] cola, you want which one
"Beer or cola, which one would you like?"
Wh-Question (forcing alternative reading)

However, it is often more natural to use the conjunction 和 *hé / and* , as in (29), or to omit the connective altogether. The significant effort required to produce an alternative reading with *huòzhě* serves as strong evidence that this function is not part of its semantic profile.

(29) píjiǔ **hé** kělè, nǐ xiǎng yào nǎ ge?
啤酒 **和** 可乐, 你 想要 哪个？
beer **and** cola, you want which
"Beer and cola, which one do you want?"

Special Cases of the Open List

The `LIST` function of *huòzhě* is particularly evident in first-person declarative statements of preference. In these contexts, the disjuncts are typically understood as a non-exhaustive list of acceptable options rather than a statement of strict choice.

One such case is sentence (30), where the speaker is naturally understood to like both, or at least to indicate that they are acceptable options, implying the list may not be exhaustive.

(30) wǒ xǐhuān hē kāfēi **huòzhě** chá 。
我 喜欢 喝 咖啡 **或者** 茶。
I like drink coffee **or**[1] tea .
"I like drinking coffee or tea."

This open-list reading also can be realized by using conjunction *hé /and* :

(31) wǒ xǐhuān hē kāfēi **hé** chá 。
我 喜欢 喝 咖啡 **和** 茶。
I like drink coffee **and**[3] tea .
"I like drinking coffee and tea."

Comparing the two, (31) conveys a more determinate and exhaustive preference: the speaker likes both coffee and tea, implying a closed set. In contrast, (30) presents the items as examples from an open list of options.

Interestingly, this list-like interpretation of *huòzhě* is weakened when the subject is in the third person.

(32) tā xǐhuān hē kāfēi **huòzhě** nǎichá 。
她 喜欢 喝 咖啡 **或者** 奶茶。
She likes drink coffee **or**[1] bubble tea .
"She likes drinking coffee or bubble tea."

In (32), the interpretation shifts towards a standard disjunction, where the speaker is more likely expressing uncertainty about the subject's preferences (i.e., *Not sure which of the two she likes, but it is one of them*). This contrast might suggest that first-person declarative statements with *huòzhě* in such contexts can carry some epistemic bias.

2.1.3 *huòzhě* under Negation

huòzhě (或者) exhibits the `DUAL` function, where the negation of a disjunction is equivalent to the conjunction of the negated disjuncts. This follows De Morgan's Laws, formally, $\neg(p \vee q) \implies \neg p \wedge \neg q$.

The following example from literature illustrates this function, where the negation licenses a *neither...nor* reading.

(33) 这个样子，恐怕不是受凉**或者** [1] 中暑，很像是猩红热。
——张恨水，《春明外史》。

"*Judging by this appearance, I'm afraid it's not a cold* ***or***[1] *heatstroke, but rather scarlet fever.*"
—Zhang Henshui, *Chunming Waishi.*

(34)

kǒng pà	bú shì	shòu liáng	**huòzhě**	zhòng shǔ
恐怕	不是	受凉	**或者**	中暑
afraid	is not	catch cold	**or[1]**	heatstroke

"I'm afraid it's not a cold or a heatstroke."

In this example, the negation *búshì* scopes over the entire disjunctive phrase *a cold or a heatstroke*. This licenses the logical inference that the condition is not a cold and not a heatstroke.

2.1.4 Exhaustive Function (`EXHA`)

huòzhě (或者) lacks the `EXHA` function, as demonstrated by the following example. Consider the dialogue and the felicity of the response:

(35) 李："她说英语**或者**说法语。"
Li: "She speaks English ***or***[1] *French."*
王："是的，而且她还会日语。"
Wang: "Yes, and she also speaks Japanese."

The acceptability of Wang's response, which adds a third option without causing contradiction, directly indicates that no exhaustive inference is triggered by *huòzhě*. If Li's statement had been exhaustive—meaning "only English or French"—then Wang's assertion would have resulted in a contradiction. The felicity of this exchange thus confirms the non-exhaustive nature of *huòzhě*.

2.1.5 Possibility-marker Function (POSS)

huòzhě (或者) can also serve an epistemic function, signaling possibility in a way functionally equivalent to English expressions like *maybe* or *perhaps*. This use is more frequently encountered in Classical Chinese, where the 或 *huò* frequently be used as a marker of possibility. Nonetheless, this function persists in Modern Mandarin, particularly in formal registers or literary styles. Consider the following examples:

(36)

wǒ	de	lǐxiǎng	**huòzhě**	yě	zhǐshì	kōngxiǎng
我	的	理想	**或者**	也	只是	空想。
I	POSS	ideal	**or**[1]	also	merely	fantasy

"Maybe my ideal is just a fantasy."

(37)

yùnchǎnqī	gāowēi	yīnsù	**huò**	yòufā	gūdúzhèng
孕产期	高危	因素	**或**	诱发	孤独症
prenatal	high-risk	factor	**or**[1]	trigger	autism

"High-risk factors during pregnancy may trigger autism."

The construction in (36) can sound somewhat literary in everyday conversation. In contrast, the simplex form *huò* in (37) is more common in formal written contexts to introduce a possibility.[9]

A crucial structural feature of both examples is that *huòzhě* and *huò* take only a single propositional complement, rather than functioning as a binary connective joining two disjuncts. This unary, modal-like function is a primary reason for classifying their role here as an off-map function, distinct from their canonical function as a a binary disjunctive operator.

2.2 Functional Profile of *háishì*

While the summary of Chapter 1 identified the core function of 还是 *háishì or*[2] as ALT, it also exhibits several distinct *off-map* uses. This section categorizes these into four functions, though some may share underlying semantic components:

- **ALT function**: Its most prototypical use, forming alternative questions.
- **Continuity marker**: Indicating the persistence of a state or action.
- **Preference/Suggestion marker**: Expressing a preferred course of action.
- **Emphatic/Focus marker**: Highlighting surprising or noteworthy information.

Although the primary goal of this thesis is to capture the ALT function of *háishì*, and a full analysis of its other roles is beyond our current scope, it is nevertheless productive to discuss several of these special instances. A common thread across these functions is the association of háishì with focus, highlighting either specific propositions or alternatives. Each of these uses will be explored in the sections that follow.

[9] It is worth noting that in contemporary Mandarin, epistemic possibility is more frequently expressed using 或许 *huòxǔ* ("perhaps"). These forms also share the morpheme 或 *huò*, suggesting a diachronic link in the expression of modality.

2.2.1 Alternative Function (ALT)

The most prototypical use of *háishì or*^{2} is in forming alternative questions, which present the addressee with a set of options, prompting a selection among them.

(38) tā shuō yīngyǔ **háishì** fǎyǔ?
她 说 英语 **还是** 法语?
She speak English **or**^{2} French
"Does she speak English or French?"
Alternative Question

As an alternative question, the expected response to (38) is one of the disjuncts, i.e., *English* or *French*. A polar *yes/no* answer is infelicitous. This aligns with ALT function, which denotes a set of possibilities, and requires information to selects one.

Given that *háishì* consistently patterns in this way, it follows that *háishì* lacks the INCL, EXCL, and LIST functions as defined in this thesis. These functions are fundamentally tied to truth-conditional assertions, whereas the canonical use of *háishì* is to construct non-truth-conditional interrogative clauses.

A crucial prosodic feature is that*háishì* intuitively has rising intonation, a common correlate of interrogative mood. A downward pitch contour renders the sentence pragmatically odd and semantically deviant, as it clashes with the interrogative function.

(39) tā shuō yīngyǔ **háishì** fǎyǔ ↓
她 说 英语 **还是** 法语 ↓。
she speak English **or**^{2} French
"She speaks English or French(?)"

The utterance in (39) is nearly impossible to interpret as a simple declarative. However, the requirement for rising intonation is lifted when the question is embedded under a verb of knowing or saying, as the illocutionary force of the main clause is declarative.

(40) 李：她说什么语言？
Li: *What language does she speak?*
王：她说英语**还是**法语，我记不清了。
Wang: *She speaks English* ***or***^{2} *French, I can't remember clearly.*

(41) tā shuō Yīng yǔ **hái shì** Fǎ yǔ, wǒ jì bù qīng le
她 说 英语 **还是** 法语, 我 记不清 了
She speaks English **or**^{2} French, I remember-not-clear PRT
"I can't remember clearly whether she speaks English or French."

Here, the clause "She speaks English or French" is not asserted by the speaker but is presented as the content of their uncertainty. This is a embedded question.

Embedded Questions and Conditionals

In embedded environments, *háishì* consistently introduces an alternative question (a concealed *alternaltive-question*).

(42)

wǒ	méi	xiǎnghǎo	chī	pīsà	**háishì**	hànbǎo
我	没	想好	吃	披萨	**还是**	汉堡。
I	haven't	decided	eat	pizza	**or**[2]	burger

"I haven't decided whether to eat pizza or a burger."

Embedded Alternative Question

Sentence (42) unambiguously conveys *embedded alternative question* that a choice should be made between the two options. This is distinct from constructions with *huòzhě*[1], which can introduce an *embedded polar (yes/no) question.* [10]

(43)

wǒ	méi	xiǎnghǎo	yào	bùyào	chī	pīsà	**huòzhě**	hànbǎo
我	没	想好	要	不要	吃	披萨	**或者**	汉堡。
I	haven't	decided	want	not want	eat	pizza	**or**[1]	burger

"I haven't decided whether to eat pizza or a burger."

Embedded Polar (Yes/No) Question

Here, (42) concerns the identity of the meal to be chosen, but (43) concerns the decision of whether to eat at all. This minimal pair provides robust evidence for the core `ALT` semantics of *háishì*.

Furthermore, *háishì* appears in concessive conditional constructions, often called free choice contexts. Here, it helps generate a universal quantification over the alternatives.

(44)

bùlùn	guāfēng	**háishì**	xiàyǔ,	wǒ	dōu	huì	qù
不论	刮风	**还是**	下雨,	我	都	会	去。
no matter	wind blows	**or**[2]	rain falls,	I	all	will	go

"No matter whether it's windy or rainy, I will go."

2.2.2 *háishì* under Negation

As a canonical interrogative operator, directly negating a *háishì*-question is semantically **incoherent**, as questions are not truth-evaluable entities. This is supported by empirical evidence: we find no natural instances where negation takes wide scope over a *háishì*-question. We therefore conclude that *háishì* lacks the `DUAL` function (i.e., it cannot express $\neg(p \vee q)$).

In practice, any negation present in a *háishì* clause is interpreted with narrow scope. The operator creates an alternative question from the negated propositions, resulting in the reading: "*Is it not p, or is it not q?*" $(\neg p \mathbin{\backslash\!\!/} \neg q)$.

[10] It is worth noting that the English translation, "I haven't decided whether to eat pizza or a burger,"is ambiguous between these two readings.

(45) tā bù chī zhūròu **háishì** niúròu ?
她 不 吃 猪肉 **还是** 牛肉？
she not eat pork **or**^{2} beef ?
"Is it pork or beef that she doesn't eat?"
Alternative Question

The question in (45) is not about whether she eats or doesn't eat, but about identifying the object of her non-eating from the given set.

2.2.3 Exhaustive Function (EXHA)

The EXH function requires the alternatives to form a closed set. Standard diagnostics show that háishì does not enforce such exhaustivity, as evidenced by the felicity of denying all presented options:

(46) 李：音乐课是在周一**还是**周二？
Li: *Is the music class on Monday* ***or***^{2} *Tuesday?*
王：都不是，在周三。
Wang: *Neither. It's on Wednesday.*

Given the felicity of Wang's response, it follows that Li's *háishì*-question was non-exhaustive, thereby confirming that *háishì* lacks the EXH function.

2.2.4 Off-map Functions

Beyond its primary role as a question operator, *háishì* has several off-map functions, which can be broadly classified as follows.

Continuity Marker

The first usage indicates the continuity or persistence of a state or action, corresponding to the adverb *still* in English.

(47) wǒ shì le hǎo jǐ cì, **háishì** bùxíng
我 试了 好几次, **还是** 不行。
I tried several times, **still/or**^{2} not work
"I tried several times, but it still doesn't work."

(48) duō nián bùjiàn, tā **háishì** nàme niánqīng
多年 不见, 她 **还是** 那么 年轻。
many years not see, she **still/or**^{2} so young
"After many years, she still looks so young."

In both examples, the focus is on the predicate following *háishì*.

Preference or Suggestion Marker

The second usage expresses a preference or makes a polite suggestion, similar to phrases like "*it would be better to…*" or "*perhaps we should…*".

(49)

tiānqì	liáng	le,	**háishì**	duō	chuān	diǎnr	ba
天气	凉	了,	**还是**	多	穿	点儿	吧。
weather	cool	ASP,	**better/or**[2]	more	wear	a bit	SUG

"The weather is getting cooler—you'd better wear more."

Emphatic or Counter-expectational Marker

Finally, *háishì* can be used to emphasize a surprising or noteworthy fact, often with a counter-expectational force comparable to *even* or *actually*.

(50)

tā	**háishì**	bóshì	ne
她	**还是**	博士	呢。
she	**even/or**[2]	PhD	PRT

"She is even a PhD."/ "She's actually a PhD."

This emphatic use is highly context-dependent. For instance, (50) could be used to express surprise at someone's inability despite their credentials (i.e., *"She's a PhD, how can she not know this?"*) or to express admiration (i.e., *"She's not only so beautiful , she's even a PhD!"*).

A semantic thread uniting these functions is that *háishì* consistently places focus on a specific proposition, highlighting its continuity, preferability, or unexpectedness in the given context.

2.3 Functional Profile of *yàome or*[3]

The Mandarin disjunctive construction 要么…要么 *yàome…yàome or*[3] operates as a correlative disjunction, syntactically linking two or more alternatives. In Chapter 1, we identified three functions of it: Inclusive (`INCL`), Exclusive (`EXCL`), and Exhaustivity (`EXHA`). In this section, we argue that its most prominent feature is the `EXHA` function. Unlike some complex disjunctive constructions in other languages, *yàome* does not inherently encode exclusivity—though native speakers often perceive it.

Yàome…yàome frequently appears in imperative or directive contexts, where it conveys a strong sense of obligation or necessity. The construction typically signals that the alternatives presented form a closed set of exhaustive options, allowing no room for further possibilities. Consider the following examples:

(51) 龙清秀严厉地对县领导说："…你们**要么 (yàome)** 还钱，**要么 (yàome)** 卖车！"
——《人民日报》2001 年 08 月 06 日[11]

"*Long Qingxiu sternly told the county leaders: '…You **either**[3] pay back the money, **or**[3] sell the cars!*"
—People's Daily, August 6, 2001

[11] https://cn.govopendata.com/renminribao/2001/8/6/4/

In this example, the speaker imposes a strong directive that restricts the listener's choices to exactly two—repayment or asset liquidation—thereby excluding any third option.

2.3.1 Exhaustive Function (EXHA)

As discussed above, the primary semantic function of *yàome…yàome* is EXHA. This entails the exclusion of all contextually relevant alternatives not explicitly mentioned. Consider the following example:

(52)

yīnyuè kè	**yàome**	zài	xīngqīyī,	**yàome**	zài	xīngqī'èr
音乐课	**要么**	在	星期一，	**要么**	在	星期二。
music class	**either**[3]	on	Monday,	**or**[3]	on	Tuesday

"The music class is (only) on Monday or on Tuesday (and not on any other day)."

In the context of this utterance, the salient set of alternatives includes the other days of the week (e.g., Wednesday, Thursday). The use of *yàome…yàome* asserts that the proposition holds only for the disjuncts mentioned, thereby excluding all other alternatives from this set. This exhaustive force is significantly stronger and more stable than that of the simple disjunction *huòzhě or*[1].

The exhaustive force of *yàome…yàome* becomes particularly clear in dialogue:

(53) 李：她**要么**说英语，**要么**说法语。
*Li: She **either**[3] speaks English **or**[3] French.*[12]
王：# 是的，而且她还会日语。
Wang: #Yes, and she also speaks Japanese.
王：不对，她还会说日语。
Wang: No, she also speaks Japanese.

The initial response is infelicitous (marked with #) because *yàome…yàome* commits the speaker to an exhaustive disjunction. To introduce Japanese as another possibility, Wang must first negate Li's assertion.

In contrast, the use of *huòzhě* permits additional alternatives:

(54) 李：她说英语**或者**说法语。
*Li: She speaks English **or**[1] French.*
王：是的，而且她还会日语。
Wang: Yes, and she also speaks Japanese.

Similarly, *háishì* appears in interrogative contexts and does not entail exhaustivity:

(55) 李：她说英语**还是**说法语？
*Li: Does she speak English **or**[2] French?*
王：她英语和法语都说，而且还说日语。
Wang: She speaks both English and French, and also Japanese.

[12] In Mandarin Chinese, the verb can only appear after 要么/*yàome*, so I chose to preserve this syntactic structure in the English translation.

Exhaustivity becomes logically significant when viewed through the lens of disjunctive syllogism. A disjunctive syllogism is an inference pattern where from the premises *A or B* and *not A*, we can deduce that B must be true.

(56) 李：她**要么**英语，**要么**说法语。
*Li: She **either**[3] speaks English **or**[3] French.*
王：我确定她不会说英语。
Wang: I know for sure she doesn't speak English.
李：那么她肯定是说法语。
Li: Then she definitely speaks French.

With *huòzhě*, such a conclusion would be pragmatically weaker, given the possibility of unmentioned options:

(57) 李：她说英语**或者**说法语。
*Li: She speaks English **or**[1] French.*
王：我确定她不会说英语。
Wang: I know for sure she doesn't speak English.
李：?? 那么她肯定说法语。
Li: ??Then she must speak French.[13]
李：那她应该是说法语。
Li: Then she probably speaks French.

In the case of *háishì*, a question remains open even when one disjunct is negated:

(58) 李：她说英语**还是**说法语？
*Li: Does she speak English **or**[2] French?*
王：我知道她肯定不会说英语。
Wang: I know for sure she doesn't speak English.
李：那她说法语吗？
Li: Then does she speak French?
王：我不知道。
Wang: I don't know.

[13]This inference may be acceptable in some contexts but not in others. By comparison, the inference from the *yàome…yàome* construction is significantly stronger. The prior use of this example to demonstrate the `LIST` function of *huòzhě* is consistent with this analysis.

2.3.2 *yàome…yàome* under Negation

The exhaustive function (EXHA) of *yàome…yàome* remains robust even under the scope of negation. Notably, when negated, it is not the disjunction that is denied, but rather its exhaustivity. Consequently, *yàome…yàome* lacks DUAL function.

We can construct examples to test this property. First, consider the positive statement in (59):

(59) tā **yàome** zuò chuán qù **yàome** zuò chē qù
她 **要么** 坐船去 **要么** 坐车去
she **either**[3] go by boat **or**[3] go by car
"She is going either by boat or by car."

This sentence implies that her only travel options are {boat, car}. Now, we negate the sentence:
Now observe its negated counterpart:

(60) tā bìng bù shì **yàome** zuò chuán qù **yàome** zuò chē qùs
她并不是 **要么** 坐船去 **要么** 坐车去
she NOT is **either**[3] go by boat **or**[3] go by car
"It's not the case that she is going either by boat or by car."

Sentence (60) is a wide-scope negation over the exhaustive proposition in (59).[14] The negation targets the exhaustive claim, meaning *It is not true that her options are only boat or car.*[15]

This pattern is attested in corpus data:

(61) 在每一格内放入供一次饮用的奶粉，既能保证宝宝的饮用量，不会产生**要么/yàome** 不足**要么/yàome** 浪费的现象，又很方便，值得称道。
——新浪博客[16]

"*Placing a single serving of milk powder into each compartment ensures the correct portion for the baby and* ***will not produce the phenomenon of either***[3] *insufficiency* ***or***[3] *waste. This is very convenient and praiseworthy.*"
—Sina Blog

Here, the negation cancels the exhaustivity, not the disjunction. It does not assert that insufficiency is impossible, nor does it assert that waste is impossible.

Similarly, the following example[17] with a modal verb illustrates this effect:

(62) nǐ bù néng měi tiān **yào me** zuò zhe **yào me** tǎng zhe, nǐ děi qǐ lái yùn dòng
你不能每天 **要么** 坐着 **要么** 躺着, 你得起来运动
you cannot every day **either**[3] sit **or**[3] lie down, you should get up exercise
"You can't just either sit or lie down every day —you need to get up and move!"

This sentence does not forbid sitting or lying down. Rather, it negates the exhaustivity of that choice set; it asserts that one's daily activities should not be limited to ONLY {sitting, lying down}.

[14] It is worth noting that negation can appear naturally within the scope of *yàome…yàome*, as in 她要么不说中文，要么不说英文。*She either doesn't speak Chinese, or she doesn't speak English.* This expresses the logical form $\neg p \vee \neg q$, which is distinct from the $\neg(p \vee q)$ structure we are concerned with here.

[15] The relative unnaturalness of sentences like (60) may stem from the cognitive load required to process a negation that targets the exhaustivity operator rather than the core proposition.

[16] https://blog.sina.com.cn/s/blog_49180ce90100vqzr.html

[17] A similar example is available for reference, but it is somewhat more complex, so I chose not to use it. https://news.sina.com.cn/c/xl/2019-03-15/doc-ihsxncvh2733374.shtml

2.3.3 Exclusive Function (EXCL)

The *yàome…yàome* construction also exhibits an EXCL function. In such cases, it emphasizes that precisely one of the alternatives must be true—but not both. This EXCL readings is especially arise when the alternatives are logically incompatible[18]. In such contexts, *yàome…yàome* tends to be preferred:

(63) 如果一只老鼠准备绕过一只猫，按照经典物理理论，它**要么 (yàome)** 从左边**要么 (yàome)** 从右边穿过。而按量子理论，它可以同时从猫的左边和右边穿过。
——中国科学院网站，2001 年 10 月 16 日。[19]

"*If a mouse intends to get around a cat, according to classical physics, it pass by* ***either***^{3} *its left* ***or***^{3} *its right side. According to quantum theory, however, it can pass by both the left and right sides simultaneously.*"
—Website of the Chinese Academy of Sciences, October 16, 2001.

But when exclusivity is not entailed by logic or context, the EXCL reading is defeasible:

(64) 王：她**要么**说英语，**要么**说日语。
Wáng: She ***either***^{3} *speaks English* ***or***^{3} *speaks Japanese.*
李：# 错了，她两个都会说。
Lǐ: #No, you're wrong. She speaks both.
李：是的。甚至她有可能两个都会说。
Lǐ: Yes. And it's even possible she speaks both.

(65) 王：我们**要么**周一去，**要么**周二去。
Wáng: We'll ***either***^{3} *go on Monday* ***or***^{3} *go on Tuesday.*
李：难道我们就不能周一和周二都去吗？
Lǐ: Can't we just go on both Monday and Tuesday?
王：当然可以啊，我又没说不行。
Wáng: Of course we can. I never said we couldn't.

2.3.4 Inclusive Function (INCL)

Despite its strong association with exclusivity, *yàome…yàome* can also function inclusively (INCL). While inclusive readings are less common and often require specific contextual licensing, they are nonetheless possible. The following example from a modern novel, which explicitly allows for both alternatives to be chosen, illustrates this use:

[18] This is unsurprising, as all disjunctions are naturally exclusive in such contexts. However, it is noteworthy that in Mandarin, when the context explicitly signals and aims to highlight the mutual exclusivity of two options, *yàome…yàome* tends to be preferred—possibly even exclusively so. This raises the possibility that speakers' intuitions about the exclusivity of certain lexical items may arise from these contextual patterns, rather than from any inherent semantic. This remains a compelling topic for future empirical investigation.

[19] https://www.cas.cn/hy/hyyg/200110/t20011016_1689707.shtml

(66) 恋爱永远不能等同于一般的事，它有它的仪式。**要么/yào me** 一句话，**要么/yào me** 一个动作，也可以两样一起上，一起来。只有某一个行为把某一种心照不宣的东西点破之后，那才能算是恋爱。
——毕飞宇《推拿》

"*Love isn't like anything else; it has its own defining moments.* ***Either***^{3} *a sentence,* ***or***^{3} *an movement, and possibly both. It only really counts as love after some acts makes a shared, unspoken feeling explicit.*"
—Bì Fēiyǔ, *Blind Massage*

Here, the inclusive interpretation is explicitly supported by the subsequent clause. This demonstrates that the inclusive function (INCL) is available for *yàome…yàome*.[20]

[20] An interesting secondary observation concerns the exhaustive function (EXHA). In this highly abstract and metaphorical context, the set of potential alternatives to *a word* and *a gesture* is not clear. This ambiguity makes it difficult to ascertain whether the list is intended to be exhaustive. It is plausible that the ill-defined nature of the alternatives in such complex contexts may weaken not only the exclusive but also the exhaustive force typically associated with the construction.

Chapter 3

Approaches from Inquisitive Logic

Traditional truth-conditional semantics, as developed in classical logic, characterizes the meaning of a sentence in terms of the conditions under which it is true. While this approach is highly effective for modeling declarative statements, it encounters limitations when applied to interrogative constructions. This limitation becomes particularly evident when analyzing disjunctive expressions in natural languages like Mandarin, which lexically distinguishes between the declarative disjunctor and interrogative.

To address this challenge, this chapter adopts the framework of *Inquisitive Semantics*, particularly its propositional variant, known as *Inquisitive Propositional Logic* (henceforth **InqB**). Our analysis is based primarily on the works of Ciardelli, Groenendijk, et al. (2019); Ciardelli (2022). Inquisitive Propositional Logic is built upon an *information-based semantics*. In this paradigm, the meaning of a sentence is not its truth conditions, but support conditions. This system provides a unified account for capturing both declarative and interrogative sentences. We will formally introduce the InqB system and demonstrate its applicability to the semantics of Mandarin disjunctions.

Specifically, we begin by formally defining the core constructs of InqB, including inquisitive disjunction ($\vee$), the non-inquisitive closure operator (!), and the question operator (?). Based on this framework, we will provide formal definitions for the functions of disjunction discussed in the previous chapters. We will then apply InqB to the Mandarin data, proposing that *huòzhě* realizes non-inquisitive disjunction, whereas *háishì* [2] is inherently inquisitive. We also analyze the role of the sentence-final particle 吗 *ma* in forming polar questions, demonstrating how InqB unifies the interpretation of various question types. Furthermore, we will introduce a pragmatic exhaustivity operator, $\texttt{exh}^c$, to account for the unique behavior of *yàome…yàome* [3].

3.1 Inquisitive Propositional Logic

We begin with the definitions from Ciardelli, Groenendijk, et al. (2019); Ciardelli (2022).

Definition 1 (Language $\mathcal{L}_P$ of Propositional Inquisitive Logic)**.**

$$\varphi ::= p \mid \bot \mid (\varphi \wedge \varphi) \mid (\varphi \to \varphi) \mid (\varphi \vee \varphi)$$

where $p \in \mathsf{Prop}$.

We also define negation and verum as: $\neg\varphi := \varphi \to \bot$ and $\top := \neg\bot$.

A model for such a language is defined as:

Definition 2 (Propositional Information Models)**.** *Let P be a set of propositional atoms. A* propositional information model *for P is a pair $\mathcal{M} = \langle W, V \rangle$, where:*

- *W is a non-empty set of possible worlds;*
- *$V : W \times P \to \{0, 1\}$ is a* valuation function *that assigns to each world $w \in W$ and each atom $p \in P$ a truth value $V(w, p)$, where $V(w, p) = 1$ means that p is true at w, and $V(w, p) = 0$ means that p is false at w.*

Definition 3 (Information State)**.** *An information state (or simply a state) s is a set of possible worlds, where $s \subseteq W$.*

In InqB, the central semantic notion is *support*, a relation between information states and formulas. An information state s supports a formula φ, written $s \models \varphi$, if the information available in s is sufficient to establish φ.

Definition 4 (Support Conditions in InqB)**.** *Let $\mathcal{M} = \langle W, V \rangle$ be a model and $s \subseteq W$ be an information state. The support relation $\mathcal{M}, s \models \varphi$ is defined recursively as follows:*

$$
\begin{array}{ll}
\mathcal{M}, s \models p & \text{iff } V(w, p) = 1 \text{ for all } w \in s \\
\mathcal{M}, s \models \bot & \text{iff } s = \emptyset \\
\mathcal{M}, s \models \varphi \wedge \psi & \text{iff } \mathcal{M}, s \models \varphi \text{ and } \mathcal{M}, s \models \psi \\
\mathcal{M}, s \models \varphi \to \psi & \text{iff for all } t \subseteq s,\ \mathcal{M}, t \models \varphi \text{ implies } \mathcal{M}, t \models \psi \\
\mathcal{M}, s \models \varphi \mathbin{\mathbb{V}} \psi & \text{iff } \mathcal{M}, s \models \varphi \text{ or } \mathcal{M}, s \models \psi
\end{array}
$$

Definition 5 (Downward closure)**.** *If $S \subseteq \mathscr{P}(W_M)$, the* downward closure *of S is the set:*

$$S^{\downarrow} = \{s \subseteq W_M \mid s \subseteq t \text{ for some } t \in S\}.$$

Definition 6 (Propositions)**.**

- *A proposition P is a non-empty, downward closed set of information states.*
- *The set of all propositions will be denoted by $\mathcal{P}$.*

Definition 7 (Support)**.** *An information state s supports a proposition P if and only if $s \in P$.*

Definition 8 (Informative content)**.** *For any proposition P:*

$$\text{info}(P) \coloneqq \bigcup P$$

Definition 9 (Informative and Inquisitive Propositions)**.**

- *A proposition P is informative iff* info*$(P) \neq W$*
- *A proposition P is inquisitive iff* info*$(P) \notin P$*

Definition 10 (Alternatives in a proposition)**.**

- *The maximal elements of a proposition P are called the* alternatives *in P.*
- *The set of alternatives in P is denoted as* $\mathsf{alt}(P)$.

A proposition containing finitely many elements is inquisitive if and only if it contains multiple alternatives.

From these basic concepts, we can define two crucial operators that distinguish statements from questions.

Definition 11 (Question Operator)**.**

$$?\varphi := \varphi \mathbin{\mathbb{V}} \neg\varphi$$

A state s supports $?\varphi$ if and only if it either supports φ or it supports $\neg\varphi$. This captures the essence of a polar question: it presents two alternatives (φ and $\neg\varphi$) and is resolved once one of them is established.

Definition 12 (Non-Inquisitive Closure Operator)**.**

$$!\varphi := \neg\neg\varphi$$

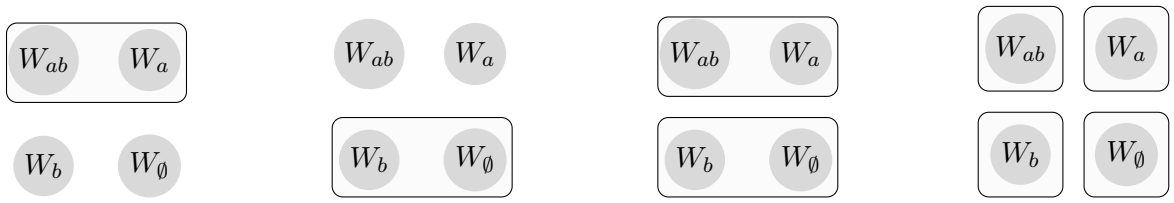
Applying ! to a formula φ yields a formula that is equivalent to the classical truth-conditional content of φ. Semantically, it corresponds to taking the proposition expressed by φ and returning a new proposition consisting of all subsets of its informational content, effectively collapsing all alternatives into one.

We can define the notions of *issues* and their *resolving*, thereby capturing interrogative sentences within the inqB system. More specifically, an information state *supports* an issue if and only if it can *resolve* that issue.

Definition 13 (Issues)**.** *An* issue *is a non-empty, downward closed set of information states.*

Definition 14 (Resolving an issue)**.** *We say that an information state s* resolves *an issue I just in case $s \in I$. If s resolves I, we will sometimes also say that I is* settled *in s.*

Definition 15 (The issue embodied by a proposition)**.** *The issue embodied by a proposition P is the one that is resolved in a state s just in case $s \in P$.*



(a) a (b) $\neg a$ (c) $?a$ (d) $?a \wedge ?b$

Figure 3.1: Basic pictures for inquisitive semantics

As shown in Figure 3.4, we can consider these examples. Each diagram represents a logical space of possible worlds. A proposition is visualized by its *alternatives*—its maximal supporting states—which are enclosed in shaded boxes.

Figure 3.4 (a) depicts the non-inquisitive proposition expressed by the statement a. It has a single alternative, which is the set of all worlds where a is true. Correspondingly, (b) shows the proposition for $\neg a$, containing the single alternative of all worlds where a is false.

In contrast, (c) illustrates an inquisitive proposition. It contains two distinct alternatives, representing the two ways to resolve the issue it raises. This corresponds to the polar question $?a$, which is defined as $a \mathbin{\mathbb{V}} \neg a$. Similarly, (d) represents the conjunctive question $?a \wedge ?b$, which is resolved only when both the issue of whether a and the issue of whether b are settled, resulting in four alternatives corresponding to each combination of truth values.

3.2 Application of InqB

In this section, we build on the InqB framework to formally define the seven distinct functions of disjunction identified in Chapter 1. At the same time, we construct lexical entries for the Mandarin disjunctive terms, as well as the sentence-final particle. We provide the InqB-based definitions for each of the disjunctive functions, as summarized in Table 3.1.

Function	**InqB Definition**	**or¹**	**or²**	**or³**
INCL	$\texttt{INCL}(p_1, \ldots, p_n) := !(p_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} p_n)$	✓		✓
EXCL	$\texttt{EXCL}(p_1, \ldots, p_n) := \bigvee_{i=1}^{n} p_i \wedge \bigwedge_{1 \leq i < j \leq n} \neg(p_i \wedge p_j)$	✓		✓
ALT	$\texttt{ALT}(p_1, \ldots, p_n) := p_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} p_n$		✓	
LIST	$\texttt{LIST}(p_1, \ldots, p_n) := ?!(p_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} p_n)$	✓		
DUAL	$\texttt{DUAL}(p_1, \ldots, p_n) := \neg!(p_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} p_n)$	✓		
EXH	$\texttt{EXHA}(p_1, \ldots, p_n) := \texttt{exh}^c!(p_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} p_n)$			✓
POSS	$\texttt{POSS}(p) := p \mathbin{\mathbb{V}} \top$	✓		

Table 3.1: Functional Definitions in the InqB System

Building on these functional definitions, we now proceed to specify the lexical entries for the Mandarin disjunctive expressions and the question particle, as shown in Table 3.2.

Lexical Item	**Lexical Entry**
huòzhě / or¹:	$[\![\text{或者}]\!] = \lambda P_1 \ldots \lambda P_n.\ !(P_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} P_n)$
háishi / or²:	$[\![\text{还是}]\!] = \lambda P_1 \ldots \lambda P_n.\ P_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} P_n$
yàome / or³:	$[\![\text{要么}]\!] = \lambda P_1 \ldots \lambda P_n.\ exh^c(!(P_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} P_n))$
ma / Q-SFP:	$[\![\text{吗}]\!] = \lambda P.\ ?P$

Table 3.2: Lexical Entries for Mandarin Disjunctives and Question Particle in InqB

3.2.1 Inclusive and Exclusive Functions

The *Inclusive* function (INCL) represents the classical logical disjunction: a statement of the form $p \vee q$ is true if at least one of the disjuncts holds. In contrast, the *Exclusive* function (EXCL) excludes the possibility that both disjuncts are true simultaneously.

Based on the InqB framework, we define these functions as follows:

$$\texttt{INCL}(p_1, \ldots, p_n) := !(p_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} p_n) \tag{3.1}$$

$$\texttt{EXCL}(p_1, \ldots, p_n) := \bigvee_{i=1}^{n} p_i \wedge \bigwedge_{1 \le i < j \le n} \neg(p_i \wedge p_j) \tag{3.2}$$

However, as discussed in Chapter 2, the existence of exclusive disjunctions in natural language remains a question. More commonly, exclusivity arises when the two disjuncts are logically or contextually incompatible. Consider the following examples:

(67)

shuìzháo le	**huòzhě**	xǐngzhe
睡着了	**或者**	醒着
Asleep	**or**[1]	awake

"Asleep **or**[1] awake."

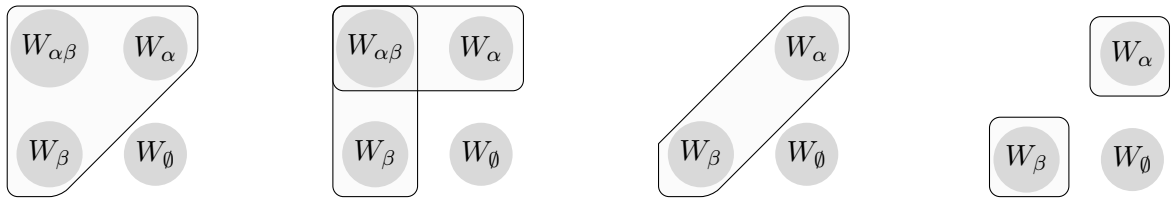
(68)

nǐ	xǐhuān	**háishi**	bùxǐhuān
你	喜欢	**还是**	不喜欢
you	like	**or**[2]	dislike

"Do you like it **or**[2] dislike it?"
Alternative Question

We illustrate this in Figure 3.2, where (a) represents a declarative sentence expressing inclusive disjunction, while (b) illustrates an alternative question. However, for examples like (67) and (68), we may assume that there is no possible world in which both disjuncts co-occur. Therefore, these sentences are better captured by the structures in (c) and (d), respectively.

The sentence in (67) expresses a declarative proposition with mutually exclusive alternatives, while (68) presents an exclusive alternative question.



(a) $!(\alpha \mathbin{\mathbb{V}} \beta)$ (b) $\alpha \mathbin{\mathbb{V}} \beta$ (c) $!(\alpha \mathbin{\mathbb{V}} \beta)$ (d) $\alpha \mathbin{\mathbb{V}} \beta$

Figure 3.2: Examples

[1]This remains an alternative question, where the expected response '喜欢 *like*' or '不喜欢 *dislike*', rather than a *yes/no* answer.

3.2.2 Alternative Functions

The Alternative function (ALT) is characteristic of interrogative environments, where disjunction introduces a set of alternatives and prompts the addressee to make a choice.

Formally, within the framework of Inquisitive Semantics (InqB), the ALT function takes a set of formulas $\{p_1, \ldots, p_n\}$ and applies the inquisitive disjunction operator ($\Vee$). This yields a new, inquisitive proposition that embodies the question of which of the alternatives holds.

The ALT function can be defined as follows:

$$\texttt{ALT}(p_1, \ldots, p_n) := p_1 \Vee \cdots \Vee p_n \tag{3.3}$$

As discussed in chapter 2, disjunctive questions are categorized into two types: *polar questions* and *alternative questions*. While a language like English relies on a single coordinator, *or*, to form both question types—leaving the distinction to be resolved by prosody and context—Mandarin Chinese lexicalizes this functional difference, thereby avoiding such surface ambiguity. This distinction is further exemplified by the sentence-final particle *ma*, which, as discussed in Chapter 2, functions exclusively as a marker for polar questions.

Based on InqB, we can formalize the semantic contributions of these terms and particle with the following translations:

1. Denotation of *háishì* ($\texttt{or}^2$):

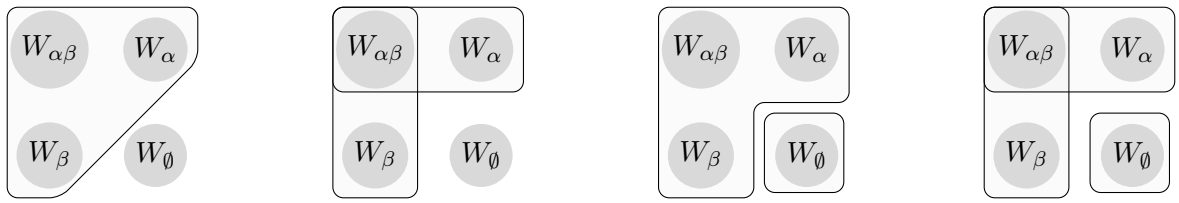
$$[\![\text{还是}]\!] = \lambda P_1, \ldots, \lambda P_n.\ P_1 \Vee \cdots \Vee P_n \tag{3.4}$$

2. Denotation of *huòzhě* ($\texttt{or}^1$):

$$[\![\text{或者}]\!] = \lambda P_1, \ldots, \lambda P_n.\ !(P_1 \Vee \cdots \Vee P_n) \tag{3.5}$$

3. Denotation of sentence-final particle *ma* (Q-SFP):

$$[\![\text{吗}]\!] = \lambda P.\ ?P \tag{3.6}$$



(a) $!(\alpha \Vee \beta)$ (b) $\alpha \Vee \beta$ (c) $?!(\alpha \Vee \beta)$ (d) $?(\alpha \Vee \beta)$

Figure 3.3: Examples of disjunctive sentences

We can now apply the InqB system to concrete examples. Consider the propositions depicted in Figure 3.3, defined over the logical space $W = \{W_{\alpha\beta}, W_\alpha, W_\beta, W_\emptyset\}$, where α represents *she speaks English* and β represents *she speaks French.*

Here, (a) illustrates the semantics of a declarative sentence with *huòzhě* or^1, corresponding to $!(\alpha \Vee \beta)$. The proposition is non-inquisitive, containing only one alternative: the set of worlds where

either α or β (or both) is true. It simply provides information.

And (b) illustrates the semantics of an alternative question with *háishi* or^2, corresponding to $\alpha \mathbin{\mathbb{V}} \beta$. This proposition is inquisitive because it contains two distinct alternatives: the set of worlds where α is true, and the set of worlds where β is true. It raises an issue by requesting a choice between these alternatives.

By contrast, (c) depicts the semantics of a polar question formed with *huòzhě* or^1 and the particle *ma*. The formula is $?!(\alpha \mathbin{\mathbb{V}} \beta)$, meaning *Is it the case that* α *or* β*?*. It presents two alternatives: the state where α or β is true, and the state where it is false (i.e., the world $W_\emptyset$).

InqB can also model expressions that are often perceived as unnatural. Consider the following example, where the inquistive disjunction *háishi* is combined with the question particle *ma*.

(69)	tā	shuō	yīngyǔ	**háishì**	gǎyǔ	ma？
	* 她	说	英语	**还是**	法语	吗？
	She	speak	English	**or**^{2}	French	**Q**?

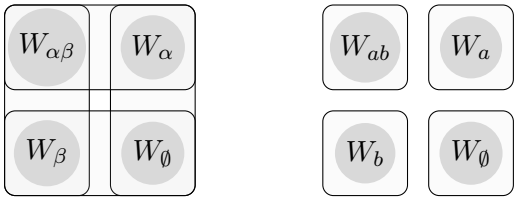
The infelicity of this sentence can be explained by its complex semantic representation. The resulting composition is $?(\alpha \mathbin{\mathbb{V}} \beta)$. This formula expands to $(\alpha \mathbin{\mathbb{V}} \beta) \mathbin{\mathbb{V}} \neg(\alpha \mathbin{\mathbb{V}} \beta)$ and presents three distinct alternatives to be resolved, as visualized in (d). This hybrid question structure is not a canonical polar or alternative question.

Furthermore, InqB can provide a semantic account for why certain complex question constructions, while grammatically possible, are pragmatically infelicitous. Consider the following example, where the alternative-question-forming *háishì* is used to coordinate two polar questions marked by *ma*.

(70)	tā	shuō	yīngyǔ	ma	**háishì**	tā	shuō	fǎyǔ	ma？
	? 她	说	英语	吗	**还是**	他	说	法语	吗？
	She	speak	English	**Q**	**or**^{2}	he	speak	French	**Q**?

"Does she speak English, or does he speak French?"

This sentence is markedly odd because it attempts to form a disjunction of two distinct polar questions. Within InqB, this structure is formalized as $?\alpha \mathbin{\mathbb{V}} ?\beta$, where α is *she speaks English* and β is *she speaks French*.



(a) $?\alpha \mathbin{\mathbb{V}} ?\beta$ (b) $?a \wedge ?b$

Figure 3.4: Complex questions

As visualized in Figure 3.4 (a), this composition results in a complex proposition with four overlapping alternatives: $\{W_{\alpha\beta}, W_\alpha\}$, $\{W_\beta, W_\emptyset\}$, $\{W_{\alpha\beta}, W_\beta\}$, and $\{W_\alpha, W_\emptyset\}$. The resulting issue is neither a simple polar question nor a standard alternative question. Its complex and overlapping structure makes it difficult for a hearer to resolve, which accounts for its pragmatic infelicity.

This contrasts sharply with a felicitous conjunctive question like $?a \wedge ?b$ (Figure 3.4b), which produces a well-behaved set of four distinct, non-overlapping alternatives. Thus, the semantic complexity predicted by the InqB model directly corresponds to the sentence's intuitive oddness.[2]

3.2.3 Exhaustive Functions

The Exhaustive function (EXHA) captures the interpretation of a disjunction as a complete set of possibilities. This reading implies an inference that the explicitly mentioned alternatives are the *only* possible ones. Within the framework of InqB, EXHA can be formally defined as:

$$\texttt{EXHA}(p_1, \ldots, p_n) := \texttt{exh}^c!(p_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} p_n)$$

This is achieved via a silent exhaustivity operator, $\texttt{exh}^c$, which is akin to *only*. The operator takes a proposition φ and a set of contextually relevant alternatives, and strengthens φ by excluding contextually excludable alternatives.

The central challenge lies in determining which alternatives can be safely negated without leading to a contradiction. To formally define $\texttt{exh}^c$, we introduce the following notions:

Definition 16 (Alternative-generating Function U)**.** *Let $\mathcal{L}$ be a set of formulas. The function $U : \mathcal{L} \to \mathcal{P}(\mathcal{L})$ maps each formula $\phi \in \mathcal{L}$ to its set of contextually relevant alternatives, $U(\phi)$. This set contains formulas that belong to the same semantic field as ϕ and is constrained by the topic of discourse and world knowledge.*

Definition 17 (Explicit Set Function E)**.** *The function $E : \mathcal{L} \to \mathcal{P}(\mathcal{L})$ maps each formula $\phi \in \mathcal{L}$ to the set of alternatives it explicitly asserts. For any ϕ, it holds that $E(\phi) \subseteq U(\phi)$.*

Definition 18 (Implicit Set Function I)**.** *The function $I : \mathcal{L} \to \mathcal{P}(\mathcal{L})$ maps each formula $\phi \in \mathcal{L}$ to its set of implicit alternatives. This set consists of the alternatives in $U(\phi)$ that were not explicitly mentioned in ϕ. It is defined as the set-theoretic complement of $E(\phi)$ within $U(\phi)$:*

$$I(\phi) := U(\phi) \setminus E(\phi)$$

Example 19. *Imagine a context of ordering a main course. The universal set of options is { beef, chicken, fish, vegetarian}. If a guest says, "I will have the beef or the chicken," then:*

- *The Explicit Set is {beef, chicken}.*
- *The Implicit Set is {fish, vegetarian}.*

The exhaustivity inference is that the guest will not have fish and will not have the vegetarian option. The $\texttt{exh}^c$ operator is responsible for negating the members of I.

Definition 20 (Contextual Exhaustification)**.** *Let φ be a proposition and $\mathcal{C}$ the context of utterance. Let $I(\varphi)$ denote the set of contextually implicit alternatives to φ in $\mathcal{C}$. The contextual exhaustification of φ is defined as:*

$$\texttt{exh}^c(\varphi) := \varphi \wedge \bigwedge_{\psi \in I(\varphi)} \neg\psi$$

[2] Some may consider that this sentence (70) could be interpreted as $?a \wedge ?b$. This is left for future discussion. In any case, the sentence is quite vague and complex.

Application to *yàome*

To reiterate our earlier points, the most significant and obligatory semantic component of the operator *yàome* is its association with exhaustivity: it triggers the exclusion of unmentioned alternatives.

For example, consider the context: Four people (Zhao, Xu, Yao, Cui) are in a competition.

(71) 王：你觉得谁会得第一名？
Wang: Who do you think will win first place?
李：要么小赵，要么小崔。
Li: Either[3] Zhao or[3] Cui.

Here, *yàome* conveys that only Zhao or Cui can win—Xu and Yao are excluded. By contrast, if we replace *yàome* with *huòzhě/or*[1], the sense of exhaustivity is significantly weaker.

Lexical Entry for 要么 *yàome* / or[3]:

$$[\![\text{要么}]\!] = \lambda P_1 ... \lambda P_n.\ \texttt{exh}^c(!(P_1 \Vee ... \Vee P_n))$$

The next example highlights the strong exhaustivity of *yàome*, whereas *huòzhě* is weaker.

(72) Wang: 校长下周什么时候会在办公室？
When will the Principal be in the office next week?
Li: **要么**星期一，**要么**星期二。
Either[3] Monday or[3] Tuesday.
Xu: 不对，她星期五下午也会在的。
That's incorrect, she will also be there on Friday afternoon.

Xu's correction is felicitous only because *yàome* implicates exhaustivity over days. Now compare with *huòzhě*:

(73) Li: 星期一**或者**星期二。
Monday or[1] Tuesday.
Xu: # 不对，她星期五下午也会在的。
#That's incorrect, she will also be there on Friday afternoon.
Li: 但她星期一会在，对吗？我没有说错。
(But she will be there Monday, right? I wasn't wrong.

Xu's reply is infelicitous here: *huòzhě* does not exhaust the set of possibilities.

We propose that *yàome/or*[3] lexically and obligatorily encodes $\texttt{exh}^c$, whereas disjunctions like *huòzhě*[1] or *háishi*[2] invoke exhaustivity only pragmatically, depending on context. This distinction can be observed in the following discussion of the DUAL and LIST functions.

3.2.4 Dual-under-negation Functions

The Dual-under-negation function (DUAL) captures a fundamental inferential pattern rooted in De Morgan's laws. Specifically, the negation of a disjunction distributes over its disjuncts:

$$\neg(p \vee q) \Leftrightarrow (\neg p \wedge \neg q)$$

In the Inquisitive Semantics framework (InqB), we define the DUAL function as follows:

$$\texttt{DUAL}(p, \ldots, q) := \neg!(p \between \cdots \between q)$$

The Case of *huòzhě* (or^1)

As previously discussed, the lexical entry for *huòzhě* or^1 is given by:

$$[\![\text{或者 (huòzhě)}]\!] = \lambda P_1 \ldots \lambda P_n.\ !(P_1 \between \cdots \between P_n)$$

Consider the declarative sentence:

(74)

tā	qù	yīngguó	**huòzhě**	fǎguó
她	去	英国	**或者**	法国
she	go	UK	**or**^{1}	France

"She is going to the UK or France."

The formal representation of (74) is $!(e \between f)$. Upon negation, we obtain:

(75)

tā	bú	qù	yīngguó	**huòzhě**	fǎguó.
她	不	去	英国	**或者**	法国。
she	not	go	UK	**or**^{1}	France.

"She is not going to the UK or France."

This resulting proposition precisely corresponds to the DUAL function, that is $\neg!(e \between f)$. Semantically, it asserts that she is not going to the UK and she is not going to France, which is the intended meaning.

The Case of *háishi* (or^2)

The disjunctive iterm *háishi* introduces inquisitive disjunction:

$$[\![\text{还是 (háishi)}]\!] = \lambda P_1 \ldots \lambda P_n.\ P_1 \between \cdots \between P_n$$

For example:

(76)

tā	qù	yīngguó	**háishi**	fǎguó?
她	去	英国	**还是**	法国？
she	go	UK	**or**^{2}	France?

"Is she going to the UK or France?"

The sentence (76) forms an alternative question, with the denotation $e \between f$. If we attempt to add negation directly (syntax) :

(77)

tā	bú	qù	yīngguó	**háishi**	fǎguó?
她	不	去	英国	**还是**	法国？
she	not	go	UK	**or**^{2}	France?

"She is not going to the UK or she is not going to France?"

The resulting sentence (77) is semantically interpreted as $\neg e \curlyvee \neg f$, still an alternative question, and thus fails to yield the DUAL effect of $\neg!(e \curlyvee f)$. In fact, in Mandarin, a sentence like (78) that trying to express $\neg(e \curlyvee f)$ is uninterpretable and doesn't make any sense:

(78) ?? tā búshì qù yīngguó **háishi** fǎguó.
?? 她 不是 去 英国 **还是** 法国。
?? she not that go UK **or**[2] France.
?? "Not that is she going to the UK or France"

However, such negation can be conveyed through discourse:

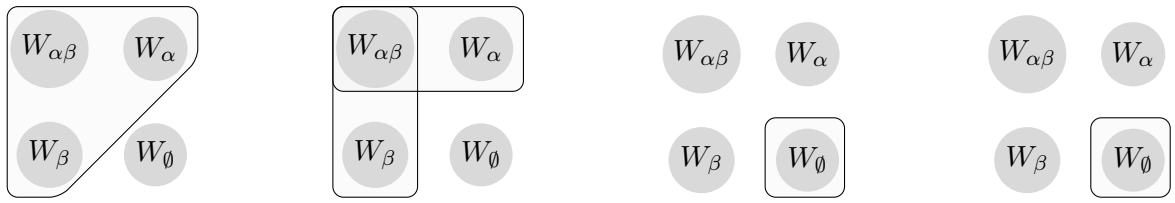
(79) **Wang:** 她去英国还是法国？
Wang: Is she going to the UK or France?
Li: 不，她去日本。
Li: No, she is going to Japan.[3]

Therefore, under our analysis, *háishi* is incompatible with the DUAL function. Empirically, direct syntactic negation of *háishi*-disjunctions—such as in (78)—results in ill-formed sentences. Formally, the DUAL function requires a non-inquisitive proposition as its argument, necessitating the presence of the ! operator, which is absent from the lexical entry of *háishi*.

Nevertheless, although direct syntactic negation is blocked, the inquisitive proposal introduced by *háishi* can still be rejected at the conversational level, as illustrated in the dialogue above. This suggests that *háishi*-disjunctions cannot directly appear in the syntactic scope of a negation operator.

From a discourse-semantic perspective, rejecting an alternative question as a whole is pragmatically odd, as it leaves the question unresolved. Based on the above considerations, I propose that *háishi* inherently blocks the licensing of sentential negation within its scope, thereby enforcing an inquisitive interpretation that resists negation.

See Figure 3.5.



(a) $!(\alpha \curlyvee \beta)$ (b) $\alpha \curlyvee \beta$ (c) $\neg!(\alpha \curlyvee \beta)$ (d) $\neg(\alpha \curlyvee \beta)$

Figure 3.5: Examples

The Case of *yàome* (or[3]).

Finally, we turn to *yàome*. As a disjunction with an exhaustive component, *yàome* behaves significantly differently from regular disjunctions under negation.

[3]Here, if Wang's utterance is interpreted as an open-ended suggestion, it is possible to respond with "*no*". However, if the context requires Wang's utterance to be understood clearly as a alternative question, a more appropriate response would be "*Neither, actually, she is going to Japan.*"

(80) tā **yàome** qù yīngguó **yàome** qù Fǎguó
她 **要么** 去英国 **要么** 去法国
she **either**^{3} go to UK **or**^{3} go to France
"She is going **either**^{3} to the UK **or**^{3} to France."

(81) tā **bìng bù shì** **yàome** qù yīngguó **yàome** qù Fǎguó
她 **并不是** **要么** 去英国 **要么** 去法国
she **is not** **either**^{3} go to UK **or**^{3} go to France
"It is not the case that she is going **either**^{3} to the UK **or**^{3} to France."

Interpretation: The exhaustive options are denied. This implies that her destination is not limited to only the UK or France. For instance, she **may** visit one of the mentioned countries along with a new one (e.g., the UK and Japan), or travel to a different country altogether.
Formal reading: $\neg \texttt{exh}^c(!(e \vee f))$

Now consider the following context: Suppose Wang is deciding among three destinations—UK (e), France (f), and Japan (j). Consider the following proposition:

$$\varphi = !(e \Vee f)$$

When using the disjunction *huòzhě*, the sentence exactly expresses the proposition $\varphi = !(e \Vee f)$:

(82) 她去英国**或者**去法国。
She is going to the UK ***or***^{2} *France.*

In contrast, with *yàome*, the sentence expresses a exhaustified interpretation:

(83) 她**要么**去英国，**要么**去法国。
She is going ***either***^{3} *to the UK* ***or***^{3} *to France.*

Based on the discussion above, the proposition expressed here is:

$$\texttt{exh}^c(!(e \Vee f))$$

Let φ denotes the sentence (83). Assume the contextual universal alternative set is $U(\varphi) = \{e, f, j\}$. And clearly the explicit set $E(\varphi) = \{e, f\}$.Then we have implicit set $I(\varphi) = \{j\}$.

Therefore, by our definition, the contextual exhaustification yields the meaning:

$$\texttt{exh}^c(!(e \Vee f)) = !(e \Vee f) \wedge \neg j$$

That is, the utterance entails: "*She is going either to the UK or to France, and not to Japan.*"

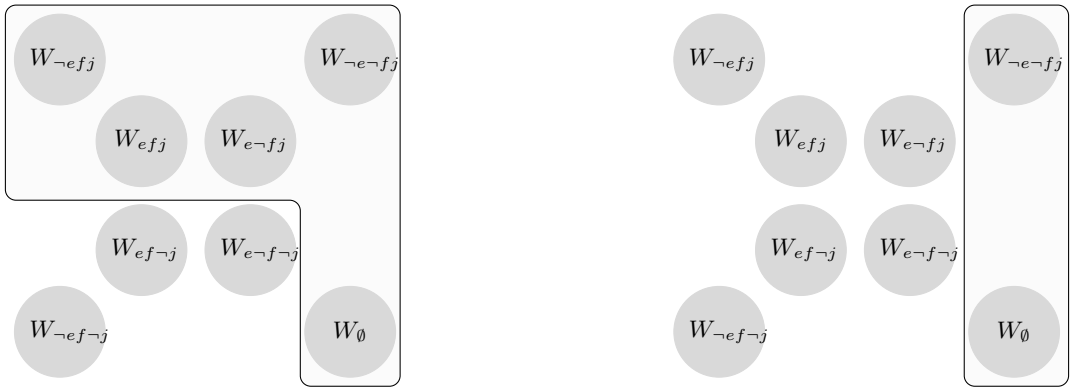
Now consider the negation:

(84) 她**并不是要么**去英国**要么**去法国。
It is **not** the case that she is going **either**^{3} to the UK **or**^{3} to France.

The formal representation of (84) is:

$$\neg \text{exh}^c(!(e \Vee f)) = \neg\,(!(e \Vee f) \wedge \neg j)$$

This logical form captures the denial of an exhaustive disjunction. In other words, sentence (84) is true if and only if she is going neither to the UK nor to France, or if she is going to Japan. See Figure 3.6(a) for a visual representation.



(a) $\neg\,(!(e \mathbin{\mathbb{V}} f) \wedge \neg j)$ (b) $\neg!(e \mathbin{\mathbb{V}} f)$

Figure 3.6: $\neg\texttt{exh}^s(!(e \mathbin{\mathbb{V}} p))$

For comparison, consider a negated *huòzhě*-disjunction:

(85) 她**不**去英国**或者**去法国。
*She is **not** going to the UK **or**[1] to France.*
Interpretation: A standard De Morgan inference: she is not going to the UK *and* she is not going to France.
Formal representation: $\neg(!(e \mathbin{\mathbb{V}} f)) \Leftrightarrow \neg e \wedge \neg f$

This interpretation is visualized in Figure 3.6(b).

Scope of Negation. Throughout this analysis, we assume that negation always takes scope *above* the exhaustification operator. That is, negation targets the exhaustified proposition, rather than the bare disjunction.

This scopal configuration explains why expressions like *yàome* fail to license the standard `DUAL` function: negating an exhaustified disjunction does not yield the distributive inferences predicted by De Morgan's laws.

3.2.5 List-marker Functions

The `LIST` function is used to present a non-exhaustive enumeration. This function introduces a set of examples while remaining open to other, unstated options.

Formally, within Inquisitive Semantics (InqB), this function takes a set of formulas $\{p_1, \ldots, p_n\}$ and is defined as:

$$\begin{aligned}\texttt{LIST}(p_1, \ldots, p_n) :=& ?!(p_1 \mathbin{\mathbb{V}} \ldots \mathbin{\mathbb{V}} p_n)\\ \equiv& !(p_1 \mathbin{\mathbb{V}} \ldots \mathbin{\mathbb{V}} p_n) \mathbin{\mathbb{V}} \neg!(p_1 \mathbin{\mathbb{V}} \ldots \mathbin{\mathbb{V}} p_n)\end{aligned}$$

Here, the inquisitive disjunction $(p_1 \mathbin{\mathbb{V}} \ldots \mathbin{\mathbb{V}} p_n)$ creates a state with multiple possibilities. The '!' operator then flattens this inquisitive state into a simple assertion. Then, the '?' operator provides a non-exhaustive reading by adding a new alternative.

The Case of *huòzhě* (or^1)

(86)
tā	shuō	yīngyǔ	**huòzhě**	fǎyǔ	↑
她	说	英语	**或者**	法语	↑
she	speak	English	**or**^{1}	French	↑

"She speak English or French ↑ "

The prosodic rise at the end of (86) indicates uncertainty. Formally, this corresponds to:

$$?!(e \veebar f)$$

As visualized in Figure 3.7a, this expression yields a prototypical `LIST` reading: the speaker presents a set of salient alternatives but leaves open the possibility that other options may also be valid.

The Case of *háishi* (or^2)

As discussed in Chapter 2, Mandarin, as a tonal language, exhibits more complex semantic distinctions arising from sentence-final intonation patterns. In particular, the disjunctive particle *háishi* intuitively carries a rising tone. Consider the following example:

(87)
tā	shuō	yīngyǔ	**háishì**	fǎyǔ	↑
她	说	英语	**还是**	法语	↑
she	speak	English	**or**^{2}	French	↑

"Does she speak English or French?"

Under specific prosodic contours—such as a pause followed by a drawn-out *háishi*—the sentence in (87) can convey uncertainty rather than functioning as a typical alternative question. In this context, the speaker is not simply asking for a choice between two options. Instead, they are expressing a weakly held belief and inviting confirmation or correction. The intended meaning approximates a much fuller proposition, such as:

"*I seem to recall she speaks either English or French, but I am not entirely certain and invite you to correct me if you know otherwise.*"

A more explicit and common way to say：

(88)
tā	shuō	yīngyǔ	**háishì**	fǎyǔ,	**háishì**...
她	说	英语	**还是**	法语,	**还是**...
she	speak	English	**or**^{2}	French,	**or**^{2}...

"Does she speak English, or French, or...?"

In (88), the repetition of *háishi* explicitly signals that there are more than two alternatives. The structure "A *háishi* B, *háishi*..." creates a three-way disjunction where the third option is an open placeholder for any other possibility. This reading can be illustrated by the partition in Figure 3.7b.

The Case of *yàome* (or^3)

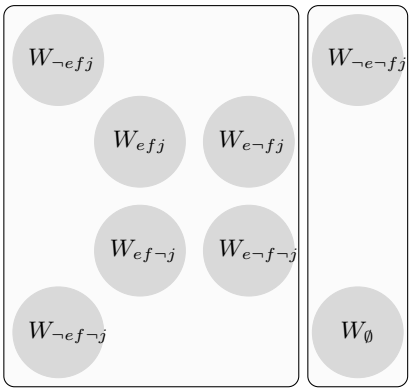
(89) tā **yàome** shuō yīngyǔ **yàome** shuō fǎyǔ ↑
她 **要么** 说英语 **要么** 说法语 ↑
she **either**[3] speak English **or**[3] speak French ↑
"She speaks either English or French↑"

The rising intonation at the end of (89) signals an interrogative speech act, suggesting uncertainty or a request for confirmation. However, unlike the standard `LIST` reading associated with *huòzhě*, this sentence admits at least two distinct interpretations:

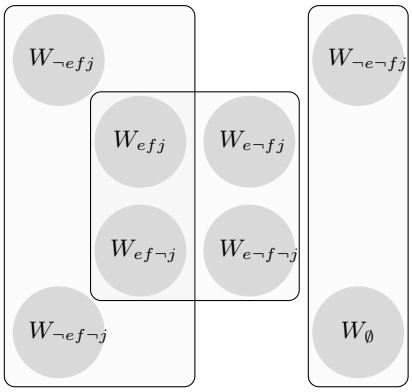
(i) The uncertainty about exhaustion, targeting the $\texttt{exh}^c$. This is illustrated in Figure 3.7c.

(ii) An *exhaustive uncertainty* reading: The speaker presupposes an exhaustive set of options English, French but expresses localized doubt about a single disjunct, considering a potential replacement (e.g., Japanese for French). This is illustrated in Figure 3.7d.

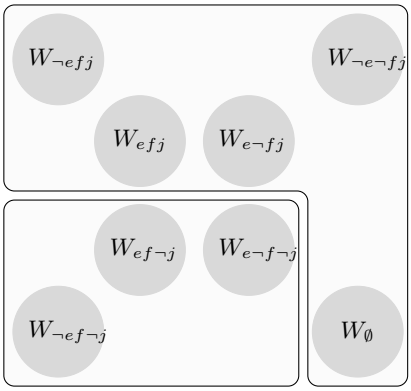
This behavior shows that *yàome* does not support a prototypical `LIST` function. Rather than inviting an open-ended enumeration of options, *yàome* structures the proposition around a fixed set of mutually exclusive alternatives, often with a presupposition of exhaustivity. Accordingly, we conclude that *yàome* is incompatible with the `LIST` function, as it resists non-exhaustive extension and cannot be naturally used for open-ended listing.



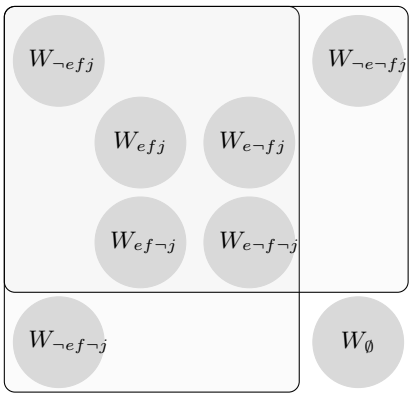
(a) $?!(e \mathbb{V} j)$



(b) $?(e \mathbb{V} j)$



(c) yàome Reading 1



(d) yàome Reading 2

Figure 3.7: A comparison of `LIST` readings.

3.2.6 Possibility-marker Functions

Finally, the *Possibility-marker* function (POSS) captures a use of disjunction that expresses epistemic uncertainty. This use is attested in certain languages, such as Mandarin *huòzhě* and Japanese *aruiwa*, where disjunctive terms approximate modal expressions like *maybe* or *perhaps*, as illustrated with Mandarin *huò* below:

(90)

jǔ	ge	lìzi	**huò**	kě	yī mù liǎorán
举	个	例子	**或**	可	一目了然
give	an	example	**or**[1]	can	clear-at-a-glance

"An example might could make it clear at a glance."

To formalize this function, we adopt the approach from Ciardelli, Groenendijk, et al. (2009), which was originally proposed to account for English words like *might*. We find this method suitable because, in its POSS function, the disjunctive behaves analogously to these modal verbs. Notably, this framework defines the operation as a disjunction between a proposition and verum ($\top$). Since the primary role of *huòzhě* in Mandarin is also disjunction, this parallel presents an interesting topic for further investigation.

The semantic value of this modal use of disjunction is defined as a function that takes a proposition P and returns its inquisitive disjunction with the trivial proposition, $\top$ (verum). This operation generates what is known as *attentive content*.

$$[\![\text{或 (huò)}]\!]_{\text{modal}} = \lambda P.\ P \veebar \top$$

To understand the rationale behind this definition, we must delve deeper into the notion of possibilities in Inquisitive Semantics.

Definition 21 (Possibility)**.** *A possibility is a set of possible worlds.*

Unlike propositions, possibilities are not downward closed.

Definition 22 (Maximal Possibility)**.** *A possibility α in a set of possibilities P is maximal if there is no other possibility $\beta \in P$ such that $\alpha \subset \beta$.*

Definition 23 (Non-maximal Possibility)**.** *A possibility α is non-maximal in a proposition if there is another possibility β in that same proposition such that $\alpha \subset \beta$.*

Possibilities that are proper subsets of others are considered redundant, as they do not contribute to the informative or inquisitive content of a sentence. Hence, it is standard in inquisitive semantics to disregard such *non-maximal* possibilities.

The presence of non-maximal possibilities marks what is known as an *attentive sentence*:

Definition 24 (Informativeness and Attentiveness)**.** *For any sentence φ:*

- *φ is* informative *if and only if the maximal possibility in φ is not $\{w\}$.*
- *φ is* attentive *if and only if φ is not empty and contains a non-maximal possibility.*

Based on these definitions, we can now see how the POSS function derives its meaning from the presence of $\top$ in inquisitive disjunction. The formula $P \mathbin{\mathbb{V}} \top$ introduces a non-maximal possibility that signals the speaker is highlighting P as something to attend to—typically in the context of uncertainty.

This framework allows us to analyze the modal-like uses of *huò*. The sentence in (90) can be represented by the formula $\alpha \mathbin{\mathbb{V}} \top$, visualized in Figure 3.8a. We can clearly see a non-maximal possibility (the inner shaded area, representing the possibility of α) contained within the maximal one (the outer shaded area, representing ω). The sentence is therefore not informative but serves to draw the hearer's attention to the possibility that an example would clarify things.

Furthermore, consider following example:

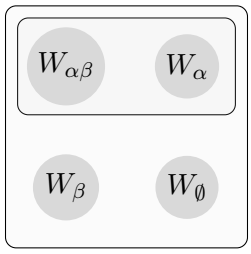
(91)

tóngxuémen	**huò**	chànggē	**huò**	tiàowǔ
同学们	**或**	唱歌	**或**	跳舞
students	**or**[1]	sing	**or**[1]	dance

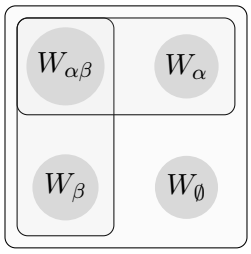
"The students perhaps sang, perhaps danced."

This sentence is captured by the formula $(\alpha \mathbin{\mathbb{V}} \top) \mathbin{\mathbb{V}} (\beta \mathbin{\mathbb{V}} \top)$, which is equivalent to $\alpha \mathbin{\mathbb{V}} \beta \mathbin{\mathbb{V}} \top$. As visualized in Figure 3.8b, this proposition contains three possibilities: α, β, and ω. Both α and β are non-maximal. This accurately represents the meaning of (91): it raises the possibilities that students sang and that they danced, without excluding the possibility that they did neither.

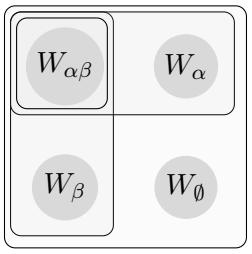
In contrast, the conjunctive counterpart, $(\alpha \mathbin{\mathbb{V}} \top) \wedge (\beta \mathbin{\mathbb{V}} \top)$, depicted in Figure 3.8 (c), expresses *maybe* α *and maybe* β. Its proposition contains the possibilities $\alpha \wedge \beta, \alpha, \beta$ and ω. This highlights the individual possibilities of α and β as well as their conjunction, while still being non-informative overall.



(a) $\alpha \mathbin{\mathbb{V}} \top$



(b) $(\alpha \mathbin{\mathbb{V}} \top) \mathbin{\mathbb{V}} (\beta \mathbin{\mathbb{V}} \top)$



(c) $(\alpha \mathbin{\mathbb{V}} \top) \wedge (\beta \mathbin{\mathbb{V}} \top)$

Figure 3.8: Examples of POSS

Chapter 4

Free Choice

4.1 Introduction

The Free Choice (FC) phenomenon is a long-standing puzzle that reveals a gap between classical logic and natural language. For instance, a sentence like *You may eat cake or ice cream* is generally understood as the speaker granting two permissions: *You may eat cake* and *You may eat ice cream*. This has been famously discussed by Wright (1968), Kamp (1974), and Zimmermann (2000).

This intuitive inference (i.e., $\Diamond(p \vee q) \rightsquigarrow \Diamond p \wedge \Diamond q$) would lead to catastrophic consequences if we add it as an axiom to logic systems. As Kamp (1974) pointed out, this would allow deriving any permission from a true permission. For example, starting from *You can eat cake*, according to the disjunction introduction rule in classical logic, we can get *You can eat cake or poison*, and then applying the free choice principle, we would arrive at the absurd conclusion *You can eat poison*.

The traditional pragmatic approach, especially the analysis based on Gricean conversational implicature theory, holds that free choice inferences are not semantic entailments but cancellable pragmatic implicatures that usually cannot be embedded under logical operators (see, e.g., Gazdar (1979); Franke (2011); Champollion et al. (2019)). The main evidence for this view is that in certain contexts, the free choice effect can indeed be cancelled. For example, *You can go to Paris or Rome, but I forget which one*.

However, purely pragmatic explanations also face challenges. First, in the context of epistemic modality, the free choice effect seems to be non-cancellable. For example, *He might be in Beijing or Shanghai* strongly implies that both possibilities exist. Second, Chemla (2009) shows that free choice inferences can be embedded under universal quantifiers, which is inconsistent with the characteristics of typical conversational implicatures. These behaviors have prompted new theoretical explorations.

A novel approach, exemplified by the work of Aloni (2022), moves beyond a strict semantics-pragmatics dichotomy, seeking instead to model them within a unified logical framework. Its core idea is that the free choice effect stems from an inherent cognitive tendency in human language understanding, namely *neglect-zero*. The *zero models* refer to models that happen to satisfy a sentence due to an empty set configuration (for example, *All unicorns have horns* is true in a world with no unicorns).

In summary, these modern logical tools offer a powerful perspective on the complex FC phenomenon. This theoretical background lays a solid foundation for the subsequent investigation into Mandarin Chinese.

This chapter is structured as follows. First, it analyzes the Free Choice phenomenon in Mandarin,

focusing on three distinct disjunctive expressions. It then evaluates the capacity of Inquisitive Logic (InqB) to capture these empirical findings. Finally, the chapter introduces Bilateral State-based Modal Logic (BSML) and demonstrates how it provides a more comprehensive analysis of Mandarin disjunctions.

4.2 Free Choice Phenomena in Mandarin

This section begins with a discussion of the *Ignorance Inference* that often accompanies Free Choice (FC) interpretations, focusing on different disjunctions in Mandarin.

Subsequently, the chapter investigates the Free Choice (FC) phenomenon in Mandarin. Specifically, we examine the behavior of three Mandarin disjunctive particles—*huòzhě* or^1, *háishi* or^2, and *yàome…yàome* or^3—in interaction with epistemic and deontic modals.

4.2.1 Ignorance Inference

Disjunctions in natural language often give rise to an **ignorance inference**, meaning that when a speaker utters a disjunctive sentence, it typically implies that the speaker does not know which disjunct is true. We can test this phenomenon using the experimental paradigm proposed by Degano et al. (2025).

In their task, participants were shown three boxes: two *transparent* (revealing their contents, such as colored balls) and a third *opaque* mystery box. The key assumption was that the mystery box must contain a ball identical in color to one of the two visible boxes.

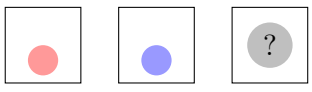
Participants are then asked to judge the felicity of a target sentence (as *Good* or *Bad*) in response to different scenarios.

Test sentence:

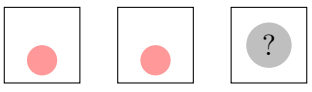
> *"The mystery box contains a red ball or a blue ball."*

We consider two experimental conditions, depicted in Figure 4.1:

1. **Target-1**: The first box contains a red ball and the second contains a blue ball.
2. **Target-2**: Both of the first two boxes contain red balls.



(a) Target-1



(b) Target-2

Figure 4.1: Mystery box paradigm

The results reported by Degano et al. (2025) indicate that participants tend to judge the target sentence as *Good* in Condition 1, but as *Bad* in Condition 2. This aligns with the predictions of the *ignorance inference*. In Condition 2, any rational observer knows the mystery box must contain a red ball, thus violating the ignorance condition.

Interestingly, while the Mandarin disjunctive particle *huòzhě* or^1 behaves as predicted by this model, the exclusive disjunction *yàome…yàome* or^3 exhibits a different pattern.[1]

First, let us replace the target sentence with one constructed with *huòzhě* and evaluate it in the context of Condition 2, where ignorance is violated.

(92) 王：第三个盒子里的球是红色**或者**蓝色的。
Wáng: The ball in the third box is red ***or***^{1} *blue.*
李：错了，只能是红色的。
Lǐ: That's wrong. It can only be red.

Here, Wang's use of *huòzhě* is infelicitous. Because both visible boxes are red, making blue an impossible option. Li's direct rejection is therefore justified. This supports that *huòzhě* carries an ignorance inference.

However, when we substitute the construction with *yàome…yàome*, the utterance is no longer clearly false. Instead of being judged as *Good* or *Bad*, the utterance is better described as *Fine*:

(93) 王：第三个盒子里的球，**要么**是红色的**要么**是蓝色的。
Wang: The ball in the third box is ***either***^{3} *red* ***or***^{3} *blue.*

李：# 错了，只能是红色的。
Li: # That's wrong. It can only be red.

李：但我们都知道只能是红色的啊。
Li: But we both know it can only be red.

王：没错，但我说的也不矛盾啊。
Wang: True, but what I said isn't contradictory.

Li's response in (93) marked with # is pragmatically infelicitous. Although Wang's statement, *The ball in the third box is* ***either***^{3} *red* ***or***^{3} *blue,* is pragmatically odd because it conveys redundant information in this context, it is not strictly false.

This suggests that the *yàome…yàome* construction does not carry the same mandatory ignorance inference as *huòzhě*. Instead, its primary function is to present an *exhaustive judgment*. That is, it asserts that the possibilities are strictly limited to the disjuncts mentioned—the ball can *only* be red or blue. While this does not explicitly identify which of the two colors is correct, the act of asserting exhaustivity implies that the speaker is not entirely ignorant, because they at least have the knowledge that it is impossible for the ball to be any other color.

Based on the preceding discussion, we can conclude that *yàome…yàome* consistently involves an `EXHA` function.

4.2.2 The Case of *huòzhě* or^1

In this section, we test the Free Choice (FC) reading of *huòzhě*. The target sentences for the test is based on Aloni (2022). We use question mark (?) in the results to indicate that the inference is uncertain or context-dependent. A full analysis of these cases is left for future research.

[1]The role of *háishì* or^2 is not addressed in this analysis. This is because substituting it into the target sentence would merely yield an alternative question (e.g., "Is the ball red or blue?"), rather than the declarative assertion our experiment is designed to test.

Narrow scope free choice

Huòzhě is the canonical declarative disjunction in Mandarin. As we will see, it robustly generates Free Choice inferences in narrow-scope contexts, formalized as:

$$\Diamond(\alpha \vee \beta) \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta \qquad \text{(Narrow scope free choice)}$$

For this analysis, we will specifically test the validity of the following entailment:

$$\Diamond(\alpha \vee \beta) \rightarrow \Diamond\alpha \qquad \text{(FC Principle)}$$

Consider a sentence where *huòzhě* has narrow scope with respect to an epistemic modal like 可能 *kěnéng* (*might/probably*) or a deontic modal like 可以 *kěyǐ* (*can/may*).

Epistemic modal:

(94)

wǒ men	kě néng	qù	gōngyuán	**huòzhě**	bó wù guǎn
我们	可能	去	公园	**或者**	博物馆
we	probably	go to	park	**or**[1]	museum

"We might go to the park or the museum."

Inference Test:

$\Diamond(\alpha \vee \beta) \Rightarrow \Diamond\alpha$	Yes
$\Diamond\alpha \Rightarrow \Diamond(\alpha \vee \beta)$	No

Deontic modal:

(95)

wǒ men	kě yǐ	qù	gōng yuán	**huòzhě**	bó wù guǎn
我们	可以	去	公园	**或者**	博物馆
we	can	go to	park	**or**[1]	museum

"We can go to the park or the museum."

Inference Test:

$\Diamond(\alpha \vee \beta) \Rightarrow \Diamond\alpha$	Yes
$\Diamond\alpha \Rightarrow \Diamond(\alpha \vee \beta)$	No

Wide Scop Free Choice

When the disjunction takes wide scope over the modals, the FC reading is formalized as:

$$\Diamond\alpha \vee \Diamond\beta \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta \qquad \text{(Wide scope free choice)}$$

Epistemic modal:

(96)

wǒ men	kě néng	qù	gōng yuán	**huòzhě**	kě néng	qù	bó wù guǎn
我们	可能	去	公园	**或者**	可能	去	博物馆
we	probably	go	park	**or**[1]	probably	go	museum

"We might go to the park or might go to the museum."

Inference Test:

$$\Diamond\alpha \vee \Diamond\beta \Rightarrow \Diamond\alpha \qquad ??\ ^{2}$$
$$\Diamond\alpha \Rightarrow \Diamond(\alpha \vee \beta) \qquad \text{No}$$

Deontic modal:

(97)

wǒ men	kě yǐ	qù	gōng yuán	**huòzhě**	kě yǐ	qù	bó wù guǎn
我们	可以	去	公园	**或者**	可以	去	博物馆
we	can	go	park	**or**[1]	can	go	museum

"We can go to the park or can go to the museum."

Inference Test:

$$\Diamond\alpha \vee \Diamond\beta \Rightarrow \Diamond\alpha \quad ??$$

Dual Prohibition

The phenomenon of *Dual Prohibition* arises when a disjunction (e.g., *or*) is embedded under the scope of negation and a modal. It triggers a strengthened interpretation where the negation distributes over each disjunct individually, yielding a conjunctive inference of prohibition $\neg\Diamond\alpha \wedge \neg\Diamond\beta$, which is stronger than the interpretation of merely negating the disjunction $\neg\Diamond(\alpha \vee \beta)$.

(98)

wǒ men	**bù**	kě néng	qù	gōng yuán	**huòzhě**	bó wù guǎn
我们	**不**	可能	去	公园	**或者**	博物馆
we	**no**	probably	go to	park	**or**[1]	museum

"We can't possibly go to the park or the museum."

Inference Test:

$$\neg\Diamond(\alpha \vee \beta) \rightsquigarrow \neg\Diamond\alpha \Rightarrow \text{Yes}$$
$$\neg\Diamond(\alpha \vee \beta) \rightsquigarrow \neg\Diamond\alpha \wedge \neg\Diamond\beta \Rightarrow ??\text{Yes}$$

Deontic modal:

(99)

wǒ men	**bù**	bèi yùn xǔ	qù	gōng yuán	**huòzhě**	bó wù guǎn
我们	**不**	被允许	去	公园	**或者**	博物馆
we	**no**	are allowed	go to	park	**or**[1]	museum

"We are not allowed to go to the park or the museum."

Inference Test:

$$\neg\Diamond(\alpha \vee \beta) \rightsquigarrow \neg\Diamond\alpha \Rightarrow \text{Yes}$$
$$\neg\Diamond(\alpha \vee \beta) \rightsquigarrow \neg\Diamond\alpha \wedge \neg\Diamond\beta \Rightarrow ??\text{Yes}$$

[2] One possible reading is that the second disjunctor seems to imply the negation of the first one, meaning that only one of them can be true.

Universal Free Choice

Deontic modal:

(100) suǒ yǒu xué sheng dōu bèi yǔn xǔ qù gōng yuán **huòzhě** bó wù guǎn

所有 学生 都 被允许 去 公园 **或者** 博物馆

all students all are allowed go to park **or**[1] museum

"All the students are allowed to go to the park or the museum."

Inference Test:

$$\forall x \Diamond(\alpha \vee \beta) \rightsquigarrow \forall x(\Diamond\alpha \wedge \Diamond\beta) \Rightarrow \text{Yes}$$

Double Negation

(101) **bú shì** **méi yǒu** kě néng qù gōng yuán **huòzhě** tú shū guǎn

不是 **没有** 可能 去 公园 **或者** 图书馆

not **not**[2] possible to go to the park **or**[1] the library

"It is not impossible to go to the park or the library."

Inference Test:

$$\neg\neg\Diamond(\alpha \wedge \beta) \rightsquigarrow \Diamond(\alpha \wedge \beta) \Rightarrow \text{Yes}$$
$$\neg\neg\Diamond(\alpha \wedge \beta) \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta \Rightarrow ??$$

4.2.3 The Case of *haishi or*[2]

The disjunctive particle *háishi* (还是) exhibits fundamentally different behavior from the declarative disjunction *huòzhě*. The core reason is that *háishi* is an obligatorily interrogative particle. Its primary function is to form alternative questions.

The Absence of a Narrow-Scope Reading

A narrow-scope configuration simply cannot be constructed with *háishi*. Sentences using *háishi* always function as alternative questions, even when they appear in embedded contexts. Consider the following example: although the surface syntax seems to suggest a narrow-scope reading, the semantics of the sentence clearly reflect a wide-scope interpretation:

(102) wǒ men kě néng qù gōng yuán **hái shi** bó wù guǎn

我们 可能 去 公园 **还是** 博物馆

we probably go to park **or**[2] museum

"We might go to the park or the museum?"

Wide Scop Free Choice

Epistemic modal:

(103)

wǒ men	kě néng	qù	gōng yuán	**hái shi**	kě néng	qù	bó wù guǎn
我们	可能	去	公园	**还是**	可能	去	博物馆
we	probably	go	park	**or**^{2}	probably	go	museum

"We might go to the park or might go to the museum ?"

Inference Test:

$$\Diamond\alpha \vee \Diamond\beta \Rightarrow \Diamond\alpha \quad ??$$

Deontic modal:

(104)

wǒ men	kě yǐ	qù	gōng yuán	**hái shì**	kě yǐ	qù	bó wù guǎn
我们	可以	去	公园	**还是**	可以	去	博物馆
we	can	go	park	**or**^{2}	can	go	museum

"We can go to the park or can go to the museum ?"

Inference Test:

$$\Diamond\alpha \vee \Diamond\beta \Rightarrow \Diamond\alpha \quad ??$$

The sentence in (103) and (104) is clearly a question. Here, we choose to reinterpret the test as a way of probing the *speaker's epistemic state*. Under this view, the formula does not represent a logical premise, but rather the cognitive state of a speaker who utters the question. We have marked the outcome of this test with ??, remains a question for future work.

Universal Free Choice

Deontic modal:

(105)

suǒ yǒu	xué sheng	dōu	bèi yǔn xǔ	qù	gōng yuán	**hái shì**	bó wù guǎn
所有	学生	都	被允许	去	公园	**还是**	博物馆
all	students	all	are allowed	go to	park	**or**^{2}	museum

"All the students are allowed to go to the park or the museum."

The reading is always wide scope and is still an alternative question: $\forall x\Diamond\alpha \wotimes \forall x\Diamond\beta$.

4.2.4 The Case of *yàome or*^{3}

Narrow scope free choice

Epistemic modal:

(106) Wáng xiānsheng yǒu kěnéng **yàome** dàizǒu 50 wàn **yàome** dàizǒu 1000 kè jīnzi [3]
王先生 有可能 **要么** 带走 50 万元 **要么** 带走 1000 克金子
Mr. Wang might **either**[3] take 500,000¥ **or**[3] take 1000g gold
"Mr. Wang might take either 500,000¥ or 1000 grams of gold."

Inference Test:

$$\Diamond(\alpha \vee \beta) \Rightarrow \Diamond\alpha \quad ??\ \text{No}$$
$$\Diamond\alpha \Rightarrow \Diamond(\alpha \vee \beta) \quad ??\ \text{Yes}$$

This test presents a certain difficulty, as the free choice inference is significantly weaker here than in the deontic version.

Deontic modal:

(107) Wáng xiānsheng bèi yǔnxǔ **yàome** dàizǒu 50 wàn **yàome** dàizǒu 1000 kè jīnzi
王先生 被允许 **要么** 带走 50 万元 **要么** 带走 1000 克金子
Mr. Wang is permitted **either**[3] take 500,000¥ **or**[3] take 1000g gold
"Mr. Wang is allowed to take either 500,000¥ or 1000 grams of gold."

Inference Test:

$$\Diamond(\alpha \vee \beta) \Rightarrow \Diamond\alpha \quad \text{Yes}$$
$$\Diamond\alpha \Rightarrow \Diamond(\alpha \vee \beta) \quad \text{No}$$

Wide Scop Free Choice

Epistemic modal:

(108) wǒ men **yào me** kě néng qù gōng yuán, **yào me** kě néng qù bó wù guǎn
我们 **要么** 可能去 公园, **要么** 可能去 博物馆
we **or** [3] might go to park, **or** [3] might go to museum
"We either might go to the park or might go to the museum."

Inference Test:

$$\Diamond(\alpha \vee \beta) \Rightarrow \Diamond\alpha \quad \text{No}$$
$$\Diamond\alpha \Rightarrow \Diamond(\alpha \vee \beta) \quad \text{Yes}$$

Deontic modal:

(109) wǒ men **yào me** kě yǐ qù gōng yuán, **yào me** kě yǐ qù bó wù guǎn
我们 **要么** 可以 去 公园, **要么** 可以 去 博物馆
we **or** [3] can go to park , **or** [3] can go to museum
"We either can go to the park or can go to the museum."

Inference Test:

$$\Diamond(\alpha \vee \beta) \Rightarrow \Diamond\alpha \quad \text{No}$$
$$\Diamond\alpha \Rightarrow \Diamond(\alpha \vee \beta) \quad \text{Yes}$$

[3]Natural language examples of similar usage can be found, for instance, at https://cn.govopendata.com/renminribao/2000/3/29/12/. However, I decided not to use this example given the complexity of its explanation.

4.3 Free Choice in InqB

As demonstrated by the inference tests above, we summarize the key result: the particle *huòzhě* or^1 supports narrow-scope Free Choice (FC) inferences with both epistemic and deontic modals, an inference pattern captured as:

$$\Diamond(\alpha \vee \beta) \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta$$

In contrast, *yàome…yàome* or^1 only reliably licenses such FC readings in deontic modal contexts.

This section investigates how this empirical contrast can be accounted for within the framework of inquisitive semantics. While several approaches have been proposed for incorporating modality into inquisitive logic, this chapter adopts the framework of Nygren (2023), who developed a treatment of free choice inferences within inquisitive logic.

We begin with the *alternative reduct* of a set of information states A, denoted ALT($\mathcal{A}$), which is its maximal information states under set inclusion. Formally:

$$\mathrm{ALT}(A) := \{X \in A \mid \text{for all } Y \in A, \text{ if } X \subset Y \text{ then } X = Y\}$$

Definition 25 (Possibility Modal)**.** *Let M be a model and s be an information state. Then:*

$$M, s \models \blacklozenge\varphi \quad \textit{iff} \quad \forall w \in s,\ \forall\, Y \in ALT_M(\varphi),\ Y \cap R(w) \neq \emptyset$$

Here, $R(w)$ is the set of worlds accessible from w. This definition requires that for any world w in the current state s, and for any alternative Y for φ, there is at least one world accessible from w where Y is true.

As shown by Nygren (2023), this setup derives the conditional free-choice principle for inquisitive disjunction.

Definition 26 (Non-subordination relation)**.** *Let A and B be sets of information states. A and B are* non-subordinate*, written $A\#B$, if and only if:*

$$\forall s \in A,\ \forall t \in B,\ s \not\subseteq t \textit{ and } t \not\subseteq s.$$

Proposition 1 (Conditional Free-Choice Principle)**.** *Let $\mathcal{M}$ be any model and let $\varphi, \psi \in \mathcal{L}_{\blacklozenge}$ be any formulas. Then:*

$$ALT_{\mathcal{M}}(\varphi)\#\, ALT_{\mathcal{M}}(\psi) \quad \textit{implies} \quad \mathcal{M} \models \blacklozenge(\varphi \mathbin{\mathbb{V}} \psi) \to (\blacklozenge\varphi \wedge \blacklozenge\psi)$$

Based on the previous discussion, we know that the lexical entry of *háishì* or^2 is that of a pure inquisitive disjunction. However, empirical data shows that *háishì* does not give rise to free choice inferences.

In contrast, the disjunction *huòzhě* or^1 can give rise to a free choice inference in modal contexts. We represent the lexical entry for *huòzhě* or^1 as follows:

$$[\![\text{或者}]\!] = \lambda P_1 \ldots \lambda P_n.\ !(P_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} P_n)$$

For example, consider the sentence:

(1) X 先生可以坐车或者坐船。

Mr. X can take a car or a boat.

This sentence can be formally represented as $\blacklozenge!(p \Vee q)$, where p is *Mr. X takes a car* and q is *Mr. X takes a boat.* This expression licenses the free choice inference that both options are possible: $\blacklozenge p \wedge \blacklozenge q$.

However, this empirically observed inference is not logically valid in this setting.

Proposition 2.

$$\blacklozenge!(p \Vee q) \not\models \blacklozenge p \wedge \blacklozenge q$$

Proof. Consider a model $\mathcal{M}$ where w, v, u $\in$ W. Suppose state s is $\{u\}$, w$\in R(u)$ and v, u$\notin R(u)$. Let V_w(p)=V_v(q)=1, and V_w(q)=V_v(p)=0. By definition, we have that $ALT_M(!(p \Vee q)) = \{!(p \Vee q)\}$, taht is $\{w, v\}$. Thus we have $\{!(p \Vee q)\} \cap R(u) = \{w\}$, which means $\forall t \in s,\ \forall\ Y \in ALT_M(!(p \Vee q)),\ Y \cap R(t) \neq \emptyset$. By definition, we have $M, s \models \blacklozenge!(p \Vee q)$.

However, $M, s \not\models \blacklozenge p \wedge \blacklozenge q$, since by definition, $M, s \models \blacklozenge p \wedge \blacklozenge q$ iff $M, s \models \blacklozenge p$ and $M, s \models \blacklozenge q$. That means, $\forall t \in s,\ \forall\ Y \in ALT_M(p),\ Y \cap R(t) \neq \emptyset$ and $\forall t \in s,\ \forall\ Y \in ALT_M(q),\ Y \cap R(t) \neq \emptyset$. But since $ALT_M(q) = v$, and v$\notin R(u)$. We have that $ALT_M(q) \cap R(u) = \emptyset$.

Thus we have $M, s \models \blacklozenge!(p \Vee q)$ but $M, s \not\models \blacklozenge p \wedge \blacklozenge q$. Therefore, $\blacklozenge!(p \Vee q) \not\models \blacklozenge p \wedge \blacklozenge q$

□

Furthermore, another disjunctive construction in Mandarin, *yàome…yàome*, as we discussed earlier, consistently enforces an exhaustive interpretation. This behavior can be modeled by applying a covert exhaustivity operator, exh^c, to the standard classical disjunction.

$$[\![\text{要么}]\!] = \lambda P_1 ... \lambda P_n.\ \text{exh}^c(!(P_1 \Vee ... \Vee P_n))$$

As we observed in Chapter 2, the deontic free choice inference persists for *yàome*. To capture this formally, the following entailment would need to be valid, where $\neg r$ represents the exhaustive component:

$$\text{(Desired Entailment)} \quad \blacklozenge(!(p \Vee q) \wedge \neg r) \models \blacklozenge p \wedge \blacklozenge q \wedge \blacklozenge \neg r$$

However, in the current inquisitive system, this desired inference pattern is not valid. The exhaustive permission does not logically guarantee permission for the individual disjuncts.

Proposition 3.

$$\blacklozenge(!(p \Vee q) \wedge \neg r) \not\models \blacklozenge p \wedge \blacklozenge q \wedge \blacklozenge \neg r$$

Proof. This follows Proposition 2 trivially. □

Based on the preceding discussion, we conclude that the existing definitions proposed within InqB currently fall short of fully accounting for the free choice phenomena exhibited by different disjunctive expressions in Mandarin. Future work may explore ways to extend the framework to account for such lexical variation.

4.4 BSML with Inquisitve Disjunction

Bilateral State-Based Modal Logic (BSML) wes proposed by Aloni (2022) and Aloni et al. (2024). It is designed to model the interaction between logic, pragmatics, and linguistic, particularly concerning phenomena like free choice.

The language of BSML is defined following

Definition 27 (Language of BSML)**.**

$$\varphi ::= p \mid \bot \mid \neg\varphi \mid (\varphi \wedge \varphi) \mid (\varphi \vee \varphi) \mid \Diamond\varphi \mid NE$$

where $p \in Prop$. The box operator, $\Box\varphi$, is defined as usual as $\neg\Diamond\neg\varphi$.

A **model** M for the language is a triple (W, R, V), where:

- W is a non-empty set of **possible worlds**.
- $R \subseteq W \times W$ is an **accessibility relation**.
- $V : \text{Prop} \to \mathcal{P}(W)$ is a **valuation function** that assigns a set of worlds to each atomic proposition.

BSML semantics is defined over **states**, where a state s is a subset of W ($s \subseteq W$), representing an information state. The system is **bilateral**, meaning each formula φ is assigned both **support conditions** ($M, s \models \varphi$) and **rejection conditions** ($M, s \dashv \varphi$). These conditions are defined recursively.

Definition 28 (Semantics of BSML)**.**

$$\begin{aligned}
M, s \models p &\iff \forall w \in s,\ w \in V(p) \\
M, s \dashv p &\iff \forall w \in s,\ w \notin V(p) \\
M, s \models \bot &\iff s = \emptyset \\
M, s \dashv \bot &\quad \textit{always holds} \\
M, s \models \neg\varphi &\iff M, s \dashv \varphi \\
M, s \dashv \neg\varphi &\iff M, s \models \varphi \\
M, s \models \varphi \wedge \psi &\iff M, s \models \varphi \textit{ and } M, s \models \psi \\
M, s \dashv \varphi \wedge \psi &\iff \exists t, u \subseteq s \textit{ s.t. } s = t \cup u,\ M, t \dashv \varphi,\ M, u \dashv \psi \\
M, s \models \varphi \vee \psi &\iff \exists t, u \subseteq s \textit{ s.t. } s = t \cup u,\ M, t \models \varphi,\ M, u \models \psi \\
M, s \dashv \varphi \vee \psi &\iff M, s \dashv \varphi \textit{ and } M, s \dashv \psi \\
M, s \models \Diamond\varphi &\iff \forall w \in s,\ \exists t \subseteq R[w] \textit{ s.t. } t \neq \emptyset \textit{ and } M, t \models \varphi \\
M, s \dashv \Diamond\varphi &\iff \forall w \in s,\ M, R[w] \dashv \varphi \\
M, s \models \Box\varphi &\iff \forall w \in s,\ M, R[w] \models \varphi \\
M, s \dashv \Box\varphi &\iff \forall w \in s,\ \exists t \subseteq R[w] \textit{ s.t. } t \neq \emptyset \textit{ and } M, t \dashv \varphi
\end{aligned}$$

Note in particular the support condition of $(\varphi \vee \psi)$, where the evaluation is split over subteams. We all it as **split disjunction**, and it plays a crucial role in explaining the Free Choice phenomenon.

The semantic clauses above define a consequence relation that is equivalent to classical logic. The non-classical features of BSML arise from the formalization of pragmatic strengthening through the *non-emptiness atom (NE)*. This operator draws its motivation from the pragmatic assumption that speakers tend to avoid trivial or empty contributions (a "Neglect-Zero" principle).

Non-Emptiness Atom (NE):

$$M, s \models \mathrm{NE} \iff s \neq \emptyset$$
$$M, s \mathrel{=\!\!|} \mathrm{NE} \iff s = \emptyset$$

The NE atom is used to define a **pragmatic enrichment function**, denoted $[\ \ ]^+$, which is recursively defined as:

$$\begin{array}{rcll} [p]^+ & := & p \wedge \mathrm{NE} & \\ [\bigcirc\varphi]^+ & := & \bigcirc([\varphi]^+) \wedge \mathrm{NE} & \text{for } \bigcirc \in \{\neg, \Diamond, \Box\} \\ [\varphi \triangle \psi]^+ & := & ([\varphi]^+ \triangle [\psi]^+) \wedge \mathrm{NE} & \text{for } \triangle \in \{\wedge, \vee\} \end{array}$$

This enrichment has a non-trivial effect primarily on disjunctions in positive contexts. For an enriched disjunction $[\varphi \vee \psi]^+$, a state s must be the union of two **non-empty** substates, each supporting an enriched disjunct. This is the core mechanism for deriving Free Choice inferences.

To capture the semantics of questions and certain disjunctive particles, BSML could be extended to **BSML**$^{\mathbb{V}}$ with a **inquisitive disjunction** ($\mathbb{V}$).

Inquisitive Disjunction ($\mathbb{V}$):

$$M, s \models \varphi \mathbb{V} \psi \iff M, s \models \varphi \text{ or } M, s \models \psi$$
$$M, s \mathrel{=\!\!|} \varphi \mathbb{V} \psi \iff M, s \mathrel{=\!\!|} \varphi \text{ and } M, s \mathrel{=\!\!|} \psi$$

Furthermore, to account for the different behaviors of modal verbs, Aloni (2022) define two properties for the accessibility relation R.

Definition 29. *Let $M = (W, R, V)$ be a model and $s \subseteq W$.*

1. *R is **indisputable** in (M, s) iff $\forall w, v \in s : R[w] = R[v]$.*
2. *R is **state-based** in (M, s) iff $\forall w \in s : R[w] = s$.*

These properties allow us to draw a formal distinction between epistemic and deontic modals.

a. Epistemic modals $\mapsto$ R is state-based
b. Deontic modals $\mapsto$ R is possibly indisputable

The BSML framework, particularly with pragmatic enrichment, makes precise predictions about Free Choice (FC) phenomena. Aloni (2022) shows following results in BSML:

Narrow Scope FC: $\big[\Diamond(\alpha \vee \beta)\big]^+ \models \Diamond\alpha \wedge \Diamond\beta$

Wide Scope FC: $\big[\Diamond\alpha \vee \Diamond\beta\big]^+ \models \Diamond\alpha \wedge \Diamond\beta$ (if R is indisputable)

Dual Prohibition: $\big[\neg\Diamond(\alpha \vee \beta)\big]^+ \models \neg\Diamond\alpha \wedge \neg\Diamond\beta$

Double Negation: $\big[\neg\neg\Diamond(\alpha \vee \beta)\big]^+ \models \Diamond\alpha \wedge \Diamond\beta$

4.4.1 Appliction of BSML

BSML provides a robust framework for analyzing the nuanced meanings of different disjunctive and question particles in languages like Mandarin.

Within BSML, we define the functions discussed in Chapter 1, which are detailed in Table 4.1.

Function	Definition in BSML
INCL	$\texttt{INCL}(p_1, \ldots, p_n) := (p_1 \vee \cdots \vee p_n)$
EXCL	$\texttt{EXCL}(p_1, \ldots, p_n) := \bigvee_{i=1}^{n} p_i \wedge \bigwedge_{1 \leq i < j \leq n} \neg(p_i \wedge p_j)$
ALT	$\texttt{ALT}(p_1, \ldots, p_n) := p_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} p_n$
LIST	$\texttt{LIST}(p_1, \ldots, p_n) := (p_1 \vee \cdots \vee p_n) \mathbin{\mathbb{V}} \neg(p_1 \vee \cdots \vee p_n)$
DUAL	$\texttt{DUAL}(p_1, \ldots, p_n) := \neg(p_1 \vee \cdots \vee p_n)$
EXH	$\texttt{EXHA}(p_1, \ldots, p_n) := \texttt{exh}^c(p_1 \vee \cdots \vee p_n)$
POSS	$\texttt{POSS}(p) := \Diamond p$

Table 4.1: Functional Definitions in BSML

Based on BSML, the distinct semantic contributions of Mandarin disjunctives and question particles can be captured with the following lexical entries, as shown in 4.2.

Lexical Item	Lexical Entry
huòzhě / or[1]:	$[\![\text{或者}]\!] = \lambda P_1 \ldots \lambda P_n.\ P_1 \vee \cdots \vee P_n$
háishi / or[2]:	$[\![\text{还是}]\!] = \lambda P_1 \ldots \lambda P_n.\ P_1 \mathbin{\mathbb{V}} \cdots \mathbin{\mathbb{V}} P_n$
yàome / or[3]:	$[\![\text{要么}]\!] = \lambda P_1 \ldots \lambda P_n.\ exh^c(P_1 \vee \cdots \vee P_n)$
ma / Q-SFP:	$[\![\text{吗}]\!] = \lambda P.\ P \mathbin{\mathbb{V}} \neg P$

Table 4.2: Lexical Entries for Mandarin Disjunctions and Question Particle in BSML

In the Bilateral State-based Modal Logic (BSML) framework, the Free Choice (FC) properties of different Mandarin disjunctives can be precisely characterized. The following outlines the distinct behaviors of 或者 *huòzhě*, 还是 *háishì*, and 要么 *yàome* when embedded under a possibility modal ($\Diamond$). The operator $[\cdot]^+$ denotes pragmatic enrichment.

或者 (huòzhě) / or[1]

Based on the preceding analysis, within the BSML framework, *huòzhě* can be treated as a split disjunction, denoted as $\vee$. This approach correctly derives the narrow scope free choice inference, which is consistent with the collected data.

Fact 1. $[\Diamond(p \vee q)]^+ \models \Diamond p \wedge \Diamond q$

还是 (háishì) / or[2]

As a marker for alternative questions, *háishì* blocks the Free Choice inference. The inquisitive disjunction does not permit distribution of the possibility modal.

Fact 2. $[\Diamond(p \mathbin{\mathbb{V}} q)]^+ \not\models \Diamond p \wedge \Diamond q$

要么 (yàome) / or[3]

Following the preceding discussion, we argue that *yàome* always triggers an exhaustive (`EXHA`) function. We adopt the definition of the contextual exhaustivity operator, $\texttt{exh}^c$, from Chapter 4. Based on this, we have:

$$\begin{aligned} \mathrm{EXH}(p_1, \ldots, p_n) &:= \texttt{exh}^c(p_1 \vee \cdots \vee p_n) \\ &\equiv (p_1 \vee \cdots \vee p_n) \wedge \neg\Gamma_c \end{aligned}$$

where Γ_c is the set of contextually salient alternatives.

This construction licenses a stronger, exhaustive version of Free Choice, entailing not only the possibility of each disjunct but also the possibility that any other relevant alternative is false. This is illustrated by the following entailment:

Fact 3. $[\Diamond((p \vee q) \wedge \neg r)]^+ \models \Diamond p \wedge \Diamond q \wedge \Diamond\neg r$

In summary, BSML provides a robust account of the distinct semantic behaviors of Mandarin disjunctive particles. Analyzing *háishì* as an interrogative particle points to future research: developing a more comprehensive interpretation for interrogative sentence in conversation.

Chapter 5

Open Questions

This chapter moves from established analyses to open questions, providing new data to motivate future research. First we explore a range of disjunctive structures in Mandarin. Then we examine the distinct behavior of various Mandarin disjunctions in Classical Chinese. Finally, we highlight the complex distribution of negation (such as *bù* and *méi*) with various conjunctions, identifying their interaction with modality and quantification as a rich field for future analysis.

5.1 Disjunction

5.1.1 Negative free choice

Negative Free Choice (NFC) is a linguistic phenomenon where a sentence with a negated necessity modal combined with a conjunction takes on a specific meaning. For example, *"It is not required that you do A and B"* means $\neg\Box(\alpha \wedge \beta)$. However, it often gives rise to the NFC inference, which is $\neg\Box\alpha \wedge \neg\Box\beta$, that is *"You are not required to do A, and you are not required to do B"*.

In Mandarin, whether this inference is available depends crucially on the choice of conjunction. Let's examine how different conjunctions in Mandarin interact with negation and modality：

(110)	**méi yǒu**	yāo qiú	nǐ	chī	píng guǒ	**bìng qiě**	chī	jú zi
	没有	要求	你	吃	苹果	**并且**	吃	橘子
	not	required	you	eat	apple	**and**[1]	eat	orange

"It is not required that you eat the apple and eat the orange."

Inference Test:

$$\neg\Box(\alpha \wedge \beta) \rightsquigarrow \neg\Box\alpha \wedge \neg\Box\beta \Rightarrow \text{No}$$

(111)	**méi yǒu**	yāo qiú	nǐ	chī	píng guǒ	**hé**	jú zi
	没有	要求	你	吃	苹果	**和**	橘子
	not	required	you	eat	apple	**and**	orange

"It is not required that you eat the apple and the orange."

Inference Test:

$$\neg\Box(\alpha \wedge \beta) \rightsquigarrow \neg\Box\alpha \wedge \neg\Box\beta \Rightarrow ?\ \text{Yes}$$

(112) **méi yǒu** yāo qiú nǐ bǎ píng guǒ **hé** jú zi chī le
没有 要求 你 把 苹果 **和** 橘子 吃了
not required you (take) apple **and** orange eat
"It is not required that you eat the apple and the orange."

Inference Test:

$$\neg\Box(\alpha \wedge \beta) \rightsquigarrow \neg\Box\alpha \wedge \neg\Box\beta \Rightarrow \text{ ? No}$$

5.1.2 Hurford's Constraint

Hurford's Constraint posits that a disjunction of the form *A or B* is pragmatically infelicitous when one disjunct entails the other (i.e., if $A \rightarrow B$ or $B \rightarrow A$). For instance, the sentence *"She was born in Paris or in France"* sounds odd because *"being born in Paris"* entails *"being born in France,"* rendering the second disjunct redundant. Nevertheless, this constraint may be violated under specific circumstances.

(113) wǒ men xū yào yī míng lái zì Hélán **huòzhě** Ōuzhōu de xuéshēng
我们 需要 一名 来自 荷兰 **或者** 欧洲 的 学生
we need one from the Netherlands **or**[1] Europe MOD student
"We need a student from the Netherlands or Europe."

In (113), it is acceptable here, possibly due to pragmatic factors such as speaker emphasis.
The word order is critical. But focus markers or modal elements can help shift the emphasis:

(114) **zuì hǎo** chuān hēisè **huòzhě** shēnsè yīfú
最好 穿 黑色 **或者** 深色 衣服
best wear black **or**[1] dark-colored clothes
"It's best to wear black or dark clothes."

(115) chuān shēnsè **huòzhě** hēisè yīfú **zuì hǎo**
穿 深色 **或者** 黑色 衣服 **最好**
wear dark-colored **or**[1] black clothes **best**
"Wearing dark or black clothes is best."

5.1.3 *Either…or* vs. *Not…Then*

Mandarin Chinese employs several correlative constructions to express *Not…Then*, among the most notable are the structures *fēi…jí* (非…即) and *bùshì…jiùshì* (不是…就是) . These expressions bear an intuitive resemblance to disjunction *either…or* like *yàome…yàome* (要么…要么). As we will see in the following examples, these two forms are often intuitively equivalent in their interpretation, conveying an exhaustive choice between two alternatives.

Mandarin Chinese uses several correlative constructions to express the meaning of *'either…or'*. The structures *fēi…jí* and *bùshì…jiùshì* are prime examples. Intuitively, examples (116), (117), and (118) are equivalent in their interpretation:

(116) **fēi** fù **jí** guì
非 富 **即** 贵
not rich **then** noble
"Either rich or noble."

(117) **bù shì** yǒu qián **jiù shì** yǒu quán
不是 有钱 **就是** 有权
not have money **then** have power
"Either rich or powerful."

(118) **yàome** yǒu qián **yàome** yǒu quán
要么 有钱 **要么** 有权
or[3] have money **or**[3] have power
"Either rich or powerful."

5.1.4 Special Cases of *yào me*

In certain cases, *yào me* seems to introduce a focused expression rather than a disjunction:

(119) **yào me** shuō dà zìrán shì zuì wěidà de yìshùjiā
要么 说 大自然 是 最 伟大的 艺术家。
or[3] say nature be most great artist
"No wonder that nature is the greatest artist."

The phrase *yào me shuō* ("or say") introduces a kind of rhetorical move rather than disjunction.

5.1.5 Conditional sentence

Different disjunctions behave differently in conditional sentences. Consider the following examples.

(120) annà **huòzhě** jiǎn lái, wǒ huì hěn kāixīn
安娜 **或者** 简 来, 我会很开心
Anna **or**[1] Jane come, I will be very happy
"I will be very happy if Anna or Jane comes."

(121) annà **háishì** jiǎn lái, wǒ dōu huì hěn kāixīn
安娜 **还是** 简 来, 我都会很开心
Anna **or**[2] Jane come, I all will be very happy
"Whether Anna or Jane comes, I will be very happy."

(122) **yàome** annà lái, **yàome** jiǎn lái, wǒ cái huì kāixīn
要么 安娜 来, **要么** 简来，我才会开心
or[3] Anna come, **or**[3] Jane comes, only then will I be happy
"Either Anna comes or Jane comes, only then will I be happy."

Based on the previous discussion, we know that *yàome…yàome or*[3] is consistently implies the exclusion of unmentioned alternatives. Consequently, sentence (122) means that *I will be happy only if Anna or Jane comes*. In contrast, sentence (120) does not have this reading. However, sentence (121) also seems to carry an exhaustive implication, which requires further evidence and can be left for future research.

5.2 Classical Chinese

One of the characteristics of Classical Chinese is its flexibility. Through a process known as conversion or zero derivation, a word may shift from one grammatical category to another—such as from noun to verb, or verb to adjective—based solely on its syntactic position and contextual function.

For example, the word 或 *huò* can function as an indefinite pronoun meaning *someone*, a modal adverb meaning *perhaps*, or a temporal adverb meaning *sometimes*.

This multifunctionality is made possible by the absence of overt morphological marking, requiring interpretation through contextual disambiguation. Such features not only reflect the highly economical nature of Classical Chinese grammar but also pose unique challenges for modern linguistic analysis and translation.

5.2.1 *huò*

The modern disjunction *huòzhě* is composed of two morphemes *huò* and *zhě*. The morpheme *zhě* historically functioned as a nominalizer particle, often indicating the presence of an entity (person, thing, event, etc.)

The particle *huò* alone was polysemous, with at least three distinct yet related uses:

Epistemic Possibility (*maybe*): expressing uncertainty about a proposition.

Indefinite Subject (*someone*): introducing an unspecified individual.

Enumerative Disjunction (*some…some*): listing multiple alternative cases or actions.

Semantic Ambiguity In some contexts, *huò* may exhibit semantic ambiguity, simultaneously activating more than one of its possible interpretations, which are subject to translation choices.

A well-known illustration comes from the *Mencius* (孟子), in a passage where Mengzi responds to King Hui:

> Mengzi replied: "Since Your Majesty is fond of warfare, allow me to make an analogy with battle. When the war drums beat and the weapons clash, some soldiers throw down their armor and flee. Some stop after running a hundred paces, while others stop after fifty. Yet those who ran only fifty steps mock those who ran a hundred—is that appropriate?"
>
> King Hui said: "Certainly not. They both fled—the only difference is how far."

(Adapted from Mencius, Liang Hui Wang I《孟子·梁惠王上》)

(123) **huò** bǎi bù ér hòu zhǐ, **huò** wǔ shí bù ér hòu zhǐ
或 百步 而后 止, **或** 五十步 而后 止
or[1] hundred steps then stop, **or**[1] fifty steps then stop
"(Some) stopped after retreating a hundred steps, (others) after fifty."

This sentence is typically interpreted as an enumeration of soldiers who fled to different extents. While the English gloss uses "*some…others,*" one could also interpret this as "*maybe some…maybe some,*" especially if emphasizing the possibility rather than exhaustiveness of alternatives.

In certain contexts, *huò* can convey a meaning that akin to "*sometimes…sometimes*". This raises intriguing questions regarding the semantics of disjunction and existential quantification, especially in Inquisitive Semantics. Notably, in Inquisitive Logic, the existential quantifier ($\exists$) is inquisitive in much the same way as the inquisitive disjunction operator ($\veebar$). That is, both introduce alternatives in a way that supports the resolution of issues rather than merely asserting truth conditions.

This suggests a potentially deeper connection between existential quantification and disjunction. 或 *huò* thus provides a compelling empirical point of departure for exploring how semantic operators encode inquisitiveness. This pattern of inquisitiveness invites further cross-linguistic investigation, as a deeper understanding of the phenomenon may contribute to our broader knowledge of disjunctive strategies in natural language.

5.2.2 *Háishì*

Classical Chinese does not typically use lexicalized disjunctive markers in alternative questions.

Instead, such questions are generally formed through syntactic means, often marked by uncertainty and finalized with sentence-final particles that signal interrogativity.

5.2.3 *Yàome*

The component *yào* (要) in modern *yàome or*[3] has a range of meanings in Classical Chinese, including:

要是 *yàoshì*): conditional meaning —*if, in case.*

想要 *xiǎngyào*: volitional meaning —*want, intend.*

需要 *xūyào*: necessity or obligation —*must, need.*

重要 *zhòngyào*: emphasis on importance —*essential, significant.*

要挟 *yāoxié*: coercive force —*coerce, threaten.*

贫困 *pínkùn*: scarcity or lack —*be poor, impoverished.*

These historical meanings suggest that the semantics of *yào* are deeply rooted in notions of condition, necessity, and desire—features that align with the exhaustive interpretation of alternatives expressed by modern *yàome.*

(124) 我们三个…有福同享，有难同当，**要么 (yàome)** 一起转正，**要么 (yàome)** 一起不转正。
——刘醒龙《天行者》

"*The three of us…share in blessings and endure hardships together.* ***Either***^{3} *we all get permanent status,* ***or***^{3} *none of us do.*"
—Liu Xinglong, *Tianxingzhe*

This example underscores a sense of group solidarity and mutually exclusive outcomes, reinforcing the exhaustive interpretation of *yàome*.

5.3 Conjunction

Mandarin has a range of conjunction expressions, including 并且 *bìngqiě*, 而且 *érqiě*, 和 *hé*, and 也 *yě*, among others. In follows, I outline three representative types of conjunctions in Mandarin.

- **and**^{1} ***bìngqiě*:** Used to coordinate verb phrases or clauses, often with emphatic force.
- **and**^{2} ***yě*:** Used to coordinate parallel predicates; typically restricted to verbs or verb phrases.
- **and**^{3} ***hé*:** Used to coordinate noun phrases or entities.

Consider the following examples：

喝咖啡和茶
Drink coffee and tea (as a combined item)
$D(c \wedge t)$ (and^3)

喝咖啡和喝茶
Drink coffee and drink tea (separate events)
$D(c) \wedge D(t)$ (and^3)

喝咖啡也喝茶
Drink coffee and drink tea
$D(c) \wedge D(t)$ (and^2)

喝咖啡并且喝茶
Drink coffee and drink tea
$D(c) \wedge D(t)$ (and^1)

Without modal verbs, Type and^1 and and^2 are nearly indistinguishable. But when modals are present, the differences become prominent.

Examples:

我们可以去书店，并且可以去图书馆。
We can go to the bookstore, and^1 *(in addition) to the library.*
$\Diamond G(a) \wedge \Diamond G(a \wedge b)$ (and^1)

我们可以去书店，也可以去图书馆。
We can go to the bookstore, and^2 *can go to the library.*
$\Diamond G(a) \wedge \Diamond G(b)$ (and^2)

我们可以去 [书店和图书馆]。
We can go to [the bookstore and^3 *the library].*
$\Diamond G(a \wedge b)$ (and^3)

我们可以去书店和我们可以去图书馆。[1]
We can go to the bookstore and^3 *we can go to the library.*
$\Diamond G(a)$ & $\Diamond G(b)$ (and^3)

In testing for Free Choice (FC) inferences, we observe that the proposition $\Diamond\alpha\wedge\Diamond\beta$ can be expressed in Mandarin Chinese in several ways. The choice of conjunction yields different semantic nuances and, consequently, different results in our tests.

***The case of yě and*^{2}**

(125)

wǒmen	kěnéng	qù	gōngyuán	**yě**	kěnéng	qù	bówùguǎn
我们	可能	去	公园	**也**	可能	去	博物馆
we	probably	go	park	**and**^{2}	probably	go	museum

"We might go to the park, and might go to the museum."

The data concerning $\Diamond(\alpha \vee \beta)$ was introduced in Chapter 2. Here, (125) represents $\Diamond\alpha \wedge \Diamond\beta$.

Test:$\Diamond(\alpha \vee \beta) \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta$

huòzhě or^1 Yes
yàome or^3 No

Deontic modal:

(126)

wǒ men	kě yǐ	qù	gōng yuán	**yě**	kě yǐ	qù	bó wù guǎn
我们	可以	去	公园	**也**	可以	去	博物馆
we	can	go	park	**and**^{2}	can	go	museum

"We can go to the park, and can go to the museum."

Test:$\Diamond(\alpha \vee \beta) \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta$

huòzhě or^1 Yes
yàome or^3 No

[1]This sentence is particularly unusual, as is not adequately captured by classical logic. The reason is that the utterance does not seem to be concerned with truth values; rather, it functions as a mere act of combination.

***The case of bìngqiě and*[1]**

(127) wǒmen kěyǐ qù gōngyuán **bìngqiě** kěyǐ qù bówùguǎn
我们 可以 去 公园 **并且** 可以 去 博物馆
we can go park **and**[1] can go museum
"We can go to the park and the museum."

Test:$\Diamond(\alpha \vee \beta) \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta$

huòzhě or[1] No
yàome or[3] No

Deontic modal:

(128) wǒ men kě yǐ qù gōng yuán **bìng qiě** kě yǐ qù bó wù guǎn
我们 可以 去 公园 **并且** 可以 去 博物馆
we can go park **and** can go museum
"We can go to the park, and can go to the museum."

Test:$\Diamond(\alpha \vee \beta) \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta$

huòzhě or[1] No
yàome or[3] No

The case of *bìngqiě and* [1] **+ *yě and*** [2]

(129) wǒ men kě néng qù gōng yuán **bìng qiě** **yě** kě néng qù bó wù guǎn
我们 可能 去 公园 **并且** **也** 可能 去 博物馆
we probably go park **and**[1] **and**[2] probably go museum
"We might go to the park, and also might go to the museum."

Test:$\Diamond(\alpha \vee \beta) \rightsquigarrow \Diamond\alpha \wedge \Diamond\beta$

huòzhě or[1] ? ? Yes
yàome or[3] No

The case of *hé and*[3]

(130) wǒ men kě néng qù gōng yuán **hé** kě néng qù bó wù guǎn
我们 可能 去 公园 **和** 可能 去 博物馆
we probably go park **and**[3] probably go museum
"We might go to the park, and might go to the museum."

This sentence is grammatically correct, but it appears to be non-truth-conditional. It is analogous to a bare phrase like "*coffee and milk*," which can only be assigned a truth value within the dynamic context of a conversation.

(131) demonstrates the usage of *hé and* [3]:

(131)

wǒ men	kě néng	qù	gōng yuán	**hé**	bó wù guǎn
我们	可能	去	公园	**和**	博物馆
we	probably	go	park	**and**[3]	museum

"We might go to the park and the museum."

5.4 Negation

Mandarin also has a variety of negation expressions, each with distinct syntactic and semantic roles. We can classifie them as follows:

Type not[1]: 不 *bù*, used to negate present, habitual actions, states, or future intentions.

Type not[2]: 没有 *méiyǒu*, used for past events or to deny existence. (? weak negation)

Type not[3]: 别 *bié*, used in prohibition (negative imperatives).

Examples:

Li: "你相信他说的话吗？"
"*Do you believe what he said?*"

Wang: "我**不**相信。"
"*I don't believe it.*"
I believe what he said is a lie. (not[1])

Wang: "我**没**相信。"
"*I didn't believe it.*"
But it doesn't imply that I think what he said is a lie. I might be indifferent. (not[2])

Li: "**别**相信他。"
"*Don't believe him!*" (not[3])

Li: "你**别**相信他。"
"*You, don't believe him!*" (not[3])

Li: "# 我**别**相信他。"
"*#I don't believe him.*" (*ungrammatical)

This chapter has outlined several unresolved issues concerning disjunction, conjunction, and negation in Mandarin, highlighting key empirical patterns and theoretical challenges. The data and observations presented here open up productive avenues for future research.

Chapter 6

Conclusion

This thesis proposes a novel functional classification of disjunctive expressions in Mandarin Chinese by integrating empirical observations with formal frameworks. It identifies seven functions, organizing them into core, associated, and off-map types. Empirical investigation further revealed the distinct semantic profiles of the three Mandarin disjunctives, *huòzhě*, *háishì*, and *yàome*, particularly in interrogative structures and under negation. Formally, the study showed that inquisitive logic provides an effective account of Mandarin interrogative disjunction. Its limitations in deriving Free Choice inferences motivate the application of Bilateral State-based Modal Logic (BSML), which succeeds in capturing Mandarin Free Choice inferences.

It should be recognized that this thesis has certain limitations. While it provides a lot of data and tests regarding the behavior of disjunction, some inferences rely on introspective judgments and require more robust, empirical validation. Furthermore, the study does not offer in-depth theoretical explanations for all the observed patterns or engage with broader philosophical implications. These aspects, alongside promising connections with syntactic and pragmatic research, remain opportunities for further investigation.

Additionally, given that disjunction constitutes a broad and complex domain, neither InqB nor BSML currently offers a complete account of all related phenomena. However, this is not a definitive shortcoming but rather an invitation for further development of these systems. Promising directions include extending the frameworks to handle negation and conjunction more comprehensively, as well as deepening the inquiry into the interaction between disjunction and existential quantification in InqB. Although these aspects lie beyond the scope of the present study, they represent fertile ground for future research.

Overall, this thesis attempts to move beyond the classical truth-functional view of disjunction. By integrating detailed linguistic data with formal modeling, it aims to foreground a set of semantic distinctions that are often obscured in standard logical treatments. The proposed functional map and the accompanying analyses, we hope, can provide a conceptual and methodological foundation for future inquiry—not only into Mandarin disjunction, but also into the general architecture of logical meaning in natural language.

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