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Cross-linguistic difference in disjunction in two-dimensional semantics*

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Abstract Disjunction, expressed by *or* in English, is a primary connective available in natural language. It was traditionally analyzed as the Boolean connective $\vee$ (e.g., Montague 1973), but subsequent studies revealed a number of inadequacies in this approach, which led to the 'dynamic turn' in natural language semantics (Karttunen 1974; Heim 1982; *et seq*). However, the empirical base of this literature almost exclusively comprises examples from English. The cross-linguistic (in)adequacy of the theory has yet to be investigated. This paper addresses this research gap by inspecting disjunction in Japanese. More specifically, this paper examines the (non-)replicability of the observations that support the dynamic analysis for English 'ϕ *or* ψ' which hardwires the *local context* $\neg\phi$. I argue that Japanese disjunction exhibits some kinds of evidence for the local context, but not others.

Keywords: disjunction, local context, dynamic semantics, comparative semantics, two-dimensional semantics, Japanese

1 Introduction and Summary

The literature in dynamic semantics analyzes the English disjunction 'ϕ *or* ψ' as $\phi \vee (\neg\phi \wedge \psi)$, departing from the classical translation into $\phi \vee \psi$. The posited $\neg\phi$ in the second disjunct is often called a *local context* for ψ, a notion of which has played an important role since Stalnaker (1974), Karttunen (1974), and Heim (1982). In English, the significance of local context has been supported by various observations (Klinedinst & Rothschild 2012 for an overview), and the prevailing support has led researchers to build the local context into the lexical semantics of *or* (in the literature in dynamic semantics – Veltman 1996; Groenendijk, Stokhofand & Veltman 1996; Beaver 2001) or to devise a pragmatic strategy to derive it from the classical definition (in works inspired by Stalnaker 1974 – Schlenker 2008, 2009).

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However, the (non-)replicability of the observations and the (in)adequacy of the local context for other languages have rarely been discussed. This paper shows that support for the local context does not prevail cross-linguistically. A novel paradigm will show that the supporting observations are only partially replicated in Japanese. More specifically, the presence of local context in Japanese disjunctions of the form 'ϕ *ka* ψ *(ka)*,' is only evident for presupposition projection. The other supporting observations are not replicated in the language.

Building the formalization on *two-dimensional semantics* (in the sense of Karttunen & Peters 1979), I argue that the local context $\neg\phi$ is present in ϕ *ka* ψ*(ka)* only in the presuppositional dimension. Its absence in the assertive dimension explains the partial replicability of the supporting data available in English.

The rest of this paper is organized as follows. The next section sets up the necessary background, focusing on presupposition projection in English. Section 3 presents the paradigm, and section 4 offers a formalization. An implication for modal disjunction is also discussed there. Section 5 is a brief note on a covert argument in Japanese, which at first sight seems to argue against the claim.

2 Background – Presupposition projection as the first support of the local context

The primary support for the local context in English was furnished by facts about *presupposition projection* from disjunction. Let ϕ_p be a proposition ϕ with a presupposition p. Karttunen (1973) observes that p projects in the disjunction 'ϕ *or* ψ_p' (i.e., p is presupposed by the entire disjunction) except when *the negation of* ϕ, $\neg\phi$, *entails* p.[1,2] Therefore, while (1a) presupposes that Jack has children, (1b) does not.

(1) a. Either [$_\phi$ baldness is not hereditary] or [$_{\psi_p}$ all of Jack's children are bald].
b. Either [$_\phi$ Jack has no children] or [$_{\psi_p}$ all of Jack's children are bald].

In the dynamic analysis of presupposition (Heim 1982 *et seq*), presuppositions must be entailed by the *local context*. The pattern in (1) suggests that the local context for ψ in the disjunction 'ϕ *or* ψ' is $c_1 \cap \neg\phi$, where c_1 is the initial context set, modeled as a set of possible worlds. The reasoning is illustrated in Figure 1. c_2

[1] This remark oversimplifies the matter. One school of thought maintains that the presupposition of the sentence is in the conditional form, $\neg\phi \rightarrow p$, and that the conditional presupposition is strengthened to p by a pragmatic reasoning (see, for example, Heim 1990; Beaver 2001; Van Rooij 2007). I ignore this complication in this paper. See also footnote 3.

[2] Throughout this paper, I will avoid translating natural language expressions such as *and* and *or* into $\wedge$ and $\vee$, respectively, since this paper concerns itself with cross-linguistic differences and the translation blurs which (natural) language is discussed. Therefore, the natural language expressions and object interpretation symbols (e.g., ϕ, ψ) are often mixed in the following examples, but I hope this will not cause too much confusion.

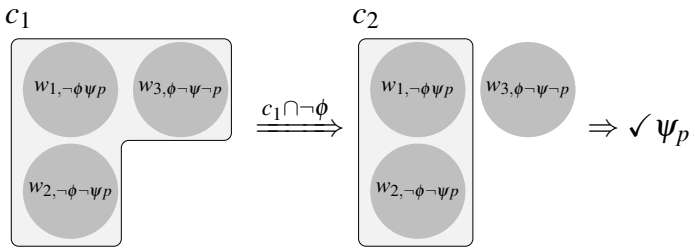

Figure 1 The dynamic effect of disjunction in (1b).

is the intersection $c_1 \cap \neg\phi$. If $\neg\phi$ entails p, p is true in all worlds in c_2. The local context guarantees the felicity of ψ_p. This reasoning holds for any c_1, hence the generalization: p is filtered (i.e. does not project) in $\phi \vee \psi_p$ if $\neg\phi$ entails p.[3]

To capture the observed pattern, English disjunction is dynamically defined as (2) (Veltman 1996; Groenendijk et al. 1996; Beaver 2001). The crucial part is the right-hand side of the union, $(c \cap \neg\phi) \cap \psi$. It emulates the update illustrated in Figure 1. The update by ψ only concerns the worlds in c where ϕ is *false*, i.e., $\neg\phi$ is true. The semantically hard-wired local context correctly predicts the projection pattern.

(2) $c[\phi \textit{ or } \psi] = (c \cap \phi) \cup ((c \cap \neg\phi) \cap \psi)$

3 The paradigm: Further support for the local context and its (non-) replicability

The presence of the local context in disjunction, $\neg\phi$, has been supported by various independent phenomena – *bathroom anaphora* (attributed to Barbara Partee), *polarity-reversed sluicing* (Kroll 2019), and the domain restriction of modality (Rothschild 2013), reviewed shortly. These observations are made exclusively in English, however. A novel paradigm shows that the support is not replicated in Japanese, suggesting that the local context is much less robust in the language.

[3] The reasoning here encounters an issue called the *proviso problem* (Geurts 1996): It predicts that (1a) presupposes $\neg\phi \rightarrow p$, which is weaker than the intuitively available presupposition, p. The proviso problem is inherited by almost any theory of presupposition projection, and it appears for disjunction and conditional as well, notably except for versions of *Discourse Representation Theory* (Kamp 1981 *et seq*). See Kamp & Reyle (1993), Van der Sandt (1992), Geurts (1999), Kamp (2001), and Kamp, Genabith & Reyle (2010) for DRT formulations of presupposition projection, as well as footnote 1 and the references therein for the view that the conditional presupposition is not the wrong prediction. It is worth noting that the Japanese paradigm discussed here goes against Van der Sandt's (1992) conjecture that presuppositions are resolved as anaphora. The Japanese data shows that presupposition and anaphora do not exhibit parallel behavior.

Japanese disjunction 'ϕ *ka* ψ'

Disjunction is most typically expressed as 'ϕ *ka* ψ' in Japanese, exemplified in (3). The second disjunct can optionally be followed by another occurrence of *ka*, as in 'ϕ *ka* ψ *ka* ,' without any truth-conditional effect. Clausal disjunctions are most natural when they are embedded. When embedded, the second occurrence of *ka* is obligatory. In the following examples, the disjunction is often embedded under '... *da*' ('*it's ...*').

(3) [$_\phi$ *Taroo-ga odoru*] *ka,* [$_\psi$ *Hanako-ga utau*] *(ka da).*
Taro-NOM dance or Hanako-NOM sing or COP
'It's either Taro will dance or Hanako will sing.'

Presupposition projection

Karttunen's (1973) generalization holds for the *ka*-disjunction as well, and the presupposition p is filtered in 'ϕ *ka* ψ_p' if $\neg\phi$ entails p. The second disjuncts in (4) carry the presupposition that Taro used to smoke, triggered by the verb *yame-ta* '*stopped*.' This presupposition projects in (4a), where ϕ and p are logically independent, whereas it is filtered in (4b), where $\neg\phi$ entails p.

(4) a. [$_\phi$ *Taroo-wa okane-ga nai*] *ka,*
Taro-TOP money-NOM NEG or
[$_{\psi_p}$ *kare-wa tabako-o suu-no-o* ***yame-ta***] *(ka da).*
he-TOP smoke-ACC smoke-NMNL-ACC stop-PAST or COP
'Taro does not have any money or he stopped smoking.'
(*Presupposes: Taro used to smoke.*)

b. [$_\phi$ *Taroo-wa tabako-o sut-ta koto-ga nai*] *ka,*
Taro-TOP smoke-ACC smoke-PAST experience-NOM NEG or
[$_{\psi_p}$ *kare-wa tabako-o suu-no-o* ***yame-ta***] *(ka da).*
he-TOP smoke-ACC smoke-NMNL-ACC stop-PAST or COP
'Taro has never smoked or he stopped smoking.' (*No presupposition*)

Despite the same projection pattern, Japanese diverges from English in the replicability of other supporting observations: Japanese does not replicate *bathroom anaphora*, *polarity-recersed sluicing*, the domain restriction of modality, or non-truth tabular *or*, to which I turn now.

Bathroom anaphora

Bathroom anaphora, exemplified by the pronoun and the definite description in (5), has provided another motivation for the local context. (The observation is attributed to Barbara Partee, slightly modified.)

(5) Either there is no bathroom in this building, or {**it / the bathroom**} is in a funny place.

Kamp & Reyle (1993) claim that the pronoun and the definite description in the second disjunct find their antecedent in the local context, as represented in (6). Augmented with the local context, (5) is interpreted as (6a), which is reduced to (6b) via Double Negation Elimination (DNE).[4] The anaphora is anteceded by the indefinite *a bathroom* in the $\neg\phi$ clause conjoined with the ψ-clause.[5] Since conjunction supports anaphora from a conjunct to the previous conjunct(s), the bathroom anaphora is resolved, with the crucial reliance on the local context.

(6) a. Either [$_{\phi}$ there is no bathroom], or
[[$_{\neg\phi}$ *it is not the case that there is no a bathroom*] and [$_{\psi}$ the bathroom is in a weird place]].

b. Either [$_{\phi}$ there is no bathroom], or
[[$_{\neg\phi}$ *there is a bathroom*] and [$_{\psi}$ the bathroom is in a weird place]].

The motivation for the local context from bathroom anaphora does not carry over to Japanese, where bathroom anaphora is not replicated with an overt anaphoric element (Kurafuji 1998). The definite description *sono N* '*the N*' and the pronoun *sore* '*it*' in (7) are infelicitous in the intended interpretation. (See section 5 for a discussion on the covert pronoun, which does allow the intended interpretation.)

[4]Whether or not DNE is valid in dynamic semantics is a complicated matter. It is not valid in the frameworks proposed in the first period of the development of dynamic semantics (e.g., Heim 1982; Groenendijk & Stokhof 1991; Groenendijk et al. 1996), but subsequent literature validates it (Krahmer & Muskens 1995; Aloni 2023; Elliot & Sudo 2024;). I will also pursue dynamic semantics with DNE being validated below.

[5]The local context is *conjoined* here, although Krahmer & Muskens (1995) argue that it should serve as an antecedent of *conditional*: *if* $\neg\phi$*, then* ψ. They argue that the truth of (5) entails that all bathrooms (if any) are in a weird place. Though I share the intuition, I will keep assuming the conjoined local context for simplicity. Nothing hinges on this choice.

(7) #[$_\phi$ *Kono tatemono-ni-wa toire-ga nai*] ***ka,***
This building-DAT-TOP bathroom-NOM NEG or,

[$_\psi$ { ***sono toire**-ga* / ***sore**-ga* } *hen-na tokoro-ni aru*]
the bathroom-NOM it-NOM funny place-DAT exists

ka da.
or TOP

'(It's either) there is no bathroom, or the bathroom is in a funny place.'

Polarity-reversed sluicing

Another support for the local context is provided by *polarity-reversed sluicing*, exemplified in (8).

(8) (Students were given the option to do an extra credit problem, but were required to mark which problem they did next to their name on a spreadsheet. There is no mark next to John's name. The TA says:)

'*Either* [$_\phi$ *John didn't do an extra credit problem*], *or* [$_\psi$ *he didn't mark which one ~~he did~~*].' (Kroll 2019:2)

Apparently, the antecedent of the sluicing is the ϕ-clause. However, the ϕ-clause has the opposite polarity to the elided clause, and because of this major theories of ellipsis do not predict the sluicing anteceded by the ϕ-clause. In a theory that requires syntactic isomorphism between an elided clause and its antecedent (e.g., Rooth 1992), the sluicing in (8) is not licensed because the negative particle *n't* makes the ϕ-clause syntactically non-isomorphic with the elided clause. In the theory that requires some form of uni- or bi-directional entailment between an elided clause and its antecedent (e.g., Merchant 1999), (8) is not licensed because in no way does a proposition χ entail, or is it entailed by, its negative counterpart, $\neg\chi$.[6] This challenge is overcome with the local context (Kroll 2019). The local context in (8) is [$_{\neg\phi}$ *John did do an extra credit problem*], which entails the elided clause *modulo* focus closure (Merchant 1999). The well-formedness of sluicing in (8) supports the presence of the local context.

The sluicing in (8) is not replicable in Japanese. The Japanese counterpart in (9)

[6] The only theory I am aware of that licenses the sluicing in (8) is Rudin's (2019) head-based syntactic identity theory. Roughly, it states sluicing is licensed as long as the syntactic constituent below *v*P of the elided clause is identical to that of the antecedent. The polarity-reversed sluicing is then licensed if the negative particle in the ϕ-clause in (8) is located above *v*P. In this analysis, the sluicing is licensed without even mentioning the local context. The discussion in the main text still applies, however. Notice that Rudin's (2019) theory overgenerates impossible sluicings discussed in Kroll (2019), for example, (i).

is ill-formed, even though polarity-reversed sluicing is attested outside disjunction (Sato 2022; Yagi, Sakamoto & Tatsumi 2022). Sato (2022) observes (10), which is the Japanese counterpart of (11), another instance of polarity-reversed sluicing discussed by Kroll (2019).[7,8]

(9) #[$_{\phi}$ *John-wa tsuika kadai-o yara-nak-atta*] *ka,*
John-TOP extra assignment-ACC do-NEG-PAST or

[$_{\psi}$ *dore-o*$_1$ [~~*kare-ga*~~ t_1 ~~*ya-tta*~~] *ka kiroku-si-nak-atta*] *(ka da).*
which-ACC he-NOM do-PAST Q record-do-NEG-PAST (or COP)

Intended: 'Either John didn't do an extra credit problem, or he didn't mark which one ~~**he did**~~.'

(10) *Boku-wa* [*kotosizyuuni koronaka-ga syuusokusuru-to*]
I-TOP by.the.end.of.this.year coronavirus.crisis-NOM is.over-COMP

*omottei-**nai**-si, naze* [~~***kotosizyuuni***~~ ~~***koronaka-ga***~~
think-NEG-and why by.the.end.of.this.year coronavirus.crisis-NOM

~~***syuusokusi-nai***~~] *ka-mo aruteido kentoogatsuiteiru.*
is.over-NEG Q-also to.some.extent can.guess

'I don't think that the coronavirus crisis will be over by the end of this year, and I can kind of guess why ~~it will not be over by then~~.' (Sato 2022:342)

(i) (Students in a semantics class were given a set of extra credit problems, which they could choose to do up to half of. All students were required to put a mark on a spreadsheet next to each question, indicating whether they did or didn't do it. The professor and TA look at the spreadsheet and see that John has not put a mark next to all of the questions. The TA says to the professor:)
John marked which problems he did but he didn't mark which problems* ~~*he didn't do***~~
(Kroll 2019: 26)

Being aware of the overgeneration problem, Rudin (2019: 3.1.) claims that a pragmatic principle regulates the interpretation of sluiced clauses so that it licenses the intended interpretation in (8) but not in (i). We can then hypothesize that the pragmatic principle mentions entailment by a local context. That is, the interpretation in (8) is possible *because* it is entailed by the local context, and the one in (i) is impossible because there is no such local context. As long as some principle is required to regulate the interpretation of sluiced clauses, the felicity of (8) with the interpretation motivates the local context.

[7]Sluicing in Japanese is notoriously complex. The issue is if the elided material in (9) has a full clausal structure as specified there, or is derived as a *pseudo-sluicing* (roughly:*which problem* ~~*is it*~~). Nevertheless, the literature agrees that the case marker in the remnant wh-phrase guarantees that the construction is an instance of genuine sluicing. See, for example, Takahashi (1994).

[8]The sluicing here does not hinge on Neg-raising. See Kroll (2019) for discussion.

(11) I don't think that [California will comply], but I don't know why [~~**California will not comply**~~].

Domain restriction

The local context provides the domain restriction of a modal in the second disjunct (Klinedinst & Rothschild 2012; Rothschild 2013). Otherwise, the use of epistemic *must* in (12) would be pragmatically odd because of the *ignorance principle*: the disjunction $\phi \vee \psi$ implies that the speaker does not commit to the truth of either disjunct. But then the presence of *must* in the disjunction in (12), if it is interpreted without the domain restriction by the local context, implies that the speaker is not certain about their own epistemic state, which would be pragmatically infelicitous. If the modal is restricted by the local context, it conveys the speaker's attitude *on condition that* $\neg\phi$.

(12) Either [$_\phi$ John is in the basement], or [$_\psi$ he must be in the kitchen].
(Rothschild 2013:65)

The analogous interpretation is absent in the *ka*-disjunction. (13a) and (13b) sound quite odd. The only interpretation available is that the speaker is uncertain about his/her own epistemic state.

(13) a. #[$_\phi$ *Taroo-wa* *chika-ni* *iru*] *ka* [$_\psi$ *Taroo-wa* *kicchin-ni*
Taro-TOP basement-DAT present or Taro-TOP kitchen-DAT
iru ***nichigainai***] .
present must
'Either Taro is in the basement, or it must be the case that Taro is in the kitchen.'

b. #[$_\phi$ *Taroo-wa* *chika-ni* *iru*] *ka* [$_\psi$ *Taroo-wa* ***kakujitsuni***
Taro-TOP basement-DAT present or Taro-TOP surely
kicchin-ni *iru*] .
kitchen-DAT present
'Taro is in the basement, or Taro is surely/certainly in the kitchen.'

The same observation is obtained with other modal expressions. The objective probability modal in (14) cannot be interpreted as '*if Taro is not in the basement, it is highly likely...*' Instead, it is interpreted as Taro being highly likely to be in the kitchen, whether or not he is in the basement.[9]

[9]The intended interpretation becomes available if a local context is explicitly created with overt expressions.

	Presupposition	Bathroom Anaphora	PRS	Domain restriction
Eng	✓	✓	✓	✓
Jpn	✓	∗	*	*

Table 1 The summary of the paradigm.

(14) [$_\phi$ *Taroo-wa* *chika-ni* *iru*] *ka* [$_\psi$ *Taroo-wa* *kicchin-ni*
Taro-TOP basement-DAT present or Taro-TOP kitchen-DAT
iru ***kanousei-ga*** ***takai***]
present possibility high
'Taro is in the basement, or it is highly likely that Taro is in the kitchen.'

The paradigm is summarized in Table 1, where PRS stands for polarity-reversed sluicing.[10]

4 Explanation and Formalization

The paradigm suggests that the four phenomena do not align as expected and that the presupposition filtering in disjunction is attested independently from the other three. Notice that the three phenomena that are not replicated in Japanese incorporate the

(i) [$_\phi$ *Taroo-wa* *chika-ni* *iru*] *ka* ***soo-de*** ***nak-ereba*** [$_\psi$ *Taroo-wa* *kicchin-ni*
Taro-TOP basement-DAT present or so-COP NEG-if Taro-TOP kitchen-DAT
iru ***kanousei-ga*** ***takai***]
present possibility high
'Taro is in the basement, or if not it is highly likely that Taro is in the kitchen.'

[10]Another contrast worth noting here involves what Klinedinst & Rothschild (2012) dubbed 'non-truth tabular' use of English *or*, exemplified in (i). Klinedinst & Rothschild (2012) argues that the local context in the second disjunct is a necessary (but not sufficient) condition to derive this reading. The reading is not replicated in Japanese, which follows if Japanese does not satisfy the necessary condition, i.e., the presence of local context.

(i) [$_\phi$ John has no friends] or [$_\psi$ he would throw a party].
$\rightsquigarrow$ [$_\phi$ John has no friend] [$_{\neg\phi}$ **If he did have a friend**], [$_\psi$ he would throw a party].
(Klinedinst & Rothschild 2012: 138)

(ii) [$_\phi$ *John-ni-wa* *tomodachi-ga* *inai*] ***ka***,
John-DAT-TOP friend-NOM absent or
[$_\psi$ *paatii-o* *sita* *darou*] *(ka* *da)*
party-ACC did would (or COP)
Intended: 'John has no friends, or he did have a friend he would have thrown a party.'

local context meaning in the *assertive contents* of sentences. This is most evident in the case of the domain restriction of an epistemic modal. The sentence contains within its assertive content a quantification $\forall w[w \in D...]$, where D is a suitable domain restriction. If D is characterized by the local context, the local context must be available in the assertive content. The same reasoning holds for the other two phenomena. Sluicing arguably takes place as a part of the assertion, so Kroll's (2019) strategy requires that the local context be available in the assertive content so that it licenses the ellipsis. The resolution of bathroom anaphora also takes place as a part of the assertive content.

Therefore, the paradigm summarized in Table 1 can be restated as follows. The Japanese disjunction ϕ *ka* ψ has access to the local context $\neg\phi$ *in its presuppositional content*, hence the replicability of the generalization regarding presupposition filtering, but *not in its assertive content*, hence the nonreplicability of the other supporting phenomena. On the other hand, English avails itself of the local context in both assertive and presuppositional contents.

Given the above intuition, I suggest explaining the difference between the two languages in the framework of dynamicized two-dimensional semantics (in the sense of Karttunen & Peters 1979), which separates updates by presuppositional contents from assertive contents.[11] I let natural language sentence S be translated into a *pair* $\langle [\![S]\!]_\pi, [\![S]\!]_\alpha \rangle$ of meanings via function $[\![-]\!]$, where $[\![S]\!]_\pi$ is the presuppositional meaning of S and $[\![S]\!]_\alpha$ is the assertive meaning of S. For atomic sentences, the propositional and the assertive meanings solely depend on the lexical meanings of their contents. For example:

(15) a. $[\![\textit{John stopped smoking}]\!] = \left\langle \begin{array}{l} [\![\textit{John stopped smoking}]\!]_\pi, \\ [\![\textit{John stopped smoking}]\!]_\alpha \end{array} \right\rangle$

$= \left\langle \begin{array}{l} \texttt{John\_used\_to\_smoke}, \\ \texttt{John\_not\_smoke\_now} \end{array} \right\rangle$

b. $[\![\textit{John must be upstairs}]\!] = \left\langle \begin{array}{l} [\![\textit{John must be upstairs}]\!]_\pi, \\ [\![\textit{John must be upstairs}]\!]_\alpha \end{array} \right\rangle$

$= \left\langle \begin{array}{l} \top, \\ \Box\texttt{John\_is\_upstairs} \end{array} \right\rangle$

[11] Two-dimensional semantics is notoriously known to suffer from the *binding problem*, but a few solutions have been proposed in the literature. See, for example, Dekker (2008) and Sudo (2013). In particular, dynamic semantics is useful to overcome the problem, as both Dekker (2008) and Sudo (2013) pursued. Nevertheless, since overcoming the binding problem is not the main purpose of this paper, I will not discuss it further below. The proposal can be recast in Sudo's (2013) definition of two-dimensional update, which circumvents the problem.

The assertive meaning of the sentence *John stopped smoking* is that John does not smoke now; the presuppositional meaning is that he used to smoke. The presuppositional meaning of *John must be upstairs* is a tautology, represented as $\top$, because the sentence does not carry any intuitive presupposition.

The assertive and presuppositional meanings of complex sentences with conjunction or negation are recursively determined as follows.

(16) a. $[\![S \textit{ and } S']\!] = \left\langle \begin{array}{l} [\![S]\!]_\alpha \rightarrow [\![S']\!]_\pi, \\ [\![S]\!]_\alpha \wedge [\![S']\!]_\alpha \end{array} \right\rangle$

b. $[\![\textit{not } S]\!] = \left\langle \begin{array}{l} [\![S]\!]_\pi, \\ \neg[\![S]\!]_\alpha \end{array} \right\rangle$

I argue that the difference between the Japanese *ka*-disjunction and the English *or*-disjunction lies in their assertive meanings. Compare (17a) and (17b).

(17) a. $[\![S \textit{ or } S']\!] = \left\langle \begin{array}{l} \neg[\![S]\!]_\alpha \rightarrow [\![S']\!]_\pi, \\ [\![S]\!]_\alpha \vee (\neg[\![S]\!]_\alpha \wedge [\![S']\!]_\alpha) \end{array} \right\rangle$

b. $[\![S \textit{ ka } S']\!] = \left\langle \begin{array}{l} \neg[\![S]\!]_\alpha \rightarrow [\![S']\!]_\pi, \\ [\![S]\!]_\alpha \vee [\![S']\!]_\alpha \end{array} \right\rangle$

Or and *ka* share their presuppositional meanings, but the assertive meanings differ in that *or* posits an additional $\neg[\![S]\!]_\alpha$ clause in the second disjunct (i.e. the local context). Despite the classical equivalence $\phi \vee \psi \equiv \phi \vee (\neg\phi \wedge \psi)$, the extra clause $\neg\phi$ has significant consequences once the formula is interpreted dynamically. This difference, I argue, teases the two disjunctions apart and predicts the empirical paradigm we have observed so far.

In order for the proposed system to be fully worked out to account for the observations above, we need a couple of more ingredients besides the two-dimensionality:

- Dynamics
- Double Negation Elimination

Dynamic semantics provides an analysis of how the domain of modal quantification in the second disjunct is restricted in (12), and how that restriction licenses polarity-reversed sluicing in (11). I follow the first-order update semantics proposed in Groenendijk et al. (1996) to implement it (see also Beaver 2001).

Groenendijk et al.'s (1996) update semantics, however, does not validate Double Negation Elimination (DNE), which is one of the design features of the first-generation dynamic semantics. The validity of DNE is pivotal to analyzing bathroom anaphora in English. I will incorporate *bilateralism* into the dynamic setting to validate DNE (Krahmer & Muskens 1995; Aloni 2023; Elliot & Sudo 2024).

4.1 Dynamics

A pair of formulae translated from natural language expressions is subject to dynamic interpretation. Here are the minimal ingredients from Groenendijk et al. (1996) to discuss the current paradigm. Notice that now a context set, called *state* here, is defined as a set of *pairs* of a possible world and an assignment function.

Definition 1. *state*, *descendance*, *subsistence*

- *State* s is a set of $i = \langle w, f \rangle$, w a possible world and f an assignmnet function.
- $f[x/d]$ is an assignment function f' such that f' differs from f at most in that $f'(x) = d$ for some $d \in D_e$.
- $i[x/d] \coloneqq \langle w, f[x/d] \rangle$, given $i = \langle w, g \rangle$
- $s[x/d] \coloneqq \{i[x/d] \mid i \in s\}$
- $i \leq i'$ iff $f_i \subseteq f'_i$ and $w_i = w_{i'}$[12]
- i' is a descendant of i in s iff $i' \in s$ and $i \leq i'$
- i subsists in s iff i has one or more descendants in s

Definition 2. Updates

- $s[Rx_1, ..., x_n] = \{i \in s \mid \langle f_i(x_1), ..., f_i(x_n) \rangle \in I(w_1)(R)\}$
- $s[\phi \wedge \psi] = s[\phi][\psi]$
- $s[\neg\phi] = \{i \in s \mid i \text{ does not subsist in } s[\phi]\}$
- $s[\phi \rightarrow \psi] = \{i \in s \mid$ if i subsists in $s[\phi]$, then all descendants of i in $s[\phi]$ subsists in $s[\phi][\psi]\}$
- $s[\exists\phi] = \bigcup_{d \in D} \big(s[x/d][\phi]\big)$
- $s[\Box\phi] = s$ if for all $i \in s : i$ subsists in $s[\phi]$. $\emptyset$ otherwise.

Let $\Phi = [\![S]\!]$ be a pair $\langle [\![S]\!]_\pi, [\![S]\!]_\alpha \rangle$ of formulae, and $\pi(\Phi) = [\![S]\!]_\pi$ and $\alpha(\Phi) = [\![S]\!]_\alpha$. The *two-dimensional update* of s by Φ, $s[\Phi]$, is defined as follows. The state $*$ is a designated context set for undefinedness such that $s/* = s \cup * = s \cap * = *$ for any set s.[13]

[12] Instead of assuming assignment functions are partial, I suppose a discourse starts with a singleton set $\{\langle w, f_\star \rangle\}$, where $f_\star(x) = \star$ for any variable x. $\star$ is a designated individual (hence the domain is extended to be $D_c \cup \star$) that renders any predicationn undefined (cf. van den Berg 1996). Therefore, read $f_i \subseteq f'_i$ as: *for any variable* v *: if* $f(v) \neq \star$ *then* $f(v) = f'(v)$.

[13] This definition does *not* circumvent the binding problem, but I set it aside in this paper.

Definition 3. Update of s by a pair Φ of formulae

$$c[\Phi] = \begin{cases} c[\alpha(\Phi)] & \text{if } c[\pi(\Phi)] = c \\ * & \text{otherwise} \end{cases}$$

To emulate the partiality of the assignment function, I extend the domain of individuals D_e to be $D_e \cup \{*\}$. $*$ is a designated individual that renders any predication undefined. The emulated partially will play a crucial role in accounting for the contrast of bathroom anaphora.

4.2 Accounting for presupposition projection, polarity-reversed sluicing, and domain restriction

The definitions laid out above are designed to replicate the facts regarding presupposition projection reported in Karttunen (1974) and discussed in section 2. For an illustration, consider (19), with the entries in (18) and the two-dimensional definiton of English *or* in (17a).[14]

(18) a. $[\![\textit{John has never smoked}]\!] = \left\langle \begin{array}{l} \top, \\ \texttt{never\_smoke}(j) \end{array} \right\rangle$

b. $[\![\textit{John stopped smoking}]\!] = \left\langle \begin{array}{l} \texttt{used\_to\_smoke}(j), \\ \texttt{not\_smoke\_now}(j) \end{array} \right\rangle$

(19) (Either) John has never smoked or John stopped smoking.

$$= \left\langle \begin{array}{l} \neg\texttt{never\_smoke}(j) \rightarrow \texttt{used\_to\_smoke}(j), \\ \texttt{never\_smoke}(j) \vee (\neg\texttt{never\_smoke}(j) \wedge \texttt{not\_smoke\_now}(j) \end{array} \right\rangle$$

The two-dimensional update is defined if and only if

$$s[\neg\texttt{never\_smoke}(j) \rightarrow \texttt{used\_to\_smoke}(j)] = s.$$

It holds with the uncontroversial assumption that $\neg\texttt{never\_smoke}(j) \equiv \texttt{used\_to\_smoke}(j)$. If defined, the update by the assertion is computed as

$$s[\texttt{never\_smoked}(j)] \cup s[\neg\texttt{never\_smoked}(j)][\texttt{not\_smoke\_now}(j)].$$

[14] Suppose j is an individual constant such that $f(j) = \textit{john}$ for any f. A more natural way to put the same proposition would be *Either John has never smoked or* ***he*** *stopped smoking*. To analyze this formula, which contains an anaphor, requires three things: (i) *John* updates a state in a way existential quantification does, (ii) the negation *never* takes scope over the first disjunct, and (iii) Double Negation Elimination. In order to focus on the way presupposition filtering works here, I will not implement the full analysis here. See below for validating Double Negation Elimination, though.

A pair $\langle w, f \rangle$ subsists in this update just in case John has never smoked in w, or he has smoked but does not smoke now in w.

Now consider the Japanese counterpart of the above update. Given the definition in (17b), we obtain (20) as the input for dynamic interpretation.

(20) $\left\langle \begin{array}{l} \neg \texttt{never\_smoke}(j) \rightarrow \texttt{used\_to\_smoke}(j), \\ \texttt{never\_smoke}(j) \vee \texttt{not\_smoke\_now}(j) \end{array} \right\rangle$

Since *ka* and *or* share the presuppositional meaning, the update is defined under precisely the same condition. If defined, the assertive update would be calculated as

$$s[\texttt{never\_smoked}(j)] \cup s[\texttt{not\_smoke\_now}(j)].$$

A pair $\langle w, f \rangle$ subsists in the state resulting from the update just in case John has never smoked in w, or he does not smoke now in w. In fact, the asserting update in Japanese is equivalent to the one in English in this case, due to the classical equivalence $\phi \vee (\neg\phi \wedge \psi) \equiv \phi \vee \psi$.

However, the lack of the $\neg[\![S]\!]_\alpha$ clause has significant consequences for other cases. Consider, for instance, the case of domain restriction in (12) and (13). The assertive updates of these sentences are represented as (21a) and (21b), respectively:

(21) a. $s[\texttt{basement}(j)] \cup s[\neg\texttt{basement}(j)][\Box\texttt{kitchen}(j)]$ (English)

b. $s[\texttt{basement}(j)] \cup s[\Box\texttt{kitchen}(j)]$ (Japanese)

In English, the necessity modal is interpreted against the state $s' = s[\neg\texttt{basement}(j)]$. Therefore, $s'[\Box\texttt{kitchen}(j)] \neq \emptyset$ just in case for every $\langle w, f \rangle \in s$ such that John is *not* in the basement, he is in the kitchen. Intuitively, this is what the use of the necessity modal in the second disjunct in English suggests. In contrast, the necessity modal in Japanese is evaluated against s itself. Suppose that $s[\Box\texttt{kitchen}(j)] \neq \emptyset$. Then $s[\texttt{basement}(j)] = \emptyset$, given that one person cannot be in different places simultaneously. But then the speaker is sure that John is in the kitchen, which voids any motivation to assert the disjunction – the first disjunct does not contribute to the meaning at all. Conversely, suppose that $s[\Box\texttt{kitchen}(j)] = \emptyset$. Then (21b) = $s[\texttt{basement}(j)] \cup \emptyset$, which is equivalent to $s[\texttt{basement}(j)]$, again voiding any motivation to assert the disjunction. This time, the second disjunct does not contribute to the meaning. Either way, the use of the necessity modal in Japanese violates *genuineness* (Zimmermann 2000), which requires that both disjuncts be a 'live possibility.' In the current technical setting, genuineness is satisfied in (21) if and only if neither side of the union comes out to be an empty set. This is possible in English (21a), but not in Japanese (21b). Hence, the assertion of the Japanese sentence in (13) is pragmatically odd.

The oddness due to genuineness does not necessarily arise in the case with a

probability modal in (14). Nevertheless, sentence (14) does *not* mean the same as the English counterpart in (22).

(22) John is in the basement or it is likely that he is in the kitchen.

The difference between the expressions in the two languages can be seen in their inference patterns. Klinedinst & Rothschild (2012) (attributed to Seth Yalcin) as well as Cariani (2016) point out that the following inference is invalid:

(23) a. (22)
b. It is not the case that it is likely that he is in the kitchen.
c. Therefore, John is in the basement.

I suppose this is because *it is likely* in (22) and the one in (23b) have different domains of quantification. Due to the local context in the assertive dimension in English disjunction, the modal in the second disjunct is evaluated only under the supposition that the first disjunct is false. On the other hand, the modal in (23b) is evaluated against the global context. This in turn means that (23b) is *not* negating the same proposition in the second disjunct of (22). Hence, the inference is invalid.

If Japanese lacks the local context in the assertive dimension, the modal in the second disjunct should be evaluated against the global context, and the corresponding inference should be valid. This prediction is borne out. The inference in (24) is valid, which adds further support for the lack of the local context in the assertive dimension in Japanese.

(24) a. (13)
b. *Taroo-ga kicchin-ni iru kanousei-ga taka-kunai.*
Taro-NOM kitchen-DAT present possibility high-NEG
'It is not the case that it is likely that Taro is in the kitchen.'
c. *Dakara, Taroo-wa chika-ni iru.*
Therefore, Taro-TOP basement-DAT present
'Therefore, Taro is in the basement.'

Lastly, polarity reversed-sluicing in (8) is licensed in English because, as Kroll (2019) argues, the elided clause is entailed by its local context, namely by the negation of the first disjunct. I conjecture that the ellipsis must be licensed in the assertive dimension. Since the local context is absent in Japanese i.e., the second disjunct is only evaluated against the global context, the sluicing is not possible there.

4.3 Bathroom anaphora

The bathroom sentence in (5) can be translated into (25), with the local context being added explicitly.

(25) $\neg\exists x\texttt{bathroom}(x) \vee (\neg\neg\exists x\texttt{bathroom}(x) \wedge \texttt{weird\_place}(x))$

The variable in `weird_place` is resolved by virtue of dynamics of the current technical setup *if* Double Negation Elimination is validated, which does not hold by the definitions laid out above. A few proposals to validate it have been made (e.g., Krahmer & Muskens 1995; Gotham 2019). Here I adopt the line of analysis in Krahmer & Muskens (1995) and Aloni (2023), incorporating *bilateralism*.

In bilateral update semantics (Aloni 2023), formulae are associated with *positive upates* and *negative updates*. The positive update of each formula can be kept as in Definition 4 except that the clause for negation is redefined as

- $s[\neg\phi] = s[\phi]^-$,

where $s[\phi]^-$ is the negative update of s by ϕ. Negative updates by n-place predicates, conjunction, negation, and disjunction are defined as follows (Aloni 2023).

Definition 4. Updates

- $s[Rx_1,...,x_n]^- = \{i \in s \mid \langle f_i(x_1),...,f_i(x_n)\rangle \notin I(w_1)(R)\}$
- $s[\phi \wedge \psi]^- = s[\phi]^- \cup s[\psi]^-$
- $s[\neg\phi]^- = s[\phi]$
- $s[\phi \vee \psi]^- = s[\phi]^- \cap s[\psi]^-$
- $s[\exists x\phi]^- = \{i \in s \mid i \text{ does not subsist in } s[\exists x\phi]\}$

Of importance for the current disjunction are the positive and negative updates by negation. Obviously, DNE is validated: $s[\neg\neg\phi] = s[\neg\phi]^- = s[\phi]$. Therefore, the update by (25) is reduced to

$$s[\exists x\texttt{bathroom}(x)]^- \cup s[\exists x\texttt{bathroom}(x)][\texttt{weird\_place}(x)].$$

The familiar dynamics in the right side of the union resolves the variable x in $\texttt{weird\_place}(x)$ to be a bathroom.

It is now obvious why the Japanese counterpart of the bathroom sentence in (7) is infelicitous. Since the *ka*-disjunction lacks the local context for the second disjunct, we obtain

$$s[\exists x \texttt{bathroom}(x)]^{-} \cup s[\texttt{weird\_place}(x)].$$

The variable in the right side of the union is not resolved to be a bathroom – either the predication is undefined (if x is not 'in use' in the previous discourse), or x is interpreted as whatever the previous discourse assigned to x. In any case, the reading we are after is not obtained.

5 A note on covert pronouns

The absence of motivation for the local context is not discredited by Kurafuji's other observation that a reading analogous to bathroom anaphora is obtained with a null argument, represented as *e* in (26).

(26) [$_{\phi}$ *Kono tatemono-ni-wa toire-ga nai*] ***ka,***
This building-DAT-TOP bathroom-NOM NEG or,

[$_{\psi}$ *e hen-na tokoro-ni aru*] *ka da.*
funny place-DAT exists or TOP

'(It's either) there is no bathroom, or the bathroom is in a funny place.'

However, (26) is not necessarily an instance of bathroom anaphora. Although Kurafuji assumes that the null argument in (27) is a null *pronoun*, it can also be derived via *argument ellipsis* (Oku 1999; Kim 1999, a.m.o.) Then (26) might as well be interpreted as (27), where a null argument is a result of the ellipsis of an *indefinite*, anteceded by another indefinite in the first disjunct.

(27) Either there is not a bathroom, or ~~a bathroom~~ is in a weird place.

In fact, it is evident from (28) that an indefinite licenses argument ellipsis across negation (28a) and disjunction (28b).[15] The null argument *e* there is interpreted as *a book*, and it cannot be interpreted as anaphora because negation and disjunction insulate the anaphoric relation between an indefinite and a definite description, as observed in (28).

[15]When and how exactly argument ellipsis is licensed is a complicated matter. E.g., see Sakamoto (2019) and Fujiwara (2022).

(28) a. *Taroo-wa hon-o kawa-nak-atta. Hanako-wa e kat-ta.*
Taro-TOP book-ACC buy-NEG-PAST Hanako-TOP buy-PAST
'Taro didn't buy a book. Hanako bought one.'

b. [$_\phi$ *Taroo-ga hon-o kau*] *ka,* [$_\psi$ *Hanako-ga e kau*] *ka*
Taro-TOP book-ACC buy or Hanako-NOM buy or
(dochiraka da).
either COP
'(It is either) Taro buys a book or Hanako buys *e*.'

(29) further shows that the null argument in the alleged bathroom configuration can be interpreted as indefinite. The second disjunct ψ is interpreted as '*he recently raises* ***a pet*** *carefully*.' If the null argument were a pronoun anaphoric to the indefinite in the first disjunct, the interpretation of the second disjunct would be that Taro carefully raises the pet he has let die, which is not available or sensible. Thus, the null argument must be interpreted as an elided indefinite.

(29) (Checking his history with pets, there is no trait that shows Taro let his pet die recently. The speaker concludes:)
[$_\phi$ *Taro-wa petto-o korosita koto-ga ichidomo nai*] *ka,*
Taro-TOP pet-ACC killed experience-NOM once NEG or
[$_\psi$ *saikin-wa e taisetsu-ni sodateteiru*] *(ka da)*
recently-TOP carefully raise or COP
'Either Taro never let a pet die, or he recently raises one carefully.'

The discussion reveals that the observation in (7) is real: unlike English, no evidence shows that Japanese felicitously forms bathroom anaphora.

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