Dynamics and alternatives of unconditionals[1]

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Abstract. The *indistinguishable participants* configuration, typically observed within conditional sentences, has motivated dynamic analyses of anaphora resolution. This study points out that the configuration is attested in *unconditionals* as well. We analyze these instances of indistinguishable participants by augmenting dynamic semantics to Rawlins' (2013) proposal for unconditionals, which utilizes Hamblinian alternative semantics. The result is a combination of dynamic semantics and update semantics. The success of the analysis provides further support for the combinatory system, which is independently motivated by Li (2021).

Keywords: alternative semantics, update semantics, unconditionals, Japanese.

1. Introduction and summary

Anaphora resolution in the so-called *bishop sentence* or *indistinguishable participants*, exemplified in (1), has been taken as a motivation to prefer dynamic analyses (Heim 1982; Kamp 1981; Groenendijk and Stokhof 1991; a.m.o.) over their major competitor, the *d*/*E*-type analysis (Cooper 1979; Heim 1990; Elbourne 2001, 2005; a.m.o.).

(1) If a bishop meets another bishop, he greets him.

The latter analysis claims, with some auxiliary assumptions with which we are not concerned with here,[2] that the pronouns *he*/*him* denotes *a unique bishop* in a (minimal) situation where the antecedent proposition is true. The analysis fails for no such uniqueness is established.[3] At least two bishops exist in the antecedent situation. The former, dynamic analysis, takes the pronoun as anaphoric to a *discourse referent* introduced by the indefinites in the antecedent. Since the two indefinites introduce distinct discourse referents, the pronouns can pick up one of them without any further assumptions.

This study concerns a variant of the indistinguishable participants, an instance observed within *unconditionals*. The Japanese sentence in (2) exemplifies it. Throughout this paper, anaphoric relation is explicated with superscript indices (for antecedents) and subscript indices (for anaphoric elements).

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[2]For example, Elbourne 2001 claims that *he* is decomposed into *he bishop* at an LF-syntax level, where *he* has the same denotation as *the* (requiring uniqueness) and the description *bishop* is deleted via NP-deletion.

[3]See, however, Elbourne (2016) for an attempt to overcome the problem outlined here. Evaluation of the attempt is beyond the scope of this paper.

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(2) ***Dare***^{x}*-ga hokano* ***dare***^{y}*-ni atte-mo,* ***soitu***$_{x}$*-wa* ***soitu***$_{y}$*-ni aisatu-suru.*
who-NOM other who-DAT meet-MO, s/he-TOP s/he-DAT greet-do.
Lit. 'whoever meets anyone else, s/he greets him/her.'

Rawlins (2013) proposes to analyze unconditionals with Hamblinian alternative semantics. The indistinguishable participants motivate to *dynamicize* the alternative-semantic analysis. The aim of this paper is to implement such dynamicization.

We propose that each propositional Hamblinian alternative is a *Context Change Potential* (CCP) (Heim 1982). The antecedent of an unconditional forms a set of CCPs. Each member of the set restricts the quantificational domain of the modal in the consequent (Kratzer 1986) via Pointwise Functional Application (PFA). The composition results in a set of conditionals. This set is universally quantified by a designated quantificational particle, realized as *mo* in Japanese. It requires every conditional in the set to be true, resulting in the meaning of unconditional. The resulting system is a version of alternative dynamic semantics independently motivated by Li (2021).

The rest of this paper is organized as follows. Section 2 sets up necessary backgrounds. Section 2.1 describes the static analysis of English unconditionals proposed by Rawlins (2013) and demonstrates that the analysis is applicable to the unconditionals in Japanese. Section 2.2 lays out an analysis of conditionals in update semantics, built on Groenendijk et al. (1996). Section 3 is the core of the paper. It illustrates how anaphora in (2) is resolved. Predictions, consequences, and remaining issues of the proposal are discussed in Section 4.

2. Background

2.1. Unconditionals in static semantics (Rawlins 2013)

In *alternative semantics* (Hamblin 1973 *et seq*), natural language expressions are translated into a *set* of the canonical denotation(s). A sentence *John is tall* is translated into a singleton set of a proposition (3a); a verb phrase *is tall* is into a singleton set of a predicate (3b); a noun phrase *John* is into a singleton set of an individual (3c). (3a) is obtained by composing (3b) and (3c) via PFA, defined as (4).[4]

(3) a. $[\![\textit{John is tall}]\!] = \{\lambda w.T(\mathtt{j})(w)\}$
b. $[\![tall]\!] = \{\lambda x.\lambda w.T(x)(w)\}$
c. $[\![John]\!] = \{\mathtt{j}\}$

(4) *Point Wise Functional Application (PFA)*
if α and β are daughters of γ and $[\![\alpha]\!] \subseteq D_{AB}$ and $[\![\beta]\!] \subseteq D_A$ for some type A and B, then $[\![\gamma]\!] = \text{PFA}([\![\alpha]\!],[\![\beta]\!]) = \{Y \in D_B \mid \exists f \in [\![\alpha]\!] : \exists X \in [\![\beta]\!] : f(X) = Y\}$

Some expressions denote a non-singleton set. Wh-expressions are primary examples. *Who*, for example, denotes a set of (relevant) individuals. PFA lets *who is tall* be the set of propositions in (5b).

[4]Below, when no confusion arises, we omit the brackets in $T(\mathtt{j})(w)$ and simply notate as $T\mathtt{j}w$.

(5) a. $[\![who]\!] = \{\mathtt{a}, \mathtt{b}, \mathtt{c}, ...\}$

b. $[\![\textit{who is tall(?)}]\!] = \{\lambda w.T\mathtt{a}w, \lambda w.T\mathtt{b}w, \lambda w.T\mathtt{c}w, ...\}$

Rawlins (2013) proposes to analyze unconditional with Hamblinian alternative semantics. There, an antecedent of unconditional denotes a set of propositions. Each member of the set restricts the quantificational domain of the modal in the consequent (Kratzer 1986). The result is a set of conditionals. This set is universally quantified, resulting in the intended meaning of unconditional.

Consider (6) for illustration. The antecedent α in (6a) denotes a set of alternative propositions. The set is non-singleton due to *whatever*: just like *who*, *whoever* also denotes a set of relevant individuals. The consequent β in (6b) denotes a singleton set whose sole member is the canonical denotation for conditional consequents. The function$f$ is a *modal base* that takes a world and returns a set of propositions. The contents of the returned set vary depending on the flavor of the modality. Here we suppose *must* is epistemic, and $f(w)$ returns a set of propositions that the speaker believes. The intersection of the set, $\bigcap(f(w))$, returns the set of worlds where every proposition believed by the speaker is true. This set is further intersected by p, which is saturated by the antecedent of the conditional. The quantification requires in every world w' where all the propositions that the speaker believes and p are true, the consequent is also true. α and β are composed by PFA as (6c), resulting in a set of conditionals. Informally, the set is equivalent to (6d). The set is universally quantified by a Hamblinian universal operator, defined as (7). The quantification results in an unconditional statement: for every individual x, if x tries to convince him, John argues harshly.

(6) [$_\alpha$ Whoever tries to convince him], [$_\beta$ John must argue harshly].

a. $$[\![\alpha]\!] = \left\{\begin{array}{l} \lambda w.\ \mathtt{Alex\_tries\_to\_convince\_him}(w) \\ \lambda w.\ \mathtt{Beth\_tries\_to\_convince\_him}(w) \\ \lambda w.\ \mathtt{Chris\_tries\_to\_convince\_him}(w) \\ \vdots \end{array}\right\}$$

b. $$[\![\beta]\!] = \{\lambda p.\lambda w.\forall w' \in \bigcap(f(w)) \cap p\ [\mathtt{John\_argues\_harshly}(w')]\}$$

c. $$\text{PFA}([\![\alpha]\!], [\![\beta]\!]) =$$
$$\left\{\begin{array}{l} \lambda w.\ \forall w' \in \bigcap(f(w)) \cap [\lambda w''\mathtt{Alex\_tries\_to\_convince\_him}(w'')] \\ \qquad\qquad [\mathtt{John\_argues\_harshly}(w')] \\ \lambda w.\ \forall w' \in \bigcap(f(w)) \cap [\lambda w''\mathtt{Beth\_tries\_to\_convince\_him}(w'')] \\ \qquad\qquad [\mathtt{John\_argues\_harshly}(w')] \\ \lambda w.\ \forall w' \in \bigcap(f(w)) \cap [\lambda w''\mathtt{Chrsi\_tries\_to\_convince\_him}(w'')] \\ \qquad\qquad [\mathtt{John\_argues\_harshly}(w')] \\ \vdots \end{array}\right\}$$

d. $\mathrm{PFA}(\llbracket\alpha\rrbracket, \llbracket\beta\rrbracket) =$

$$\left\{\begin{array}{l}\textit{If Alex tries to convince him, John argues harshly}\\ \textit{If Beth tries to convince him, John argues harshly}\\ \textit{If Chris tries to convince him, John argues harshly}\\ \vdots\end{array}\right\}$$

e. $\llbracket\forall\rrbracket(\llbracket(6a)\rrbracket) = \{\lambda w.\forall p \in \llbracket(6a)\rrbracket\ [p(w) = 1]\}$

(7) Hamblinian Universal Operator (Kratzer and Shimoyama 2002)
Where $\llbracket\alpha\rrbracket$ is a set of propositions,
$\llbracket\forall\alpha\rrbracket = \{\lambda w.\forall p \in \llbracket\alpha\rrbracket\ [p(w) = 1]\}$

Unconditionals in Japanese are constructed in the same way. Consider (8). The antecedent α contains a wh-indeterminate *dare* '*who*', which denotes a set of individuals (Shimoyama 2006). The particle ***mo*** is a morphological realization of the Hamblinian universal operator. The composition proceeds in the same way as in English. α denotes a set of propositions, each member of which is taken as an argument by the consequent via PFA. The result is a set of conditionals. *Mo* universally quantifies the set, resulting in an unconditional.

(8) [$_\alpha$ ***Dare***-*ga* *paati-ni* *kite*] -***mo*** [$_\beta$ *John-wa* *yorokobu*] .
who-NOM party-DAT come -∀ John-TOP happy
'Whoever comes to the party, John will be happy.'

2.2. Conditionals in update semantics

Resolving the indistinguishable participants in (2) calls for dynamicizing the analysis by Rawlins (2013). To pave the way for such dynamicization, this subsection describes the analysis of conditionals in update semantics (Groenendijk et al. 1996).

The primitive notions in update semantics are *possibilities* and *states*.

- A *possibility* i is a pair (g, w), g an assignment function, w a possible world.
- A *state* s is a set of possibilities.

Possible worlds are functions that assign each expression its extension in the worlds. Assignment functions g are partial functions from variables to individuals. The denotation of α in i, $i(\alpha)$, is defined as

- $i(\alpha) = w(\alpha)$ if α is a constant.[5]
  - $w(\alpha) \in D$ if α is an individual constant.
  - $w(\alpha) \in D^n$ is α is an n-place predicate.

[5] w in update semantics is information of, or a model of, the corresponding possible world. The worlds in the information state only project and describe the corresponding possible worlds and do not denote the possible worlds themselves. However, the possible worlds in static alternative semantics denote the worlds themselves just as a constant denotes an individual. That is, the ontological levels of these two "possible worlds" are different: The possible worlds in alternative semantics are entities in the object language, while w in update semantics is a symbol in the meta language. As far as no confusion arises, we use the same symbol for both (cf. Section 4.2).

- $i(\alpha) = g(\alpha)$ if α is a variable and is in the domain of g. Otherwise, $g(\alpha)$ is undefined.

Sentences are interpreted as *Context Change Potentials* (CCPs; Heim 1982). For any sentence S, we notate $[\![S]\!]$ for the canonical proposition denoted by S, and $[S]$ for the CCP specified by S. When no indefinites are involved, a CCP takes a state s and returns the maximal subset $s' \subseteq s$ such that $[\![S]\!]^i$ is true for every $i \in s'$. Below, we notate $s[\phi]$ for update of s by CCP $[\phi]$. $s[\phi][\psi]$ a shorthand form of $(s[\phi])[\psi]$.

Consider s_0 in (9) for some predicate P, for example. Each cell in the table represents a possibility. In the top left i_1, g_1 assigns a to x and only a is P in w_1. x is not in the domain of g_4, and the undefinedness of $g_4(x)$ is represented as $\uparrow$. Updating s_0 by CCP $[Px]$, $s_0[Px]$, results in s_1, where the grayed cell indicates that the possibility is excluded: $s_1 = \{i_1\}$. $i_2 - i_4$ are excluded because $[\![P(x)]\!]$ is not true w.r.t. these possibilities. Formally, $[Px]$ is translated as (10).[6]

(9)

s_0			s_1	
$i_1 = (g_1, w_1)$ $g_1(x) = \mathsf{a}$ $w_1(P) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \mathsf{a}$ $w_2(P) = \{\mathsf{b}\}$	$s_0[P(x)]$ $\Longrightarrow$	$i_1 = (g_1, w_1)$ $g_1(x) = \mathsf{a}$ $w_1(P) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \mathsf{a}$ $w_2(P) = \{\mathsf{b}\}$
$i_3 = (g_3, w_3)$ $g_3(x) = b$ $w_3(P) = \{\mathsf{a}\}$	$i_4 = (g_4, w_4)$ $g_4(x) = \uparrow$ $w_4(P) = \{\mathsf{b}\}$		$i_3 = (g_3, w_3)$ $g_3(x) = \mathsf{b}$ $w_3(P) = \{\mathsf{a}\}$	$i_4 = (g_4, w_4)$ $g_4(x) \uparrow$ $w_4(P) = \{\mathsf{b}\}$

(10) $[Px] \rightsquigarrow \lambda s_s.\{i \mid i \in s \;\&\; [\![Px]\!]^i = 1\}$

Updates are not always eliminative. For any variable x and individual d, $[x/\mathsf{d}]$ is a CCP that updates the domain and the range of an assignment function. Consider s_0 again in (11). Updating s_0 by $[x/\mathsf{d}]$ returns s_2. For all $(g, w) \in s_2$, $g(x)$ is defined and returns d.

- $(g, w)[x/\mathsf{d}] := (g', w')$ such that $w = w'$ and g' agrees with g except that $\mathtt{Domain}(g') = \mathtt{Domain}(g) \cup \{x\}$ and $g'(x) = \mathsf{d}$
- $[x/\mathsf{d}] := \lambda s_s.\{(g, w)[x/\mathsf{d}] \mid (g, w) \in s\}$

(11)

s_0			s_2	
$i_1 = (g_1, w_1)$ $g_1(x) = \mathsf{a}$ $w_1(P) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \mathsf{a}$ $w_2(P) = \{\mathsf{b}\}$	$[x/\mathsf{d}]$ $\Longrightarrow$	$i_1 = (g_1, w_1)$ $g'_1(x) = \mathsf{d}$ $w_1(P) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g'_2(x) = \mathsf{d}$ $w_2(P) = \{\mathsf{b}\}$
$i_3 = (g_3, w_3)$ $g_3(x) = b$ $w_3(P) = \{\mathsf{a}\}$	$i_4 = (g_4, w_4)$ $g_4(x) = \uparrow$ $w_4(P) = \{\mathsf{b}\}$		$i_3 = (g_3, w_3)$ $g'_3(x) = \mathsf{d}$ $w_3(P) = \{\mathsf{a}\}$	$i_4 = (g_4, w_4)$ $g'_4(x) = \mathsf{d}$ $w_4(P) = \{\mathsf{b}\}$

[6] We use s, s',... for variables over states, and use s for the type of states. Since $[Px]$ is a function from states to states, the update should more accurately be notated as $[Px](s)$. Following Groenendijk et al. (1996), however, we keep using the infix notation.

Indefinites in natural language are translated into existential quantification, defined as follows in update semantics.[7] $[\exists x\phi]$ induces random (re)assignment for the variable x.

- $[\exists x\phi] := \lambda s_s.\bigcup_{\mathtt{d}\in D}(s[x/\mathtt{d}][\phi])$

Consider s_3 in (12) updated by $[\exists xPx]$. s_3 is a singleton set that only contains $i_1 = (g_1, w_1)$. Suppose $D = \{\mathtt{a},\mathtt{b},\mathtt{c}\}$, and $w_1(P) = \{\mathtt{a},\mathtt{c}\}$. s_3 is updated as $s_3[x/\mathtt{d}][Px]$ for all $\mathtt{d} \in D$, as illustrated in (12). The resultant state is the union of s_5, s_7, and s_9, i.e., $\{i'_1, i'''_1\}$.

(12)

s_3: $i_1 = (g_1, w_1)$, $g_1(x) = \mathtt{b}$, $w_1(P) = \{\mathtt{a},\mathtt{c}\}$	$\xrightarrow{s_3[x/\mathtt{a}]}$	s_4: $i'_1 = (g_1, w_1)$, $g'_1(x) = \mathtt{a}$, $w_1(P) = \{\mathtt{a},\mathtt{c}\}$	$\xrightarrow{s_4[Px]}$	s_5: $i'_1 = (g_1, w_1)$, $g'_1(x) = \mathtt{a}$, $w_1(P) = \{\mathtt{a},\mathtt{c}\}$
s_3: $i_1 = (g_1, w_1)$, $g_1(x) = \mathtt{b}$, $w_1(P) = \{\mathtt{a},\mathtt{c}\}$	$\xrightarrow{s_3[x/\mathtt{b}]}$	s_6: $i''_1 = (g_1, w_1)$, $g''_1(x) = \mathtt{b}$, $w_1(P) = \{\mathtt{a},\mathtt{c}\}$	$\xrightarrow{s_6[Px]}$	s_7: $\emptyset$
s_3: $i_1 = (g_1, w_1)$, $g_1(x) = \mathtt{b}$, $w_1(P) = \{\mathtt{a},\mathtt{c}\}$	$\xrightarrow{s_3[x/\mathtt{c}]}$	s_8: $i'''_1 = (g_1, w_1)$, $g'''_1(x) = \mathtt{c}$, $w_1(P) = \{\mathtt{a},\mathtt{c}\}$	$\xrightarrow{s_8[Px]}$	s_9: $i'''_1 = (g_1, w_1)$, $g'''_1(x) = \mathtt{c}$, $w_1(P) = \{\mathtt{a},\mathtt{c}\}$

It is helpful to have the notions *descendants* and *subsistence* defined as follows.

- i *subsists* in s iff i has one or more descendant(s) in s.
- (g', w') is a *descendant* of (g, w) iff $w = w'$ and $\mathtt{Domain}(g) \subseteq \mathtt{Domain}(g')$.

In (12), for example, i_1 has a descendant in s_5, namely i'_1, for $w_1 = w_1$ and $\mathtt{Domain}(g_1) \subseteq \mathtt{Domain}(g')$. Accordingly, i_1 *subsists* in $s_3[x/\mathtt{a}][Px](= s_5)$. On the other hand, i_1 does not subsist in s_7 because there is no descendant of i_1 in there (for s_7 being empty). Therefore, i_1 does not subsist in $s_3[x/\mathtt{b}][Px]$. In other words, i subsists in $\{i\}[\phi]$ if ϕ can be classically true at i. We say $[\![x/\mathtt{d}\ \phi]\!]^i$ is classically true at i if and only if $[\![\phi]\!]^{i_{x/\mathtt{d}}}$ is classically true, where $i_{x/d}$ agrees with i except that $\mathtt{Domain}(i_{x/\mathtt{d}}) = \mathtt{Domain}(i) \cup \{x\}$ and $i(x) = \mathtt{d}$. Then i_1 does not subsist in $\{i_1\}[x/\mathtt{b}][Px]$ in (12) because $[\![P\mathtt{b}]\!]^i$ is not classically true.

Now, conditionals are defined as follows in Groenendijk et al. (1996).

- $s[\phi \rightarrow \psi] =$
  $\{i \in s : \text{if } i \text{ subsists in } s[\phi], \text{ then all descendants of } i \text{ in } s[\phi] \text{ subsist in } s[\phi][\psi]\}$

Under this definition, i subsists in $\{i\}[\phi \rightarrow \psi]$ if and only if (a) $[\![\phi]\!]^i$ is classically true and $[\![\phi \wedge \psi]\!]^i$ is classically true (where $s[\phi \wedge \psi] \equiv s[\phi][\psi]$), or (b) $[\![\phi]\!]^i$ is classically false. The definition replicates the semantics of material implication.

For illustration, consider (13a), which we suppose is translated as $\exists xHx \rightarrow Fx$, H for being a horse, and F for being well-fed. Suppose that the domain of individual contains $\{\mathtt{a},\mathtt{b},\mathtt{c}\}$.

[7] D is the domain of individuals.

Consider s_{10} in (13b). When s_{10} is updated by $[\exists x Hx \to Fx]$, first each $i \in s_{10}$ is checked if i subsists in $s_{10}[\exists x Hx]$. It is illustrated in the first updates in (13c-e). i_1 and i_3 but not i_2 subsist in $s_{10}[\exists x Hx]$. At this point, i_2 is guaranteed to subsist in $s[\exists x Hx \to Fx]$ (for $[\![\exists x Hx]\!]^{i_2}$ is classically false). In (13c, e), i_1 and i_3 are further checked if all of their descendants in $s_{10}[\exists x Hx]$ subsist in $s_{10}[\exists x Hx][Fx]$. Not all descendants of i_1 do, because i''_1 does not have any descendant in $s_{10}[\exists x Hx][Fx]$ (for $i'_1(x) \neq i''_1(x)$ and $i''_1(x) \notin w_1(F)$). On the other hand, i'_3, which is the only descendant of i_3 in $s_{10}[\exists x Hx]$, does subsist in $s_{10}[\exists x Hx][Fx]$. Therefore, $s_{10}[\exists x Hx \to Fx] = \{i_2, i_3\}$. Notice that $[\![\exists x Hx \wedge Fx]\!]^{i_3}$ is classically true.

(13) a. If there is [a horse]^x, [the horse]$_x$ is well-fed $\rightsquigarrow \exists x Hx \to Fx$

b. s_{10}

$i_1 = (g_1, w_1)$ $g_1(x) = \uparrow$ $w_1(H) = \{\mathsf{a}, \mathsf{b}\}$ $w_1(F) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \uparrow$ $w_2(H) = \emptyset$ $w_2(F) = \emptyset$
$i_3 = (g_3, w_3)$ $g_3(x) = \uparrow$ $w_3(H) = \{\mathsf{c}\}$ $w_3(F) = \{\mathsf{c}\}$	

c.
$$\boxed{\begin{array}{c} i_1 = (g_1, w_1) \\ g_1(x) = \uparrow \\ w_1(H) = \{\mathsf{a},\mathsf{b}\} \\ w_1(F) = \{\mathsf{a}\} \end{array}} \xrightarrow{[\exists x Dx]} \boxed{\begin{array}{c} i'_1 = (g'_1, w_1) \\ g'_1(x) = \mathsf{a} \\ w_1(H) = \{\mathsf{a},\mathsf{b}\} \\ w_1(F) = \{\mathsf{a}\} \\ \hline i''_1 = (g''_1, w_1) \\ g''_1(x) = \mathsf{b} \\ w_1(H) = \{\mathsf{a},\mathsf{b}\} \\ w_1(F) = \{\mathsf{a}\} \end{array}} \xrightarrow{[Fx]} \boxed{\begin{array}{c} i'_1 = (g'_1, w_1) \\ g'_1(x) = \mathsf{a} \\ w_1(H) = \{\mathsf{a},\mathsf{b}\} \\ w_1(F) = \{\mathsf{a}\} \end{array}}$$

d.
$$\boxed{\begin{array}{c} i_2 = (g_2, w_2) \\ g_2(x) = \uparrow \\ w_2(H) = \emptyset \\ w_2(F) = \emptyset \end{array}} \xrightarrow{[\exists x Dx]} \emptyset$$

e.
$$\boxed{\begin{array}{c} i_3 = (g_3, w_3) \\ g_3(x) = \uparrow \\ w_3(H) = \{\mathsf{c}\} \\ w_3(F) = \{\mathsf{c}\} \end{array}} \xrightarrow{[\exists x Dx]} \boxed{\begin{array}{c} i'_3 = (g'_3, w_3) \\ g'_3(x) = \mathsf{c} \\ w_3(H) = \{\mathsf{c}\} \\ w_3(F) = \{\mathsf{c}\} \end{array}} \xrightarrow{[Fx]} \boxed{\begin{array}{c} i'_3 = (g'_3, w_3) \\ g'_3(x) = \mathsf{c} \\ w_3(H) = \{\mathsf{c}\} \\ w_3(F) = \{\mathsf{c}\} \end{array}}$$

Below, we partially adopt the restrictor analysis of conditionals (Kratzer 1986) for compositionality, ignoring a modal base and an ordering source (see Section 4.2 for an extension of the proposal with a modal base, though). We suppose that the consequent of (un)conditionals always contain an overt or cover modality, represented as $\Box$. $\Box$ is the source of conditionality. $\Box\psi$ waits for an antecedent to come to form a conditional. $[\Box\psi]$ is defined as (14).

(14) $$[\Box\psi] \rightsquigarrow \lambda p_{ss}.\lambda s_s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } p(s)\text{, then all descendants}\\ \text{of } i \text{ in } p(s) \text{ subsist in } (p(s))[\psi]\end{array}\right\}$$

3. Unconditinoals in alternative update semantics

We adopt the analysis of unconditionals by Rawlins (2013), but propose to extend it so that *each alternative is a CCP*. The idea is illustrated as follows. Consider (15). The wh-indeterminate ***dare*** creates alternatives (suppose again the domain contains a, b, and c), percolating up to the entire conditional antecedent via PFA. The antecedent denotes a *set* of CCPs. The consequent is also a (singleton) set of CCPs. The antecedent and the consequent are composed to form a set of conditionals (15b) (where C is for *comes to the party* and E is for *enjoy*). The particle ***mo*** universally quantifies over the set, resulting in the meaning of unconditionals. Since each alternative is a CCP, the anaphora in the consequent is resolved.

(15) $[_\alpha$ ***Dare***^{x}*-ga* *paati-ni* *kite*] ***-mo*** $[_\beta$ ***soitu***$_x$*-wa* *tanosimu*] .
who-NOM party-DAT come -∀ the.person-TOP enjoy
'Whoever comes to the party, s/he will enjoy.'

a.
$$\left\{\lambda p_{ss}.\lambda s_s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } p(s)\text{, then all descendants}\\ \text{of } i \text{ in } p(s) \text{ subsist in } (p(s))[Ex]\end{array}\right\}\right\}\left(\left\{\begin{array}{l}\lambda s.s[x/\mathtt{a}][Cx],\\ \lambda s.s[x/\mathtt{b}][Cx],\\ \lambda s.s[x/\mathtt{c}][Cx]\end{array}\right\}\right)$$

b.
$$\left\{\begin{array}{l}\lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } s[x/\mathtt{a}][Cx]\text{, then all descendants}\\ \text{of } i \text{ in } s[x/\mathtt{a}][Cx] \text{ subsist in } s[x/\mathtt{a}][Cx][Ex]\end{array}\right\},\\[2ex] \lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } s[x/\mathtt{b}][Cx]\text{, then all descendants}\\ \text{of } i \text{ in } s[x/\mathtt{b}][Cx] \text{ subsist in } s[x/\mathtt{b}][Cx][Ex]\end{array}\right\},\\[2ex] \lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } s[x/\mathtt{c}][Cx]\text{, then all descendants}\\ \text{of } i \text{ in } s[x/\mathtt{c}][Cx] \text{ subsist in } s[x/\mathtt{c}][Cx][Ex]\end{array}\right\}\end{array}\right\}$$

The rest of this section is devoted to formalizing the idea. Alternative semantics laid out in Section 2 is modified to conform to update semantics. The antecedent α of (15) is composed with the translations in (16).

(16) a. *dare*^{x}*(-NOM)* $\rightsquigarrow \{\lambda P_{e,ss}.\lambda s.\, P(x)(s[x/\mathtt{d}]) : \mathtt{d} \in D\}$
b. *comes to the party* $\rightsquigarrow \{\lambda x_e.\lambda s.\, s[Cx]\}$
c. *dare*^{x}*-NOM comes to the party* $\rightsquigarrow \{\lambda s.s[x/\mathtt{d}][C(x)] : \mathtt{d} \in D\}$

The consequent β, which we suppose contains a covert modal $\Box$, is translated as:

(17) a. *soitu*$_x$ $\rightsquigarrow \{\lambda P_{e,ss}.\lambda s.\, P(x)(s)\}$
b. *enjoy* $\rightsquigarrow \{\lambda x_e.\lambda s.\, s[Ex]\}$

c. $\square \rightsquigarrow \left\{\lambda q.\lambda p.\lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } p(s)\text{, then all descendants}\\ \text{of } i \text{ in } p(s) \text{ subsist in } q(p(s))\end{array}\right\}\right\}$

d. $\square$ *soitu*$_x$-NOM *enjoy* $\rightsquigarrow \left\{\lambda p.\lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } p(s)\text{, then all descendants}\\ \text{of } i \text{ in } p(s) \text{ subsist in } (p(s))[Ex]\end{array}\right\}\right\}$

Morpho-syntactically, the particle *mo* is attached to the antecedent. We define the particle so that it is first composed with the antecedent and then the consequent. Following Shimoyama (2006), the definition is type-general so that it appears outside unconditionals as well (see Section 4.4).

(18) *mo* $\rightsquigarrow \{\lambda\alpha.\lambda\beta.\lambda s_s.\{i \in s : \forall a \in \alpha\,[\,i \text{ subsists in } \beta(a)(s)\,]\}\}$

Combining the antecedent and *mo* results in:

(19) *dare*^{x}*-NOM comes to the party mo* $\rightsquigarrow$
$$\{\lambda\beta.\lambda s_s.\{i \in s : \forall a \in \{\lambda s.s[x/\mathsf{d}][C(x)] : \mathsf{d} \in D\}\ [\,i \text{ subsists in } \beta(a)(s)\,]\}\}$$

Suppose again $D = \{\mathsf{a}, \mathsf{b}, \mathsf{c}\}$. Then (19) is equivalent to:

(20) $$\left\{\lambda\beta.\lambda s_s.\left\{i \in s : \forall a \in \left\{\begin{array}{l}\lambda s.s[x/\mathsf{a}][C(x)],\\ \lambda s.s[x/\mathsf{b}][C(x)],\\ \lambda s.s[x/\mathsf{c}][C(x)]\end{array}\right\}[\,i \text{ subsists in } \beta(a)(s)\,]\right\}\right\}$$

(20) takes the consequent. Decomposing the universal quantification, the composition results in (21). The anaphora in the consequent of the unconditional is resolved in the usual fashion: the anaphora is interpreted as a variable.

(21) *dare*^{x}*-NOM comes to the party mo soitu*$_x$*-TOP enjoys* $\rightsquigarrow$
$$\left\{\lambda s_s.\left\{i \in s : i \text{ subsists in } \left\{\begin{array}{l}\left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[x/\mathsf{a}][Cx]\text{, then all descendants}\\ \text{of } j \text{ in } s[x/\mathsf{a}][Cx] \text{ subsist in } s[x/\mathsf{a}][Cx][Ex]\end{array}\right\},\\ \left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[x/\mathsf{b}][Cx]\text{, then all descendants}\\ \text{of } j \text{ in } s[x/\mathsf{b}][Cx] \text{ subsist in } s[x/\mathsf{b}][Cx][Ex]\end{array}\right\},\\ \left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[x/\mathsf{c}][Cx]\text{, then all descendants}\\ \text{of } j \text{ in } s[x/\mathsf{c}][Cx] \text{ subsist in } s[x/\mathsf{c}][Cx][Ex]\end{array}\right\}\end{array}\right\}\right\}\right\}$$

(21) is a singleton set of CCPs. The CCP takes a state s and collects the possibilities $i \in s$ such that i subsists in all of $s[x/\mathsf{a}][Cx \to Ex]$, $s[x/\mathsf{b}][Cx \to Ex]$, and $s[x/\mathsf{c}][Cx \to Ex]$. More intuitively and informally, (21) is equivalent to (22).

(22) $$\left\{\lambda s_s.\left\{i \in s : i \text{ subsists in } \begin{array}{l}s[\textit{if } \mathsf{a} \textit{ comes to the party } \mathsf{a} \textit{ enjoys}]\text{, and}\\ s[\textit{if } \mathsf{b} \textit{ comes to the party } \mathsf{b} \textit{ enjoys}]\text{, and}\\ s[\textit{if } \mathsf{c} \textit{ comes to the party } \mathsf{c} \textit{ enjoys}]\end{array}\right\}\right\}$$

Consider s_{11} in (23), updated by the unconditional in (21). i_2 and i_3 subsist in the update by all the three alternative conditionals, but i_1 does not: i_1 does not subsist in $s_{11}[\textit{if } \mathsf{b} \textit{ comes to the party } \mathsf{b} \textit{ enjoys}]$. Therefore, the result of the update is $\{i_2, i_3\}$.

(23) s_{11}

$i_1 = (g_1, w_1)$ $g_1(x) = \uparrow$ $w_1(C) = \{a, b\}$ $w_1(F) = \{a\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \uparrow$ $w_2(C) = \{a\}$ $w_2(F) = \{a, b\}$
$i_3 = (g_3, w_3)$ $g_3(x) = \uparrow$ $w_3(C) = \{c\}$ $w_3(F) = \{c\}$	

Now that the semantics for unconditionals is dynamicized, the indistinguishable participants in (2) are dynamically resolved with the following indexation.

(2) ***Dare***^{x}*-ga hokano* ***dare***^{y}*-ni atte-mo,* ***soitu***$_x$*-wa* ***soitu***$_y$*-ni aisatu-suru.*
who-NOM other who-DAT meet-MO, s/he-TOP s/he-DAT greet-do.
Lit. 'whoever meets whoever, s/he greets him/her.'

(24) shows how the anaphora in (2) are resolved under the assumption that $D = \{a, b, c\}$. (24a) is the result of composition. The self-meeting event (e.g., a *meets* a) is excluded from the antecedent because *hokano* (other) factors out the possibility that the second *dare* denotes the individual same as the one denoted by the first *dare*. Consider the initial state s_{12} in (24b), where M is for meeting and G for greeting. i_2 and i_3 subsist in all six states. But i_1 doesn't, for b and c do not greet each other although they meet in i_1. Thus, the update by (2) results in $\{i_2, i_3\}$ as in (24c), which identifies with the intuitive interpretation of (2).

(24) a. *dare-NOM other dare-DAT meet mo, s/he-NOM s/he-DAT greet*

$$\rightsquigarrow \left\{ \lambda s_s \left\{ i \in s : i \text{ subsists in } \begin{matrix} s[\textit{if } a \textit{ meets } b, a \textit{ greets } b], \\ s[\textit{if } a \textit{ meets } c, a \textit{ greets } c], \\ s[\textit{if } b \textit{ meets } a, b \textit{ greets } c], \\ s[\textit{if } b \textit{ meets } c, b \textit{ greets } c], \\ s[\textit{if } c \textit{ meets } a, c \textit{ greets } a], \\ s[\textit{if } c \textit{ meets } b, c \textit{ greets } b] \end{matrix} \right\} \right\}$$

b. s_{12}

$i_1 = (g_1, w_1)$ $g_1(x) = \uparrow$ $w_1(M) = \{\langle a, b\rangle, \langle b, a\rangle, \langle b, c\rangle, \langle c, b\rangle\}$ $w_1(G) = \{\langle a, b\rangle, \langle b, a\rangle\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \uparrow$ $w_2(M) = \{\langle a, b\rangle, \langle b, a\rangle\}$ $w_2(G) = \{\langle a, b\rangle, \langle b, a\rangle, \langle b, c\rangle, \langle c, b\rangle\}$
$i_3 = (g_3, w_3)$ $g_3(x) = \uparrow$ $w_3(M) = \{\langle b, c\rangle, \langle c, b\rangle\}$ $w_3(G) = \{\langle b, c\rangle, \langle c, b\rangle\}$	

c. $s_{12}[(2)] = \{i_2, i_3\}$

The proposal can be extended to an instance of the *sage-plant* configuration, exemplified in (25). The update is illustrated in (26). Here, we suppose the domain of human individuals D_H is $\{\mathsf{a},\mathsf{b}\}$ and the domain of non-human individuals D_I is $\{\mathsf{p}_i : i \in \mathbb{N}\}$. The composition of (25) converges to the update potential in (26). Applying this to the initial state s_{13} in (26b), the updated state includes only i_2 and i_3. i_1 is eliminated because both a and b do not buy nine items. Note that i_2 subsists in $s[$*if* b *buys* p_{n_1}, b *buys* $\mathsf{p}_{n_2}, \ldots, \mathsf{p}_{n_9}]$ because b does not buy anything in i_3.

(25) ***Dare**-ga* ***dore**-o* *katte-mo soitu-wa sore-to issyoni 8-tu betuno-o kau*
who-NOM which-ACC buy-MO s/he-TOP it-with together 8-CLS other-ACC buy
Lit. 'whoever buys whichever, s/he buys eight others along with it. '

(26) a. *dare-*NOM *dore-*ACC *buy mo, s/he-*NOM *it-*DAT *together 8 others buy* ⇝

$$\left\{\lambda s_s \left\{ i \in s : i \text{ subsists in } \begin{array}{l} s[\textit{if } \mathsf{a} \textit{ buys } \mathsf{p}_{n_1}, \mathsf{a} \textit{ buys } \mathsf{p}_{n_2}, \mathsf{p}_{n_3}, \ldots, \textit{and}, \mathsf{p}_{n_9}], \textit{and} \\ s[\textit{if } \mathsf{b} \textit{ buys } \mathsf{p}_{n_1}, \mathsf{b} \textit{ buys } \mathsf{p}_{n_2}, \mathsf{p}_{n_3}, \ldots, \textit{and}, \mathsf{p}_{n_9}], \\ \text{for each } n_1, \ldots, n_9 \in \mathbb{N} \text{ where } n_k \neq n_{k'} \text{ if } k \neq k'. \end{array} \right\}\right\}$$

b. s_{13}

$i_1 = (g_1, w_1)$ $g_1(x) = \uparrow$ $w_1(B) = \{\langle \mathsf{a}, \mathsf{p}_m \rangle, \langle \mathsf{b}, \mathsf{p}_n \rangle : m \in \mathbb{N}_{\leq 7}, n \in \mathbb{N}_{\leq 5}\}$
$i_2 = (g_2, w_2)$ $g_2(x) = \uparrow$ $w_2(B) = \{\langle \mathsf{a}, \mathsf{p}_m \rangle, \langle \mathsf{b}, \mathsf{p}_n \rangle : m \in \mathbb{N}_{\leq 10}, n \in \mathbb{N}_{\leq 10}\}$
$i_3 = (g_3, w_3)$ $g_3(x) = \uparrow$ $w_2(B) = \{\langle \mathsf{a}, \mathsf{p}_m \rangle : m \in \mathbb{N}_{\leq 9}\}$

c. $s_{13}[(25)] = \{i_2, i_3\}$

4. Consequences, predictions, and remaining issues

4.1. Conditionals and unconditionals

Recall the updates of s_{10} by the conditional in (13) and the parallel update of s_{11} by the unconditional in (15) illustrated above. The updates result in $\{i_2, i_3\}$. The results are equivalent due to the validity of Egli's theorem in update semantics.

(27) $\exists x Px \rightarrow Qx \equiv \forall x[Px \rightarrow Qy]$ (Egli's theorem)

Could unconditionals be more simply analyzed as dynamic conditionals? More specifically, could we take wh-indeterminates in unconditionals as indefinites rather than sources of alternatives?

This is not the case. If wh-indeterminates were indefinites and unconditional were a sort of conditionals, it would be predicted that unconditionals in Japanese are well-formed even without *mo*, which, in our proposal, 'flattens' a non-singleton set of alternatives to a singleton set via quantification. The quantification is pivotal for the well-formedness of unconditionals as declarative sentences. Under alternative semantics, declarative sentences should denote a singleton set. If the cardinality of a set is more than one, the sentence is understood as a question. If wh-indeterminates do not induce alternatives, unconditional sentences will denote a singleton set of (dynamic) propositions even without *mo*, and they should be interpreted as well-formed declarative sentences. This prediction is not borne out. (28), which is a variant of (8) without *mo*, is only interpreted as a question (as far as the sentence is acceptable – it is not fully natural). Our proposal straightforwardly predicts this fact. The wh-indeterminates *dare* creates alternatives, which must be fattened by *mo* for the sentence to be declarative; otherwise the sentence is interpreted as a question, which is indeed the case in (28).[8]

(28) ? [$_\alpha$ ***Dare**-ga* *paati-ni* *kite*][$_\beta$ ***soitu**-wa* *tanosimu*] *?*
who-NOM party-DAT come the.person-TOP enjoy
'Who will come to the party and enjoy?'

Conditionals and unconditionals also differ in presuppositions. The conditional sentence in (29) reflects the form of the left-hand side of Egli's equation in (27). The truth condition of this sentence is identical to that of a corresponding unconditional (30), just as Egli's theorem predicts. Nevertheless, the presupposition behind these two sentences are different: (30) presupposes that at least one person comes to the party, while the speaker of (29) would not deny the possibility that no one will come to the party. We assume, with Rawlins (2013), that the presupposition comes from the *exhaustivity* requirement of unconditionals: antecedents in the alternative set must exhaustify the logical space. When $D = \{\mathtt{a}, \mathtt{b}, \mathtt{c}\}$, the three propositions `a_comes_to_the_party`, `b_comes_to_the_party`, and `c_comes_to_the_party` together exhaust the logical space. It excludes the possibility that no one will come, hence the presupposition. The difference in presuppositions would not be predicted if we equate unconditionals with dynamic conditionals.

(29) *Dare-ka-ga ki-tara paati-wa tanosii.*
who-∃-NOM come-COND party-TOP fun
'If someone comes to the party, it will be fun.'

(30) *Dare-ga kite-mo paati-wa tanosii.*
who-NOM come-MO party-TOP fun
'If someone comes to the party, it will be fun.'

The above discussion reveals the combinatory system, alternative update semantics, is still motivated.

[8]The CCP of (28) obtained within our analysis amounts to the set of conditionals. On the other hand, (28) is a conjunctive question. However, unconditionals are exhaustive (Rawlins 2013), and thus the possible world in the information state that is to be updated by (28) necessarily assigns at least one individual to the predicate in the first conjunct. Hence, the conditionals in the alternative set become equivalent to conjunctions.

4.2. Adding Modal Base

Following Kratzer's analysis, we assumed in 2.2 that conditionality comes from an overt or covert modal operator. In the standard Kratzerian framework, the quantificational domain of the modal operator is further restricted by a modal base. This subsection demonstrates that the modal base can be incorporated into our proposal. The modal base is represented as a function f, which takes a world and returns a set of propositions. For the clear distinction between a symbol for a possible world (i.e., possible worlds in the sense of alternative semantics) and the model of a possible world (i.e., possible worlds in the sense of dynamic semantics), we notate a possible world in boldface (see also footnote 5).

(31) $f(\mathbf{w}) = \{p_1, \ldots, p_n\}$

The extended modal operator $\Box$ in (32) takes a consequent and adds the modal base as the restriction.

(32) $$[\Box\psi] \rightsquigarrow \left\{\lambda\phi.\lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } s[f(\mathbf{w})][\phi]\text{, then all descendants}\\ \text{of } i \text{ in } s[f(\mathbf{w})][\phi] \text{ subsist in } s[f(\mathbf{w})][\phi][\psi]\end{array}\right\}\right\}$$

By this implementation, all possibilities that are not consistent with propositions specified by $f(\mathbf{w})$ are not evaluated. For example, consider (15), repeated below.

(15) [$_\alpha$ ***Dare***-*ga* *paati-ni* *kite*] ***-mo*** [$_\beta$ ***soitu***-*wa* *tanosimu*] .
who-NOM party-DAT come -∀ the.person-TOP enjoy
'Whoever comes to the party, s/he will enjoy.'

Suppose there is a party today, and Alex, Beth, Cathy, and Mary (for short, a, b, c, and m) are invited to the party. Mary does not like a party; hence, she will not enjoy it if Mary comes to the party. However, the speaker knows she will not attend the party because Mary is sick today. In this context, one of the propositions in the set $f(\mathbf{w})$ is $\neg C(\mathtt{m})$ (we use the same abbreviation as Section 3. C is for *comes to the party*, E is for *enjoy*). For simplicity, we assume $f(\mathbf{w}) = \{\neg C(\mathtt{m})\}$ and $D_e = \{\mathtt{a}, \mathtt{b}, \mathtt{c}, \mathtt{m}\}$. The translations for the sentence (17) is below.

(33) *dare*^{x}*-NOM comes to the party mo soitsu*$_x$*-TOP enjoys* $\rightsquigarrow$
$\{\lambda s_s.\{i \in s : \forall\alpha \in S,\ i \text{ subsists in } \alpha\}\}$, where

$$S = \left\{\begin{array}{l}
\left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[\neg C\mathtt{m}][x/\mathtt{a}][Cx]\text{, then all descendants}\\ \text{of } j \text{ in } s[\neg C\mathtt{m}][x/\mathtt{a}][Cx] \text{ subsist in } s[\neg C\mathtt{m}][x/\mathtt{a}][Cx][Ex]\end{array}\right\},\\
\left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[\neg C\mathtt{m}][x/\mathtt{b}][Cx]\text{, then all descendants}\\ \text{of } j \text{ in } s[\neg C\mathtt{m}][x/\mathtt{b}][Cx] \text{ subsist in } s[\neg C\mathtt{m}][x/\mathtt{b}][Cx][Ex]\end{array}\right\},\\
\left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[\neg C\mathtt{m}][x/\mathtt{c}][Cx]\text{, then all descendants}\\ \text{of } j \text{ in } s[\neg C\mathtt{m}][x/\mathtt{c}][Cx] \text{ subsist in } s[\neg C\mathtt{m}][x/\mathtt{c}][Cx][Ex]\end{array}\right\},\\
\left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[\neg C\mathtt{m}][x/\mathtt{m}][Cx]\text{, then all descendants}\\ \text{of } j \text{ in } s[\neg C\mathtt{m}][x/\mathtt{m}][Cx] \text{ subsist in } s[\neg C\mathtt{m}][x/\mathtt{c}][Cx][Ex]\end{array}\right\}
\end{array}\right\}$$

Roughly speaking, we have to consider four conditionals to determine the truth condition of (15). $\neg C\mathtt{m} \wedge C\mathtt{a} \rightarrow E\mathtt{a}$, $\neg C\mathtt{m} \wedge C\mathtt{b} \rightarrow E\mathtt{b}$, $\neg C\mathtt{m} \wedge C\mathtt{c} \rightarrow E\mathtt{c}$ and $\neg C\mathtt{m} \wedge C\mathtt{m} \rightarrow E\mathtt{m}$. The last conditional is vacuously true because the antecedent is logically false. Therefore, we only have to consider three conditionals associated with Alex, Beth, and Cathy. In this way, the current analysis correctly captures the domain restriction by the speaker's epistemicity.

4.3. Interaction with Quantificational Adverbs

Gawron (2001) points out that the domain of quantification is different between conditionals and unconditionals. In his analysis, the conditional in (34) is true if, in most situations where John cooks, Mary is pleased. That is, the conditional quantifies over situations. On the other hand, unconditionals quantify over individual dishes. The truth condition of (35) is that Mary is pleased with most dishes John cooks.

(34) If John cooks, Mary is usually pleased.

(35) Whatever John cooks, Mary is usually pleased.

The two readings are teased apart by scenario (36). (34) is false in (36) while (35) is true. The falsity of (34) is due to the portion of situations where Mary is pleased: she was pleased in only one situation out of nine. On the other hand, (35) is true because Mary was pleased with 20 dishes out of 28.

(36) John cooked 20 dishes in one situation and only one dish in eight situations. In the first situation, where John cooks 20 dishes, Mary is pleased. But in the other eight situations, she wasn't.

Japanese unconditionals are interpreted as a combination of quantification over individuals and situations.[9] (37) is an unconditional corresponding to (35). An intuitive paraphrase of this sentence is as follows: for each kind of food (e.g., salad, dumpling, tom yum soup), in most situations where John cooks it, Mary is pleased.

(37) *Nani-o John-ga ryoorisite-mo Mary-wa taitei yorokobu*
what-ACC John-NOM cook-MO Mary-TOP usually pleased
'Whatever John cooks, Mary is usually pleased.'

The difference in the truth conditions between (35) and (37) comes into sharp relief under scenario (38). (35) is true because Mary was pleased with 32 dishes out of 36. By contrast, (37) is false because Mary was not pleased with all the dishes of tom yum soup John cooked, even though she usually was with salad and dumplings.[10]

[9] We owe Muyi Yang (p.c.) for this observation.

[10] One might argue that this contrast is caused by the ambiguity of the word *ryoorisuru* (cook). The internal argument of the verb *ryoorisuru* can be both a kind of food and a dish. Thus, the alternative set raised by *nani* (what) in (37) can be the set of kinds of food. However, (38), where the argument of the verb is specified as an individual human, also has a different truth condition from the corresponding English unconditional. It is true if, for each individual, Mary is usually pleased with their coming to the party.

(i) *Dare-ga paati-ni kite-mo Mary-wa taitei yorokobu.*
who-NOM party-DAT come-MO Mary-TOP usually pleased
'Whoever comes to the party, Mary is usually pleased.'

(38) John cooked ten dishes of salad in three situations, one dish of dumplings in three other situations, and one dish of tom yum soup in three other situations. Mary was pleased in three salad situations and two dumpling situations.

The analysis of Japanese unconditionals in this paper captures this intuition. (39) is the CCP specified by (37) in our analysis (when the kinds of food are only salad, dumpling, and tom yum soup). In each alternative of the set, the quantification by the antecedent of conditionals is over situations. Thus, the possibilities eliminated in the update are the ones where there is even one kind of food that Mary is not pleased with in most situations where John cooks it.[11]

(39) $$\left\{\lambda s_s.\left\{i \in s : i \text{ subsists in } \begin{array}{l} s[\textit{if John cooks salad, Mary is usually pleased}], \\ s[\textit{if John cooks dumplings, Mary is usually pleased}], \\ s[\textit{if John cooks tom yum soup, Mary is usually pleased}] \end{array}\right\}\right\}$$

4.4. Generality of *Mo*

As extensively discussed by Shimoyama (2006), *mo* also appears as a part of individual quantification, as exemplified in (40). Intuitively the instance of *mo* there quantifies over the set of individuals.

(40) ***Dare**-mo-ga waratta.*
who-∀-NOM laughed.
'Everyone laughed.'

The definition of *mo* proposed above is general enough to derive the individual quantification compositionally. Recall our definition of an indeterminate phrase *dare*, repeated in (41a), and a quantificational particle *mo*, repeated in (41b). Shifting the type of predicate as in (41c), the CCP of the sentence (40) is obtained compositionally as in (42).[12]

(41) a. *dare* $\rightsquigarrow \{\lambda P_{e,ss}.\lambda s.P(x)(s[x/\mathrm{d}]) : \mathrm{d} \in D\}$
b. *mo* $\rightsquigarrow \{\lambda\alpha.\lambda\beta.\lambda s_s.\{i \in s : \forall a \in \alpha\,[\,i \text{ subsists in } \beta(a)(s)\,]\}\}$
c. *waratta* $\rightsquigarrow \{\lambda\xi_{\langle\langle\langle e,ss\rangle,s\rangle,s\rangle}.\lambda s.\xi(\lambda x_e.\lambda s.s[laugh(x)])(s)\}$

(42) *dare-mo-NOM laugh*

$$\rightsquigarrow \left\{\lambda s_s.\left\{i \in s : \begin{array}{l} \forall a \in \{\lambda P_{e,ss}.\lambda s.P(x)(s[x/\mathrm{d}]) : \mathrm{d} \in D\} \\ [i \text{ subsists in } \lambda\xi_{\langle\langle\langle e,ss\rangle,s\rangle,s\rangle}.\lambda s.\xi(\lambda x_e.\lambda s.s[laugh(x)])(s)] \end{array}\right\}\right\}$$
$$= \{\lambda s_s.\{i \in s : \forall \mathrm{d} \in D : [i \text{ subsists in } s[x/\mathrm{d}][laugh(x)]]\ \}\}$$

[11]Note that Japanese conditionals quantify over situations similarly to English counterparts. For instance, (39) is true if Mary is pleased in most situations where John cooks. In particular, it is false under the condition (36).

(i) *John-ga ryoorisi-tara Mary-wa taitei yorokobu*
John-NOM cook-COND Mary-TOP usually pleased.
'If John cooks, Mary is usually pleased.'

[12]The type shift occurs to prevent the type mismatch between the predicate and the indefinite. This type shift parallels the type shift discussed in Partee and Rooth (1983), which prevents the mismatch between a quantifier phrase and a predicate.

(42) is a singleton set of CCP that consists of possibilities that subsist in $\lambda s_s.laugh(\mathsf{a})$, $\lambda s_s.laugh(\mathsf{b})$, and $\lambda s_s.laugh(\mathsf{c})$ if $D = \{\mathsf{a}, \mathsf{b}, \mathsf{c}\}$. This is roughly a universal quantification over the set of propositions $\{laugh(\mathsf{d}) \mid \mathsf{d} \in D\}$. Beyond the context of *unconditionals*, Our definition of the indeterminate phrase *dare* and the quantificational particle *mo* correctly derives the truth condition of (40).

Nevertheless, we must leave the analysis of other use of *mo*: *mo* also marks additivity as in (43) and concessivity as in (44). (44) is concessive in that John's coming to the party is relatively less likely to lead to Mary's being happy than other alternative possibilities. Our analysis cannot easily account for these uses of *mo*.

(43) *John-mo kita*
John-MO come
'Also John came.'

(44) *John-ga paati-ni kite-mo Mary-wa yorokobu*
John-NOM party-DAT come-MO Mary-TOP happy
'Even if John comes to the party, Mary is happy.'

Another work left for a future occasion is the analysis of (45). (45) is an unconditional with only two alternatives. Rawlins (2013) dubs it an *alternative unconditional* and analyzes it parallelly to *wh-unconditional*. The corresponding Japanese counterpart includes two *mo* particles, to which we have nothing to offer as an analysis. See Yagi (2022) for an attempt to unify unconditionals and concessive conditionals in Japanese, and Yagi and Yuan (2022) for an attempt to derive concessivity from additivity.

(45) Whether John comes to the party or not, Mary is happy.

(46) *John-ga paati-ni kite-mo ko-nakute-mo Mary-wa yorokobu.*
John-NOM party-DAT come-MO come-NEG-MO Mary-TOP happy
'Whether John comes to the party or not, Mary is happy.'

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