Copula, Additive, and Wh-indeterminates

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1 Introduction

Since Kuroda (1965, Ch. 3–4), it has been widely known that in the Japanese language, interrogative pronouns (known as *wh-indeterminates*) are the hubs of various quantificational and interrogative expressions, focus-sensitive operators being the spokes. This chapter will focus on a particular combination of wh-indeterminates and their associating operators. *Dare-mo-ga* 'everyone' is a universal quantifier, as demonstrated below (1). *Mo* is known as an additive and a scalar additive marker, as in *Tarō-mo ki-ta* 'Taro also came / Even Taro came'. However, the universal reading is not universal across different types of wh-indeterminates, as pointed out by Kobuchi-Philip (2010) and Oda (2012). When *mo* associated with *nan-CL* (how.many-CL), the resulting quantificational force is much weaker than what one expects from a universal quantifier.[1] As shown in (2), *nan-nin-mo(-ga)* (how.many-CL.people-MO-NOM)[2] means 'many people' rather than 'every people', 'the largest number of people' or 'every number of people'. It is by no means universal, but exis-

[1] List of non-obvious abbreviations: CL = classifier, NOM = nominative, TOP = topic, ACC = accusative, NEG = negation.

[2] The parenthesized nominative case marker *(-ga)* indicates that it is droppable. The nominative marker *-ga* in *dare-mo-ga*, on the other hand, is harder to omit though not impossible.

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tential.

(1) zyū-min-wa dare-mo-ga raizyō si-ta.
resident-TOP who-MO-NOM attendance do-PAST
(lit.) 'As for the residents, all of them attended.'

(2) zyū-min-wa nan-nin-mo-ga raizyō sita.
how.many-CL.people-MO-NOM
(lit.) 'As for the residents, many of them attended.'

To add to the complication, when the two wh-elements meet another focus-sensitive operator, *-de-mo(-ga)*, both of them end up with universal quantification. In (3), all of the residents came;[3] in (4), for all numbers of people there is a possible situation that they came.[4]

(3) zyū-min-wa dare-de-mo-ga raizyō si-ta.
who-be-MO-NOM
(lit.) 'As for the residents, any of them attended.'

(4) zyū-min-wa nan-nin-de-mo(??-ga) raizyō si-ta.
how.many-CL.people-be-MO-NOM
(lit.) 'As for the residents, any of them attended.'

The apparent quantificational inconsistency between the various instances of wh+*mo* invites two immediate questions: (i) What makes the differences between *dare-mo* (1) and *nan-nin-mo* (2)? Can we maintain a uniform *mo* despite the different quantificational outcomes? (ii) What is the effect of *-de* in *-de-mo*, which neutralizes the quantificational forces between (3) and (4) and as a consequence highlights the idiosyncrasy of *nan-nin-mo* (2)?

To answer the first question, this chapter will utilize one particular difference between the alternative sets generated by individuals and numerals. Individual alternatives make a lattice in terms of (generalized) entailment, while numeral alternatives "line up." I will propose a particular meaning-strengthening mechanism sensitive to this logical distinction. That is comparable to, but simpler than and superior to, grammatical exhaustification approaches (Fox, 2007; Chierchia, 2013). As for the second question, I endorse the decompositional view that *-de* in *-de-mo* is the adverbial form of

Nan-nin-mo(-ga) will be used hereafter to refer to the numeral wh-*mo* (how.many-CL-MO-NOM) in general.

3 Contra Oda (2021, 298, (50)), *-de-mo-ga* is attested at least 96 times in the BCCWJ corpus, including the example *dare-de-mo-ga tate-sō-na hōsoku* 'a principle that anyone could formulate' (LBc7_00033: 5840).

4 In fact, (4) is not the best exemplar of *nan-nin-de-mo(-ga)*. It usually occurs in modal environments such as *Kē-ki-wa nan-ko-de-mo tabe-rare-masu* 'You can eat any number of cakes' (vs. *nan-ko-mo tabe-rare-masu* 'You can eat a lot of cakes').

the copula *da* / *de-aru* (Numata, 2007; Nakanishi, 2021, 1026; inter alia). This chapter will sketch an analysis utilizing the exactness nature proffered by the copula *-de* (Rhie, 2010). Exactness, or exhaustivity in general, changes entailment-based structures between alternatives and thus remolds both individual and number alternative sets to the same type of structures.

The discussion will proceed in the following way. Facts about wh+*mo*, in particular their quantificational forces, are examined in §2. Previous studies will be reviewed in §3, highlighting the lack of resolution of the first question. §§4–5 offer our analysis and predictions. Lastly, several theoretical consequences are digested in §6.

2 Establishing Facts

The observational statement that *nan-nin-mo* (2) is uniquely existential unlike the others (1, 3, 4) is not well founded until it passes the scrutiny of linguistic criteria. §2.1 applies the tests of monotonicity (Barwise and Cooper, 1981, §4.7). §2.2 further verifies the different quantificational forces with adversative conjunction.[5] These observations will further corroborate Oda (2012)'s argumentation that *nan-nin-mo* must be a quantifier with a genuine existential force.

2.1 Monotonicity

A generalized quantifier G is upward monotonic with regard to its restrictor iff for any restrictor P, nucleus Q, and any P' such that for all $x \in D_e$ such that $P(x) \models P'(x)$, $G(P)(Q) \models G(P')(Q)$. G is downward monotonic with regard to its restrictor iff $G(P')(Q) \models G(P)(Q)$. Upward and downward monotonicity suffice to distinguish quantifiers with universal force and those with existential force.[6]

The individual wh+*mo* such as *dare-mo-ga* (1) is downward monotonic with regard to the restrictor. In (5), *sannensē* 'juniors (in a college, lit. Grade 3 students)' is a hyponym of *gakusē* 'students'. Thus for all $x \in D_e$, junior$(x) \models$ student(x). However, the inference pattern (5c) shows contravariance: dare-mo(junior)(run) does not entail, but is entailed by, dare-mo(student)(run). This fact validates the universal quantificational force of *dare-mo-ga*.

[5] Unmentioned at the time of the presentation, *hotondo* 'almost' can also distinguish the universal *dare-mo-ga* and the existential *nan-nin-mo(-ga)* (Oda 2021, 287; see also references therein).

[6] In alignment with Kobuchi-Philip (2009), this chapter assumes that every floating quantifier-like construction represents a dislocated restrictor/nucleus pair. This schema can be represented as "NP$_i$ … FQ$_i$ …" Many other genuine floating quantifiers as well as *dare-mo-ga* endorse this reasonable assumption, e.g. *gakusē$_i$-wa kinō* { *san-nin / takusan / taitē / zen'in* }$_i$ *taiho sare-ta* 'for the students, { three / a lot / most / all } of them got arrested yesterday'. See also Kobuchi-Philip (2008a) for relevant discussions.

(5) a. sannensē-wa dare-mo-ga hasit-ta.
junior-TOP who-MO-NOM run-PAST
'All of the juniors (in the college) ran.'

b. gakusē-wa dare-mo-ga hasit-ta.
'All of the students ran.'

c. (a) $\not\models$ (b); rather, (b) $\models$ (a)

On the other hand, *nan-nin-mo(-ga)* (2) is not universal. When a crowd of students ran, there may well be no junior runners. The entailment pattern (b) $\models$ (a) would not fail if *nan-nin-mo(-ga)* were purely universal.

(6) a. sannensē-wa nan-nin-mo(-ga) hasit-ta.
junior-TOP who-MO-NOM run-PAST
'Many juniors (in the college) ran.'

b. gakusē-wa nan-nin-mo(-ga) hasit-ta.
'Many students ran.'

c. (a) $\models$ (b); (b) $\not\models$ (a)

That the entailment relation between (a) and (b) goes the other way around[7] further indicates that *nan-nin-mo(-ga)* is unlikely to be a proportional quantifier like *most*. If many juniors ran, there are many students who ran, but if most of the juniors ran, there is no guarantee that they account for the majority of the students.[8]

Finally, both *dare-de-mo(-ga)* (3) and *nan-nin-de-mo(-ga)* (4) are judged to be downward monotonic with regard to restrictors (see (7) and (8)). Considering their free choice meanings, it is safe to conclude that their quantificational forces are universal.

(7) a. Kanto-no hon-wa nan-de-mo yon-da.
Kant-GEN book-TOP what-be-MO.ACC read-PAST
'I read any books written by Kant.'

b. tetugakusya-no hon-wa nan-de-mo yon-da.
'I read any books written by philosophers.'

c. (a) $\not\models$ (b); (b) $\models$ (a)

[7] Contra proportional quantifiers (e.g. *most* and *ōku-no* 'most of'), there is a way of reading to fix the relevant threshold θ so that (a) $\models$ (b) holds.

[8] That *nan-nin-mo(-ga)* is a weak quantifier (or at least has a weak variant; Milsark, 1974; Barwise and Cooper, 1981) is further supported by the fact that it appears in various existential constructions including the possessive construction: *Tarō-ni kodomo-ga* { *nan-nin-mo / # hotondo* } *i-ru* 'Taro has { many / # most } children.'

(8) a. Kanto-no hon-wa nan-satu-de-mo yon-da.
how.many-CL.volume-be-MO
'I read any number of books written by Kant.'

b. tetugakusya-no hon-wa nan-satu-de-mo yon-da.

c. (a) $\not\models$ (b); (b) $\models$ (a)

2.2 Some but Some Not

A second observation pointing to the different quantificational forces among wh$+$*mo* is the choice between normal and adversative conjunction.[9] In (9a),[11] the subject read every work of Goethe while (s)he didn't read *Faust*. The plain conjunction *yon-de* 'read and' sounds contradictory (marked by $\perp$). The adversative conjunction *yon-da-ga* 'read but' comes as an ex post rescue, arguably by eliminating *Faust* from the restrictor / domain of quantification. Thus there is no contradiction happening there. This difference between the *dare-mo-ga* and the *nan-nin-mo(-ga)* series is no mystery if we assume that the former is a universal and the latter is an existential quantifier.

(9) a. Gēte-no sakuhin-o nani-mo-kamo
Goethe-NOM work-ACC what-MO-kamo
yon-{ $^{\perp}$de / $^{??}$da-ga } Fausuto-wa yom-anakat-ta.
read-{ and / PAST-but } Faust-TOP.ACC read-NEG-PAST
'(S)he read every work by Goethe { $^{\perp}$and / $^{??}$but } didn't read *Faust*.'

b. Gēte-no sakuhin-o nan-satu-mo yon-{ de / da-ga } Fausuto-wa yom-anakat-ta.

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[9] A more straightforward substantiation, found after the conference, can be made by the test of tolerance (Horn, 2001, 237). For any predicate p, $\forall x.\, p(x) \wedge \forall x.\, \neg p(x)$ is contradictory ($\forall$ is intolerant) but $\exists x.\, p(x) \wedge \exists x.\, \neg p(x)$ is consistent ($\exists$ is tolerant). (i) exhibits an exact parallelism between $\forall$ / $\exists$ and *dare-mo* / *nan-nin-mo*.

(i) a. $^{\perp}$ Hanako-wa korerano hon-o nani-mo-kamo kat-{ te / ta-ga }
Hanako-TOP these book-ACC what-MO-kamo buy-{ and / PAST-but }
nani-mo-kamo kaw-azuni sumase-ta.
buy-without manage-PAST
'(S)he bought all of these books { and / but } she managed without (buying) them.'[10]

b. Hanako-wa korerano hon-o nan-satu-mo kat-{ $^{??}$te / ta-ga } nan-satu-mo kaw-azuni sumase-ta.
'(S)he bought many of these books { $^{??}$and / but } she managed without many (others).'

[11] The counterpart of *dare-mo-ga* for *nani* is *nani-mo-ka-mo(-ga)* rather than the simpler **nani-mo-ga*. Hiraiwa (2017) discusses this discrepancy.

‘(S)he read a lot of works by Goethe { and / but } didn’t read *Faust*.’

Dare-de-mo(-ga) (3) and *nan-nin-de-mo(-ga)* (4) both align to the case of *dare-mo-ga* (1). Space limitation prohibits detailed demonstration, but the facts can be easily reproduced.

3 Previous Studies

The last section established that *nan-nin-mo(-ga)* (2) is unique in that its quantificational force is existential. In fact, the observation that *nan-nin-mo(-ga)* is peculiarly existential is by no means a novel discovery. To the contrary, it is no more than a reiteration of what Kobuchi-Philip (2010, §3.2) presented and Oda (2012) thoroughly investigated.

That Kobuchi-Philip (2010)’s first stab on this issue proves to be not so successful is explicated by Oda (2012, §3.2; for details, refer to the literature). However, her alternative proposal is in fact still not quite satisfactory.[12] As she admits, neither does infinity invalidate a universal reading of wh+*mo*, nor does its absence facilitate it. (10) attributes the generic property *iki-o su-u* ‘breathe’ to all people of all time, where the number of human entities is arguably infinite. However, the infinity does not prevent *dare-mo-ga* from acquiring a universal force.

(10) Ningen-wa dare-mo-ga iki-o su-u.
human-TOP who-MO-NOM breath-ACC intake-NonPAST
‘All humans breathe.’

Further recall (9b) in the previous section, where the finiteness of the number of Goethe’s works does not make *nan-satu-mo* universal. It is thus clear that there must be another factor that distinguishes *nan-nin-mo* and the others.[13]

12 (iia) is her formulation, which is followed by her hedges (iib).

(ii) a. *Mo* is an existential quantifier when its sister denotes a set of scalar alternatives. Otherwise, it is a universal quantifier. (Oda, 2012, 311, (78))

b. [...] this might be because it is hard to obtain a situation where [the agent’s] reading every number of [the patient] is true, or it could be [...] nonsense. [It] could be also related to potentially undefined semantics when a universal quantifier quantifies into a set of scalar alternatives. [...] However, this is a very weak argument, since domains are usually restricted by context, and such a contextually defined upper limit would prevent such undefined meaning. (Oda, 2012, 311)

13 See also Mohri (2017) for other shortcomings of the existential analysis of the *nan-nin-mo* series in terms of (i) the **hitori-mo(-ga)* (one.person-MO) ‘even one’ constraint and (ii) the lexical vs. scope controversy on the semantics of scalar additive in general.

4 Another Path

So, how else can we tease apart the individual / numeral discrepancy? Whatever remains, however improbable, might be of help.

Fortunately, there is a difference between individuals and numerals that seems to be helpful. Let $p :: e \to t$ be an arbitrary predicate, $i_1, i_2 :: e$ be individuals, and $q_1, q_2 :: (e \to t) \to t$ be numeral quantifiers in the one-sided lower-bound reading.[14] There are some i_1, i_2 such that $p(i_1)$ and $p(i_2)$ do not entail each other. On the other hand, no q_1, q_2 can be so picked up that $q_1(p)$ and $q_2(p)$ are mutually independent. This means that alternative sets of individuals make a more sophisticated structure (either a sparse or a lattice structure) than those of numeral quantifiers (necessarily scalar or totally ordered). A way to take advantage of this property is to (i) assume an existential-based semantics for *mo* and (ii) somehow replicate its semantic effect only on sparse or lattice structures. To be precise, for any alternative set A and its subsets A', if there are some elements $a, b \in A'$ which are logically independent, we want to duplicate the effect of *mo* by applying *mo* to all such alternative sets, and if not, we do nothing. This manipulation can be encapsulated in a SAT (for "saturation") operator (11):

(11) Let O be a focus-sensitive operator, (a, A) an NP denotation (see (13) below) and its alternative set, and p, q fragments that together restore the predicate applied to a.
$\mathrm{SAT}(O)(a, A)(q)(p)$
$\stackrel{\text{def}}{=} O(a, A)(q)(p) \;\wedge\; \forall A' \subseteq A.\; \pitchfork (p \circ q, A') \to O(a, A')(q)(p),$
where $\pitchfork (r, A')$
$\stackrel{\text{def}}{=} \exists x, y \in A'. [r(x, A') \not\models r(y, A')] \wedge [r(y, A') \not\models r(x, A')].$

What comes as the alternative set A depends on the type of the NP. A natural assumption is as below:

[14] This chapter assumes that numerals in *nan-nin-mo(-ga)* and its non-wh counterpart n-*nin-mo(-ga)* have a lower-bounded, or "at-least" quantificational semantics. For arbitrary number n, n-*nin-mo(-ga)* is interpreted as a generalized quantifier $\lambda P_{e \to t}. \exists x_e, P(x) \wedge |x| = n$, where e is mereologically understood. (Note: this semantics can be derived from the predicative denotation using Partee's type-lifting maneuvers.)
Here are two remarks in favor of this "at-least" treatment. First, the mirativity of n-*nin-mo(-ga)* must concern the largeness of the number but not anything else (smallness, evenness, etc.). Thus n-*nin-mo(-ga)* cannot be used in expressing propositions such as *# kono tippu-no gē-to-haba-wa go-miri-mo aru* 'the gate pitch of this microchip is as much as 5mm' (when emphasizing excellence in chip manufacturing processes, in which narrower is better) and *# gosyūgi-wa yonsen'en-mo at-ta* 'the amount of the wedding gift is as much as 4,000 JPY' (mirativity is intended on the breach of a commonsense among Japanese people that even numbers must be avoided for wedding gifts). Entailment naturally fits in the role of confining interpretations. Second, a close variant of n-*nin-mo(-ga)*, i.e. n-*nin-mo(*-ga)* '(no) more than', is negation-sensitive. Numeral expressions in the "exact" reading (or those of the predicative variant) fail to facilitate the correct semantic output in negative environments (cf. the numeral+*de-mo* cases in Footnote 18).

(12) a. For individual NPs, $A = D_e = \{\text{john}, \text{mary}, \dots\}$.

b. For numeral NPs,
$$A = D_\sigma = \left\{ \begin{array}{l} \lambda p_{e \to t}.\, \exists D' \subseteq D_e. \\ \qquad |D'| = n \land \forall i \in D'.\, p(i) \end{array} \middle| \begin{array}{l} n \in \mathbb{N}, \\ n \leq |D_e| \end{array} \right\}.$$

The standard semantics of *mo* is a focus-sensitive one (Nakanishi, 2006) with an existential presupposition (ExistsP) and a scalar presupposition (ScalarP). Here is an opinionated implementation:[15]

(13) For any individual or numeral NP α, $[\![\alpha]\!]^{M,w,g} = (a, A)$, where a is the content of the NP (either of type e or type $(e \to t) \to t$) and A is its (contextually determined) alternative set.

(14) Let V be some degree predicate and θ a contextually given threshold.
$[\![[_\beta \dots \alpha_i \dots]\text{-mo}_i]\!]^{M,w,g}$
$= [\![\text{-mo}]\!]([\![\alpha]\!]^{M,w,g})(q := \lambda x.\, [\![[_\beta \dots g(i) \dots]]\!]^{M,w,g[i \mapsto x]}) = \lambda p.$

a. $(p \circ q)(a)(w)$ (prejacent)

b. $\land\, \exists b \in A.\, (p \circ q)(b)(w) \land [(p \circ q)(b) \not\models (p \circ q)(a)]$ (ExistP)

c. $\land\, V((p \circ q)(a)) > \theta$ (ScalarP)

When *mo* is fed to SAT, the semantic effect of *mo* is duplicated over $\pitchfork$-compliant subsets of alternatives. As to the question of where to locate SAT, I take a lexicalist stand and attribute it to wh-indeterminates because the universality / existentiality discrepancy happens just in cases of wh-indeterminates.

Wh-indeterminates, translated to a tuple $(\star, (A^\uparrow)^{\vee\wedge})$, will play a double role: (i) the SAT effect abovementioned and (ii) an underspecificational $\star$ that

[15] Our ExistP and ScalarP in (14) are remote from Karttunen and Peters (1979) and its application to *mo* (Nakanishi, 2006). Instead of expatiating my intention, which would require many pages, I will briefly mention three considerations that support this analysis. First, an explicit degree semantics using V and θ in the ScalarP better reflects its nature that the threshold θ is contextually determined and consistent throughout discourse segments (cf. Greenberg 2019). Second, *mo* does not require any mirativity of the antecedent. Suppose that Rafael Nadal and Noam Chomsky (and nobody else) won prizes in some tennis tournament. It is fine to utter *Tyomusukī-mo nyūsyō sita-noka!* 'Even Chomsky won a prize!' (counted as a pure additive with optional mirativity) without any surprise at Nadal's winning a prize. The same point is shown by *ringo-o gohyaku-ikko-mo syūkaku sita* 'harvested as many as 501 apples' in situations where harvesting 500 apples were below one's expectation. Hence, antecedency conditions must be tangibly separated from mirativity ones (contra Greenberg, 2017, §2.2). Finally, non-equality (or logical independence) between the focus a and the antecedent alternative b is insufficient to account for the numeral+*mo* case. **Hitori-mo(-ga)* (one.people-MO-GA) is unacceptable (unless it is taken as a minimizer, with a flat accent pattern), but its ungrammaticality must hinge on the fact that it is the weakest in terms of entailment. Hence, it cannot be the case that antecedent $\models$ focus. Consideration must also be made that no entailment relation is available for the pure additive *mo* for obvious reasons. Therefore, the appropriate formulation is antecedent $\not\models$ focus. (A final note: (14) does not need separate compositional dimensions for ExistP and ScalarP. The continuative or type-lifting λp takes on projective jobs instead.)

can be incarnated as anything in the type-raised and $\vee\wedge$-closed alternative set

$$(A^{\uparrow})^{\vee\wedge} \stackrel{\text{def}}{=} \left\{ \lambda q, p.\ \bigwedge_{a' \in A'} (p \circ q)(a') \;\middle|\; A' \subseteq (A^{\uparrow})^{\vee} \right\}$$

where

$$(A^{\uparrow})^{\vee} \stackrel{\text{def}}{=} \left\{ \lambda q, p.\ \bigvee_{a' \in A'} (p \circ q)(a') \;\middle|\; A' \subseteq A \right\}.$$

Candidates for $\star$ will be filtered out after the semantic derivation if they result in semantic anomaly.

(15) $[\![\text{wh}]\!]^{M,w,g} = \lambda O.\ \mathrm{SAT}(O)(\star, (A^{\uparrow})^{\vee\wedge})$

5 Predictions

5.1 The Individual Wh+*mo*

(1) zyū-min-wa dare-mo-ga raizyō si-ta.

(lit.) 'As for the residents, all of them attended.'

$$\begin{aligned}
&\overset{M,w,g}{\rightsquigarrow} \mathrm{SAT}([\![\text{-mo}]\!])(\star, (D_e^{\uparrow})^{\vee\wedge})(\mathrm{id})(\lambda(a, _).\ \mathrm{attend}(a)(w)) \\
&\quad = [\![\text{-mo}]\!](\star, (D_e^{\uparrow})^{\vee\wedge})(\mathrm{id})(\lambda(a, _).\ \mathrm{att}(a)(w)) \qquad \cdots\cdots \text{(A)} \\
&\qquad \wedge \forall A' \subseteq (D_e^{\uparrow})^{\vee\wedge}. \\
&\qquad\quad \pitchfork ((\lambda(a, _).\ (\mathrm{att} \circ \mathrm{id})(a)(w)), A') \\
&\qquad\quad \rightarrow [\![\text{-mo}]\!](\star, A')(\mathrm{id})(\lambda(a, _).\ \mathrm{att}(a)(w)) \qquad \cdots\cdots \text{(B)}
\end{aligned}$$

SAT retains the original semantic contribution of *-mo* (14) as the (A) part and at the same time multiplies this contribution over $\pitchfork$-compliant subsets of the individual alternative set $(D_e^{\uparrow})^{\vee\wedge}$ (the (B) part). Below is the result of the application and expansion of SAT and $[\![\text{-mo}]\!]$ in each part.

$$\begin{aligned}
\text{(A)} = {} & \star(\mathrm{att})(w) \wedge \exists b \in (D_e^{\uparrow})^{\vee\wedge}.\ b(\mathrm{att})(w) \wedge [b(\mathrm{att}) \not\models \star(\mathrm{att})] \qquad \cdots \text{(ExistP)} \\
& \wedge V(\star(\mathrm{att})) > \theta \qquad \cdots\cdots \text{(ScalarP)}
\end{aligned}$$

(B) =For any $\pitchfork$-compliant subset A',

$$\begin{aligned}
& \star(\mathrm{att})(w) \wedge \exists b \in A'.\ b(\mathrm{att})(w) \wedge [b(\mathrm{att}) \not\models \star(\mathrm{att})] \qquad \cdots \text{(ExistP)} \\
& \wedge V(\star(\mathrm{att})) > \theta \qquad \cdots\cdots \text{(ScalarP)}
\end{aligned}$$

It can be shown that the underspecification $\star$ is eventually identified as $\forall$.[16]

[16] **Proposition**: Let α and β be an arbitrary type, $A :: \mathrm{Set}(\alpha)$, $|A| \geq 2$, $\star \in (A^{\uparrow})^{\vee\wedge}$, $p :: \beta \rightarrow t$, and $q :: \alpha \rightarrow \beta$. Licit candidates of $\star$ in $\mathrm{SAT}([\![\text{-mo}]\!])(\star, (A^{\uparrow})^{\vee\wedge})(q)(p)$ must be either $\lambda q, p.\ \bigwedge_{y \in A}(p \circ q)(y)$ or $\lambda q, p.\ \bigwedge_{y \in A \setminus \{x\}}(p \circ q)(y)$ for an arbitrary $x \in A$.
Proof: Harrison et al. (2015, 23) guarantee that disjunctive normal forms can be made of infinitary propositions, assuming that the number of arguments m is finitely bounded and that the size

5.2 The Numeral Wh$+$*mo*

(2) zyū-min-wa nan-nin-mo-ga raizyō sita.

(lit.) 'As for the residents, many of them attended.'

$$\begin{aligned}
&\overset{M,w,g}{\rightsquigarrow} \mathrm{SAT}(\llbracket\text{-mo}\rrbracket)(\star, (D_\sigma^{\uparrow})^{\vee\wedge})(\mathrm{id})(\lambda(a, _).\, \mathrm{att}(a)(w))\\
&\quad = \llbracket\text{-mo}\rrbracket(\star, (D_\sigma^{\uparrow})^{\vee\wedge})(\mathrm{id})(\lambda(a, _).\, \mathrm{att}(a)(w)) && \cdots\cdots(\mathrm{A})\\
&\qquad \wedge \forall A' \subseteq (D_\sigma^{\uparrow})^{\vee\wedge}.\\
&\qquad\quad \pitchfork((\lambda(a, _).\, (\mathrm{att} \circ \mathrm{id})(a)(w)), A')\\
&\qquad\quad \to \llbracket\text{-mo}\rrbracket(\star, A')(\mathrm{id})(\lambda(a, _).\, \mathrm{att}(a)(w)) && \cdots\cdots(\mathrm{B})
\end{aligned}$$

The idiosyncractic existentiality of *nan-nin-mo(-ga)* comes from the fact that no $\pitchfork$-compliant subset can be obtained from $(D_\sigma^{\uparrow})^{\vee\wedge}$. For any two distinct numbers n and m and an arbitrary predicate p, either $[\exists D' \subseteq D_e.\, |D'| = n \wedge \forall i \in D'.\, p(i)] \models [\exists D' \subseteq D_e.\, |D'| = m \wedge \forall i \in D'.\, p(i)]$ or vice versa, and crucially, this time, the $\vee\wedge$-closure does not append any substantial higher-order alternatives. As a result, the (B) part is vacuous and the underspecificational $\star$ can be anything as long as the (A) part satisfies other constraints. Among these are ExistP (14b), which excludes the number one (thus **hitori-mo-ga* (1-MO-NOM)), and the mirative interpretation, which is obligatorily evoked in the case of numeral$+$*mo*, arguably for good reasons.[17]

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of propositional signatures is at most $\Sigma_{i=0}^{m}(|D_{e^i \to t}| \cdot |D_e|^i)$. The proposition $\star(p \circ q)$ will fall on the set $\mathscr{F}_1$.

[The case $\star = \lambda q, p.\, (\bigwedge_i (p \circ q)(x_i)) \vee (\bigwedge_i (p \circ q)(y_i))$ for arbitrary $x_i, y_i \in A$] The sub-alternative set $A' = \{\bigwedge_i (p \circ q)(x_i), \bigwedge_i (p \circ q)(y_i)\}$ satisfies $\pitchfork (p \circ q, \_)$ (if not, one of the disjuncts in $\star$ can be eliminated and $\star$ is reduced to the next, simpler case). Neither $\bigwedge_i (p \circ q)(x_i)$ nor $\bigwedge_i (p \circ q)(y_i)$ can satisfy ExistP in (14b) since $\bigwedge_i (p \circ q)(x_i) \models \star(p \circ q)$ and $\bigwedge_i (p \circ q)(y_i) \models \star(p \circ q)$. Thus the whole proposition ends up being contradictory.

[The case $\star = \lambda q, p.\, \bigwedge_{y \in X} (p \circ q)(y)$ where there are distinct $z_1, z_2 \in A$ such that $z_1, z_2 \notin X$ and $(p \circ q)(z_1)$ and $(p \circ q)(z_2)$ are logically independent] One of the spoiling sub-alternative sets is $\{z_1 \wedge \bigwedge_{y \in X} (p \circ q)(y), z_2 \wedge \bigwedge_{y \in X} (p \circ q)(y)\}$. $\square$

An unfortunate fact is that $\lambda q, p.\, \bigwedge_{y \in A \setminus \{x\}} (p \circ q)(y)$ (for an arbitrary $x \in A$) is not ruled out since no spoiling sub-alternative set that is $\pitchfork$-compliant can be found. To avoid this "last one mile" problem, it is inevitable to resort to some kind of quantificational simplicity such as the monotonicity in Steinert-Threlkeld and Szymanik (2019).

17 Kobuchi-Philip (2008b, 501–502) follows Nakanishi (2006, 151) and Nakanishi (2009) which suggest that "being in terms of entailment is a sufficient condition for being less likely". In our settings (14), some constraints need to be postulated to disallow vacuous V in ScalarP whenever the antecedency of ExistsP can be vacuously met ("avoid vacuity"). This complication is destined since we advocate a unified treatment of individual$+$ and numeral$+$*mo* and the particular lexical analysis (14) (with the argumentations in Footnote 15), in which ScalarP is totally severed from additive antecedents.

5.3 The *-de-mo* Cases

With the assumptions that *-de* is the adverbial form of the copula *da* / *de-aru* and that both individuals and numerals are exhaustified at the adjacent position of that copula,[18] our theory makes the correct prediction that the quantificational forces in (3) and (4) are both universal.[19]

Limitations of space allow us to only demonstrate the semantics of *nan-nin-de-mo(-ga)* (4); but in fact the yield from (3) is essentially no different from this.

(4) zyū-min-wa nan-nin-de-mo(??-ga) raizyō si-ta.

(lit.) 'As for the residents, any of them attended.'

$$\overset{M,w,g}{\rightsquigarrow} \mathrm{SAT}(\llbracket\text{-mo}\rrbracket)(\star, D_\sigma)(\lambda(a,A).\,\mathrm{exact}(a,A;\mathrm{BE}(a)(x'))) \begin{pmatrix} \lambda\mathcal{Q}.\,\mathcal{M} \\ \quad\big(\lambda(w',x').\,w' \in \mathrm{Best}_{w,\mathrm{OS},\mathrm{MB}\cup\{\mathcal{Q}\}}\big) \\ \quad(\lambda(w',x').\,\mathrm{att}(x')(w')) \end{pmatrix}$$

$$= \llbracket\text{-mo}\rrbracket(\star, D_\sigma)(\lambda(a,A).\,\cdots)(\lambda\mathcal{Q}.\,\mathcal{M}(\cdots)(\cdots)) \quad \cdots\cdots\text{(A)}$$
$$\wedge\, \forall A' \subseteq D_\sigma.\ \pitchfork((\lambda(a,A).\,\mathcal{M}(\cdots)(\cdots)), A')$$
$$\to \llbracket\text{-mo}\rrbracket(\lambda(a,A).\,\cdots)(\lambda\mathcal{Q}.\,\mathcal{M}(\cdots)(\cdots)) \quad \cdots\cdots\text{(B)}$$

where $\mathrm{exact}(a,A;p) \overset{\text{def}}{=} p(a) \wedge \forall a' \in A.\,[p(a) \not\models p(a')] \to \neg p(a')$, $\mathrm{BE}(q \coloneqq \lambda P, w'.\,\exists x'.\,|x'| =_{w'} n \wedge P(x')(w'))(x)(w)$ $\overset{\text{def}}{=} [q(\lambda x'', w''.\,x'' =_{w''} x)(w)] = [|x| =_w n]$, and $\mathcal{M}$ is some modal operator determined by the given sentence. If there is none available

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[18] The strategy here is to begin with an "at-least" type quantificational semantics of numerals, which are to be exhaustified by the exact operator later in the course of composition (for the facts, refer to Rhie (2010, 53, §4.2)). A quick note should be added that the exact operator is different from scalar implicature (or the Foxian / Chierchian grammaticalized exh) in that (i) the effect is two-sided, as in *gakuse-wa go-nin-da* 'The number of the students is exactly five (rather than six or four)', and that (ii) the effect survives in downward environments, as in *gakusei-wa go-nin-zya-nai* 'The number of the students is not five (may be six or four)' (answering one of the referees).
Admittedly, there is a much more promising alternative in which numerals followed by a copula are the basic form of (all) numeral expressions, whose semantics is predicative ($\lambda x, w.\,|x| =_w n$). If this is the case, the mutual non-entailment of two numeral "predicates" comes for free. Our fundamental ideas are still alive; instead of the (non-)existence of the exact operator, we can attribute the difference of *nan-nin-mo(-ga)* and *nan-nin-de-mo(-ga)* to their different overall semantic gain, the former of which is logically totally ordered while the latter is mutually independent.

[19] In particular, this chapter adopts the idea of Oda (2021), Nakanishi (2021), and Hiraiwa and Nakanishi (2021) that *-de-mo* is in fact a phonetically contracted unconditional. Instead of Oda (2021, 303, (61))'s E-type analysis using free variables, this chapter implements donkey anaphora in a more structural way, treating them as a collateral λ-abstraction that depends upon world-variable abstractions.

(i.e. the sentence is episodic), a cover modal operator fills in.[20] OS, MB, and Best stand for an ordering source, a modal base, and the operator yielding best worlds, respectively.

Crucially, for any two numbers n and m, the propositions made of n-*nin-de-mo* and of m-*nin-de-mo* do not entail each other. Hence, SAT comes to require that $\star$ be logically non-weaker than either of them. Among the simple quantifiers, the only candidate for $\star$ is $\lambda P, w. \forall n \in \mathbb{N}. P(\lambda P', w'. \exists x'. |x'| =_{w'} n \wedge P'(x')(w'))$. This means that for *every* number n, in every (or some) optimal world w' where there is some residents x' of size n, x' attended. This outcome renders *nan-nin-de-mo(-ga)* universal.

6 Conceptual Remarks

The proposal made here is novel and unique in the following three respects. First, the semantic uniformity of *-mo* (arguably including the pure additive) as an existential is maintained.[21] Second, wh-elements here are more sophisticated than many previous studies.[22] Third, the schema $\exists b \in A. \cdots \wedge p(b) \not\models \star(p)$ (14b) is a revival of Gil (1995, 341–342) and Kobuchi-Philip (2009, 11), but this time with an extension to the case of the numeral+*mo*.

The anti-scale condition $\pitchfork (p, A)$ in SAT (11) has an inquisitive connection (Ciardelli et al., 2019). Our claim can be paraphrased as: Universality obtains only if the relevant alternative set is inquisitive. This reminds us of Fox (2007)'s innocent exclusion[23] and the licensing condition of mention-

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20 The flavor of the filling-in modal $\mathcal{M}$ in episodic propositions can be, for example, conceptual depedencies that cannot be reduced to factual information (Jayez and Tovena, 2005, 43–) or causality (Panaitescu, 2018). Whichever choice it is, it is necessary that $\mathcal{M}$ have some ingredients that make commitments on the actual world. Thus $\mathcal{M}$ must be based on the following template: $\mathcal{M}(p_1)(p_2) = \exists x. p_2(x)(w) \wedge \mathcal{M}'(p_1)(p_2)$, where $\mathcal{M}'$ is either a possibility or a necessity modal operator. Cf. von Fintel (2000)'s Analysis I, in which ιx is used instead of $\exists x$.

21 This existential standpoint is in accordance with Xiang (2020, 197–) (and references therein), where *even* is treated as an $\exists$, but goes against Shimoyama (2006, 523–) and Ohno (1989, (30)) among others.

22 In other studies, wh-elements are mere variables (Nishigauchi, 1990 inter alia) pointed sets (Kratzer and Shimoyama, 2002 inter alia), reduced conjunctions (Numata, 2009, 154–155), Lahirian predicates (weakest predicates; Kuno, 2010), and Fox-Chierchian underlyings ($\exists$ + covert D-exh; Mitrović, 2014, 267–; Balusu, 2017, §3.2; Erlewine, 2019). A particular problem of postulating $\exists$ for wh-elements is that (i) it leaves no way to address the universal nature of the NPI *dare-mo(*-ga)* (Shimoyama, 2011). Besides, (ii) these studies say few things about the cases of numeral+*mo* and numeral+*de-mo*, and (iii) they obscure the possibility that *mo*, being an additive ("not only but also"), reveals the double exhaustification exh $\circ$ exh in an overt way.

23 Among Sauerland alternatives $\{A, B, A \wedge B\}$, IE excludes only $A \wedge B$ after collecting all the subsets of the alternative set that can be all negated away (safely) and then taking an intersection out of the qualified sets. Apparently, the qualified subsets $\{A, A \wedge B\}$ and $\{B, A \wedge B\}$ are inquisitive together.

some questions (Xiang, 2016, Ch. 2–3).[24]

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[24] Mention-some questions allow non-maximal answers, and these answers are inquisitive together (e.g. *Where can you buy newspapers?* — { *At the kiosk. / From this guy over there. / ...* }). Interestingly, no mention-some answer is allowed to the question *How fast can you drive on this highway?* (Fox, 2013, (22b)), in which the wh-expression is a numeral and its alternatives fail to be inquisitive.

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