Toward a Semantic Theory of Universal NCIs

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Abstract

Negative Concord Items (NCIs) are quantificational expressions that must be licensed by a local negation. Though the licensing condition has often been characterized by syntactic terminologies, Kuhn (2022) pursued semantic characterization of the condition. This paper extends Kuhn's analysis to NCIs with universal quantificational force, focusing on Japanese *dare-mo*. This is achieved by augmenting Hamblinian alternative semantics in Kuhn's dynamic setup. The success of the analysis provides further support for merging dynamic semantics and alternative semantics.

1 Introduction and Summary

Negative Concord Items (NCIs) are quantificational expressions that exhibit the three distinguishing properties summarized in (1). (Suppose the sentence in the `typewriter font` is a quasi-English.)

(1) a. "`Mary didn't see person`$_{\text{NCI}}$" is interpreted as "*Mary saw no one*".
b. NCIs must be licensed by a negation.
c. The licensing negation must be local to an NCI.

Although the accumulated literature pursues *syntactic* analyses of (1), Kuhn (2022) proposes a semantic analysis of these properties with the apparatus of dynamic semantics, which is reviewed in section 2. Despite an analytical success, Kuhn (2022) bases the proposal on the assumption that NCIs are *existential* quantifiers that take scope below negation, and this assumption is ill-suited to languages whose NCIs are *universal* quantifiers (Shimoyama 2011; see also Giannakidou 2000). This study aims to overcome this dilemma by augmenting Kuhn's dynamic analysis with Hamblinian alternative semantics (Hamblin 1973).

The focus of this paper is a Japanese NCI *dare-mo*, which Shimoyama (2011) convincingly argued to be a universal quantifier. The arguments by Shimoyama are laid out in section 3. Following Shimoyama (2011), we assume that *dare-mo* semantically takes scope over the licensing negation via syntactic movement. The movement leaves a higher-type trace, which lets *dare-mo* take split scope (Kuhn 2022) below and above negation. Below negation, *dare-mo* introduces Hamblinian alternatives to the composition. Above negation, it universally quantifies over the alternative. Furthermore, *dare-mo* enforces the empty value condition on a variable, notated as $\mathbf{0}_x$, which is the pivotal aspect of the semantic theory of NCI licensing put forth by Kuhn (2022).

The proposal, laid out in section 4, inherits Kuhn's correct predictions on the licensing condition of NCIs. Furthermore, it correctly predicts the scope interaction between *dare-mo* and quantificational adverbs observed in Shimoyama (2011). The success of the analysis offers

further support for the augmentation of dynamic semantics and plural alternative semantics, independently pursued by Li (2021).

2 Kuhn (2022)

The gist of Kuhn's (2022) proposal is summarized as follows.

(2) a. NCIs are existential quantifiers that undergo Quantifier Raising (QR) above the licensing negation.

b. They take split scope below and above the negation: their existential force takes scope below the negation, and they impose the empty value condition on a variable above it.

Kuhn (2022) formalizes the idea with a dynamic system. To assimilate the notation with our proposal, we describe it here with Plural Dynamic Logic (PDL; van den Berg 1996). PDL works with *plural information states* (PISs), i.e., sets (G, H, ...) of variable assignments functions $g, g', ..., h, h', ...$ Existential quantification $\exists_x\phi$ is interpreted in the standard way in dynamic literature, namely as random (re)assignment of the value x. We assume that a discourse starts with an empty state G such that $g(\alpha) = \star$ for every $g \in G$ and any variable α. $\star$ is the designated individual that makes every predicate undefined (van den Berg 1996). The formal details are laid out in section 4.

Consider now the formulae in (3) and (4). The intended interpretation is spelled out in words in the second line, and their dynamic effects are visualized in Figures 1 and 2. In (3), the existential force takes scope below the negation to derive the intended "*saw no one*" reading, satisfying (1a). Since negation insulates the dynamic effect of existential quantification, the first conjunct of (3), $\neg(\exists_x \wedge \texttt{saw}(\texttt{m}, x))$, is externally static. Hence, after interpreting the first conjunct, the value under x is still empty ($h(x) = \star$ for any $h \in H$). The contribution of the empty value condition $\mathbf{0}_x$ is the underlined part of the spelled-out interpretation. It tests if the value(s) stored under the variable x is empty. The condition is satisfied in (3) due to negation, and the sentence is grammatical. Since (4) does not contain negation, the dynamic effect of the existential quantification is passed onto the evaluation of the last conjunct, $\mathbf{0}_x$. The empty value condition is not satisfied because some values are stored under the variable x due to the dynamicity of existential quantification. Hence, the sentence is ungrammatical.

(3) $\neg(\exists_x \wedge \texttt{saw}(\texttt{m}, x)) \wedge \mathbf{0}_x$ (`Mary didn't see person`$_{\text{NCI}}$.)
$\rightsquigarrow$ It is not the case that there is a person x such that Mary saw x. <u>There is no such x.</u>

(4) $\exists_x \wedge \texttt{saw}(\texttt{m}, x) \wedge \mathbf{0}_x$ (`Mary saw person`$_{\text{NCI}}$.)
$\rightsquigarrow$ There is a person x such that Mary saw x. #<u>There is no such x.</u>

G	x	y	....
g_1	$\star$	$\star$	....
g_2	$\star$	$\star$	....
g_3	$\star$	$\star$	....

$\xRightarrow{\neg(\exists_x \wedge \texttt{saw}(\texttt{m},x))}$

H	x	y	....
h_1	$\star$	$\star$	....
h_2	$\star$	$\star$	....
h_3	$\star$	$\star$	....

$\Longrightarrow \checkmark\mathbf{0}_x$

Figure 1: The dynamic effect of the grammatical use of NCI in (3)

G	x	y	....
g_1	$\star$	$\star$	....
g_2	$\star$	$\star$	....
g_3	$\star$	$\star$	....

$\xRightarrow{(\exists_x \wedge \texttt{saw}(\texttt{m},x))}$

H	x	y	....
h_1	a	$\star$	....
h_2	b	$\star$	....
h_3	c	$\star$	....

$\Longrightarrow \#\mathbf{0}_x$

Figure 2: The dynamic effect of the ungrammatical use of NCI in (4)

The locality requirement of the licensing negation, although Kuhn (2022) himself does not commit to any theory, can be attributed to (2a). QR across the negation is a prerequisite for an NCI to take a split scope so that the existential force can take below the scope of negation and impose the empty value condition above it. The clause-boundedness of QR then accounts for the locality requirement (= (1c)).

3 Shimoyama (2011)

The Japanese *dare-mo* (WHO-ALSO/EVEN) is often analyzed as an existential quantifier scoping under negation like the English NPI *anyone* (e.g. Kawashima 1994 and Kishimoto 2008). Shimoyama (2011), however, claims that *dare-mo* is a universal quantifier scoping over negation. The argument comes from the way how *dare-mo* scopally interacts with a quantificational expression Q and negation, the combination of which is a Non-Anti-Additive (NAA) function $Q\neg_{NAA}$. A $Q\neg_{NAA}$ function does not validate anti-additivity, i.e. $f(A \vee B) \not\Rightarrow f(A) \wedge f(B)$, and separates otherwise indistinguishable $\forall > \neg$ and $\neg > \exists$ readings: $\forall > Q\neg_{NAA}$ is not equivalent to $Q\neg_{NAA} > \exists$. Shimoyama (2011) utilizes the quantificational adverb *taitei* (usually) to create a NAA function because it takes wide scope over clausemate negation as in (5).

(5) *Taro-wa taitei sankasi-nakat-ta.*
Taro-TOP usually participate-not-PAST
'It was usually the case that Taro did not participate.' (usually > not)
*'It was not the case that Taro usually participated.' (not > usually)

By employing the NAA function $Q_{usually}\neg_{NAA}$, Shimoyama (2011) demonstrates that *dare-mo* in Japanese indeed has the $\forall > \neg$ reading. Consider (6).

(6) *Nihonjin gakusei-no* ***dare-mo***$_{NCI}$ ***taitei*** *sankasi-****nakat****-ta.*
Japanese student-GEN NCI usually participate-not-PAST
'For every Japanese student, it was usually the case that s/he did not participate.'

We assume with Shimoyama (2011) that '*taitei*(ϕ)' is true for a proposition ϕ iff ϕ is true more than 50% out of all situations. Suppose then that there are three Japanese students and six meetings and that each student missed four out of the six meetings, as depicted in Table 1 (✓ marks attendance). Since every student misses more than three meetings, the $\forall >$ *taitei* $> \neg$ reading is true, and the sentence is indeed judged to be true under this scenario. On the other hand, the *taitei* $> \neg > \exists$ reading (i.e. it was usually the case that no students participated) is false under the same scenario because there were only two meetings in which no student participated. The truth of the $\forall >$ *taitei* $> \neg$ reading, therefore, indicates that *dare-mo* is a universal quantifier.

	MTG1	MTG2	MTG3	MTG4	MTG5	MTG6
STD1					✓	✓
STD2	✓					✓
STD3	✓	✓				

Table 1: Scenario for (6)

Coupled with the fact that *dare-mo* obeys the same licensing conditions as NCIs (see Watanabe 2004; Kataoka 2006), Shimoyama's (2011) observation suggests that *dare-mo* should be analyzed as a universal NCI.[1] Shimoyama (2011), however, does not commit to how the NCI

[1] We do *not* claim that every NCI in language is a universal quantifier. See, for example, Kamali and Zeijlstra (2024) for fine-grained discussions.

is licensed. At the same time, we cannot directly apply Kuhn's (2022) analysis to *dare-mo*, because NCIs are existential quantifiers under his analysis. Our solution augments Kuhn's (2022) analysis with *Hamblinian alternatives* (Hamblin 1973), which is independently motivated by the fact that *dare-mo* involves the indeterminate pronoun *who* (see Kratzer and Shimoyama 2017).

4 Proposal

Following Brasoveanu (2008), we adopt a logical object language with type t (truth values), type e (individuals) and type s (*states*), which models variable assignments. We take a *discourse referent* (dref) u_n as a function from states to individuals.[2] We abbreviate $\langle se\rangle$ (dref) as E, $\langle st, \langle st, t\rangle\rangle$, (*dynamic proposition*, i.e. a relation between PISs) as T and $\langle\langle st, \langle st, t\rangle\rangle, t\rangle$ (a set of dynamic propositions) as $\{T\}$. We adopt the PDL update rules in (7).

(7) a. $G[\![P(u_1)...(u_n)]\!]H$ iff $G = H$ & $\forall g \in G : \langle u_1(g), ..., u_n(g)\rangle \in I(P)$ (lexical relation)
b. $G[\![u = u']\!]H$ iff $G = H$ & $\forall g \in G : u(g) = u'(g)$ (dref identity)
c. $G[\![u = a]\!]H$ iff $G = H$ & $\forall g \in G : u(g) = a$ (value identity)
d. $G[\![\phi \wedge \psi]\!]H$ iff $\exists K : G[\![\phi]\!]K$ & $K[\![\psi]\!]H$ (conjunction)
e. $G[\![\neg\phi]\!]H$ iff $G = H$ & $\neg\exists K : H[\![\phi]\!]K$ (negation)
f. $G[\![\exists_u]\!]H$ iff $\forall g \in G : \exists h \in H : g[u]h$&$\forall h \in H : \exists g \in G : g[u]h$ (existential quantifier)
g. $G[\![\mathbf{0}_u]\!]H$ iff $\{d \mid d \neq \star$ & $\exists h \in H : d = u(h)\} = \emptyset$ (empty value condition)

We follow the semantic composition in Ciardelli, Roelofsen, and Theiler (2017). A sentence without a set-expanding item ends up denoting a dynamic proposition.

(8) a. $[\![\text{student}]\!] = \lambda v_E : \{\text{student}(v)\}$ / $[\![\text{participate}]\!] = \lambda v_E : \{\text{participate}(v)\}$
b. $[\![\text{a}]\!] = \lambda P_{\langle E\{T\}\rangle} : \lambda Q_{\langle E\{T\}\rangle} : \{\exists_u \wedge P(u) \wedge Q(u)\}$
c. $[\![\text{EC}]\!] = \lambda S_{\{T\}} : \cup S$ (existential closure)
d. $[\![\text{EC}]\!]([\![\text{A student participates}]\!]) = \cup\{\exists_u \wedge \text{student}(u) \wedge \text{participate}(u)\}$
$= \exists_u \wedge \text{student}(u) \wedge \text{participate}(u)$

Some expressions, e.g., *wh*-indefinites, expand alternatives, and the resultant sentential denotation is a non-singleton set of dynamic propositions.[3]

(9) a. $[\![\text{who}]\!] = \lambda Q_{\langle E\{T\}\rangle} : \{\exists_u \wedge \text{person}(u) \wedge Q(u) \wedge u = x \mid x \in D_e\}$
b. $[\![\text{Who participates}]\!] = \{\exists_u \wedge \text{person}(u) \wedge \text{participate}(u) \wedge u = x \mid x \in D_e\}$

We define universal quantification over alternatives as union-formation of PISs: $\Cup S$ produces H such that each dynamic proposition in S is true with respect to a subset of H.

(10) a. $G[\![\Cup S]\!]H$ iff $H = \cup\{K \mid \exists\phi \in S : G[\![\phi]\!]K\}$ (state aggregation)
b. $[\![\forall]\!] = \lambda S_{\{T\}} : \Cup S$ (universal closure)
c. $[\![\forall]\!]([\![\text{Who participates}]\!]) = \Cup\{\exists_u \wedge \text{person}(u) \wedge \text{participate}(u) \wedge u = x \mid x \in D_e\}$
where its output PIS is $\cup\{K \mid \exists x \in D_e : G[\![\exists_u \wedge \text{person}(u) \wedge \text{participate}(u) \wedge u = x]\!]K\}$

Lastly, we define negative morpheme and *taitei* (usually) in an alternative-sensitive way.[4] We take USUALLY as a placeholder for an analysis of dynamic adverbial quantification, which we put aside here. Any theory of it may work as long as it is defined for dynamic propositions.

[2] The idea is originally from Muskens (1996), but he takes a dref as primitives as well.

[3] One may use this non-singleton set of dynamic propositions to model questions (Li 2021), and one may indeed take our analysis as an extension of his theory. However, we remain neutral about how one should model questions.

[4] This choice is vital for us to define universal quantification over dynamic propositions that contain negation. The standard negation in Hamblin semantics takes the set complement of the prejacent, but this removes the structure of alternatives, which is the prerequisite for $\forall$.

(11) a. $[\![\text{not}]\!] = \lambda S_{\{T\}} : \{\neg p \mid p \in S\}$
b. $[\![\text{usually}]\!] = \lambda S_{\{T\}} : \{\textsc{usually}(p) \mid p \in S\}$

Coming back to Japanese, we define *dare-mo* with *wh*-indefinite, 0_u and $\forall$.

(12) $[\![\text{dare-mo}]\!] = \lambda Q_{\langle E\{T\}\rangle} : \Cup\{\exists_u \wedge \text{person}(u) \wedge Q(u) \wedge u = x \mid x \in D_e\} \wedge \mathbf{0}_u$ (*to be revised*)

We assume that *dare-mo* leaves the higher-order trace (Kuhn 2022), lifting its type. This achieves the split scope: $\Cup$ and $\mathbf{0}_u$ takes the highest scope while $\exists_u$ takes the narrowest scope.

(13) $[\![\text{dare-mo}]\!] =$
$\lambda R_{\langle\langle E\{T\},\{T\}\rangle,\{T\}\rangle} : \Cup R(\lambda Q_{\langle E\{T\}\rangle} : \{\exists_u \wedge \text{person}(u) \wedge Q(u) \wedge u = x \mid x \in D_e\}) \wedge \mathbf{0}_u$

Now, *dare-mo* leaves type $\langle E\{T\}, \{T\}\rangle$ trace. A simplified logical form is given below.

(14) $[_{\text{d}}$ `Dare-mo`^{u_1} $[_{\text{c}}$ λG_i $[_{\text{b}}$ `usually not` $[_{\text{a}}$ G_i `participate`]]]]

a. $G_i(\lambda v : \{\text{participate}(v)\})$
b. $[\![\text{usually}]\!]([\![\text{not}]\!](G_i(\lambda v : \{\text{participate}(v)\})))$
c. $\lambda G_{\langle E\{T\},\{T\}} : [\![\text{usually}]\!]([\![\text{not}]\!](G(\lambda v : \{\text{participate}(v)\})))$
d. $\Cup[\![\text{usually}]\!]([\![\text{not}]\!](\{\exists_{u_1} \wedge \text{person}(u_1) \wedge \text{participate}(u_1)) \wedge u_1 = x \mid x \in D_e\})) \wedge \mathbf{0}_{u_1}$
$= \Cup[\![\text{usually}]\!]\{\neg(\exists_{u_1} \wedge \text{person}(u_1) \wedge \text{participate}(u_1)) \wedge u_1 = x)) \mid x \in D_e\} \wedge \mathbf{0}_{u_1}$
$= \Cup\{\textsc{usually}(\neg(\exists_{u_1} \wedge \text{person}(u_1) \wedge \text{participate}(u_1)) \wedge u_1 = x)) \mid x \in D_e\} \wedge \mathbf{0}_{u_1}$

(14d) is informally paraphrased as (15).

(15) $\Cup\{\{K_1 \mid \text{Taro}^{u_1} \text{ usually does not participate in } K_1\}, \{K_2 \mid \text{Jiro}^{u_1} \text{ usually does not participate in } K_2\}, ...\} \wedge \mathbf{0}_{u_1}$

Crucially, the universal closure, i.e., PDL universal quantification over alternatives, takes scope over *taitei*, which creates $Q\neg_{NAA}$ with negation. Thus, the reading of (6) is correctly predicted. Since our analysis also assumes that an NCI takes split scope via QR, it correctly predicts the clause-boundedness of NCI licensing (1c). At the same time, negation is obligatory because of the empty value condition $\mathbf{0}_u$, which is evaluated at the end of dynamic conjunctions due to higher-order QR. Consider Figure 3 without negation and Figure 4 with negation.

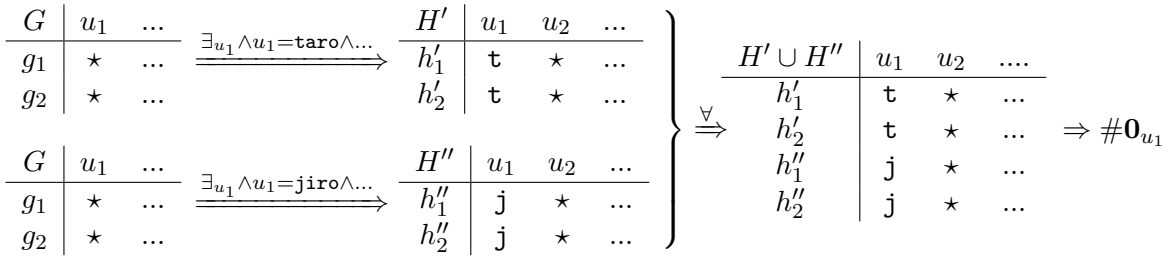

Figure 3: The dynamic effect of the ungrammatical use of universal NCI *dare-mo*

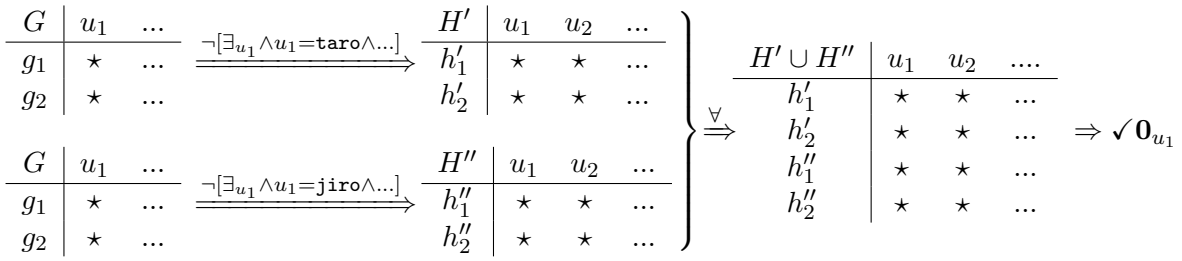

Figure 4: The dynamic effect of the grammatical use of universal NCI *dare-mo*

In Figure 3, the universal closure stores individuals who participated under the dref u_1, and

the empty value condition is not satisfied. In Figure 4, on the other hand, negation voids the dynamic effect of $\exists_{u_1}$ in each member of the set of dynamic propositions. Thus, no individual is stored under u_1 after the application of universal closure, and $\mathbf{0}_{u_1}$ is satisfied.

Notice that negation has to be applied to each member of the set of dynamic propositions. Otherwise, the cancellation of dynamic effect by negation collapses the structure of Hamblin alternatives, which is necessary to achieve (non-trivial) universal closure. Suppose that negation is defined for dynamic propositions and the alternatives expand after negation applies to the prejacent as shown in (16a). Then, one may not obtain (16b) from (16a). The value of u is assigned under negation, and thus, its value is empty outside the scope of negation. Thus, $u = x$ outside the scope of negation fails to expand the set of dynamic propositions, i.e., the value of u is $\star$ under any dynamic proposition, and (16b) is a singleton set of dynamic propositions.

(16) a. $\neg(\exists_u \wedge \text{person}(u) \wedge \text{participate}(v)))$

b. $\{\neg(\exists_u \wedge \text{person}(u) \wedge \text{participate}(v)) \wedge u = x \mid x \in D_e\}$

This poses a problem for an alternative in which the non-Hamblin system is default and ⟦dare-mo⟧ introduces Hamblin alternatives as shown in (17).

(17) $[\![\text{dare-mo}]\!] = \lambda R_{\langle\langle ET,T\rangle,T\rangle} : \Cup\{R(\lambda Q_{\langle ET\rangle} : \exists_u \wedge \text{person}(u) \wedge Q(u) \wedge u = x) \mid x \in D_e\} \wedge \mathbf{0}_u$

Because of its higher-order type, alternative-expansion takes split scope in (17), too, which leads to the problematic configuration in (18c) and (18d).

(18) $[_{\text{d}}$ `Dare-mo`^{u_1} $[_{\text{c}}$ λG_i $[_{\text{b}}$ `usually not` $[_{\text{a}}$ G_i `participate`]]]]

a. $G_i(\lambda v$:participate$(v))$

b. USUALLY$(\neg(G_i(\lambda v$:participate$(v))))$

c. $\lambda G_{\langle ET,T\rangle}$:USUALLY$(\neg(G(\lambda v$:participate$(v))))$

d. $\Cup\{\text{USUALLY}(\neg(\exists_{u_1} \wedge \text{person}(u_1) \wedge \text{participate}(u_1)) \wedge u_1 = x)) \mid x \in D_e\} \wedge \mathbf{0}_{u_1}$

Therefore, while the alternative (17) would be an attractive alternative, this runs into a problem in regard to the interaction between alternative expansion and dynamic negation.[5]

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[5]One may restore the value of a dref assigned under negation by enriching our analysis with bilateralism (Krahmer and Muskens 1995 among others), projective contents (Mandelkern 2022) or flat-update system (Hofmann 2022; Hofmann 2024). However, any successful theory still has to explain that anaphoric reference to a dref under negation is impossible from outside the scope of negation, which causes the problem observed in (16a) and (16b).

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