Alternatives in Cantonese: Disjunctions, Questions and (Un)conditionals

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1 Introduction

Cantonese has at least four lexical entries that can be translated as English 'or', *waak6ze2*, *ding6(hai6) jat1hai6* and *jik1waak6*.[1] This paper focuses on the first two, *waak6ze2* and *ding6*. Pedagogically, *waak6ze2* and *ding6* are described as 'or' in a statement and 'or' in a question, respectively.

The goal of this paper is to describe the properties of the two disjunctions and provide a compositional analysis that explains their distributions and interpretations in the framework of Suppositional Inquisitive Semantics (InqS; Groenendijk & Roelofsen, 2014).[2] Specifically, both *ding6* and *waak6ze2* denote an inquisitive disjunction which forms a union of a set of propositions, but they differ in that *ding6* has an extra syntactic requirement that the clause containing *ding6* remains inquisitive. Consequently, 'p waak6ze2 q' is a non-inquisitive sentence, while 'p ding6 q' is always inquisitive. Furthermore, the analysis correctly derives the connotations which arise from unconditional sentences.

2 Empirical Data

According to Haspelmath (2007), some languages have two kinds of disjunction, "interrogative disjunction and standard disjunction" (pp. 26–27). For instance, Mandarin Chinese (Li & Thompson, 1981; Yuan, 2015) distinguishes interrogative *háishe* and standard/declarative *huòze*. In Egyptian Arabic (Winans, 2013), a sentence contains *wallaa* is interpreted as an alternative question as it cannot be responded with 'yes' or 'no', while *aw* is a standard disjunction since in a question it is understood as a *yes/no* question.

Cantonese has a comparable pair of lexical entries, *ding6* and *waak6ze2* both of which translate to 'or' in English.[3] The grammaticality judgments of the following examples are given based on the interviews with the consultants and the results of the naturalness rating studies summarized in Figures 1 and 2 taken from Hara (2015).

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[1]Numbers indicate lexical tones. 1=high level or high falling; 2= mid rising; 3= mid level; 4= low falling; 5= low rising; 6= low level. *Hai6* in *ding6hai6* can be omitted in casual speech and omitted hereafter.

[2]Winans (2013) also provides Inquisitive Semantics analysis to two kinds of disjunction in Egyptian Arabic.

[3]Despite their similarities, the distribution pattern of Cantonese *ding6* and *waak6ze2* is different from those of Mandarin *háishe* and *huòze* and Egyptian Arabic *wallaa* and *aw*. For instance, Mandarin *háishe* and *huòze* are interchangeable under conditional antecedents and modals as reported in Huang (2010). Egyptian Arabic *wallaa* and *aw* are in complementary distribution while Cantonese *ding6* and *waak6ze2* are not. See Hara (2015) for comparison.

Figure 1 shows that in declarative constructions including embedding under modals and conditional antecedents, *ding6* is ungrammatical while *waak6ze2* is grammatical:

(1) Declaratives
Lisa sik6 zuk1 *ding6/waak6ze2 faan6
Lisa eat congee DING6/WAAK6ZE2 rice
'Lisa eats congee or rice'

(2) Modals
Lisa ho2ji5/jiu3/ho2nang4/jat1ding6-hai6 sik6 zuk1 *ding6/waak6ze2 faan6
Lisa can/must/possibly/definitely-is eat congee DING6/WAAK6ZE2 rice
'Lisa $\text{can}_{\text{deontic}}$/$\text{must}_{\text{deontic}}$/$\text{can}_{\text{epistemic}}$/$\text{must}_{\text{epistemic}}$ eat congee or rice'

(3) Conditional antecedent
jy4gwo2 Lisa sik6 zuk1 *ding6/waak6ze2 faan6, ceng2 waa6 ngo5 zi1.
if Lisa eat congee DING6/WAAK6ZE2 rice, please speak me know
'If Lisa eats congee or rice, please let me know.'

In unconditional antecedents, both *ding6* and *waak6ze2* are grammatical, as can be seen in Figure 1.

(4) Unconditional antecedent
mou4leon6 Lisa sik6 zuk1 ding6/waak6ze2 faan6, koei5 dou1 wui5 baau2
no.matter Lisa eat congee DING6/WAAK6ZE2 rice, she will be full
'Whether Lisa eats congee or rice, she will be full.'

Figure 2 shows that interrogatives with *ding6* end with a particle *aa4* and are straightforward alternative questions since they have to be answered by one of the choices. Answering 'yes' or 'no' makes the discourse anomalous.

(5) Lisa jiu3 zuk1 ding6 faan6 aa3?
Lisa want congee DING6 rice PRT
'Does Lisa want congee or rice?'
a. *jiu3 (want) 'Yes, she wants'/*m4 jiu3 (not want) 'No, she doesn't want.'
b. zuk1 (congee) 'Congee.'/faan6 (rice) 'Rice.'

On the other hand, interrogatives with *waak6ze2* are more complicated and need a more careful observation. Interrogatives with *waak6ze2* end with a particle with a different tone, *aa4* and based on the consultants' introspection-based judgments, they should be *yes-no* questions rather than alternative questions. However, the experimental result shows that in fact, none of the answers to *waak6ze2*-questions are perceived as natural as the ones to *ding6*-questions. Furthermore, just like *ding6*-questions, answering just 'yes' or 'no' to *waak6ze2*-questions is judged quite unnatural. Perhaps, this is because the speaker, being maximally cooperative, should provide the actual choice after answering, e.g., 'Yes, I want congee.' Thus, it is judged unnatural due to its uncooperativeness.

(6) Lisa jiu3 zuk1 waak6ze2 faan6 aa4?
Lisa want congee WAAK6ZE2 rice PRT
'Does Lisa want congee or rice?'
a.???jiu3 (want) 'Yes, she wants'/??m4 jiu3 (not want) 'No, she doesn't want.'
b. ?zuk1 (congee) 'Congee.'/?faan6 (rice) 'Rice.'

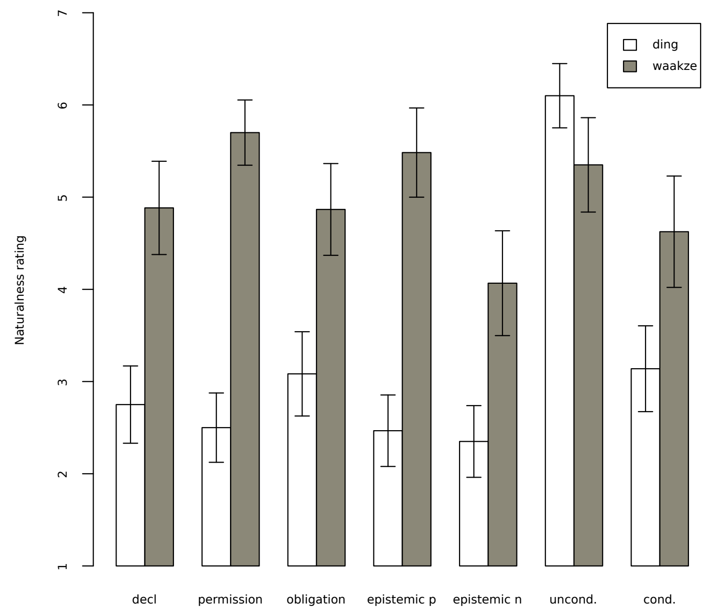

Figure 1: Average naturalness of the constructions (Hara, 2015, 18)

Another possibility is that *waak6ze2*-questions are what Roelofsen & van Gool (2010) call "open intonation" questions. According to Roelofsen & van Gool (2010), when an English disjunctive interrogative has open intonation as indicated in (7), a 'yes' answer is not licensed.

(7) Does Ann↑ or Bill↑ play?
✓No. #Yes. ✓Ann does. ✓Bill does. (Roelofsen & van Gool, 2010)

As for Cantonese *waak6ze2*-questions, indeed, as reported in Hara (2015), the average of 'no'-answers is significantly higher than 'yes'-answers ($t = 3.884, p < 0.001$). Thus, I conclude that *waak6ze2*-questions are interpreted as *yes/no* questions or open questions. The empirical characterization of the distribution of *ding6* and *waak6ze2* is summarized in the following table:

(8)

	declarative	modal	unconditional	conditional	question
ding6	*	*	✓	*	alternative
waak6ze2	✓	✓	✓	✓	yes/no, open

Thus, *waak6ze2* and *ding6* are not in complementary distribution in a strict sense. In particular, *waak6ze2* in an unconditional is also judged quite natural. Thus, Cantonese *waak6ze2* is more like English *or*, which can be treated either as a standard disjunction or an interrogative disjunction in Haspelmath's (2007) terms, while *ding6* exclusively denotes the interrogative

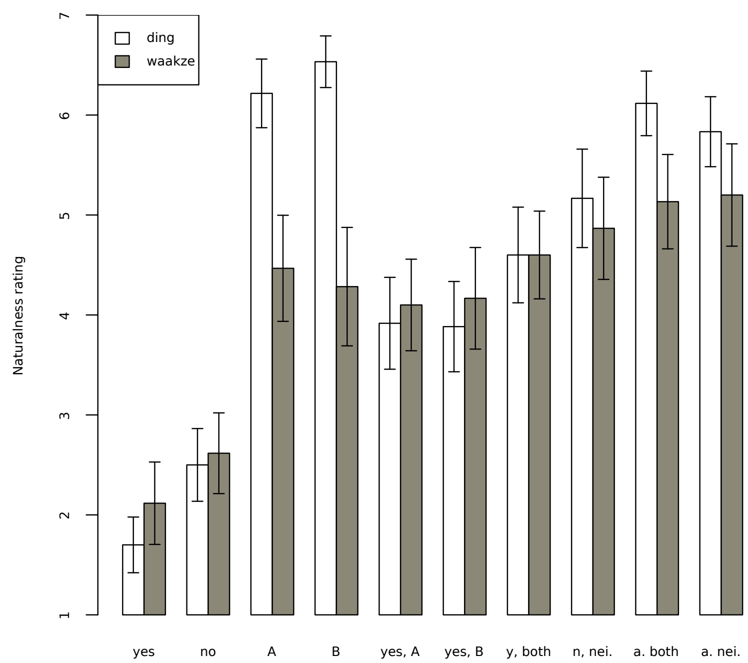

Figure 2: Average naturalness: Question-Answer Pair (Hara, 2015, 16)

disjunction.

3 Proposal

Based on the empirical data obtained in Section 2, I propose that both *ding6* and *waak6ze2* denote an (inquisitive) disjunction which forms a union of set of propositions. The difference between the two items lies in their syntactic specifications. While α-*ding6*-β carries an uninterpretable feature which forces the clause to be inquisitive and resist the declarative operator, α-*waak6ze2*-β lacks such a feature, hence its denotation can be non-inquisitive.

3.1 Suppositional Inquisitive Semantics

Suppose that a possible world is a valuation for atomic sentences and W is the set of all possible worlds. In the standard possible-world semantics, the meaning of a sentence is a set of possible worlds. Thus, $[\![\text{Lisa smiles}]\!] = |\mathsf{smile(lisa)}| = \{w|$ Lisa smiles in $w\}$. In Inquisitive Semantics (Groenendijk & Roelofsen, 2014), possible worlds constitute an information state, σ, and the meaning of a sentence φ is a set of information states that support φ. In Suppositional Inquisitive Semantics (InqS), there are two more semantic relations besides 'support':[4]

(9) Atomic sentences

a. σ *supports* p ($\sigma \vDash^{+} p$) iff $\sigma \neq \emptyset$ and $\forall w \in \sigma. w(p) = 1$.

b. σ *rejects* p ($\sigma \vDash^{-} p$) iff $\sigma \neq \emptyset$ and $\forall w \in \sigma. w(p) = 0$.

c. σ *dismisses a supposition of* p ($\sigma \vDash^{\circ} p$) iff $\sigma = \emptyset$.

A state σ supports $\neg\varphi$ just in case σ rejects φ, and σ supports $\varphi \vee \psi$ just in case σ supports φ or σ supports ψ:

(10) a. $\sigma \vDash^{+} \neg\varphi$ iff $\sigma \vDash^{-} \varphi$.

b. $\sigma \vDash^{-} \neg\varphi$ iff $\sigma \vDash^{+} \varphi$.

c. $\sigma \vDash^{\circ} \neg\varphi$ iff $\sigma \vDash^{\circ} \varphi$.

(11) a. $\sigma \vDash^{+} \varphi \vee \psi$ iff $\sigma \vDash^{+} \varphi$ or $\sigma \vDash^{+} \psi$.

b. $\sigma \vDash^{-} \varphi \vee \psi$ iff $\sigma \vDash^{-} \varphi$ and $\sigma \vDash^{-} \psi$.

c. $\sigma \vDash^{\circ} \varphi \vee \psi$ iff $\sigma \vDash^{\circ} \varphi$ or $\sigma \vDash^{\circ} \psi$.

The semantics for implication is defined as follows:

(12) a. $\sigma \vDash^{+} \varphi \rightarrow \psi$ iff $\sigma \cap \mathit{info}(\varphi) \vDash^{+} \varphi$ and $\sigma \cap \mathit{info}(\varphi) \vDash^{+} \psi$.

b. $\sigma \vDash^{-} \varphi \rightarrow \psi$ iff $\sigma \cap \mathit{info}(\varphi) \vDash^{+} \varphi$ and $\sigma \cap \mathit{info}(\varphi) \vDash^{-} \psi$.

c. $\sigma \vDash^{\circ} \varphi \rightarrow \psi$ iff $\sigma \cap \mathit{info}(\varphi) \nvDash^{+} \varphi$ and $\sigma \cap \mathit{info}(\varphi) \vDash^{\circ} \psi$.

The set of all states that support φ, $[\varphi]^{+}$ is defined as in (13).

(13) $[\varphi]^{+} := \{\sigma | \sigma \vDash^{+} \varphi\}$

In InqS, this is the meaning of a sentence, i.e., $[\![\varphi]\!] := [\varphi]^{+}$. Accordingly, the meaning of a sentence $[\![p]\!]$ in InqS becomes the powerset of $|p| = \{w | w(p) = 1\}$ excluding the empty set. Given $\wp^{+}(S) := \wp^{+}(S) - \{\emptyset\}$, thus, $[\![\text{Lisa smiles}]\!] = \wp^{+}(\{w | \text{ Lisa smiles in } w\})$.

The classical meaning of a sentence φ as a set of possible worlds, called the informative content of φ, is retrieved by taking a union of all states that support φ:

(14) $\mathit{info}(\varphi) = \bigcup[\varphi]^{+}$.

Furthermore, following Groenendijk & Roelofsen (2014), a sentence φ is said to be inquisitive when φ is supported by at least one state and φ is not supported by $\mathit{info}(\varphi)$. That is, if φ is inquisitive, accepting $\mathit{info}(\varphi)$ does not make the supporting state as our updated common ground:

(15) φ is inquisitive iff $[\varphi]^{+} \neq \emptyset$ and $\mathit{info}(\varphi) \notin [\varphi]^{+}$

(Adopted from Groenendijk & Roelofsen, 2014, 9)

3.2 Composition

Inspired by Hamblin's (1973) Alternative Semantics, Ciardelli & Roelofsen (2015); Theiler (2014) provide a framework which enables us to derive a set of information states as the meaning of a sentence without invoking a special composition rule like pointwise functional application.[5] In this framework, the semantic value of a sentence is a powerset of $|p|$, thus in each linguistic expression, all the type t's in the standard Montague grammar are replaced by $\langle\langle s, t\rangle, t\rangle$.

[4] The current paper adopts InqS instead of the basic inquisitive semantics framework, InqB, since one of the goals is to analyze unconditional sentences which involve the semantics of implication.

[5] Roelofsen & van Gool (2010) provide a machinery which directly extends Alternative Semantics, which faces several problems as pointed out by Ciardelli & Roelofsen (2015).

(16) a. $[\![\text{Lisa}]\!] \in D_e$; $[\![\text{Lisa}]\!] := \mathsf{lisa}$
b. $[\![\text{smile}]\!] \in D_{\langle e,\langle\langle s,t\rangle,t\rangle\rangle}$; $[\![\text{smile}]\!] := \lambda x.\wp^+(|\mathsf{smile}(x)|)$

In Alternative Semantics, the meaning of a sentence is also considered as a set of propositions, a set of sets of possible worlds. The crucial difference from Alternative Semantics is that in inquisitive semantics, the set is not unconstrained but downward closed, thus if $|p| \in [\![\varphi]\!]$ and $|q| \subseteq |p|$, $|q| \in [\![\varphi]\!]$.

In order to give a non-inquisitive semantics to declarative sentences containing a disjunction, I introduce a declarative operator, DECL, which amounts to perform updates of the state in the classical sense. The semantics of DECL is based on Roelofsen & van Gool's (2010) Focus operator F and naturally adapted to the framework of InqS as can be seen in (17).[6]

(17) a. $\sigma \models^+ \text{DECL}\varphi$ iff $\sigma \neq \emptyset$ and $\sigma \subseteq \mathit{info}(\varphi)$
b. $\sigma \models^- \text{DECL}\varphi$ iff $\sigma \neq \emptyset$ and $\sigma \cap \mathit{info}(\varphi) = \emptyset$
c. $\sigma \models^\circ \text{DECL}\varphi$ iff $\sigma = \emptyset$.

DECL renders all sentences into non-inquisitive ones using *info* defined in (14).[7]

(18) $[\text{DECL}\varphi]^+ = \wp^+(\mathit{info}(\varphi))$

Finally, in formalizing the semantics of alternative and polar questions, I adopt Roelofsen & van Gool's (2010) notion of excluded possibility. Following the standard assumption in the dynamic semantics, the semantics of a sentence φ encapsulate how φ updates the common ground. If a world w is not included in any information state that supports φ, then *w is excluded by φ*. In other words, the set of possibilities excluded by φ is the set of states that support $\neg\text{DECL}\varphi$ and codified as $[\![\varphi]\!]$:

(19) $[\![\varphi]\!] := [\neg\text{DECL}\varphi]^+ = \wp^+(W - \mathit{info}(\varphi))$

3.3 Analysis

I propose that both *ding6* and *waak6ze2* denote an inquisitive disjunction, which join two sets, but they are different in that only *ding6* has a syntactic-feature-driven requirement which resists the DECL operator.

Let us take a look at *waak6ze2* first, which simply denotes disjunction:

(20) For any type τ and $[\![\alpha]\!], [\![\beta]\!] \in D_\tau$, $[\![\alpha \text{ WAAKZE } \beta]\!] := [\![\alpha \vee \beta]\!]$

I propose that declarative constructions, including modalized sentences and conditional antecedents, involve the DECL operator. In a declarative sentence like (1), thus, 'p waak6ze2 q' first forms a union $\wp^+(|p|) \cup \wp^+(|q|)$ and then the DECL operator (17) renders the sentence non-inquisitive:

(21) a. $[\![p \text{ WAAKZE } q]\!] = [p \vee q]^+ = \wp^+(|p|) \cup \wp^+(|q|)$
b. $[\![\text{DECL}(p \text{ WAAKZE } q)]\!] = [\text{DECL}(p \vee q)]^+ = \wp^+(\mathit{info}(p \vee q)) = \wp^+(|p \vee q|)$

Turning to *ding6*, 'p ding6 q' has the same semantics as 'p waak6ze2 q' in that it denotes disjunction, $[\![\alpha \text{ DING } \beta]\!] := [\![\alpha \vee \beta]\!]$, while it has an additional lexical requirement that a sen-

[6] I would like to thank Katsuhiko Sano (personal communication) for his suggestion in the formalization of DECL.

[7] As noted by Roelofsen & van Gool (2010), DECL and F are akin to *non-inquisitive closure* in Groenendijk & Roelofsen (2009) and *existential closure* in Kratzer & Shimoyama (2002).

tence containing *ding6* remains inquisitive. That is, a sentence containing *ding6* cannot be the argument of the DECL operator. Thus, $\llbracket \textsc{decl}(\alpha\ \textsc{ding}\ \beta) \rrbracket$ is undefined. I implement this requirement using syntactic feature-checking. *ding6* carries an uninterpretable feature [uINQ].

(22) a. Lexicon: *ding6*: CONJ, [uINQ], $\llbracket \textsc{ding} \rrbracket$
b. Semantics: For any type τ and $\llbracket \alpha \rrbracket, \llbracket \beta \rrbracket \in D_\tau$, $\llbracket \alpha\ \textsc{ding}\ \beta \rrbracket := \llbracket \alpha \vee \beta \rrbracket$

The [uINQ] feature of *ding6* needs to be checked off by an operator $O_{[\textsc{inq}]}$ which occupies C position and carries the interpretable feature [INQ]. The operator $O_{[\textsc{inq}]}$ requires its complement to be inquisitive.

(23) $\llbracket O_{[\textsc{inq}]}\varphi \rrbracket$ is defined if $\llbracket \varphi \rrbracket$ is inquisitive.

$O_{[\textsc{inq}]}$ can be realized as the question particle *aa3* in (25-b) or the head of unconditional antecedent, *mou4leon6* in (29-a) below. Thus, 'p ding6 q' is ungrammatical in a declarative due to its uninterpretable feature. The [uINQ] of *ding6* needs to be checked by $O_{[\textsc{inq}]}$, but in a declarative sentence, the DECL operator renders the clause non-inquisitive, which conflicts with the lexical requirement of $O_{[\textsc{inq}]}$, as in (24-a). If $O_{[\textsc{inq}]}$ is not merged to the clause, [uINQ] remains unchecked and the derivation does not converge as in (24-b).

feature-checking

(24) a. *$O_{[\textsc{inq}]}$ DECL [... ding6~~[uINQ]~~ ...]
b. *DECL [... ding6$_{[u\textsc{inq}]}$ ...]

Turning to interrogative sentences like (5) and (6), I propose that *aa4* is a polar interrogative particle analogous to the interrogative complementizer Q in Roelofsen & van Gool, while *aa3* is an exhaustification presupposition particle analogous to the English L tone in Biezma & Rawlins (2012). The semantics of 'φ *aa4*' is the union of the possibilities which support φ and the possibilities which excluded by φ (25-a). In contrast, *aa3* presupposes that its prejacent is inquisitive and exhausts the common ground, thus no possibility is eliminated by the update of the prejacent proposition (25-b).

(25) a. $\llbracket \varphi\text{-}\textsc{aa4} \rrbracket := \llbracket \varphi \rrbracket \cup \| \varphi \|$
b. $\llbracket \varphi\text{-}\textsc{aa3} \rrbracket$ is defined if $\llbracket \varphi \rrbracket$ is inquisitive and $\| \varphi \| = \emptyset$. If defined, $\llbracket \varphi\text{-}\textsc{aa3} \rrbracket := \llbracket \varphi \rrbracket$.

There are at leat two ways to interpret *waak6ze2*-interrogatives. In one case, 'p waak6ze2 q' takes the DECL operator. As a result, 'p waak6ze2 q aa4?' is a *yes/no* question which is a set containing two propositions, 'Yes, p or q' and 'No, $\neg p \wedge \neg q$':

(26) $\llbracket \textsc{decl}(p\ \textsc{waakze}\ q)\text{-}\textsc{aa4} \rrbracket = \llbracket \textsc{decl}(p \vee q) \rrbracket \cup \| \textsc{decl}(p \vee q) \|$
$= \wp^+(|p \vee q|) \cup \wp^+(|\neg p \wedge \neg q|)$

In the other case, 'p waak6ze2 q' does not take the DECL operator, and 'p waak6ze2 q aa4?' is interpreted as an "open intonation" question:

(27) $\llbracket p\ \textsc{waakze}\ q\text{-}\textsc{aa4} \rrbracket = \llbracket p \vee q \rrbracket \cup \| p \vee q \| = \wp^+(|p|) \cup \wp^+(|q|) \cup \wp^+(|\neg p \wedge \neg q|)$

This is consistent with the intuition summarized in section 2 and the experimental result reported in Hara (2015). Recall that responding *yes* to *waak6ze2*-interrogatives is lowly rated but responding *no* receives a significantly higher rating. This is because the 'no'-answer can single out one possibility, '$\neg p$ and $\neg q$', while the proposition entailed by the 'yes'-answer remains inquisitive containing two possibilities, 'p' and 'q'.

In contrast, 'p ding6 q aa3?' cannot take the DECL operator, so it is always an alternative question which is denoted by a union of the two alternative propositions:

(28) $[\![p \text{ DING } q\text{-AA3}]\!]$ is defined if $[\![p \text{ DING } q]\!] = \emptyset$.
If defined, $[\![p \text{ DING } q\text{-AA3}]\!] = [\![p]\!] \cup [\![q]\!] = \wp^+(|p|) \cup \wp^+(|q|)$

3.4 Unconditionals and their connotations

Rawlins (2013) analyzes English unconditionals as universal quantification over a set of conditional sentences. Morpho-syntactically, Rawlins's analysis suits Cantonese unconditionals like (4) as they involves *ding6* or *waak6ze2*, which generates a union of sentences, and a universal quantifier *dou1* 'all'. The "antecedent" of the unconditional is inquisitive, $\wp^+(|p|) \cup \wp^+(|\neg p|)$, i.e., a union of two propositions. The head of the unconditional construction, *mou4leon6* is one of the inquisitive operators $O_{[\text{INQ}]}$, thus it requires its complement to be inquisitive and has the operation of pointwise functional application built in its lexical semantics:

(29) a. $[\![\text{MOU4LEON6 } \alpha, \beta]\!]$ is defined iff $[\![\alpha]\!]$ is inquisitive.
If defined, $[\![\text{MOU4LEON6 } \alpha, \beta]\!] := \bigcup\{[p \to q]^+ | |p| \in [\![\alpha]\!] \text{ and } |q| \in [\![\beta]\!]\}$
b. $[\![p \text{ DING } \neg p]\!] = [\![p]\!] \cup [\![\neg p]\!] = \wp^+(|p|) \cup \wp^+(|\neg p|)$
c. $[\![\text{MOU4LEON6 } p \text{ DING } \neg p,\, q]\!] = [p \to q]^+ \cup [\neg p \to q]^+$

Thus, we obtain a union of conditional sentences, $[p \to q]^+ \cup [\neg p \to q]^+$. Finally, *dou1* defined in (30) renders the union of propositions into a conjoined sentences as in (30-b).

(30) a. $[\![\text{DOU1}(\varphi)]\!] := \bigcap[\varphi]^+$
b. $[\![\text{MOU4LEON6 } p \text{ DING } \neg p,\, \text{DOU1-}q]\!] = [(p \to q) \wedge (\neg p \to q)]^+$

This InqS analysis of unconditonals can also account for the connotations of unconditionals. Intuitively, an unconditional sentence 'whether or not p, q' gives rise to a consequent entailment, e.g., in (4), 'She will be full' is always true, and an independence connotation between two issues p and q. Indeed, it can be shown that the consequent entailment holds:

Proposition 1 (Consequent entailment)**.** $\sigma \vDash^+ (p \to q) \wedge (\neg p \to q)$ imply that $\sigma \vDash^+ q$.

Proof. By assumption, $\sigma \vDash^+ p \to q$ and $\sigma \vDash^+ \neg p \to q$. By the definition of '$\to$' in (12), $\sigma \cap \mathit{info}(p) \vDash^+ p$ and $\sigma \cap \mathit{info}(p) \vDash^+ q$; $\sigma \cap \mathit{info}(\neg p) \vDash^+ \neg p$ and $\sigma \cap \mathit{info}(\neg p) \vDash^+ q$. By the definition of '$\vDash^+$', thus, $\sigma \cap \mathit{info}(p) \neq \emptyset$ and $\sigma \cap \mathit{info}(\neg p) \neq \emptyset$. Since $\mathit{info}(\neg p) = W - \mathit{info}(p)$, $\sigma \cap (W - \mathit{info}(p)) \vDash^+ q$. Thus, $\sigma \cap (W - \mathit{info}(p)) \subseteq \mathit{info}(q)$. Also, since $\sigma \cap \mathit{info}(p) \vDash^+ q$, $\sigma \cap \mathit{info}(p) \subseteq \mathit{info}(q)$. Therefore, $\sigma \subseteq \mathit{info}(q)$. Hence, $\sigma \vDash^+ q$. □

As for the independence connotation, Franke (2009) defines that two propositions are (epistemically) independent when learning the truth/falsity of one proposition does not affect the truth/falsity of the other proposition.[8] Franke's notion of independence can be carried over to the InqS framework as in (31) on the basis of Aher & Groenendijk (To appear) definition of $\Diamond$ in InqS as in (32).

(31) p and q are *independent* in σ if $\sigma \vDash^+ \Diamond x$ and $\sigma \vDash^+ \Diamond y$ imply $\sigma \vDash^+ \Diamond(x \wedge y)$, for all $x \in \{p, \neg p\}$ and $y \in \{q, \neg q\}$. (Adapted from Franke, 2009, 266)

(32) $\sigma \vDash^+ \Diamond\varphi$ iff φ is supposable in σ, i.e., $\sigma \cap \mathit{info}(\varphi) \vDash^+ \varphi$.
(Adapted from Aher & Groenendijk, To appear, 9)

[8] See Sano & Hara (2014) for a dynamic extension of independence.

In showing the truth of the unconditional “whether or not p, q” entails the independence between p and q, the following fact from Groenendijk & Roelofsen (2014) is used:

Fact 2 (Persistence modulo inconsistency)**.** If $\sigma \models^+ \varphi$ and $\sigma \supseteq \tau \neq \emptyset$, then $\tau \models^+ \varphi$
(Adapted from Groenendijk & Roelofsen, 2014, 11)

Proposition 3 (Independence)**.** If $\sigma \models^+ (p \to q) \wedge (\neg p \to q)$, then p and q are independent in σ.

Proof. Suppose $\sigma \models^+ (p \to q) \wedge (\neg p \to q)$. By Proposition 1, $\sigma \models^+ q$. We need to show the following four implications: 1. If $\sigma \models^+ \Diamond p$ and $\sigma \models^+ \Diamond q$, then $\sigma \models^+ \Diamond(p \wedge q)$. 2. If $\sigma \models^+ \Diamond \neg p$ and $\sigma \models^+ \Diamond q$, then $\sigma \models^+ \Diamond(\neg p \wedge q)$ 3. If $\sigma \models^+ \Diamond p$ and $\sigma \models^+ \Diamond \neg q$, then $\sigma \models^+ \Diamond(p \wedge \neg q)$. 4. If $\sigma \models^+ \Diamond \neg p$ and $\sigma \models^+ \Diamond \neg q$, then $\sigma \models^+ \Diamond(\neg p \wedge \neg q)$. Case 1: Suppose $\sigma \models^+ \Diamond p$ and $\sigma \models^+ \Diamond q$. By the assumption, p is supposable in σ. Thus, $\sigma \cap \mathit{info}(p) \models^+ p$ and $\sigma \cap \mathit{info}(p) \neq \emptyset$. Also, since $\sigma \models^+ q$ and Fact 2, $\sigma \cap \mathit{info}(p) \models^+ q$, which implies $\emptyset \neq \sigma \cap \mathit{info}(p) \cap \mathit{info}(p) = \sigma \cap \mathit{info}(p \wedge q)$. Since $\mathit{info}(p \wedge q) \subseteq \mathit{info}(p)$, $\sigma \cap \mathit{info}(p \wedge q) \subseteq \sigma \cap \mathit{info}(p)$. By Fact 2, $\sigma \cap \mathit{info}(p \wedge q) \models^+ p \wedge q$. Therefore, $p \wedge q$ is supposable in σ, thus $\sigma \models^+ \Diamond(p \wedge q)$. Case 2: Similar to Case 1. Case 3: Suppose $\sigma \models^+ \Diamond p$ and $\sigma \models^+ \Diamond \neg q$. By the assumption, $\sigma \cap \mathit{info}(\neg p) \models^+ \neg q$ and $\sigma \cap \mathit{info}(\neg q) \neq \emptyset$. By the definition of ‘¬’, $\sigma \cap \mathit{info}(\neg p) \models^- q$. By the assumption and Fact 2, $\sigma \cap \mathit{info}(\neg p) \models^+ q$. Since the assumptions contradict each other, this case never happens. Case 4: Similar to Case 3.

□

4 Conclusion

This paper provided a compositional analysis that explains their distributions and interpretations of the two kinds of Cantonese disjunction, *waak6ze2* and *ding6* in InqS. Both *ding6* and *waak6ze2* denote an inquisitive disjunction which contains a set of alternative propositions, but they differ in that *ding6* has an extra syntactic-feature-driven requirement that the clause remains to be inquisitive. The analysis is consistent with the result of the experiments reported in Hara (2015) and correctly derives the interpretations of the interrogative constructions and the connotations which arise from unconditional sentences.

As mentioned in section 2, Haspelmath (2007) states that there are a lot of languages which have two kinds of disjunction, “interrogative disjunction and standard disjunction”. However, Cantonese disjunction system is different from Egyptian Arabic system (Winans, 2013, See). Even the distribution of the two disjunctions in Mandarin Chinese, which is quite similar to Cantonese in a number of respects, is different from that in Cantonese. More specifically, Mandarin “interrogative” disjunction, *háishe*, is available under modals and conditional antecedents (Huang, 2010, See), while Cantonese *ding6* is ungrammatical under those constructions. It would be interesting to investigate whether this distributional difference arises from the difference in the disjunction system or the properties of modals and conditionals.

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