The semantics of Turkish numerals[1]

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Abstract. In this study, I explore Turkish numeral constructions which have typologically two interesting properties: (i) the existence of an optional classifier, (ii) the incompatibility of plurals. I argue that the numerals are modifiers of type <<e,t>,<e,t>> defined only for atomic properties as proposed by Ionin and Matushansky (2006). The explanation rests on the semantics of *bare nouns* (unmarked by the plural marker *-lAr*) which are proposed to denote sets of atoms contra Bale et al. (2010), and the semantics of *the classifier* which is claimed to be a partial identity function presupposing for atomic properties.

Keywords: numerals, atomicity, number neutrality, plurality, kinds, optional classifiers

1. Introduction

This study explores the two typologically interesting properties of Turkish numeral constructions: (i) the existence of an optional classifier, *tane*[2], and (ii) the incompatibility of plurals as shown in (1a) and (1b) below.

(1) a. iki (tane) kitap
two CL book
'two books'

b. *iki (tane) kitap-lar
two CL book-PL
'two books'

The main purpose is to show that Turkish numerals are modifiers of type <<e,t>,<e,t>> that combine with atomic properties as proposed by Ionin and Matushansky (2006) contra Bale et al. (2010) where they are treated as restrictive modifiers. The analysis revolves around the semantics of *bare nouns* (unmarked by the plural marker *-lAr*) which are proposed to denote sets of atoms here instead of being number neutral as claimed in Bale et al. (2010). In addition, the classifier *tane* is claimed to be a partial identity function presupposing for atomic properties.

This paper is organized as follows. Section 2 introduces two distinct accounts of the semantics of Turkish numerals and clarifies the relevant details. Section 3 provides an analysis for the semantics of bare nouns showing that they denote atomic properties. Section 4 incorporates the optional classifier *tane* into the overall picture. Section 5 concludes.

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[2]Turkish has two classifiers besides group denoting ones. One is *tane*, compatible with all count nouns, and the other is *adet*, compatible with non-human count nouns. In this study, I will only refer to *tane* since the distribution of both classifiers is the same. They are considered to be classifiers, because they have similar properties as the classifiers in other languages. As defined in Kim (2009), (i) classifiers are only compatible with count nouns whereas measure words are compatible with both count and mass nouns, (ii) they cannot be modified by an adjective as opposed to measure words, and (iii) they can be used with quantifiers compatible with count nouns.

2. The Semantics of Numerals

Numerals have been treated as both determiners of type <<e,t>,<<e,t>,t>> (Bennett 1974, among others) and predicates of type <e,t> (Partee 1987, Link 1987, Landman 1989, among others). Among the ones who treat numerals as predicates, Link (1987) analyzes them as restrictive modifiers. However, all of these works focus only on simplex numerals. On the other hand, Ionin and Matushansky (2006) treat numerals as modifiers of type <<e,t>, <e,t>> the lexical complement of which has to be atomic. Their illustration is simplified in (2) (pg. 321). Informally, $[\![\textit{two books}]\!]$ can be stated as in (3).

(2) a. $[\![\textit{two}]\!] = \lambda P\, \lambda x\, \exists S\, [\prod (S)(x) \wedge |S| = 2 \wedge \forall s \in S\, P(s)]$
b. $\prod (S)(x) = 1$ iff
S is a cover of x, and
$\forall z, y \in S\, [z = y \vee \neg\exists a\, [a \leq_i z \wedge a \leq_i y]]$
c. A set of individuals C is a cover of a plural individual X iff X is the sum of all members of C: $\sqcup C = X$

(3) $\lambda x \in D_e$. x is a plural individual divisible into 2 non-overlapping individuals p_i such that their sum is x and each p_i is a book.

They show that if simplex numerals were determiners it would not be possible to derive the semantics of complex numerals, like *two hundred*. Namely, if *hundred* (presumably of type <<e,t>,<<e,t>,t>>) combined with *books* (of type <e,t>) first, the resulting NP would be a generalized quantifier of type <<e,t>,t>. Consequently, this NP could not combine with another numeral. They also show that treating numerals as predicates of type <e,t> faces the same problem; the semantic composition of numerals would fail in a complex numeral construction. This time, the problem is not about types, but predicate modification would result in incorrect truth-conditions. Namely, the NP *two hundred books* would denote the empty set since for no x it is the case that the set of atoms is equal to both two and hundred simultaneously.

On the other hand, in their analysis complex numerals are derived fully compositionally, i.e. *hundred books* being of type <e,t> can be a sister to *two* that is of type <<e,t>, <e,t>>.

(4) a. $[\![\textit{two hundred books}]\!] = \lambda x\, \exists S\, [\prod (S)(x) \wedge |S| = 2 \wedge \forall s \in S\, \exists S\, \exists S\, [\prod (S)(x) \wedge |S| = 100 \wedge \forall s \in S\, \textit{book}(s)]]$
b. Informally: $\lambda x \in D_e$. x is a plural individual divisible into 2 non-overlapping individuals p_i such that their sum is x and each p_i is divisible into 100 non-overlapping individuals p_k such that their sum is p_i and each p_k is a book.

The crucial part of their claim is that they treat English *-s* in numeral constructions as number agreement (semantic concord) rather than being a genuine plural marker. They claim that true plurals cannot combine with numerals because a plural noun such as *books* denotes a set of individuals x where each x is a plurality of books and these pluralities do not necessarily have the same cardinality. In other words, *books* in *two books* has to be semantically singular, only denoting a set of atomic individuals.

There are two main approaches to Turkish numerals. One is Ionin and Matushansky's 2006 view of numerals as sketched above. They claim that languages like Turkish where numerals combine with singular forms of the nouns constitute evidence for their atomic requirement. Their claim is based on the assumption that Turkish bare nouns are atomic in nature.

The other one is in Bale et al. (2010) where following Link (1987) they treat Turkish numerals as restrictive modifiers that combine with nouns via subsective modification. In other words, numerals in Turkish are considered as functions from number neutral denotations to one of their subsets which consists of all and only the groups that are composed of n (number denoted by the numeral) non-overlapping (atomic) minimal parts. The idea is that Turkish bare nouns are number neutral, i.e. inclusive of atoms and their pluralities, instead of denoting sets of atoms. Their semantics of Turkish numerals are illustrated below (pg.10):

(5) a. $[\![two]\!] = \lambda P_{pl}.\ \{x : x \in P_{pl}\ \&\ \exists Y(Y \in PART(x)\ \&\ |Y| = 2\ \&\ \forall z(z \in Y \rightarrow z \in MIN(P_{pl})))\}$

b. A predicate Q is of type P_{pl} iff $\forall x, y \in Q(x \oplus y \in Q)$

c. $MIN(P)$ is defined iff
$\forall x, y \in P\ \&\ \neg\exists z(z \in P\ \&\ (z < y \vee z < x))) \rightarrow x \wedge y = 0)$
When defined $MIN(P) = \{x : x \in P\ \&\ \neg\exists z(z < x)\}$.

In this paper, I aim at showing that Ionin and Matushansky's view should be favored over Bale et al's. Adopting this view of numeral constructions explains the core facts of Turkish numeral constructions if the following hold: (i) Turkish bare nouns are strict singulars denoting sets of atoms, (ii) Turkish numeral constructions lack plural agreement, and (iii) the classifier *tane* is a partial identity function defined only for atomic properties. Following Ionin and Matushansky (2006) in that Turkish numeral constructions lack plural agreement unlike the English ones, I will motivate and justify the atomicity of bare nouns and the semantics of the classifier below.

3. Turkish Bare Nouns as Atomic Properties

Since the seminal work of Link (1983) the mereological treatment of pluralities has become a well-established tradition in the semantic literature, where the domain of individuals (D_e) has been assumed to include atoms and their closure under the sum operator $\oplus$. For example, the complete atomic join semilattice with a, b, and c as singular individuals include the atoms a, b, c and the pluralities a $\oplus$ b, a $\oplus$ c, b $\oplus$ c, and a $\oplus$ b $\oplus$ c.

Bale et al. (2010) argue that Turkish bare nouns denote number neutral sets, i.e. inclusive of atoms and the pluralities (see also Görgülü 2012). For example, if in a model a, b, and c are the books the Turkish noun *kitap* 'book' denotes the set $\{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$. Their claim is based on the neutral interpretation of bare nouns in predicate positions as in (6a). In addition, bare nouns in Turkish are also known as having number neutral interpretations in non-case marked direct object positions as exemplified in (6b).

(6) a. Ali ve Merve **çocuk**.
Ali and Merve child
'Ali and Merve are children.'

b. Ali **kitap** oku-du.
Ali book read-past
'Ali read a book/books.'

Despite what these cases seem to suggest, I argue that bare nouns in Turkish denote sets of atoms only, i.e. $[\![kitap]\!] = \{a, b, c\}$. My claim is established on their *singularity in argument positions* and their *singular kind denotations*. I will first illustrate the strict singularity of bare nouns and then explain the apparent number neutrality in the cases shown above.

3.1. Strict singularity in argument positions

Bare nouns in Turkish are interpreted as strictly singular and definite in subject and case-marked object positions as shown in (7a) and (7b), respectively. This constitutes evidence for their atomicity. Namely, if they denoted a neutral set inclusive of atoms and pluralities, we would expect to get a neutral interpretation in these examples.

(7) a. **Çocuk** ev-e koş-tu.
child home-dat run-past
'The child ran home.'
Not: 'The children ran home.'

b. Ali **kitab-ı** oku-du.
Ali book-acc read-past
'Ali read the book.'
Not: 'Ali read the books.'

Bale et al. (2010) claim that Turkish plurals are exclusive of atoms in denoting pluralities only (see also Görgülü 2012). Namely, the plural *kitaplar* 'books' denotes the set $\{a \oplus b, b \oplus c, a \oplus c, a \oplus b \oplus c\}$ in their view. Maintaining this strict plural analysis, one might argue that the competition between number neutral bare nouns and strict plurals results in the singular reading of bare nouns as in (7). However, plurals in Turkish are actually inclusive of atoms and their pluralities just as in English, i.e. $\{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$[3].

Krifka (2003), Sauerland et al. (2005), Spector (2007), and Zweig (2009) argue for a number neutral account of bare plurals in English. In these works, it has been observed that although bare plurals contain multiplicity as part of their denotation in positive contexts, they lose that requirement in downward entailing and question contexts. In other words, 'more than one' meaning of bare plurals do not seem to be a strict requirement in their interpretation. It has been claimed that this is due to the number neutral denotation of bare plurals, the multiplicity condition of which arises as a result of a conversational implicature in the positive contexts. So, a bare plural in English denotes a set of atomic individuals and pluralities.

This observation also holds for Turkish plurals as is evidenced by the example in (8). If we had gone to the forest and come across one bear, it would be bizarre to respond to the question in (8) as 'no'. Because seeing one bear is an efficient answer to the question in (8), the denotation of bare plural *bears* cannot be 'more than one' bear.

(8) Orman-da **ayı-lar-a** rastla-dı-nız mı?
forest-loc bear-pl-dat come.across-past-2pl QP
'Did you come across bears in the forest?

[3]See Renans et al. (2018) for an experimental study showing the neutrality of Turkish plurals.

a. Evet, bir tane gör-dü-k.
yes, one CL see-past-1pl
'Yes, we saw one.

b. #Hayır, bir tane gör-dü-k.
no, one CL see-past-1pl
'No, we saw one.'

Now, consider (9b) where a plural noun appears in a negative context[4]. In (9a), the scalar implicature surfaces since the 'more than one' interpretation is stronger than the 'one or more' interpretation. On the other hand, (9b) is felicitous when there are no children playing ball, but not if there is only one child playing, as would be predicted by a strictly plural account.

(9) a. **Çocuk-lar** sokak-ta top oynu-yor.
child-pl street-loc ball play-prog
'Children are playing ball on the street.'

b. **Çocuk-lar** sokak-ta top oyna-**mı**-yor.
child-pl street-loc ball play-neg-prog
'Children aren't playing ball on the street.'

In addition, the 'one or more' interpretation of plurals is also available in other downward entailing contexts such as the antecedents of the conditionals as in (10a) and the restrictors of universal quantifiers as in (10b). In both cases, the plural *erkekler* 'men' is interpreted neutrally.

(10) a. Eğer **erkek-ler** tarafından aldat-ıl-dı-y-sa-n, sen de biz-e
if man-pl by cheat-pass-past-cop-cond-2sg you also we-dat
katıl-abil-ir-sin.
join-abil-aor-2sg
'If you have been cheated by men, you can join us.' (one or more men)

b. **Erkek-ler** tarafından aldat-ıl-an herkes biz-e katıl-abil-ir.
man-pl by cheat-pass-rel everybody we-dat join-abil-aor.
'Everyone who has been cheated by men can join us.' (one or more men)

Therefore, in light of the argumentation for English bare plurals, I argue that Turkish plurals are also number neutral and the multiplicity condition in positive contexts arises as a result of a conversational implicature.

Bale et al. (2010) use the following sentence in (11) as evidence for their strict plural account of Turkish plurals (pg. 8, e.g. 14). The reasoning is as follows: If plurals were inclusive of atoms, then they would be expected to be predicated of singular subjects as well as plural ones. The example in (11b) shows that plurals in Turkish cannot be predicated of singular subjects.

(11) a. John ve Brad **çocuk(-lar)**.
John and Brad child-PL
'John and Brad are children.'

b. *John **çocuk-lar**.
John child-PL
Intended: 'John is a child.'

First of all, I want to point out the fact that although in English bare plurals are number neutral,

[4]The plurals in these sentences can also be interpreted as definites depending on the context. Turkish lacks an overt definite determiner, and the general view is that the definiteness in Turkish is achieved via the iota operator. Here, we are concerned with the existential interpretations of the plurals. See Section 3.2.1 for details.

they cannot be predicated of singular subjects, either. So, this is a general problem, hence does not constitute good evidence for the alleged strict plurality of plurals in Turkish by itself. Second, *-lAr* in (11a) is not the genuine plural marker but the 3rd person plural agreement, which is realized by the same morpheme appearing optionally. One way to distinguish the two is their stress pattern. The third person plural marker shifts the stress to the preceding syllable, whereas the genuine plural marker always receives it on itself (**?**). In (11a), the stress is on the syllable preceding the plural marker, so here *-lAr* cannot be the genuine plural maker. The structure of (11a) can be roughly represented as the following:

(12) $[_{TP}$ John and Brad $[_{VP}$ $[_{NP}$ çocuk] cop] T+-lar] [5].

We expect (11b) to be bad because the subject is not plural, so the 3rd person plural agreement is not realized on the predicate.

If (11a) is pronounced with the stress on *-lAr*, then the sentence means 'John and Brad are the children.', not 'John and Brad are children.', receiving an equative interpretation. We still expect (11b) to be bad since the equative reading requires the maximal unique plural individual in the denotation of the plural noun (in our case *çocuklar*). The subject *John*, however, is an atomic individual. So, there is a number mismatch between the two entities to be equated.

To wrap up, what we have seen so far is that plurals in Turkish are number neutral, inclusive of atoms and pluralities, therefore the competition story which would be possible if we adopted the account in Bale et al is not tenable. It follows that bare nouns in Turkish should be treated as denoting sets of atoms only.

3.2. Singularity in kinds

In this section, I show that kinds denoted by bare nouns in Turkish are singular being impure atomic in nature following Dayal's (2004) view on English definite singular kinds, which I take as further evidence for the singularity of bare nouns. I will first discuss the properties of kinds by introducing plural kinds in Turkish and then return back to singular kinds.

3.2.1. Overview of kind terms

We have seen that Turkish plurals are like English bare plurals in being number neutral. They are also equivalent in having primary readings: kind (13a), generic (13b), and existential (13c) as shown below (see Carlson 1977 and Chierchia 1998 for English bare plurals):

(13) a. **Dinazor-lar** 66 milyon 38 bin yıl önce yok ol-du(-lar).
dinosaur-pl 66 million 38 thousand year ago extinct be-past-3pl
'Dinosaurs became extinct 66 million 38 thousand years ago.'

[5] Kornfilt (1996) and Kelepir (2003) claim that there is a null realization of the copula *-i* between the noun and the person agreement marker in Turkish. The copula as being a clitic shifts the stress to the preceding syllable.

b. **Ayı-lar** genelde saldırgan ol-ur(-lar).
bear-pl usually aggressive be-aor-3pl
'Bears are generally aggressive.'
c. **Kedi-ler** dışarda çiftleş-iyor(-lar).
cat-pl outside mate-prog-3pl
'Cats are mating outside.'/ 'The cats are mating outside.'

I suggest following Chierchia (1998) and Dayal (2004) that bare plurals start as type <s,<e,t>> and become kind terms of type <s,e> via Chierchia's nominalization operation (nom), i.e. $^{\cap}$: $\lambda P_{<s,et>}\ \lambda s\ \iota x\ [P_s(x)]$. This implies that bare plurals can directly combine with a kind-level predicate. When they combine with object-level predicates, further operations come into the picture (Chierchia 1998). One is the inverse of nom, predicativization (pred), which takes the extension of the kind and returns the set of singular and plural entities that are the instantiations of the kind (in lines with the neutrality of plurals), i.e. $^{\cup}$: $\lambda k_{se}\ \lambda x\ [x \leq k_s]$. In generic contexts, the Generic operator binds the variables over these instantiations. The other is *Derived Kind Predication (DKP)*, which provides sort adjustment introducing existential quantification over the instantiations of the kind provided by pred in a given situation in episodic contexts.

(14) DKP: If P applies to objects and k denotes a kind, then $P(k) = \exists x\ [\ ^{\cup} k(x) \wedge P(x)]$

The application of DKP also results in narrow scope interpretation of bare plurals as in English:

(15) a. **Köpek-ler** havla-mı-yor.
dog-pl bark-neg-prog
'Dogs aren't barking.'
b. $[\![Köpekler\ havlamıyor]\!] = \neg bark\ (^{\cap} dogs) = DKP \Rightarrow \neg\ \exists x\ [^{\cup\cap}\ dogs(x) \wedge bark(x)]$

The fact that plural kinds are transparent to their instantiation sets which is achieved via pred is supported by the tests showing that access to the atomic level is necessary in object level readings (Schwarzschild 1996). Below, among such tests the compatibility with *reciprocals* and the predicate *come from different areas* are applied. The atomic level is accessible only if the instantiations of kind terms are grammatically available[6]. The compatibility of plurals with them shows that plurals have a see-through relation with their instantiations. (16a) and (16b) exemplify generic and episodic contexts respectively.

(16) a. **Kedi-ler** birbirin-e saldır-ır(-lar).
cat-pl each.other-dat attack-aor-3pl
'Cats attack each other.'
b. **Ayı-lar** bu hayvanat bahçesi-ne farklı bölge-ler-den gel-di(-ler).
bear-pl this zoo-dat different area-pl-abl come-past-3pl
'Bears came to this zoo from different areas.'

Differently from English bare plurals, Turkish plurals can also have a definite interpretation in object-level contexts besides the narrow scope existential readings as is evident in the example

[6]Schwarzschild (1996) use the incompatibility of collective/group-denoting nouns with reciprocals and the predicate *live in different cities* to show that collective nouns do not allow access to atoms.

(13c). This difference comes from the fact that Turkish lacks an overt definite article and we assume that the definite interpretations are achieved via iota. This makes the plurals in Turkish ambiguous in existential (narrow scope) and definite interpretations[7].

3.2.2. Singular kinds

What about bare nouns? As plurals, they can also combine with kind level and generic predicates as shown in (17a) and (17b). However, in episodic contexts, bare nouns are interpreted as strict singular and definite as shown in (17c) as opposed to plurals which can receive an existential reading as shown in (13c) above.

(17) a. **Dinazor** 66 milyon 38 bin yıl önce yok ol-du.
dinosaur-pl 66 million 38 thousand year ago extinct be-past
'The dinosaur became extinct 66 million 38 thousand years ago.'

b. **Ayı** genelde saldırgan ol-ur.
bear usually aggressive be-aor
'The bear is generally aggressive.'

c. **Kedi** dışarda çiftleş-iyor.
cat outside mate-prog
'The cat is mating outside.' Not: '(The) Cats are mating outside.'

The lack of existential readings with bare nouns via DKP is further shown by their inability to take scope under negation as shown in (18), where the only interpretation available for the bare noun is definiteness. This would not be expected if the instantiations of a bare kind included atoms and pluralities, contrasting with the number neutral account of bare nouns. Given this, how bare nouns can have kind denotations seems to be mysterious considering the view that kinds are inherently plural entities (Chierchia 1998).

(18) **Kedi** dışarda çiftleş-mi-iyor.
cat outside mate-neg-prog
'The cat isn't mating outside.'

Bare kinds behave more like definite singular kinds in English (also known as definite generics) which have been broadly discussed in Dayal (2004) (e.g. *The lion is extinct*.). Dayal claims that even though kinds (singular or plural) are conceptually plural, singular kinds are grammatically atomic. They are different from plural (and mass) kinds in that they do not have a semantically

[7]Nom and iota can freely apply in Turkish because there are no overt versions that would block them. This is a consequence of the Blocking Principle proposed in Chierchia (1998) which is represented below.

(i) *Blocking Principle*: For any type shifting operation ϕ and for any X: $*\phi(X)$ if there is a Determiner D such that for any set X in its domain, $D(X) = \phi(X)$.

In English, iota cannot apply freely to bare nouns since it is blocked by the overt definite marker *the*. The reason that plurals in Turkish cannot get strong indefinite interpretations is the Meaning Preservation which is again proposed in Chierchia (1998), but revised in Dayal (2004). According to the Revised Meaning Preservation, nom and iota are ranked above the existential operator, hence nouns in Turkish can shift via the former but not the latter.

(ii) *Revised Meaning Preservation*: $\{\cap, \iota\} > \exists$

transparent relation to their instantiations; namely, they are impure atomic in the sense of Link (1983) and Landman (1989) behaving more like a collective noun (see Schwarzschild 1996 for the discussion on collective nouns). This means that any grammatical means like the application of pred or Carlson's (1977) Realization (R) relation that constitutes the relation between kinds and their instantiations, i.e. $R(x,y)$ where y is a kind x is an individual corresponding to the instantiations of that kind, will not apply to singular kinds[8].

Dayal's proposal is based on the idea that common nouns systematically denote properties of ordinary individuals and properties of (sub-)kinds. Just as other determiners like *every*, *a* and also numerals, when the definite determiner in English combines with the latter it yields taxonomic readings. Namely, the definite singular kinds are derived compositionally from the regular definite determiner and a common noun that denotes a taxonomic property, i.e. ιX $[P(X)]$, X ranging over entities in the taxonomic domain. Based on that, *lion* in '*The lion is extinct*' denotes a singleton set containing a unique kind in a taxonomic domain, i.e. $\{LION\}$ if the domain of quantification is the set of taxonomic entities as lion, whale, and dog, or $\{AFRICAN\ LION, ASIATIC\ LION...\}$ if it is the set of sub-kinds of the lion kind.

Singular definite kinds in English are not compatible with object-level contexts (episodic as well as generic) unless they refer to the whole species as a singleton set (e.g. *The rat reached Australia in 1770.*). In other words, they are impure atomic terms whose only instantiation sets (when available) include a singular representative or prototypical object.

The same facts hold for bare kind terms in Turkish, which I will call singular kinds from now on based on their atomic nature. Since Turkish lacks an overt definite marker, singular kinds are realized in bare form to which the covert iota operator applies[9]. I also want to show further evidence with respect to their impure atomicity by applying the tests for the accessibility of the atomic level. Consider (19) where the bare noun *ayı* is used in an episodic context and incompatible with the distributive predicate *come from different areas* (cf with (16b)).

(19) ***Ayı** bu hayvanat bahçesi-ne farklı bölge-ler-den gel-di.
bear this zoo-dat different area-pl-abl come-past-3pl
Intended: 'Bears came to this zoo from different areas.'

The sentences in (19) shows that singular kinds do not allow distributive predication to entities we intuitively associate with them. Otherwise, bare nouns would be interpreted as plural kinds and yield grammatical results with these tests. This means that the denotations of bare nouns in object-level contexts as in (17c) must be derived without reference to their kind denotations. To be more precise, they denote atomic properties independent of being singular kind terms[10].

However, as pointed out by Dayal for English definite singular kinds, if a singular kind in Turkish refers to the totality of species as a prototypical object, then it is compatible with the object-level predicates as exemplified in (20), which represents an episodic context.

[8]By abstracting over x, we would be able to get the instantiation set of a singular kind. This way they would not be different from plural kinds.

[9]This is also the case in languages like Russian and Hindi as widely discussed in Dayal (2004).

[10]Strong indefinite readings are not available for bare nouns due to Revised Meaning Preservation.

(20) **Kitap** bu ülke-ye çok geç gel-di.
book this country-dat very late come-past
'The book reached this country very late.'

Similarly, in generic statements singular kinds are acceptable again if they refer to the whole species as a prototypical object explaining their compatibility with genericity as in (17b). The fact that singular kinds block access to the instantiations also holds for the generic contexts as is evident below, where the reciprocal test is applied (cf with (16a)).

(21) *__Kedi__ birbirin-e saldır-ır.
cat each.other-dat attack-aor
Intended: 'Cats attack each other.'

To summarize, plurals are kinds and their object-level interpretations are derived via pred and DKP. On the other hand, bare nouns are ambiguous in being singular kinds and denoting atomic properties. In object-level contexts, their atomic property denotations are made use of unless a prototypical representation of the kind term is meant. This explains the lack of narrow scope existential readings with them (i.e. DKP does not apply) and their singular interpretations.

To wrap up the discussion so far, we have seen two types of evidence showing that bare nouns in Turkish are singular, denoting sets of atoms. One was their singularity in argument positions and the other was their singular kind denotations.

3.3. Explaining Neutrality

In this section, I will explain the apparent number neutrality of bare nouns in non-case marked direct object and predicate positions, both of which stem from their singular kind denotations. The corresponding sentences in (6a) and (6b) are repeated below.

(22) a. Ali ve Merve **çocuk**.
Ali and Merve child
'Ali and Merve are children.'

b. Ali **kitap** oku-du.
Ali book read-past
'Ali did book-reading.'

3.3.1. Pseudo-incorpration

Öztürk (2005) claims that non-case marked bare nouns occupying a direct object position immediately preceding the verb undergo pseudo-noun incorporation (PI) following Massam (2001). The semantics of PI has been the focus of a number of accounts (e.g. van Geenhoven 1998, Farkas and De Swart 2003, and Dayal 2011, among others), all of which agree in that pseudo-incorporated (PI-ed) nouns are property denoting. Among them, Dayal (2011) claims that they simply modify the verb, the result of which denotes predicate of events- subtypes of the events that the verb itself is a predicate of.

Inspired by the analysis of the weak definites of English in Aguilar-Guevara and Zwarts (2010)

(e.g. *Lola is reading the newspaper.*), I argue that Turkish PI-ed bare nouns take part in sub-event kinds in line with Dayal (2011), but as singular kind arguments instead of properties. Their number neutrality is an inference due to the conceptual plurality of singular kinds.

The claim that they are arguments instead of modifiers comes from the fact that they block the occurrence of an extra object with the same thematic role that they bear as shown below (cf. with Chamorro where theme-doubling is possible (Chung and Ladusaw 2004)).

(23) *Ali Savaş ve Barış(-ı) **kitap** oku-du.
Ali war and peace-acc book read-past
Intended: 'Ali did book-reading War and Peace.'

The claim that they are singular kinds is supported by the following facts, which could not be fully captured if they denoted properties. First of all, they are interpreted neutrally although we have previously seen that their property denotation is atomic[11]. Second, modification is incompatible with them, requiring indefinite or plural forms, unless it is meant to operate at the taxonomic domain, establishing sub-kinds[12]. Consider the following contrast:

(24) a. ??Ali *eski* **kitap** oku-du.
Ali old book read-past
'Ali read an old book/old books.'

b. Ali *teknik* **kitap** oku-du.
Ali technical book read-past
'Ali did technical book-reading.'

This contrast stems from the view that singular kinds are built on taxonomic properties, not the ones of ordinary objects. (24a) is bad because the adjective *old* can be considered as operating at the level of ordinary objects[13], whereas the adjective *technical* in (24b) defines a sub-kind of the book kind, hence it is compatible with the PI-ed bare noun. Since singular kinds are impure atomic terms their instantiation sets are not available (via pred), therefore they cannot be turned into sets of individuals suitable for modification as in (24a).

Finally, PI-ed bare nouns are non-referential at the ordinary object level as shown in (25a) (Öztürk 2005)[14], but reference to the kind itself is possible as shown in (25b). (Both examples are meant to follow (22b).) This is expected since PI-ed bare nouns are kind terms, so they introduce discourse referents at the level of kinds, not ordinary objects. DKP, via $\exists$-quantification of which they would achieve this, is also not available for singular kinds.

[11]Dayal (2011) argues that Hindi PI-ed bare nouns denote atomic properties, but number neutrality is achieved as a result of their interaction with atelicity. I have pursued this idea for Turkish previously as presented in the talk, but later realized that though in telic contexts singularity is more salient in the Turkish case in line with that view, it is not necessitated especially in the subject PI (see ft 16). For reasons of space, I will not discuss this issue.

[12]Taxonomic modification is usually available with adjectives rather than more complex structures like relative clauses. It is because adjectives are considered to be providing natural classification as opposed to the others which are mostly restricted to temporal, stage-level modications (Sadler and Arnold 1994). However, depending on the context, relative clauses can also be taxonomic.

[13]The sentence can be acceptable if oldness defines a sub-kind of the book kind with a meaning like 'ancient/historical' kind of books. In addition, for some speakers it is good only with a singular interpretation.

[14]It is possible in contexts where the number inference is made salient naturally as in house-buying.

(25) a. #Reng-i kırmızı-y-dı.
color-3sgposs red-cop-past
'Its/Their color was red.'

b. Drama türünde-y-di.
tragedy in.kind-cop-past
'It was of tragedy genre.'

In summary, based on their syntactic argument status and the facts given above, I claim that PI-ed bare nouns are singular kind arguments.

I follow the view that there are event kinds as well as event tokens in the ontology as pursued in Schäfer (2007) and Gehrke and Mcnally (2011) (and references therein). I assume that event kinds are derived via nom (by a mereological treatment of events), which is considered to be a general operator also applying to events as a function from event properties to situations, from situations to the maximal event satisfying that property in that situation, i.e. $\lambda P_{<s,vt>}\ \lambda s\ \iota e\ [P_s(e)]$ (iota yielding the largest plurality of events here). Similarly, pred applies to event kinds and returns sets of event tokens in a given situation, i.e. $\lambda k_{<s,v>}\ \lambda e\ [e \leq k_s]$.

For example, the reading event kind is given in (26a) which is derived by the application of nom to the reading event property $\lambda s\ \lambda e\ [READ_s(e)]$, and the reading event token is given in (26b) which is derived by the application of pred to the reading event kind.

(26) a. $[\![read_{kind}]\!] = {}^{\cap}\lambda s\ \lambda e\ [READ_s(e)] = \lambda s\ \iota e\ [READ_s(e)]$
b. $[\![read_{token}]\!] = {}^{\cup}\lambda s\ \iota e\ [READ_s(e)] = \lambda e'\ [e' \leq \iota e\ [READ_s(e)]]$

Nom can also apply to an event property of $< s, < v, t >>$ type that has a singular kind as its theme, e.g. $\lambda s\ \lambda e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$, and the result of this application will denote a sub-event kind as shown in (27).

(27) $[\![book\text{-}read_{kind}]\!] = {}^{\cap}\lambda s\ \lambda e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$
$= \lambda s\ \iota e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$

I argue that this sub-event kind forming process is PI. The singular kind *book* does not refer to any actual books, and its role is to restrict the denotation of the reading event kind by participating in it as a theme argument. This participation in return will yield a book-reading event kind with the application of nom, which is a sub-kind of the reading event kind. In other words, PI is a process where the taxonomy of event kinds is determined by thematic arguments that will be consisted of inside these event kinds.

In an episodic context as in (22b), the book-reading event kind will undergo pred as shown in (28a), which will result in a set of event tokens, which in turn will take an agent argument and be existentially closed (ignoring the tense) as shown in (28b).

(28) a. $[\![book\text{-}read_{token}]\!] = {}^{\cup}\lambda s\ \iota e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$
$= \lambda e'\ [e' \leq \iota e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]]$
b. $[\![Ali\ book\text{-}read_{token}]\!] = \exists e'\ [e' \leq \iota e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$
$\wedge\ Ag(e') = \text{Ali}]$

Here, Ali is involved in an instance of the book-reading event kind. The assertion that at least

one episodic event token of this event kind exists will correspond to the inference of reading one or more books which are the instantiations that the singular kind is conceptually associated with[15]. This is in line with the number neutral interpretation received from PI-ed bare nouns[16].

As a final remark, nom will be undefined for event properties with non-kind arguments. For example, it will be hard to impute to a *reading this book* event a sufficiently regular behavior so that it can qualify as an event kind in light of Chierchia (1998). Instead, such arguments are introduced within event tokens, and they do not participate in (sub-)event kind formation[17].

In summary, the apparent number neutrality of PI-ed nouns is an inference due to the conceptual plurality of singular kinds.

3.3.2. Predicate positions

Finally, I will discuss the number neutrality of bare nouns appearing in predicate positions. Analogous to the analysis of pseudo-incorporation, I claim that bare nouns in predicate positions can be singular kinds and the apparent neutrality follows from that.

To recall, bare nouns can be predicated of plural subjects as exemplified in (22a) besides singular ones, which seems to suggest that they denote number neutral sets. However, a closer investigation reveals that this is not the case. Namely, when bare nouns in predicate positions are modified they are only compatible with singular subjects as shown in (29). Interestingly though, if the adjectival modifier establishes the sub-kinds/types of the nouns that it modifies then the predication is also compatible with plural subjects as shown in (30).

(29) a. Ali yakışıklı **doktor**.
Ali handsome doctor
'Ali is a handsome doctor.'

b. *Ali ve Merve yakışıklı **doktor**.
Ali and Merve handsome doctor

(30) a. Ali pratisyen **doktor**.
Ali practitioner doctor
'Ali is a practitioner doctor.'

b. Ali ve Merve pratisyen **doktor**.
Ali and Merve practitioner doctor

The former case can be explained by the claim that bare nouns denote atomic properties, and they can be modified at the ordinary object level. Additionally, since they are atomic properties, they can only be predicated of singular subjects. On the other hand, the latter case reminds us of the modification facts of PI. In parallel with this, the contrast given above can be attributed to the view that bare nouns can also appear as singular kinds in predicate positions, being

[15]Mithun (1984) shows that kind-referring nouns are normally incorporated in languages that make use of incorporation. Following Mithun, Krifka et al. (1995) argue that incorporated nouns refer to kinds, and noun incorporation is a syntactic device to stay in the kind-oriented mode.

[16] Additionally, subject PI is also available as shown by Öztürk (2005), e.g. *Ali-yi arı soktu* 'Ali got bee-stung'. I will not go into the details here but I argue that they also fall into the same analysis proposed for object PI.

[17]The difference in case is explained by the view that PI-ed bare nouns are complements to the verb while others are introduced by higher case assigning heads in Öztürk (2005).

compatible with both singular and plural subjects[18]. However, we have previously discussed the impure atomicity of singular kinds which suggests that any type-shifting operation (i.e. pred) that would take a singular kind and return its instantiation set is not available, making predication impossible in this way. Then how is it achieved?

I propose that the usage of singular kinds in predicate positions is a process of naming the subject term with respect to a kind that it belongs to, which is achieved by the copula that plays a role of a null operator associating the two. The motivation behind this claim is that singular kinds are the names of kinds as opposed to plural ones in Turkish, supported by *dediğin* 'that you call' constructions, with which you refer to the kind term by specifying what you call it as exemplified below. They are only good with singular kinds, not with plural ones[19], suggesting that this naming process is only expected to be compatible with singular kinds.

(31) **Bilgisayar(*-lar)** dediğin Charles Babbage tarafından icat ed-il-di.
computer that.you.call Charles Babbage by invent-pass-past
Literally: 'The kind that you call the computer was invented by Charles Babbage.'

The denotation that the copula has in such structures is given in (32a), and the logical form of the sentence *Ali çocuk* 'Ali is child' is represented in (32b). (k represents kinds, K represents singular kinds, R is Carlson's Realization relation, and $NAME$ is a relation constituting the relation between kinds and their names.)

(32) a. $[\![COP]\!] = \lambda x^K.\ \lambda y.\ \exists k.\ [R(y,k) \wedge NAME\ (k, x^K)]$
b. $[\![Ali\ is\ child]\!] = \exists k.\ [R(Ali,k) \wedge NAME\ (k, \iota X\ [CHILD(X)]]$

This kind-naming specification can also be achieved if the subject is a plural term considering that sum individuals can also be members of kinds, explaining the compatibility of bare nouns with plural subjects in predicate positions. So, the logical form of (22a) is represented below.

(33) $[\![Ali{+}Merve\ are\ child]\!] = \exists k.\ [R(Ali+Merve,k) \wedge NAME\ (k, \iota X\ [CHILD(X)]]$

To wrap up, bare nouns in predicate positions can be singular kinds and their compatibility with plural subjects comes from the null kind-naming specification.

4. Returning Back to Counting: The Semantics of the Classifier *tane*

So far, we have seen that bare nouns in Turkish denote atomic properties, which is in lines with Ionin and Matushansky's 2006 view of numerals where they are argued to be modifiers of type <<e,t>,<e,t>> that combine with atomic properties[20]. This way we can explain the

[18]Bare nouns in predicate positions can also be found in Romance and Germanic languages like Dutch, French, Spanish, and German, although their usage is more restricted compared to the ones in Turkish. See de Swart et al. (2007) for an account of them which is in similar lines with the analysis given here.

[19]This seems to be a language specific property, as the *so called* structures in English which can be considered similar to *dediğin* constructions are fine with both singular and plural kinds as observed by Carlson (1977).

[20]In Turkish quantificational elements *çok* 'many' and *bir kaç* 'a few' also combine with bare nouns rather than plurals. I suggest that they can also be considered to presuppose for atomicity like numerals.

grammaticality of constructions where a numeral is followed by a bare noun, instead of a plural (e.g. *iki kitap* 'two book', **iki kitap-lar* 'two book-pl')[21]. Now, I will discuss the role of the classifier *tane* in numeral constructions.

Classifiers are widely thought to be a means of mediating between the denotation of a noun and the numeral in obligatory classifier languages like Chinese. Krifka (1995) and Chierchia (1998) propose that classifiers are functions from kinds into sets of atoms constituted by the instantiations of the kind, i.e. $\lambda x_k \lambda y\ [^{\cup}x(y) \rightarrow AT(y)]$. Nouns in those languages uniformly denote kind terms of <s,e> type as they come out of the lexicon. Since kinds are inherently plural being equal to mass nouns in some sense, their atomic instances are not available for counting. Therefore, classifiers are required in order to reach the atomic level of the kind.

This view cannot be adopted for *tane*, though. Otherwise, it would be attested obligatorily with plural kinds, but plurals cannot occur in numeral constructions and *tane* is not compulsory. (Singular kinds would not be an option due to their impure atomic nature.) Instead, I propose that *tane* is a partial identity function which *triggers a presupposition* for atomic properties just like numerals[22]. I also treat it as taking numerals (represented by f) as one of its arguments[23].

(34) $[\![tane]\!] = \lambda P_{<et>}.\ \lambda f_{<et,et>}: \forall x\ [P(x) \rightarrow AT(x)]\ .\ f(P)$

This account immediately explains the grammaticality of the constructions with the classifier which combine with a bare noun, but not with a plural noun (e.g. *iki tane kitap* 'two CL book', **iki tane kitap-lar* 'two CL book-pl'). The optionality of the classifier is a consequence of the fact that besides the numeral that can directly combine with atomic properties, the language has also a partial identity function that takes both numerals and atomic properties as its arguments.

As an optional element, the classifier seems to be redundant in the language. However, there are contexts in which it is obligatory. Contra English, the ellipsis of the noun is impossible unless the numeral is accompanied by the classifier. This is also the case in the partitive constructions.

(35) a. İki *(tane) ~~elma~~ verir misin?
two CL ~~apple~~ give quest
'Can you give me two (apples)?'

b. Elma-lar-dan iki *(tane) ~~elma~~
apple-pl-abl two CL ~~apple~~
'two of the apples'

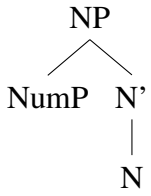
Now let me discuss a possible hypothesis about the obligatoriness of the classifier in (35a) and (35b). I follow Lobeck (1995) (for (35a)) and Ionin et al. (2006) (for (35b)) in taking such structures to involve a null (deleted) noun which needs licensing by a head (proper head-government). I suggest that numerals in Turkish are in the specifier of the nominal projection

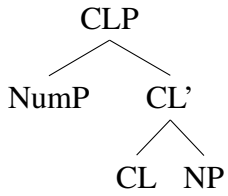
[21] Some numeral constructions of Turkish can have plural marking on them, e.g. *Nice 20 yil-lar-a!* 'To multiple 20 years! (Cheers!)', and *yedi cŭce-ler* 'seven dwarfs'. In the former, the plural marker pluralizes the denotation of the numeral construction *20 yillar* '20 years' referring to more than one instance of 20 years. This shows that it is still the genuine plural marker, rather than agreement. The latter is not a canonical numeral construction, where the numeral is just a modifier to the plural noun, denoting the most specific property of the dwarfs, i.e. being seven in number. Such structures are only possible with well-known groups (e.g. the three muskeeters).

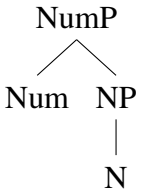
[22] Thanks to Veneeta Dayal for suggestions to explore this idea. Note that Bangla *-ra* is analyzed as a classifier that encodes a presupposition in Dayal (2014).

[23] We do not have strong evidence with regards to the order of the combination.

as shown in (36) contra numerals in English which are claimed to take the NP as a complement in Lobeck (1995) and Ionin and Matushansky (2006) as shown in (36c)[24]. Due to their non-head status, the former cannot license the elided NP. In the presence of the classifier the NP is extended by its projection as shown in (36b), so the elided noun is licensed by the classifier[25].

(36) a. 

b. 

c. 

The requirement for the classifier in ellipsis structures is also a property found in other optional classifier languages like Persian, contrasting with non-classifier languages like English. This observation calls for further inquiry. But for now, it provides an interesting new dimension to our analysis of optionality in the Turkish classifier system[26].

In summary, the classifier in Turkish is a partial identity function that presupposes for atomic properties, which, combined with Ionin and Matushansky's account of numerals, explains its optionality. The derivations of the numeral constructions are summarized below:

(37) a. $[\![2\ book]\!] = \lambda x\ \exists S\ [\prod (S)(x) \wedge |S| = 2 \wedge \forall s \in S\ book(s)] = \{a{+}b,\ b{+}c,\ a{+}c\}$
b. $[\![2\ tane\ book]\!] = \lambda x\colon \forall x\ [P(x) \rightarrow AT(x)].\ \exists S\ [\prod (S)(x) \wedge |S| = 2 \wedge \forall s \in S\ book(s)]$
$= \{a{+}b,\ b{+}c,\ a{+}c\}$

5. Conclusion

This paper has favored the claim that numerals in Turkish are modifiers of type <<e,t>,<e,t>>, the lexical complement of which has to be atomic (Ionin and Matushansky 2006) over the account where they are treated as restrictive modifiers (Bale et al. 2010). It has been shown that bare nouns denote sets of atoms only contra Bale et al. (2010), and the classifier *tane* is a partial identity function presupposing for atomic properties.

My analysis establishes that the denotations of nouns in Turkish aligns with the ones of English in that bare nouns are strict singulars and plurals are number neutral. However, the two

[24]In Ionin and Matushansky (2006) languages where numerals assign case to their nominal complements are argued to have the structure in (36c). Although English numerals do not pattern with this, they prefer to posit the same structure to them. However, the one suggested here for Turkish is not discussed in their paper, but it does not conflict with their semantic account of the numerals. In addition, because Turkish numerals do not assign case to nouns it is safe to assume a structure where numerals are in the spec of the nominal projections in Turkish.

[25]CL in (36b) is head-initial conflicting with the head-final property of Turkish. Instead, we can represent *tane* in the Spec, CLP assuming a null, head-final CL head. The crucial point is that NP is a part of CLP in the presence of CL, but it is not inside NumP.

[26]One can analyze the classifier as a semantically empty element having only a syntactic role. In such an analysis, the incompatibility of the classifier with plural nouns could be explained by the atomicity requirement of numerals. This approach is not adopted since they actually create a difference in meaning contributing an amount interpretation. The semantics of the classifier is still an ongoing project of mine and for present purposes, I want to preserve the partial identity function role for the classifier.

languages differ in the absence/presence of number agreement in numeral constructions, which is interpreted as cross-linguistic variation.

As a concluding remark, in order to situate the findings for Turkish within a broader context and to appropriately draw out the implications for natural language generally, relevant facts from other optional classifier languages like Western Armenian, Persian, and Hungarian should be analyzed.

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