

## Simulative plurality and the nature of alternatives\*

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**Abstract** This paper investigates the properties of simulative plurals, focusing on *m-reduplication* in Persian and *-toka* and *-tari* in Japanese. Although these expressions are associated with what I refer to as a *non-homogeneous plural inference* in upward-entailing contexts, I demonstrate that this inference is not an entailment of sentences with these morphemes, but is merely implicated, much like the multiplicity condition associated with English bare plurals (Krifka 2003; Spector 2007; Zweig 2009; de Swart & Farkas 2010). I propose an analysis of simulative plurals as *mereological mixtures* of a set with a set of contextually similar objects, and derive the non-homogeneous plural reading via scalar implicature. I demonstrate that deriving this implicature requires both the calculation of implicature at a subsentential level (Chierchia 2004; Chierchia 2006; Zweig 2009) and appeal to an abstract alternative (Buccola, Kriz & Chemla 2022; Charlow 2019). This latter point provides a challenge for theories of alternative generation based on structural replacements and deletions (Katzir 2007).

**Keywords:** simulative plurality, implicature, abstract alternatives, Persian, Japanese

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In this paper, I analyze the semantic properties of *similative plurals*, focusing on *m-reduplication* in Persian and the morphemes *-toka* and *-tari* in Japanese as case studies. The major empirical result of the paper is that the non-homogeneous plural inference associated with these expressions — that the expression refers to a plural entity composed of at least one entity in the denotation of the bare nominal to which reduplication is applied, and at least one entity that is in some sense similar to that kind of object — is not *entailed* by reduplication, but merely *implicated*. I propose an analysis of similative expressions as *mereological mixtures* — the set of objects derived by summing the objects in two sets (Heycock & Zamparelli 1999, Heycock & Zamparelli 2000, Champollion 2016) — of the set denoted by the bare nominal with the set of things similar to it. The analysis further takes into account some interspeaker variation in judgments about the meaning of m-reduplication in downward-entailing and question contexts, proposing slightly different mixture operations for what I refer to as *partially inclusive* and *fully inclusive* speakers. I then derive the non-homogeneous plural reading as a scalar implicature.

The analysis has implications for the theory of implicature calculation, as well as for the theory of alternatives. In particular, the analysis calls for the calculation of the implicature below the site of existential closure of the event variable, and is thus a case of *subsential implicature calculation* (Landman 2000; Chierchia 2004; Zweig 2009). Furthermore, the analysis of one set of speaker's judgments calls for the use of an *abstract alternative*, one that does not correspond to any lexical item of the language (Chemla 2007; Buccola, Kriz & Chemla 2022; Charlow 2019). This alternative cannot be derived via a series of deletion and replacement operations on the structural representation of the sentence under evaluation, and thus poses a problem for the structural theory of alternatives (Katzir 2007). I propose, in line with recent research on alternatives, that the required alternatives be derived from the conceptual representation of the expression, with possible alternatives being constrained by their *primitiveness* (Buccola, Kriz & Chemla 2022). The resulting picture is markedly at odds with (Neo-)Gricean approaches to implicature (Grice 1975, Geurts 2010), but compatible with grammatical approaches to implicature (Chierchia, Fox & Spector 2012) and approaches to alternatives that go beyond the lexical resources of any given language (Chemla 2007, Charlow 2019, Buccola, Kriz & Chemla 2022).

The paper is structured as follows. First, I detail the properties of Persian m-reduplication, discussing its behavior in upward-entailing contexts.

Second, I reveal the sensitivity of the interpretation of m-reduplication to the direction of entailment, showing that it possesses inclusive readings in downward-entailing and question contexts. I further demonstrate that establishing speaker ignorance is enough to eliminate the non-homogeneous reading even in upward-entailing contexts. Third, I develop the mixture semantic analysis of m-reduplicated nominals, as well as a pragmatic analysis of the derivation of the non-homogeneity inference as a scalar implicature. I also discuss here how the phenomena pose a challenge for global calculation of the implicature and for structural approaches to alternatives. Fourth, I turn to the Japanese similative morphemes *-toka* and *-tari*, demonstrating their major similarities to Persian m-reduplication while also discussing some differences between the two types of expression. I then extend the analysis of Persian m-reduplication to the Japanese cases, and demonstrate how it improves on previous work on the topic (Smith & Kobayashi 2018, Smith 2019). Finally, I discuss some implications of the current analysis, as well as areas for future research.

## 1 M-reduplication in Persian

Persian<sup>1</sup> possesses a type of full root reduplication, termed m-reduplication in other languages with a similar construction, and further termed a *similative plural* by Armoskaite & Kutlu 2013, which applies to nouns to create a *non-homogeneous* plural: that is, the plurality is understood to include objects with a property distinct from that of the overtly mentioned object (Nakanishi & Tomioka 2004). (1), for instance, is judged true if and only if Mohsen read at least one book, as well as something else similar to a book in the context, such as a magazine.

- (1) Mohsen ketâb metâb xund  
 Mohsen book RED read.PST  
 ‘Mohsen read a book and other such things’

(1) is judged infelicitous if only one book was read, if only books were read, or if only a magazine or something else similar to a book was read (with one important exception, to be discussed later). For the first two situations, the non-reduplicated bare plural is used, as exemplified in (2).

<sup>1</sup> The judgments reported in this paper come from 10 native speakers of Iranian Persian, the most widely studied variety of the Persian language (Windfuhr 2009). 8 of the speakers I consulted are from the capital city, Tehran. 2 speakers are from other cities: Isfahan in central Iran, and Mashhad, in northeastern Iran.

- (2) Mohsen ketâb xund  
 Mohsen book read.PST  
 ‘Mohsen read (one or more) books.’

The interpretation of an m-reduplicated noun is to a certain extent context-dependent: (1) may be interpreted as referring to a set of reading material. In this case, *ketâb metâb* will refer to the set of reading materials similar to a book, such as a magazine or comic book, but will exclude, for instance, on-line reading material such as Wikipedia pages. It could also be interpreted as types of entertainment: *ketâb metâb* might then be taken to refer to books, movies, and other pastimes involving fiction, but might exclude such things as board games. Whatever general category is selected in the context, it will always be centered on the sorts of objects denoted by the head in the reduplication.

In addition to appearing bare and receiving an existential interpretation, m-reduplicated nominals can also be quantified (3) and made definite (4). (3) is interpreted as meaning that Mohsen read two things, one of which was a book and the other of which was something similar. (4) means that Mohsen read the set of objects known to both speaker and hearer, which is composed of one or more books and one or more book-like things.

- (3) Mohsen do tâ ketâb metâb xund  
 Mohsen two CL book RED read.PST  
 ‘Mohsen read two things, one a book, the other book-like.’
- (4) Mohsen ketâb metâb -hâ -ro xund  
 Mohsen book RED -SP.PL -DOM read.PST  
 ‘Mohsen read the book and book-like things.’

NPs headed by m-reduplicated nouns have several properties that suggest that they behave like plural expressions. First, they are compatible with collective predicates. This is shown in (5), which is true as long as Mohsen collects at least one flower as well as at least one flower-like thing, in this context other types of plant matter such as leaves or sticks.

- (5) Mohsen gol mol jam’ kard  
 Mohsen flower RED collection do.PST  
 ‘Mohsen collected flowers and other such things.’

Second, NPs with m-reduplicated heads cannot be marked with the differential object marker *-ro*, a case marker that only appears on direct objects that

are in some sense definite or specific, unless the specific plural marker *-hâ* is also present.<sup>2</sup>

- (6) \*Mohsen ketâb metâb -ro xund  
 Mohsen book RED -DOM read.PST  
*Intended:* ‘Mohsen read the one book and bookish thing.’
- (7) Mohsen ketâb metâb -hâ -ro xund  
 Mohsen book RED -SP.PL -DOM read.PST  
 ‘Mohsen read the book and book-like things.’

Intuitively, the reason (6) is unacceptable is that bare nominals marked by *-ro* are definite and *singular*; this effect can be observed in (8). M-reduplicated nominals, being plural, are incompatible with this construction, and require the presence of an additional marker.

- (8) Mohsen ketâb -o xund  
 Mohsen book -DOM read.PST  
 ‘Mohsen read the book.’

Thus far, it appears reasonable to treat NPs involving m-reduplication as involving reference to non-homogeneous plural entities; for example, a noun like *ketâb metâb* would denote a set of sum individuals such that each individual contains at least one book as a part, as well as at least one thing similar to a book in the context, and nothing else, as in (9), where ‘b’ represents an individual book, ‘m’ represents an individual magazine, and ‘c’ represents an individual comic book.

- (9)  $[[ketâb\ metâb]] = \{b \oplus m, b \oplus c, b \oplus m \oplus c, \dots\}$

Although this analysis is straightforward, in the next section I will provide evidence that things are not as simple as they seem.

## 2 M-reduplication does not entail non-homogeneity or plurality

There is evidence that suggests that m-reduplicated nominals do *not* denote non-homogeneous sum individuals, as (9) suggests. In fact, in many semantic environments, m-reduplicated nominals are compatible not only with non-homogeneous plural interpretations, but also with homogeneous

<sup>2</sup> The contribution of *-hâ* has been analyzed as a kind of maximality operator on plural nouns. See [Jasbi 2014](#) for an analysis along these lines.

plural and singular interpretations as well. These environments are generally downward-entailing or non-monotone, and include negation, conditionals, polar questions, and imperatives. Furthermore, even in upward-entailing environments, m-reduplicated nominals may have singular or homogeneous plural readings if speaker ignorance is established pragmatically. I go through these cases in turn in the following subsections.

Before beginning the discussion, a few remarks on variation are in order: although all speakers agree on the interpretation of m-reduplication in upward-entailing environments not involving speaker ignorance, some interspeaker variation emerges in the interpretation of downward-entailing and non-monotonic environments. Specifically, as I show below, some speakers interpret an m-reduplicated nominal like *ketâb metâb* in a non-upward-entailing context as meaning something like ‘at least one book, and possibly something similar.’ Other speakers also permit m-reduplication to denote something from the set of objects similar, but not identical, to the set denoted by the bare noun; for these speakers, *ketâb metâb* in a non-upward-entailing context has the more inclusive meaning ‘at least one book or at least one thing similar to a book.’ In what follows, I refer to the first set of speakers as *partially inclusive speakers*, and to the second set of speakers as *fully inclusive speakers*.<sup>3</sup> Fully inclusive speakers form the majority of my consultants (7/10), but the partially inclusive speakers systematically reject the interpretations allowed by fully inclusive speakers below. I have therefore chosen to present both sets of judgments in the following sections and ultimately to provide both with separate, but closely related, analyses.

## 2.1 Non-upward-entailing environments

We start with non-upward-entailing environments. First, consider the negation in (10). Here, the speaker is understood to mean not that they simply did not read books *and* similar things, but rather that they did not read *any* books *or* things like that.

- (10) man ketâb metâb na- xund -am  
 I book -RED NEG- read.PST -1.SG

**Partially inclusive:** ‘I didn’t read books’

**Fully inclusive:** ‘I didn’t read books or anything like that’

<sup>3</sup> This terminology presages the analysis of m-reduplication in terms of partially and fully inclusive mixtures beginning in section 3.

Next, we consider conditionals. In (11), the addressee may tell the speaker even if she ate only one or more apples. For some speakers, the addressee may tell the speaker even if she did not eat an apple, but a similar fruit. She need not have eaten, say, an apple *and* an orange for the use of m-reduplication to be felicitous.

- (11) age sib mib mi- xor -i, be man be- gu!  
 if apple RED IMP- eat.PRS -2.SG to 1.SG SUBJ- say

**Partially inclusive:** ‘If you eat an apple (and possibly something else like that), tell me!’

**Fully inclusive:** ‘If you eat an apple or something like that, tell me!’

We find the same sort of behavior with polar questions. In (12), an affirmative response to the question is possible even if the one answering the question only ate one or more apples and nothing else. Again, for some speakers, an affirmative response is possible even when the answerer ate just something similar to an apple, such as an orange.

- (12) a. emruz sib mib xord -i?  
 today apple RED eat.PST -2.SG  
 ‘Did you eat an apple or something like that today?’  
 b. Âre, ye sib / do tâ sib / ye porteqâl xord -am  
 yes one apple / two CL apple / one orange eat.PST -1.SG  
 ‘Yes, I ate an apple/two apples/an orange.’

The final example we consider involves imperatives. As can be seen in (13), a felicitous way to comply with an imperative containing an m-reduplicated nominal like *sib mib* would be eating an apple, eating two apples, or, for some speakers, eating a similar type of fruit, such as an orange.

- (13) sib mib bo- xor!  
 apple RED SUBJ- eat

**Partially inclusive:** ‘Eat an apple (and possibly something else like that)!’

**Fully inclusive:** ‘Eat an apple or something like that!’

All of this suggests that the non-homogeneity inference associated with m-reduplication in Persian is not entailed, but is actually derived via implicature. In this way, m-reduplication exhibits properties in common with English bare plurals, which have readings that exclude non-atomic individuals in upward-entailing contexts but readings that *include* them in non-upward-

entailing contexts like the cases above (see [Krifka 2003](#); [Spector 2007](#); [Zweig 2009](#), a.o.).

## 2.2 Ignorance contexts

Even in upward-entailing contexts, it is possible to interpret m-reduplication as not being restricted to non-homogeneous plurals, as long as speaker ignorance is established by the context.

- (14) CONTEXT: You see Roya carrying a small lunchbox, in which she usually keeps an apple for an afternoon snack, but sometimes brings some other kind of fruit. You don't know exactly how many she has in the box (and are not entirely sure what kind of fruit it is).

Royâ sib    mib dâr        -e  
Roya apple RED have.PRS -3.SG

**Partially inclusive:** 'Roya has at least an apple (and maybe something else like that)'

**Fully inclusive:** 'Roya has an apple or something like that.'

Here, the speaker is not committed to Roya having more than one apple, nor are they committed to her having anything but apples. In fact, some speakers are not even committed to Roya having an apple in the first place. For these speakers, she could just have some other kind of small round fruit, such as an orange.

We find a parallel with the behavior of English bare plurals here too. [De Swart & Farkas \(2010\)](#) note that bare plurals can be used in contexts in which some number of entities is known to exist, but for which there is not enough evidence to establish how many entities there are. In these cases involving ignorance, a plural may be used when the speaker does not know whether or not there is more than one object, just like in the m-reduplicated example above.

- (15) Inclusive reading of bare plurals with ignorance ([de Swart & Farkas 2010](#): p. 30)
- a. CONTEXT: Speaker walks into basement and notices mouse droppings]  
Aghhh, we have micel!



- b. CONTEXT: Speaker walks into unknown house and notices toys littering the floor  
There are children in this house.

All of this goes to show that the non-homogeneous plural inference observed in Persian m-reduplication is much like the multiplicity inference associated with English bare plurals: it is sensitive to the monotonicity of the semantic environment it is in, and also vanishes in more global pragmatic contexts establishing speaker ignorance, even in semantic contexts in which the inference would otherwise be expected to arise. In the following section, I pursue an analysis further connecting m-reduplication to English bare plurals involving scalar implicature.

### 3 Analysis

My analysis consists of two components. The first component is semantic, and is the proposal that m-reduplication denotes a *mereological mixture* of the set denoted by the bare nominal and a set of objects that are similar to that bare nominal in the context. The exact type of mixture denoted by m-reduplication will depend on the speaker: for some speakers, the mixture is *fully inclusive*, while for others it is only *partially* so. I will elaborate on the precise formulation of these terms in the following subsection.

The second component of the analysis is pragmatic. Taking the unenriched meaning of an m-reduplicated nominal, the non-homogeneous plural reading of m-reduplication is derived from a partially or fully inclusive interpretation via scalar implicature, yielding an *exclusive mixture* interpretation corresponding to the non-homogeneous plural interpretation.

In what follows, I elaborate on the formal ingredients of the analysis, making precise the notion of *similarity sets*, *mereology*, and *mixtures*.

#### 3.1 Ingredients

##### 3.1.1 Similarity sets

The notion of similative plural makes crucial reference to sets of objects similar to other objects. This calls for a *similarity relation*  $\sim_C$ , which will hold between two predicates.<sup>4</sup>

<sup>4</sup> The notion of similarity between two kinds of objects or events is necessarily context-sensitive: for instance, apples and oranges may count as similar if the context makes it

$$(16) \quad P \sim_C Q \text{ iff } P \text{ counts as similar to } Q \text{ in context } C \ \& \ P \cap Q = \emptyset$$

$\sim_C$  is symmetric, irreflexive, and non-transitive. Irreflexivity is guaranteed by the requirement in  $\sim_C$ 's definition that similar sets be disjoint.<sup>5</sup> As such, it is not the case that  $P \sim_C P$ , nor does  $\sim_C$  hold of any two sets with overlap in membership. This is important for the analysis to come, as it will be necessary to construct and, ultimately, pragmatically exclude sets of objects similar to the predicate the similative plural operates on, without excluding members of that predicate. I turn now to the definition of such *similarity sets*.

I first define what I call the *proper similarity set* of  $P$ , notated  $P^\sim$ , in (17). This is the set of objects  $x$  for which there is some predicate  $Q$  similar to  $P$  in the context such that  $x$  is a  $Q$ .

$$(17) \quad \llbracket P^\sim \rrbracket = \{x \mid \exists Q: Q \sim_C P \ \& \ Q(x)\}$$

$P^\sim$  contains objects in sets contextually similar to  $P$ , but no members of  $P$  itself, due to the disjointness condition on  $\sim_C$ . This means that  $P^\sim$  is itself disjoint from  $P$ .

Having defined proper similarity set, I now define the *full similarity set*, or similarity set *simpliciter*, in terms of the union of  $P$  with  $P^\sim$ , as in (18).

$$(18) \quad \llbracket P^\approx \rrbracket = \llbracket P^\sim \rrbracket \cup \llbracket P \rrbracket$$

### 3.1.2 Mereology

Throughout this work I assume a mereological approach to the semantics of plurals (Link 1983, Krifka 2003, Champollion 2010, a.o.). In addition to atomic individuals used to model singulars, we will also have sum individuals: the sum of two individuals  $x$  and  $y$  is denoted by  $x \oplus y$ . I assume, following

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clear we are discussing kinds of fruit, but they may be dissimilar if what is at issue is kinds of red objects. Although a full account of similarity is beyond the scope of this paper, there are a number of ways to provide a more precise formal characterization. One possibility is that two predicates count as similar if they are contextual co-hyponyms, as in (i).

- (i)  $P$  counts as similar to  $Q$  in  $C$  iff there is an  $S$  such that  $S$  is salient in  $C$  and  $P \subset S$  and  $Q \subset S$ .

Another approach would define a similarity metric over sets in the model, out of which a similarity relation is constructed. See Smith 2020 for an approach along these lines that derives properties of the similarity relation discussed here.

<sup>5</sup> A similarity relation without the disjointness requirement would instead be a *tolerance relation*, which is reflexive, symmetric, and non-transitive (Smith 2020).

standard practice (Champollion 2010), that one-place predicates denote sets of atomic individuals. In order to derive number-neutral/plural predicates, I make use of the algebraic (or cumulative) closure operator  $*$  (Link 1983), which generates the set of all sums of individuals in a given set. An example of this is given in (19).

- (19) a.  $\llbracket P \rrbracket = \{a, b, c\}$   
 b.  $\llbracket *P \rrbracket = *\llbracket P \rrbracket = \{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$

In this work, I will use capital X and Y to denote variables over both atomic and sum individuals. Furthermore, following Landman 2000, I will treat predicates as sets of *atomic* individuals, using the cumulative closure operator to derive predicates containing sum individuals.

### 3.1.3 Mixtures

The analysis I develop for m-reduplication relies heavily on the notion of a *mixture*, an idea that has been alluded to in various places throughout this paper. To motivate this concept, consider (3), repeated in (20).

- (20) Mohsen do tâ ketâb metâb xund  
 Mohsen two CL book RED read.PST  
 ‘Mohsen read two things, one a book, the other book-like.’

In upward-entailing contexts, this sentence is true when there are two things, one of which is a book, and the other something similar. As such, there must be sum individuals in the denotation of *ketâb metâb* with two atomic parts, one of which is a book and the other of which is a similar object. This does not come for free however; one could not simply take the union of the two sets to get the desired effect. Instead, we need to be able to sum individuals from one set with individuals of the other. I will refer to such a set of sums as a *mixture* (Heycock & Zamparelli 1999, Heycock & Zamparelli 2000, Champollion 2016).<sup>6</sup>

- (21) Mereological mixture  
 $\llbracket \text{MIX}(P, Q) \rrbracket = \{X \oplus Y \mid X \in *P, Y \in *Q\}$

To make the effect of a mixture clearer, let us consider an example. Consider two sets  $M = \{m_1, m_2\}$  and  $W = \{w_1, w_2\}$ . The mixture of these two sets

<sup>6</sup> My terminology is most similar to Champollion’s, who refers to these sets as *P/Q mixtures*. Heycock & Zamparelli (1999), with whom the concept originates, refer to the operation of mixing sets in this way as *Set Product*.

is the set of sums of each element of the algebraic closure of M with each element of the algebraic closure of W.

$$\begin{aligned}
(22) \quad \text{MIX}(M,W) &= \{X \oplus Y \mid X \in *M, Y \in *W\} \\
&= \{X \oplus Y \mid X \in \{m_1, m_2, m_1 \oplus m_2\}, Y \in \{w_1, w_2, w_1 \oplus w_2\}\} \\
&= \{m_1 \oplus w_1, m_1 \oplus w_2, m_1 \oplus w_1 \oplus w_2, m_2 \oplus w_1, m_2 \oplus w_2, m_2 \oplus w_1 \oplus w_2, \\
&\quad m_1 \oplus m_2 \oplus w_1, m_1 \oplus m_2 \oplus w_2, m_1 \oplus m_2 \oplus w_1 \oplus w_2\}
\end{aligned}$$

The mixture of two sets denotes another set. I treat the set formed from the mixture of two others as a predicate, such that it is possible to evaluate whether or not a particular object is a member of the mixture. I distinguish the object language predicate  $\text{IsAMix}(P,Q)$  from the mixture operation  $\text{MIX}$ .

$$(23) \quad \llbracket \text{IsAMix}(P,Q)(t) \rrbracket = 1 \text{ iff } \llbracket t \rrbracket \in \text{MIX}(P,Q)$$

Mixtures have been invoked in the analysis of conjunctions of plural nouns, particularly when they are quantified (Heycock & Zamparelli 2000). For instance, in (24), there is a reading in which five people came, some of which were men and some of which were women (Champollion 2016).

(24) Five men and women came.

For this reading to be possible, ‘men and women’ must contain in its denotation sum individuals of cardinality five with parts from the set of men and parts from the set of women. A mixture of men and women is just the sort of set needed for a translation of (24), such as in (25).

$$(25) \quad \exists X[|X| = 5 \wedge \text{IsAMix}(M,W)(X) \wedge *Came(X)]$$

In previous applications, mixtures are generally *exclusive*: the sets used to form the mixture are not themselves subsets of the mixture. For the analyses of m-reduplication below, I will define mixtures that include at least one of (the algebraic closure of) the sets in the mixture, as well as ones that include (the algebraic closure of) both sets. I refer to the former variety of mixture as a *partially inclusive* mixture, and to the latter variety as a *fully inclusive*, or simply *inclusive*, mixture.

(26) A mixture  $\text{MIX}(P,Q)$  is *partially inclusive* iff  
 $*P \subseteq \text{MIX}(P,Q)$  or  $*Q \subseteq \text{MIX}(P,Q)$

(27) A mixture  $\text{MIX}(P,Q)$  is *fully inclusive* iff  
 $*P \subseteq \text{MIX}(P,Q)$  and  $*Q \subseteq \text{MIX}(P,Q)$

The sort of mixture derived via the *Mix* operation depends on the relation between the two sets being mixed. If one set is a subset of the other, this will result in a partially inclusive mixture. If the two sets are identical, a fully inclusive mixture will result. It is also possible to define new mixture operations to derive these varieties of mixture. I will make use of both strategies to derive the required mixtures in the analysis of m-reduplication below.

### 3.1.4 Alternatives and exhaustification

The final ingredient required for the analysis is a notion of alternatives and pragmatic enrichment. I will discuss the alternatives for m-reduplication in the analysis section, but for the sake of explicitness I will make use of an exhaustification operator, particularly *Exh* due to Fox (2007), to derive scalar implicatures, defined as in (28).<sup>7</sup>

$$(28) \text{ Exh}(A)(p) = p \ \& \ \forall q \in \text{IE}(A)(p) : \neg q$$

Essentially, what *Exh* does is negate all of the innocently excludable alternatives of *p*. An alternative is *innocently excludable* iff its negation does not contradict what *p* asserts.<sup>8</sup>

This concludes the introduction of the formal tools to be used in this paper. In the next two sections, I apply the ingredients developed here to the analysis of m-reduplication. Due to the observed variation in speakers' judgments concerning the meaning of m-reduplication in non-upward-entailing environments and contexts involving speaker ignorance, I divide the analysis into two separate, but very closely related analyses, starting with the partially inclusive speakers, who do not permit m-reduplicated nominals to denote objects that are simply similar to the bare nominal, followed by the analysis for the fully inclusive speakers, whose denotation for m-reduplication does include atomic individuals in the proper similarity set of the bare nominal. Each of these analyses call for an elaboration of a basic approach to the calculation of the observed implicature. The first calls for calculation of the implicature at a subsentential level, while the second calls for an abstract alternative.

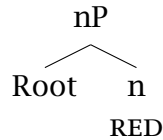
<sup>7</sup> See also the *O* operator of Chierchia 2004, 2006, which is defined similarly.

<sup>8</sup> More precisely, the set  $\text{IE}(p,A) = \bigcap \{A' \subseteq A : A' \text{ is a maximal set in } A, \text{ s.t. } A'^{\neg} \cup \{p\} \text{ is consistent}\}$ , where  $A'^{\neg} = \{\neg p : p \in A\}$  (Fox 2007).

### 3.2 Partially inclusive speakers and local implicature calculation

For partially inclusive speakers, I propose that m-reduplication denotes a mereological mixture of the predicate denoted by the bare noun and a set of objects similar to that bare noun, its similarity set. Given that m-reduplication only targets the head noun of an NP, (29) provides a structure for m-reduplication that treats RED as a categorizing head *n*, along the lines of an analysis in Distributed Morphology (Halle & Marantz 1993, Harley & Noyer 2003), taking the root as an argument, and (30) gives a logical translation for the reduplication morpheme.

(29) Syntactic structure for m-reduplicated nominals



(30)  $\text{RED} \rightsquigarrow \lambda P. \lambda X. \text{IsAMix}(P, P^{\sim})(X)$

Because  $*P$  is a subset of  $*P^{\sim}$ , the mixture of the two sets is a *partially* inclusive mixture: summing the elements of  $*P$  with the elements of the subset of  $*P^{\sim}$  equal to  $*P$  will produce that same set, due to the idempotence of the sum operation. It will also produce sum individuals that are composed of at least one member of  $*P$  and at least one member of the cumulative closure of  $P$ 's proper similarity set,  $*P^{\sim}$ . However, no member of  $*P^{\sim}$  is a member of this mixture; this is because every member of that set has been summed with an element of  $*P$ .  $\text{MIX}(P, P^{\sim})$  is therefore not a fully inclusive mixture. This exactly captures the meaning of m-reduplication for partially inclusive speakers in non-upward-entailing and ignorance contexts: for these speakers, *ketâb metâb* could mean one or more books, or a sum of at least one book and at least one book-like thing, but not simply a single book-like thing or sum containing only book-like things.

A translation of (1), repeated as (31a), is given below in (31b). I assume existential closure of the variable in the translation of m-reduplication, which can be accomplished by Partee's (1987)  $\exists$  type shifter. Composition with the verb can take place either via additional type shifting or by just having verbs take type  $\langle \langle e, t \rangle, t \rangle$  arguments as in Montague 1973, among other options.

- (31) a. Mohsen ketâb metâb xund  
 Mohsen book RED read.PST  
 'Mohsen read a book and other such things'

$$b. \exists X [\text{IsAMix}(\text{Book}, \text{Book}^{\approx})(X) \wedge * \text{Read}(X)(m)]$$

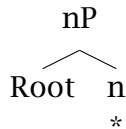
(31b) is true if Mohsen read something, and that thing is in the mixture of Book and Book<sup>≈</sup>. That is, it is either one or more books or at least one book summed with at least one bookish thing. In order to derive the exclusive mixture reading, we need to eliminate the singletons and sums composed of nothing but books.

To that end, I propose that the alternative to an m-reduplicated noun is its bare counterpart. This makes sense from a variety of standpoints. First of all, bare nouns in Persian receive number-neutral existential readings in object position, denoting a set of one or more things (Ghameshi 2003; Jasbi 2015).<sup>9</sup> In effect, they denote exactly the set of things we want to exclude.

- (32) Mohsen ketâb xund  
 Mohsen book read.PST  
 ‘Mohsen read one or more books.’

Second, the bare noun is at most as complex as its m-reduplicated counterpart, derivable via either the deletion of the reduplication morpheme or substitution of the \* operator in place of the reduplicant, and therefore is predicted to be available as an alternative by approaches such as Katzir 2007, which derive alternatives structurally. A possible tree for the bare nominal in which a head introducing the \* operator is projected in the syntax is given in (33)<sup>10</sup>.

- (33) a. Syntactic structure for bare nominals



- b.  $* \rightsquigarrow \lambda P. \lambda x. *P(x)$

Finally, the bare nominal, at least at first glance, appears to be *logically stronger* than the m-reduplicated nominal: because the denotation of \*P is a subset of the set denoted by IsAMix(P, P<sup>≈</sup>), the former *entails* the latter in upward-entailing contexts. The bare nominal, then, seems to be a viable

<sup>9</sup> Bare nouns often receive definite singular readings in subject position, but this is not a hard restriction; they can also receive a number-neutral reading as well, though definite readings may be more common.

<sup>10</sup> A simple alternative would be to introduce \* lexically. This has no bearing on the availability of the bare noun as an alternative on the structural approach to alternatives.

candidate as an alternative to m-reduplication.

Adopting a structural approach to deriving alternatives for the moment, we derive the bare noun as an alternative via deletion of the node corresponding to reduplication in the syntax. Alternatively, if the \* operator is present on a node in the syntax, we can derive the bare nominal via replacement of the node corresponding to the reduplicant with one containing \*. The representation of this, which corresponds to the translation of (32), is given in (34).

$$(34) \quad \exists X [ *Book(X) \wedge *Read(X)(m) ]$$

We can then apply *Exh* to the sentence in (1), resulting in (35).

$$(35) \quad Exh(A)(1) = \exists X [ IsAMix(Book, Book^{\simeq})(X) \wedge *Read(X)(m) ] \\ \wedge \neg \exists X [ *Book(X) \wedge *Read(X)(m) ]$$

The astute reader will notice a problem with this: technically speaking, (31b) is true whenever (34) is, but (34) is also true whenever (31b) is. This is certainly the case if (31a) is understood distributively, as made explicit in (36).

$$(36) \quad \exists X [ IsAMix(Book, Book^{\simeq})(X) \wedge \forall y [ y <_{AT} X \rightarrow *Read(y)(m) ] ]$$

A similar problem is found in implicature analyses of English bare plurals, where the sentences with the bare plural and those with its desired alternative, a singular indefinite, entail each other (Spector 2007, Zweig 2009).

In order to solve this problem, I follow Zweig 2009 in, first, moving to a Neo-Davidsonian event semantics, and, second, calculating the implicature below the existential closure of the event variable, as originally proposed by Landman (2000) and developed by Chierchia (2004).<sup>11</sup> For the first step, we need to provide Neo-Davidsonian translations for (31a) and (32) prior to existential closure of the event variable. These are given in (37) and (38), respectively.

$$(37) \quad \lambda e. \exists X [ IsAMix (Book, Book^{\simeq}) (X) \wedge *READ(e) \wedge AGENT(e) = m \\ \wedge THEME(e) = X ]$$

$$(38) \quad \lambda e. \exists X [ *Book(X) \wedge *READ(e) \wedge AGENT(e) = m \wedge THEME(e) = X ]$$

Now we can discuss how implicatures are calculated in this system. As Zweig (2009) notes, because the expressions in competition with each other are

<sup>11</sup> See Spector 2007 for an alternative solution making use of the notion of *higher-order implicature*.



*predicates*, not *propositions*, the scalar relation is not entailment, but *set containment*: a predicate A is stronger than a predicate B if A is a proper subset of B. The question we need to ask, then, is if (38) is stronger than (37) in this setup. We can do this as follows.<sup>12</sup> Suppose there are two events:  $e_1$ , an event of Mohsen reading a book (say, *Moby Dick*), and  $e_2$ , an event of Mohsen reading a magazine (say, the latest issue of *Time*). Additionally, imagine we have  $e_3 = e_1 \oplus e_2$ , the sum of  $e_1$  and  $e_2$ . This is an event of Mohsen reading *Moby Dick* and *Time*.  $e_1$  and  $e_3$  are both in the set of events denoted by (37), as they are both events in which Mohsen reads something in the mixture of the set of books with its similarity set. However, of these events, only  $e_1$  is in the set of events denoted by (38); this is because this set of events contains only those events with themes in the set of one or more books.  $e_1$  meets this requirement, as its theme is the single book *Moby Dick*, but  $e_3$  does not, as its theme is a sum individual composed of a book and a magazine. As such, there is a scalar relationship between (38) and (37): the former denotes a proper subset of the latter. As such, (38) is a stronger alternative of (37), as desired.

We are now in a position to calculate the implicature. Applying *Exh* to (37) results in the enrichment in (39), in which the alternative corresponding to (38) is negated<sup>13</sup>.

$$(39) \quad \text{Exh}(A)(37) \\ = \lambda e. \exists X [\text{IsAMix}(\text{Book}, \text{Book}^{\approx})(X) \wedge *READ(e) \wedge \text{AGENT}(e) = m \\ \wedge \text{THEME}(e) = X] \wedge \neg \exists X [*Book(X) \wedge *READ(e) \wedge \text{AGENT}(e) = m \\ \wedge \text{THEME}(e) = X]$$

Existentially closing the event variable then leads to the final enriched meaning in (40).

$$(40) \quad \exists e [\exists X [\text{IsAMix}(\text{Book}, \text{Book}^{\approx})(X) \wedge *READ(e) \wedge \text{AGENT}(e) = m \wedge \\ \text{THEME}(e) = X] \wedge \neg \exists X [*Book(X) \wedge *READ(e) \wedge \text{AGENT}(e) = m \wedge \\ \text{THEME}(e) = X]]$$

Note that calculating the implicature below the site of existential closure of the event variable results in the negation of the stronger alternative ulti-

<sup>12</sup> This scenario follows [Zweig 2009](#)'s scenario for evaluating the scalar relationship between events with plural and singular arguments.

<sup>13</sup> This requires a suitable reformulation of *Exh* so that it can apply to predicates of events. [Chierchia 2004](#) accomplishes this by generalizing all Boolean operators to functional types ([Partee & Rooth 1983](#)). One possible formulation in this context is the following.

(i)  $\text{Exh}(A)(P) = \lambda e. P(e) \wedge \forall Q \in \text{IE}(A)(P) : \neg Q(e)$

mately scoping below the event variable: (40) asserts that there is a reading event with Mohsen as agent and something in the mixture of books and book-like things as theme, and it is not the case that *this event* has something in the set of just books as its theme. That is, while subevents that are part of this event may have a (sum) individual book as theme, the event itself does not. Given this, we can conclude that the theme of the asserted event must be something in the mixture of books and book-like objects that is *not* itself in the set of one or more books. This can only be a sum individual composed of at least one book and one object in the similarity set of books. This formulation therefore successfully derives the exclusive mixture reading of m-reduplication while avoiding the problem of calculating the implicature at the propositional level.<sup>14</sup>

What happens in the case of downward-entailing environments? In these cases, the alternatives that are stronger in upward-entailing contexts are *weaker* under a downward-entailing operator. Because there are no stronger alternatives in these contexts, no implicature arises, predicting the disappearance of the implicature in downward-entailing contexts.

<sup>14</sup> While I have chosen to follow Zweig in making use of an event semantics to solve the problem of equivalence between (31b) and (34), it is important to note that the solution to this problem does not hinge on the use of events. Rather, the solution depends on calculating implicatures over *sets*. For instance, an alternative analysis is to translate (32) and (31a) as predicates, with an existential closure operation applying at a later point.

- (i) a.  $\lambda X.*\text{Book}(X) \wedge *\text{Read}(m)(X)$
- b.  $\lambda X.\text{IsAMix}(\text{Book}, \text{Book}^{\approx}) \wedge *\text{Read}(m)(X)$

Defining logical strength in terms of set containment as above, (ia) is stronger than (ib): the set of books Mohsen read is a subset of the set of things in the mixture of books and similar items that Mohsen read, as while the former set may contain Moby Dick, only the latter contains both Moby Dick and the sum of Moby Dick and Time. We could then exclude (ia) as an alternative to (ib). Applying existential closure to the result of exhaustification is (ii).

- (ii)  $\exists X [\text{IsAMix}(\text{Book}, \text{Book}^{\approx}) \wedge *\text{Read}(m)(X) \wedge \neg(*\text{Book}(X) \wedge *\text{Read}(m)(X))] =$   
 $\exists X [\text{IsAMix}(\text{Book}, \text{Book}^{\approx}) \wedge *\text{Read}(m)(X) \wedge \neg*\text{Book}(X)]$

This also delivers the exclusive mixture reading: the predicted reading is that Mohsen read something in the set of sums of books with book-like things which is not an atom or sum individual composed only of books. Though I maintain the Neo-Davidsonian representations used in the main text for ease of comparison with Zweig's analysis and for the extension of the analysis to Japanese *-tari* later in the paper, the upshot of the discussion here is that events are not strictly necessary to solve the problem of apparent equivalence between the unenriched meanings of sentences with bare and m-reduplicated nominals. I thank Kjell Johan Sæbø for pointing this out to me.

### 3.3 Fully inclusive speakers and abstract alternatives

I now turn to the analysis of fully inclusive speakers' judgments. Recall that these speakers, while having the same interpretation of m-reduplication in upward-entailing contexts as the speakers discussed in the previous section, permit a more inclusive reading of m-reduplicated nominals in non-upward-entailing and ignorance contexts: for them, an m-reduplicated nominal may denote something that is just similar to a book, in addition to any number of books and sums of books with book-like things. These speakers, therefore, treat m-reduplicated nouns as *fully inclusive* mixtures, rather than partially inclusive ones as the partially inclusive speakers do.

To generate fully inclusive mixtures, we could propose a variation on the original mixture function, an inclusive mixture function as in (41).

$$(41) \text{ Inclusive mixture} \\ \text{I-Mix}(P,Q) = \{X \oplus Y \mid X \in *P \cup *Q, Y \in *P \cup *Q\}$$

This sums elements of the union of (the algebraic closure of) both sets with elements from the same set, guaranteeing the presence of both  $*P$  and  $*Q$  as subsets of the mixture. Using this, we could give the meaning of m-reduplication for fully inclusive speakers as (42), which produces an inclusive mixture of  $P$  and its proper similarity set.

$$(42) \text{ RED} \rightsquigarrow \lambda P. \lambda X. \text{IsAI-Mix}(P, P^{\sim})(X)$$

This will produce a fully inclusive mixture. However, the reader will notice that, since the inclusive mixture function draws individuals from the union of both sets, the inclusive mixture of these two sets is the same as mixing  $P^{\sim}$  with itself. We could therefore represent m-reduplication with (43).

$$(43) \text{ RED} \rightsquigarrow \lambda P. \lambda X. \text{IsAMix}(P^{\sim}, P^{\sim})(X)$$

We can take this further: it turns out that for any  $P$ , mixing  $P$  with itself is just  $*P$ . This can be immediately appreciated given another fact about mixtures, namely, that the inclusive mixture of two sets is equivalent to applying algebraic closure to the union of those sets. That is:

$$(44) \text{ Inclusive mixture as the algebraic closure of the union of two sets} \\ \text{I-Mix}(P,Q) = *(P \cup Q)$$

It immediately follows that  $\text{I-Mix}(P,P) = *P$ , since  $*(P \cup P) = *P$ . Because of this equivalence, we can also define the other types of mixture in terms of  $*$ ,  $\cup$ , and set difference.

- (45) Exclusive mixture  
 $E\text{-MIX}(P,Q) = *(P \cup Q) \setminus (*P \cup *Q)$
- (46) Left-inclusive mixture  
 $L\text{-MIX}(P,Q) = *(P \cup Q) \setminus *Q$
- (47) Right-inclusive mixture  
 $R\text{-MIX}(P,Q) = *(P \cup Q) \setminus *P$

We thus find that  $I\text{-MIX}(P^{\approx}, P^{\approx}) = *P^{\approx}$ . From another direction, we can take advantage of the definition of  $*P^{\approx}$  as the union of  $P$  with its proper similarity set, and obtain the same result:  $I\text{-MIX}(P, P^{\approx}) = *(P \cup P^{\approx}) = *P^{\approx}$ . Given this result, we can eschew the mixture representation and simply translate the reduplicative morpheme as in (48).

$$(48) \text{ RED} \rightsquigarrow \lambda P. \lambda X. *P^{\approx}(X)$$

In other words,  $m$ -reduplication for fully inclusive speakers simply denotes the algebraic closure of the similarity set of the predicate it takes as an argument. We can thus provide the basic, unenriched translation of (1) for fully inclusive speakers as (49).

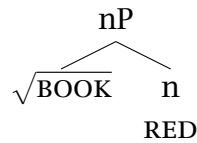
$$(49) \lambda e. \exists X [ *Book^{\approx}(X) \wedge *Read(e) \wedge \text{AGENT}(e) = m \wedge \text{THEME}(e) = X ]$$

This captures the unenriched meaning of  $m$ -reduplication for fully inclusive speakers, but it raises an issue for the derivation of the exclusive mixture reading via scalar implicature. In particular, while we are still able to derive the bare nominal as an alternative via the same process of structural deletion/ replacement, it is no longer enough to generate the exclusive mixture reading; if the bare noun is the only alternative to  $m$ -reduplication, we instead predict a partially inclusive reading in upward-entailing contexts without speaker ignorance, one in which  $m$ -reduplication refers to a set of either book-bookish sums or to one or more book-like things, but not books. This is incorrect, as the two groups of speakers agree on the interpretation of  $m$ -reduplication in upward-entailing contexts as an exclusive mixture.

In order to derive an exclusive mixture reading from the fully inclusive reading, two alternatives are required: one corresponding to the bare noun,  $*P$ , and the other corresponding to the *proper similarity set*,  $*P^{\approx}$ . This alternative is *abstract*: it does not correspond to any lexical item in the language. It therefore cannot be derived via lexical replacements or deletions, as a structural approach to the generation of alternatives would require.

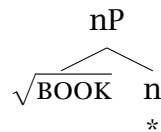
This point is worth elaborating on. Suppose we want to derive an appropriate set of alternatives from a syntactic tree containing (50) as a subtree.

(50) Subtree corresponding to *ketâb metâb*

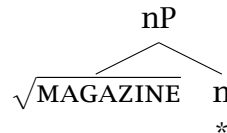


One strategy for deriving alternatives would replace the head containing RED morpheme with one containing the \* operator, deriving the necessary alternative denoting sets of one or more books (51).<sup>15</sup> Additionally, one may derive alternatives containing other subsets of the similarity set by replacing the root  $\sqrt{\text{BOOK}}$  with other roots in the lexicon. (52) shows the result of replacing  $\sqrt{\text{BOOK}}$  with  $\sqrt{\text{MAGAZINE}}$ .

(51) Subtree derived from (50) via replacement of RED with \*

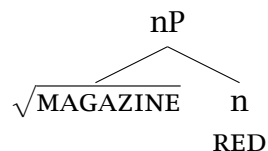


(52) Subtree derived from (50) via replacement of RED with \* and  $\sqrt{\text{BOOK}}$  with  $\sqrt{\text{MAGAZINE}}$



While each of these sets is a subset of the similarity set of *Book*, they are not enough to generate the exclusive mixture reading. This is because the similarity set also contains *sums* of the atoms in each of these sets: sum individuals consisting of books and magazines, magazines and newspapers, newspapers and comic books, and so on. Since expressions like those in (51) and (52) do not denote sets containing such mixed sums, they cannot be the only alternatives to an m-reduplicated nominal. We seem to also need *mixtures* of the appropriate alternatives. An obvious way to attempt to derive these is by merely replacing the root with contextually appropriate lexical alternatives while maintaining the RED morpheme in the syntactic structure. (53) shows one possible result of this type of replacement.

(53) Subtree derived from (50) via replacement of  $\sqrt{\text{BOOK}}$  with  $\sqrt{\text{MAGAZINE}}$



<sup>15</sup> On an approach that does not project \* in the syntax, this could be treated by deleting the node containing RED or by replacing it with one that is semantically vacuous.

This will allow the generation of mixtures, which may contain the sorts of sum individuals that we would like to exclude, such as sums of magazines and newspapers that do not contain books. Unfortunately, however, this does not solve the problem. The reason has to do with the nature of the similarity relation, namely, the fact that it is *symmetric*:  $P \sim Q \iff Q \sim P$ . Therefore, if magazines count as similar to books, then books count as similar to magazines. This further implies that if the set of magazines is in the similarity set of books, then the set of books is in the similarity set of magazines. Given this fact, the set denoted by the expression in the subtree in (53) will contain sum individuals composed of books and magazines, the sorts of individuals we do *not* want to exclude in our analysis. At best, this will simply result in incorrect predictions: excluding alternatives to an m-reduplicated nominal generated by substituting the root with roots that are similar in the context will result in unattested interpretations of m-reduplication in upward-entailing contexts. At worst, these alternatives won't be innocently excludable in the first place, as excluding them may result in contradicting the assertion of a sentence containing an m-reduplicated nominal. Their presence would therefore play no role in the calculation of the desired implicature.

The only option that guarantees the derivation of the exclusive mixture reading from the fully inclusive one is making use of the alternative corresponding to the proper similarity set, which, as discussed above, is an abstract alternative. Because this alternative does not correspond to a lexical item in the language, it will not be possible to derive the alternative using the structural replacement/deletion approach sketched above.

There has been some work suggesting that abstract alternatives are possible, and even necessary for the analysis of some phenomena (Chemla 2007; Buccola, Kriz & Chemla 2022; Charlow 2019). For example, Chemla (2007) and Buccola, Kriz & Chemla (2022) discuss the fact that the French sentence in (54), like its English counterpart, is odd, despite the fact that French, unlike English, lacks a word corresponding to *both*, competition with which would explain the oddness of the sentence in English.

- (54) #Jean s'est cassé tous les bras  
 Jean REFL=be.PRS.3.SG broken all DEF.PL arms  
 '#Jean broke all his arms.' (implies: Jean has more than two arms)

Perhaps more strikingly, Charlow (2019) discusses the case of exceptionally scoping indefinites, as in (55), in which an indefinite takes widest scope despite being deeply embedded within another phrase.

(55) John overheard the rumor that *a student of mine* was expelled

As with other indefinites, exceptionally scoping indefinites are associated with an implicature: (55) means that not all of my students were expelled. The problem is that, on either a choice-functional (Reinhart 1997) or an alternative semantics (Kratzer & Shimoyama 2002) approach to exceptional scope, the required alternative, a universal quantification over choice functions or alternatives, does not correspond to any overt or covert lexical item in English. This alternative, therefore, is abstract.

Let us return to the m-reduplication case at hand. Although the presence of an abstract alternative is not completely unprecedented, it is not entirely clear how to derive such alternatives. One option would be to merely stipulate that the proper similarity set of an expression is lexically associated with m-reduplicated nominals via a Horn scale. A more principled approach is suggested by Buccola, Kriz & Chemla 2022: alternatives are calculated on the basis of the *conceptual representation* of an expression. This is accomplished by operations on representations in the *language of thought* (Fodor 1975), making use of a notion of conceptual complexity, rather than structural complexity as argued by Katzir 2007. Alternatives are then derived on the basis of the *primitiveness* of certain concepts: some concepts, such as  $\exists$ ,  $\forall$ ,  $\wedge$  and  $\vee$ , are primitives of the language of thought, while others, such as *some but not all* and *xor*, are not. We therefore expect that the latter are not available as alternatives to the former,<sup>16</sup> and that they will not be lexicalized as frequently as the former.

Building off of this conceptualist approach to alternatives, I propose that the representation of (1) for fully inclusive speakers is as in (49), repeated in (56) below for convenience.

(56)  $\lambda e. \exists X [ *Book^{\approx}(X) \wedge *Read(e) \wedge AGENT(e) = m \wedge THEME(e) = X ]$

We now need to derive the alternatives to (56). Note that we are no longer deriving alternatives by operating over syntactic structures, but instead on representations in a language of thought. Considering the logical language provided here as a sort of proxy for the language of thought, I propose that  $*P$ , the set out of which the similarity set is constructed,  $*P^{\approx}$  itself, and  $*P^{\sim}$ , the proper similarity set, are all primitive concepts of the language of thought, and may be substituted for  $*P^{\approx}$ . In the case of (56), the innocently excludable

<sup>16</sup> As Buccola, Kriz & Chemla (2022) note, an alternative to this all or nothing view of alternativehood is a graded view of alternatives, according to which alternatives that are not primitive are associated with a higher cost, rather than ruled out entirely.

alternatives are those that replace  $*Book^{\approx}$  with  $*Book$  and  $*Book^{\sim}$ . Upon applying *Exh* to (56) and existentially closing the event variable, we can now derive (57).

$$(57) \quad \exists e \exists X [ *Book^{\approx}(X) \wedge *Read(e) \wedge AGENT(e) = m \wedge THEME(e) = X ] \\ \wedge \neg \exists X [ *Book(X) \wedge *Read(e) \wedge AGENT(e) = m \wedge THEME(e) = X ] \\ \wedge \neg \exists X [ *Book^{\sim}(X) \wedge *Read(e) \wedge AGENT(e) = m \wedge THEME(e) = X ]$$

(57) means that there is an event of Mohsen reading something made up of either one or more books, one or more book-like things, or sums of books and book-like things, and it is not the case that he read one or more books and it is not the case that he read one or more book-like things. This is equivalent to saying that Mohsen read sums of books and book-like things. We have thus derived the exclusive mixture reading of m-reduplication for fully inclusive speakers.

### 3.3.1 A conceptualist analysis of partially inclusive speakers

Recall that for the analysis of partially inclusive speakers, I used a structural approach to deriving the alternative to m-reduplication. However, for fully inclusive speakers, I used a conceptualist approach to deriving alternatives. As it stands, we therefore have two entirely distinct analyses of the computation of the implicature for each set of speakers. Ideally, we would prefer to be able to unify the two analyses using the same mechanism for deriving alternatives for both groups of speakers.

My proposal is to adopt the conceptualist approach for the partially inclusive speakers as well. Recall that for those speakers, m-reduplication denotes a partially inclusive mixture,  $MIX(P, P^{\approx})$ . In this case, we can derive two alternatives via replacement,  $*P$  and  $*P^{\approx}$ .<sup>17</sup> However, only one of these alternatives is innocently excludable:  $*P$ . If we were to negate an alternative containing  $*P^{\approx}$ , we would contradict the main assertion, because the partially inclusive mixture denoted by m-reduplication is a subset of the inclusive mixture denoted by  $*P^{\approx}$ .  $*P$ , on the other hand, corresponds to the bare noun, which denotes a subset of the partially inclusive mixture, and is therefore logically stronger and thus innocently excludable. Negating this alternative will de-

<sup>17</sup> We can derive these alternatives by either replacing  $MIX(P, P^{\approx})$  wholesale, or by replacing the expressions it takes as arguments: replacing  $P^{\approx}$  with  $P$ , for instance, will deliver  $*P$ , and replacement of  $P$  with  $P^{\approx}$  will produce  $*P^{\approx}$ .



liver the exclusive mixture reading, as desired.<sup>18</sup>

The takeaway here is that a unified approach to m-reduplication for both sets of speakers is possible, one making exclusive use of a conceptualist approach to alternatives. Fitting this with the notion of innocent exclusion, we guarantee that the enrichment of the underlying meaning ends up making use of the same alternative as the previously proposed structural approach.

### 3.4 Explaining other properties of m-reduplicated nominals

The current analysis of m-reduplication does not posit that m-reduplicated nominals denote exclusive mixtures. As such, it does not treat such nominals as referring exclusively to sum individuals. Recall that m-reduplicated nominals are compatible with collective predicates, as in (5), repeated below as (58).

- (58) Mohsen gol mol jam' kard  
Mohsen flower RED collection do.PST  
'Mohsen collected flowers and other such things.'

Of course, collective predicates like *jam' kardan* 'collect' only contain sum individuals in their denotation. M-reduplicated nominals, just like bare plurals in English, do contain sum individuals in their denotation, so we expect them to be acceptable with predicates like *jam' kardan*.

One final consideration is the unacceptability of m-reduplication with differential object marking without an additional plural marker.

- (59) \*Mohsen ketâb metâb -ro xund  
Mohsen book RED -DOM read.PST  
*Intended:* 'Mohsen read the one book and bookish thing.'

As noted previously, this receives a straightforward explanation if m-reduplication simply denotes a set of sum individuals, since without the plural marker differential object marking forces a singular interpretation. However, I have already demonstrated that m-reduplication denotes a partial or fully inclusive mixture. As such, the unacceptability of (59) is a bit of a puzzle.

This puzzle can be resolved by being more specific about the contribution of differential object marking in Persian. Building on an approach due to

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<sup>18</sup> \*P<sup>~</sup> is, in principle, also available as an alternative. However, negating it is vacuous, as the partial inclusiveness of the mixture already entails the negation of this alternative. I thank Brian Buccola for bringing this point to my attention.

Jasbi (2015), we could treat the syntactic structure of a *-ro*-marked object as containing a type-shifter, Partee's 1987 *iota*, which takes a predicate and returns the unique individual satisfying that predicate. The definition is given in (60).

$$(60) \text{ IOTA}(P) = \iota x [ P(x) ]$$

IOTA also introduces a presupposition that the set denoted by the predicate to which it applies is *singleton*: there can be only one member of the set. Let us consider how this would work with a bare noun like *ketâb*. Assume that bare nouns in Persian denote the cumulative closure of a set. As such, *ketâb* would denote the set of all possible sums of books.

$$(61) \llbracket \textit{ketâb} \rrbracket = * \{ x \mid x \text{ is a book} \}$$

The cumulative closure operator  $*$  can also apply to singleton sets. In this case, the  $*$  operator returns the same set. In other words, a singleton set is its own cumulative closure. The reason for this is that, as the set of all sums formable from a set, the cumulative closure of a singleton set can only sum the sole member of that set with itself. Because of the idempotence of the sum operation  $\oplus$ , this simply returns the sole member of the set.

$$(62) * \{ x \} = \{ x \}, \text{ for any } x.$$

Given this fact, the only context in which a bare noun in Persian will be compatible with *-ro* is if it is singleton. This successfully predicts that *-ro*-marked bare nouns are acceptable only if they denote singleton sets.

Now consider the case of an *m*-reduplicated noun, which denotes a mixture of a set with its similarity set. Assume a context in which there is a single book and a single magazine, the latter of which is in the similarity set of book.<sup>19</sup> The mixture of these two sets is given in (63).

$$(63) \text{ MIX}(\{b\}, \{m\}) = \{b, m, b \oplus m\}$$

As one can see, even a mixture of two singleton sets is necessarily non-singleton. Since *m*-reduplicated nominals denote such mixtures, they will

<sup>19</sup> One could in principle have a context in which there is only a single book. Here, though, it would be odd to use *m*-reduplication, as the *m*-reduplicated nominal would mean the same thing as the bare nominal. We could then appeal to a pragmatic principle that requires that a more specific form, in this case the bare nominal, be used when it is equivalent to the *m*-reduplicated one. Alternatively, we could place a definedness condition on *m*-reduplication, stating that the result of *m*-reduplication is only defined when there is at least one member of the similarity set that is not equal to the members of the set under evaluation.

always denote non-singleton sets, and will therefore be incompatible with *-ro* without further modification.

Now consider an example of m-reduplication with *-hâ*, which is completely acceptable with *-ro*.

- (64) Mohsen ketâb metâb -hâ -ro xund  
 Mohsen book RED -SP.PL -DOM read.PST  
 ‘Mohsen read the books and stuff.’

Just as we were more specific about the contribution of *-ro*, we can account for this case by proposing an explicit semantics for *-hâ*. I propose, building on a proposal due to Jasbi (2014), that *-hâ* reduces a set to its maximal member.

- (65)  $-hâ \rightsquigarrow \lambda P.\lambda x. x = \oplus P$

One could rightfully ask why I don’t simply define  $P-hâ$  as an individual, the maximal member of  $*P$ . There are two reasons. First, I want to maintain a uniform analysis of *-râ*-marked NPs, including those marked by *-hâ*. More importantly, though, it appears empirically necessary, as NPs marked by *-hâ* can be quantified, as the following shows (Ghomeshi 2003).

- (66) ye ketâb -hâ -i  
 a book -SP.PL -INDEF  
 ‘Some books’

In the case of (64) above, the addition of *-hâ* reduces the set to its single maximal member. Because this set is now a singleton, though containing a single sum individual, it satisfies the uniqueness requirement of IOTA, and is thus successfully predicted to be acceptable with *-ro*.

#### 4 Similitive expressions in Japanese

Having analyzed Persian m-reduplication, I turn now to my second case study: the morphemes *-toka* and *-tari* in Japanese. *-toka* is a suffix that attaches to nominal expressions, while *-tari* is a suffix that attaches to verbal constituents. Both of these morphemes bear a strong resemblance to m-reduplication in that they are associated with non-homogeneous plural inferences. For example, (67) is true if Taro and at least one other person similar to him in the context comes, while (68) is judged true if Taro cleans his room and does other similar actions, such as other chores. (67) is infelicitous if only Taro comes, or if only one person other than Taro comes. Likewise, (68) is

infelicitous if Taro cleaned his room and did nothing else, or if he did something other than clean his room.

(67) Taro -toka -ga ki -ta  
Taro -TOKA -NOM come -PST  
'Taro and someone else came'

(68) Taro -ga heya -o sooji si -tari si -ta  
Taro -NOM room -ACC clean do -TARI do -PST  
'Taro cleaned his room and did other such things.'

Like m-reduplicated nominals, *-toka* NPs are compatible with collective predicates.

(69) Taro -toka -ga kooen -de atsumat -ta  
Taro -TOKA -NOM park AT gather -PST  
'Taro and others gathered at the park.'

A few differences exist between m-reduplication and these morphemes. For one, although m-reduplication may only target the head noun, *-toka* may attach to an entire NP, and *-tari* may attach to any non-finite VP.

(70) Hanako -wa atarashii hon -toka -o yon da  
Hanako -TOP new book -TOKA -ACC read PST  
'Hanako read new books and the like.'

What's more, Japanese allows these expressions to modify another expression that overtly manifests the contextual restriction on the similative, whereas the contextual restriction of Persian m-reduplication cannot be similarly expressed.

(71) Taro -wa mikan -toka kudamono -o tabe -ta  
Taro -TOP orange -TOKA fruit -ACC eat -PST  
'Taro ate oranges and other such **fruits**'

(72) otera -ni it -tari ryokoo si -ta -i  
temple -DAT go -TARI travel do -DES -PRS  
'I want to go to temples and other such **travel-type things**

(73) \*Mohsen mive -ye sib mib xord  
Mohsen fruit -EZ apple RED eat.PST  
*Intended:* 'Mohsen ate apples and other such **fruits**

Nevertheless, there is reason to believe that this difference in syntax does not represent a major difference in semantics. In particular, I claim that *-toka*

takes a type  $\langle e,t \rangle$  argument, and that *-tari* takes a type  $\langle v,t \rangle$  argument, with *v* the type of events. The fact that these expressions cannot take arguments of a higher type can be seen by their interaction with quantifiers. Quantificational expressions, such as *gonin* ‘five people’, must take scope over the entire similative plural: (74) can only mean that five people came, and some of those people were professors and others were similar sorts of things, such as graduate students. It could not be used to describe a situation in which, for instance, five professors as well as other similar people came.

- (74) kyooju -toka -ga go -nin ki -ta  
 professor -TOKA -NOM five CL come -PST  
 ‘Five people, some of whom were professors and some of whom were similar, came’/\*Five professors and other similar people came.’

Such a result is expected if *-toka* denotes something of type  $\langle e,t \rangle$ ; a quantificational DP, of type  $\langle \langle e,t \rangle, t \rangle$ , could not be an argument of *-toka*, but it could take the *-toka* NP as an argument.

#### 4.1 *-toka* and *-tari* in non-upward-entailing contexts

*-toka* and *-tari* display another characteristic in common with Persian m-reduplication in that they too show a sensitivity to the monotonicity of the semantic environments in which they are found: their meanings become more inclusive in downward-entailing and non-monotone contexts. What’s more, the same type of variation in judgments observed with Persian speakers for m-reduplication is observed in downward-entailing contexts for *-toka* and *-tari*: some speakers are partially inclusive, and others are fully inclusive. These facts can be observed with negation (75), conditionals (76), polar questions (77), and imperatives (78).

- (75) a. Taro -wa eigo -toka -o benkyoo si -nakat -ta  
 Taro -TOP english -TOKA -ACC study do -NEG -PST  
**Partially inclusive:** ‘Taro didn’t study English’  
**Fully inclusive:** ‘Taro didn’t study English or anything like that.’
- b. Taro -ga heya -o sooji si -tari si -nakat -ta  
 Taro -NOM room -ACC clean do -TARI do -NEG -PST  
**Partially inclusive:** ‘Taro didn’t clean his room’  
**Fully inclusive:** ‘Taro didn’t clean his room or do anything like that’

- (76) a. Taro -toka -ga ki -tara Yosuke -wa ocha -o das -u  
 Taro -TOKA -NOM come COND Yosuke -TOP tea -ACC serve -PRS  
**Partially inclusive:** 'If Taro (and possibly someone else) comes, Yosuke will serve tea.'  
**Fully inclusive:** 'If Taro or someone like that comes, Yosuke will serve tea'
- b. Taro -ga heya -o sooji si -tari si -tara, mama -wa  
 Taro -NOM room -ACC clean do -TARI do COND mom -TOP  
 yorokob -u  
 become.happy -PRS  
**Partially inclusive:** 'If Taro cleans his room (and possibly does something else similar), his mom will be happy.'  
**Fully inclusive:** 'If Taro cleans his room or does something else similar, his mom will be happy.'
- (77) a. Taro -toka -ga ki -ta no?  
 Taro -TOKA -NOM come -PST Q  
**Partially inclusive:** 'Did Taro (and possibly someone like that) come?'  
**Fully inclusive:** 'Did Taro or someone like that come?'
- b. Taro -ga heya -o sooji si -tari si -ta no?  
 Taro -NOM room -ACC clean do -TARI do -PST Q  
**Partially inclusive:** 'Did Taro clean his room (and possibly do other such things?)'  
**Fully inclusive:** 'Did Taro clean his room or do other such things?'
- (78) a. tabemono -toka motteko -i!  
 food -TOKA bring -IMP  
**Partially inclusive:** 'Bring me food (and possibly something else)'  
**Fully inclusive:** 'Bring me food or something like that!'
- b. tsumaranai. Odot -tari si -ro!  
 boring dance -TARI do -IMP  
**Partially inclusive:** 'I'm bored. Dance (and maybe do something else too)!'  
**Fully inclusive:** 'I'm bored. Dance or something!'

What's more, just like with Persian m-reduplication, Japanese sentences with *-toka* and *-tari* are sensitive to pragmatic aspects of the context. As (79) shows, both *-toka* and *-tari* permit inclusive readings when speaker ignorance

is established, despite the fact that the semantic environment in which the *-toka/tari* phrase is found is upward-entailing.

- (79) a. CONTEXT: Hanako has a lunch box in which she usually carries a few apples, but sometimes brings other kinds of fruit. You don't know exactly what's in the box, nor do you know exactly how many things are in it.

Hanako -wa ringo -toka -o mot -te i -ru  
Hanako TOP apple -TOKA -ACC carry -PROG be -PRS

'Hanako has an apple or something.'

- b. CONTEXT: You and a friend have made plans to meet up with Taro. He seems to be running late, but then you remember he had a few chores to do today. You don't know exactly what he's doing today, but you know it's something around the house. Your friends asks you why Taro's running late. You say:

sentaku -o si -tari si -te i -ru  
laundry -ACC do -TARI do PROG be -PRS

'He's doing laundry or something like that.'

As such, we find that *-toka* and *-tari* exhibit behavior exactly like that of Persian m-reduplication. In the next section, I review previous analyses of the sensitivity of *-toka/-tari* to contextual factors, pointing out flaws with each case. I then propose my own analysis in the following section, building on the analysis of m-reduplication proposed above.

#### 4.2 Previous analyses of *-toka* and *-tari*

In order to derive the polarity sensitivity of these particles, previous approaches to the semantics of *-toka* and *-tari*, such as [Smith & Kobayashi 2018](#), used a Hamblin-style alternative semantics ([Hamblin 1973](#), [Kratzer & Shimoyama 2002](#)), according to which the alternatives generated by *-toka* and *-tari* are universally quantified in upward-entailing contexts, but, essentially, existentially quantified in other contexts.

There are at least two problems with such an approach, however. First, use of the universal propositional quantifier results in overly strong truth conditions: an expression with *-toka* or *-tari* is predicted to be true only if *all* the alternatives are true. In reality, they are judged true/felicitous in upward-entailing contexts when at least one other alternative is true. As such, (67)

is felicitous if Taro *and at least one similar person* comes, not just if Taro and *all* of those similar to him in the context come. Second, this analysis predicts that *-toka/-tari* should receive something like a disjunctive interpretation in downward-entailing contexts; for example, the conditional in (76a) should mean that Yosuke will serve tea if Taro *or* someone similar comes. This judgment is attested, and is reported in [Smith & Kobayashi 2018](#), but not all Japanese speakers agree with this judgment: the interpretation these speakers get is that if *at least* Taro comes (possibly along with those similar to him in the context) Yosuke will serve tea. Finally, the analysis is somewhat unprincipled: although the analysis derives an empirically unproblematic interpretation for fully inclusive speakers in downward-entailing contexts, the analysis of polar questions requires a stipulated use of the existential propositional quantifier, and the fact that weaker readings are attested in certain contexts is not connected to their downward-entailing nature. Because of this, the analysis also has nothing to say about *-toka* and *-tari*'s sensitivity not just to the semantic environment in which they appear but also to more pragmatic concerns such as speaker ignorance.

[Smith \(2019\)](#) proposes a solution to these issues using a higher-order implicature analysis, treating expressions suffixed with *-toka/-tari* as identical in their unenriched meanings to the expression without these morphemes. This analysis makes many correct predictions where the previous analysis failed: it correctly accounts for the fact that only one alternative needs to be true rather than all of them, naturally accounts for the partially inclusive readings that many Japanese speakers get with such sentences in downward-entailing, non-monotone, and ignorance contexts rather than only permitting the fully inclusive reading, is less stipulative than the previous analysis, and is able to tie the sensitivity of these expressions to certain types of contexts to well-understood properties of implicature.

Unfortunately, this analysis runs into additional problems. Empirically, it struggles to provide a natural account of the judgments of fully inclusive speakers, and the analysis of these judgments is essentially stipulated. On a more conceptual level, if sentences with *-toka/-tari* are equivalent to those without such a morpheme, it isn't clear why speakers would use the expression in non-upward-entailing contexts in the first place. The reason is clear independent of the analysis: *-toka/tari* expressions are weaker than their bare counterparts. This, however, is not reflected in an analysis based on higher-order scalar implicature.

Having demonstrated the inadequacy of previous analyses of *-toka* and



*-tari*, In the next section I lay out an analysis of these expressions in terms of the mixture analysis proposed for m-reduplication.

### 4.3 A mixture analysis of *-toka* and *-tari*

I propose that *-toka* and *-tari* be analyzed as (partially) inclusive mixtures. I begin my analysis with *-toka*. As with m-reduplication, I analyze *-toka* as a function that takes a type  $\langle e, t \rangle$  argument.<sup>20</sup> Due to the fact that *-toka*, unlike m-reduplication, allows for the overt expression of the contextual restriction on the domain in which similarity is being evaluated, I also propose that *-toka* takes an additional type  $\langle e, t \rangle$  argument. I capture the effect of the additional argument  $S$  by using a modified definition of the similarity set, the (*proper*) *similarity set restricted to  $s$* , notated  $P^{\sim}_S$  and defined as in (80).

- (80) a.  $P^{\sim}_S = \{x \mid \exists Q: Q \sim_C P \ \& \ P, Q \subset S \ \& \ Q(x)\}$   
 b.  $P^{\approx}_S = P \cup P^{\sim}_S$

(81a) shows the translation of *-toka* for partially inclusive speakers, while (81b) provides the one for fully inclusive speakers. The result is another predicate of individuals for both sets of speakers.<sup>21</sup>

- (81) a. *-toka*<sub>partially inclusive</sub>  $\rightsquigarrow \lambda P. \lambda Q. \lambda X. \text{IsAMix}(P, P^{\approx}_Q)(X)$   
 b. *-toka*<sub>fully inclusive</sub>  $\rightsquigarrow \lambda P. \lambda Q. \lambda X. \text{IsAI-Mix}(P, P^{\approx}_Q)(X)$

Deriving the exclusive reading proceeds exactly as in the m-reduplication case, where the *-toka* sentence competes with the alternative corresponding to the bare noun for partially inclusive speakers, and with the alternatives corresponding to the bare noun and its proper similarity set for fully inclusive speakers. Negation of these alternatives derives the exclusive mixture

<sup>20</sup> Names like *Taro* can be lifted to type  $\langle e, t \rangle$  via the IDENT type-shifter of Partee 1987.

(i) IDENT( $t$ )  $\Rightarrow \lambda x. x = t$

<sup>21</sup> An anonymous reviewer points out that it is also possible for *-toka* to appear on *-tari*-marked VPs, as in (i)

(i) Taro -ga heya -o sooji si -tari -toka si -ta  
 Taro -NOM room -ACC clean do -TARI -TOKA do -PST  
 ‘Taro cleaned his room and did other such things’

This sentence is more or less identical to the sentence without *-toka*. One possibility is that the *-toka* in this example is distinct from the *-toka* as defined in the text, and serves as an identity function. I leave this issue to future research.

reading for each set of speakers, as desired.

Let us turn now to the case of *-tari*. Because *-tari* involves verbal material, I propose that it takes as arguments predicates of *events*, and mixes a set of events with its similarity set or proper similarity set. Once again, we make a distinction between the analysis of *-tari* for partially and fully inclusive speakers, given in (82a) and (82b), respectively.

- (82) a. *-tari*<sub>partially inclusive</sub>  $\rightsquigarrow \lambda V. \lambda V'. \lambda e. \text{IsAMix}(V, V \sim_{V'}) (e)$   
 b. *-tari*<sub>fully inclusive</sub>  $\rightsquigarrow \lambda V. \lambda V'. \lambda e. \text{IsAI-Mix}(V, V \sim_{V'}) (e)$

Here again, the derivation of the exclusive mixture reading from the partial and fully inclusive readings respectively proceeds via calculating and negating the innocently excludable alternatives: in the case of partially inclusive speakers, the alternative corresponding to the verb phrase that *-tari* takes as complement is the only excludable alternative, and negating this alternative derives the exclusive mixture interpretation from the underlying partially inclusive semantics. In the case of fully inclusive speakers, both alternatives derived from the arguments of the mixture function in the translation of *-tari*, the predicate of events corresponding to the overt verb phrase and its proper similarity set, are innocently excludable, and negating these derives from the underlying fully inclusive semantics an exclusive mixture reading, once again as desired.

Taken all together, this analysis straightforwardly solves the problems with [Smith & Kobayashi 2018](#) and [Smith 2019](#)'s analyses: *-toka/tari* sentences are not predicted to have universal readings, and it is possible to account for the judgments of both fully and partially inclusive speakers, all while allowing for an explanation for the connection between the different interpretations of *-toka/tari* to the properties of implicature in non-upward-entailing environments and ignorance contexts. What's more, we also now have an explanation for why speakers would use *-toka/tari* in non-upward-entailing contexts: they are logically weaker than the expression without the morpheme. This solves a problem with the higher-order scalar implicature analysis proposed in [Smith 2019](#).

## 5 On the (non-)cancellability of implicatures with plurals

An anonymous reviewer points out that, although they agree with the judgments about Japanese reported above, the implicature associated with *-toka*

does not appear to be cancellable; (83) sounds very odd with an overt cancellation.

- (83) ??Hanako -wa ringo -toka -o mot -te iru -ga mot  
Hanako -TOP apple -TOKA -ACC carry -PROG be.PRS -BUT carry  
-te iru no -wa ringo -dake da  
-PROG be.PRS NMLZR -TOP apple -ONLY COP.PRS  
'Hanako has an apple and other such things, but she only has an apple.'

The same effect can in fact be replicated with Persian m-reduplication: in upward-entailing contexts, it is judged infelicitous to cancel the non-homogeneous plural inference.

- (84) #Mohsen ketâb metâb xund. Ammâ dar vâghe faghat ye ketâb  
Mohsen book RED read.PST but in reality only a book  
xund  
read.PST  
'Mohsen read books and the like. In fact, he just read a book.'

One might take these facts to cast doubt on the implicature analysis I have argued for here. However, this is less of a problem than it appears to be. First of all, it is well-known that the multiplicity inference of English bare plurals is not cancellable, despite its disappearance in non-upward-entailing environments and ignorance contexts (Chierchia, Fox & Spector 2012).

- (85) # John read books; maybe he read only one book.

Chierchia, Fox & Spector (2012) argue that the multiplicity implicature is an instance of an *obligatory implicature*: alternatives are automatically activated in the presence of plural morphology, and an exhaustification operator must associate with these alternatives in an upward-entailing context. However, in the presence of a downward-entailing operator, the stronger alternative to the plural is now weaker, so no implicature arises. This explains their disappearance in downward-entailing contexts despite their non-cancellability. Given my use of a grammatical approach to implicature in this paper, the approach of Chierchia, Fox & Spector 2012 can be immediately adapted to the cases of m-reduplication and *-toka*. In fact, this approach reveals a general characteristic of the pragmatics of plural expressions: their alternatives are automatically activated, and their implicatures are therefore obligatory in upward-entailing contexts.

More generally, much recent work has called into question the notion

that cancellability is a defining characteristic of implicatures (Ivlieva 2012, Romoli 2015, Rett 2020). Rett (2020), for instance, notes that many instances of Quantity and Manner implicature are not directly cancellable. An example of this is the implicature associated with (86), which implicates that John met a woman who does not bear some more specific relation to him.

(86) John met a woman at the bar last night. #In fact, he met his wife!

Rett argues that *calculability* is a more defining property of implicature than cancellability, and further shows that a wider set of implicatures can be cancelled if they do not directly address the QUD, or “if the phrase was introduced into the conversation before the speaker of the relevant utterance uses it” (Rett 2020: p. 7). This is done with question-answer pairs, as below.

(87) A: Did John meet a woman at the bar last night?  
B: Yes (he met a woman), in fact, he met his wife.

This exact phenomenon is attested with Persian m-reduplication (12), *-toka* (77), and English bare plurals: the implicature vanishes in answers to polar questions containing the expression over which implicature is calculated. This is shown for English below.

(88) Q: Did you see dogs today?  
A: Yes, I saw one dog.

It seems certain, then, that an implicature analysis cannot be refuted on the basis of the impossibility of certain kinds of cancellations in certain contexts.

## 6 Conclusion and discussion

In this paper, I’ve developed an analysis of non-homogeneous plural inferences in m-reduplication and Japanese similatives as scalar implicature, based on an analysis of the unenriched meaning of similative expressions as mereological mixtures of sets with their similarity sets. The analysis explains the behavior of similatives in upward-entailing as well as non-upward-entailing and ignorance contexts, and their interaction with quantificational expressions, collective predication, and other properties of the grammars of the languages under discussion, while also explaining interspeaker variation in the unenriched meaning of similative plurals.

The analysis makes several empirical and theoretical contributions. Empirically, it presents a formal treatment of the properties of similative plurals, which, to my knowledge, has not been done previously. It further re-

veals connections with the theory of bare plurals, such as those found in English, and thereby facilitates comparison with other types of plurals cross-linguistically. Theoretically, the analysis has implications for the theory of implicature calculation and of alternatives. In particular, I have argued that the derivation of the non-homogeneous plural, or exclusive mixture interpretation of similative plurals from their underlying (partially) inclusive mixture semantics requires the use of both local implicature calculation (Landman 2000; Chierchia 2004; Zweig 2009) and abstract alternatives (Chemla 2007; Buccola, Kriz & Chemla 2022; Charlow 2019). Consequently, the phenomena discussed here prove problematic for classical structural approaches to alternatives (Katzir 2007).

It is important to note that although the analysis casts doubt on the *structural* theory of *alternatives*, it does not exclude a *grammatical* approach to *implicatures*. On such theories, implicatures are derived by semantic operators in the syntax, rather than via global pragmatic inferences operating on an unenriched semantic representation. Such theories are compatible with a variety of approaches to the derivation of alternatives, including the conceptualist approach advocated for here. Likewise, different approaches to the nature of alternatives are compatible with a range of approaches to the calculation of implicatures. The conceptualist approach I adopted here was combined with a grammatical approach to implicatures, but the two ideas are logically independent.

Several interesting topics, both empirical and theoretical, remain for future research. I will briefly discuss some of these here.

### **6.1 Interspeaker variation in similative plural inferences**

In both of the case studies of similative plurality I discussed in this paper, I observed interspeaker variation in the interpretation of these expressions in non-upward-entailing and ignorance contexts: speakers differ in how inclusive their interpretations of the similative are in these environments. My analysis is able to capture this variation by positing a slightly different semantics for the expressions for each group of speakers, but it leaves unanswered the question of why such variation occurs in the first place. Do we see such variation among speakers for similatives in other languages as well? What is the cause of this variation? I leave these questions for future research.

## 6.2 Other types of non-homogeneous plurality

Another point of comparison is between simulative plurals and associative plurals, such as Japanese *-tachi*. As discussed by Nakanishi & Tomioka (2004), *-tachi* can attach to proper names (89a), in which case they refer to a group of people associated with the mentioned individual, as well as to common nouns, in which case they may still refer to a non-homogeneous group of individuals associated with the set of individuals denoted by the bare noun (89b). (89b), for instance, can be uttered in a context in which Martians have conquered the earth and conscripted a large number of humans into their army, and the attacking army is actually mostly made up of humans.

- (89) a. Taro -tachi -ga ki -ta  
Taro -TACHI -NOM come PST  
'Taro and his associates came.'
- b. Kaseijin -tachi -ga semete ki -ta  
Martian -TACHI -NOM attack come -PST  
'The group associated with Martians came to attack.'

As can be seen here, associative plurals also permit non-homogeneous plural readings. However, unlike in the case of simulative plurals, this non-homogeneity inference is not particularly strong, and speaker ignorance is not required for associative plurals to refer to homogeneous pluralities: (89b) could also be used in a context in which an army made up entirely of Martians attacked. As such, associative plurals appear to be merely *compatible* with non-homogeneous pluralities, and differ from simulative plurals in not generating implicatures about the non-homogeneity of the plurality they denote. Although associative plurals have been extensively studied from a typological and formal semantic perspective (Moravcsik 2003, den Besten 1996, Tatsumi 2017), a detailed study comparing the formal properties of associatives to those of similatives has, to my knowledge, yet to be undertaken, and I intend to pursue this topic in future work.

## 6.3 Alternatives, symmetry, and conceptual primitives

Zooming out to the broader theoretical landscape, interesting questions arise concerning constraints on the set of alternatives on the conceptualist approach I have advocated for here. Recall that I argued that the alternatives to m-reduplication for partially inclusive speakers, for whom m-reduplicated

nominals denote a partially inclusive mixture, are the cumulative closures of the bare nominal and the full similarity set. A question that arises in this discussion is whether we couldn't also replace the mixture operation itself with an alternative mixture operation. For instance, I defined several mixture operations in (44-47) above, including the exclusive mixture in (45), repeated below in (90), which directly produces the non-homogeneous plural reading we are interested in producing via implicature.

(90) Exclusive mixture

$$\text{E-MIX}(P, Q) = *(P \cup Q) \setminus (*P \cup *Q)$$

The existence of the exclusive mixture as an alternative would be problematic, as it would be a stronger alternative to the unenriched meaning of m-reduplication, and its exclusion along with the alternative corresponding to the bare noun would contradict the assertion, preventing the computation of any implicature. This state of affairs is known as the *symmetry problem*, (Fox 2007, Katzir 2007, Fox & Katzir 2011), and any theory of alternatives needs to address it.

A solution to the issue in the conceptualist framework would be to simply posit that the exclusive mixture operation, like *some but not all* and *xor*, is not a primitive of the language of thought. As such, it is not available as an alternative to other mixture operations, and the symmetry problem does not arise. One may be tempted to provide motivation for this claim from first principles; for instance, one might appeal to the relative complexity of the E-MIX operation, as E-MIX can be defined in terms of performing set difference operations on the simpler I-MIX operation. This would be analogous to the fact that *some but not all* and *xor* can also be defined in terms of other, primitive concepts.<sup>22</sup> A challenge to this line of reasoning, however, is that one cannot take for granted that a given element of the language of thought *must* be non-primitive simply because it *can* be defined in terms of simpler operations. For instance, as Goodman (1955) points out, one could just easily hypothesize that *xor* is primitive, making exclusive disjunctions just as complex as inclusive disjunctions.

Recent work on the language of thought emphasizes that proposals concerning the set of conceptual primitives is ultimately an empirical matter (Buccola, Kriz & Chemla 2022, Piantadosi, Tenenbaum & Goodman 2016):

<sup>22</sup> Note that this complexity-based reasoning does not extend to the similarity sets I defined above: on my analysis,  $P^{\approx}$  is defined in terms of  $P^{\sim}$ , making the former more complex than the latter.

such proposals are best thought of as hypotheses that can, at least in principle, be evaluated experimentally. As an example of this, Piantadosi, Tenenbaum & Goodman (2016) compare the predictions of multiple models using different sets of logical primitives with the results of a large-scale concept learning experiment, showing that the results are most consistent with language of thought models incorporating a rich set of Boolean connectives and first-order, but not second-order, quantification as primitives. In a similar vein, Buccola, Kriz & Chemla (2022) used an implicit rule discovery task to establish preferences between abstract rules corresponding to various quantificational expressions, finding evidence for a preference for rules corresponding to *all* over those corresponding to *some but not all*. It is conceivable that my proposal about the non-primitiveness of the exclusive mixture operation could be evaluated using similar empirical methods. Such work would not only shed light on questions concerning the kinds of alternatives available to speakers of languages with similatives, but also potentially make a broader contribution to the study of conceptual primitives in cognitive science.

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