Background on nouns in event semantics. N-state

Davidson – adverbial modification

(1) A baby cried softly.
\[ \exists x \exists e [\text{Cry}(x,e) \& \text{Baby}(x) \& \text{Softly}(e)] \]

(2) A baby cried.
\[ \exists x \exists e [\text{Cry}(x,e) \& \text{Baby}(x)] \]

Neo-Davidsonian

(3) A baby cried.
\[ \exists x \exists e [\text{Cry}(e) \& \text{Agent}(e,x) \& \text{Baby}(x)] \]

(4) Navin carried the chair.  
\[ \exists e [\text{Carrying}(e) \& \text{Agent}(e, \text{Navin}) \& \text{Patient}(e, \text{the chair})] \]

Statives

(5) Jack owns Loon Lake.
\[ \exists s [\text{Own}(s) \& \text{In}(s, \text{Jack}) \& \text{Theme}(s, \text{LoonLake})] \]

Adjectives

(6) Mary is sick.
\[ \exists s [s \text{ is a being-sick} \& \text{In}(s, \text{Mary})] \]

(7) Al’s coffee is hotter.
\[ \exists s [\text{Hot}(s) \& \text{Holder}(s)(ac) \& \mu(s) > d] \]

Nouns

(8) “people sometimes speak of "the state of being a doctor" as a state which many different people could be in. This is not the notion of state being utilized here. For present purposes, Mary’s state of being a doctor is a different state from John’s state if he is also a doctor; both are different states of the same kind, that is, both states are in the extension of the common noun doctor.” Parsons(1989)

(9) “if a noun such as doctor picks out underlying states, then their subjects will be in a state of being a doctor, and so they will stand in the In-ness relation to those states” Parsons(1995)

(10) Jack is a doctor.
\[ \exists s [\text{Doctor}(s) \& \text{In}(s, \text{Jack})] \]

Uncertainty about nouns – just theoretical uniformity?

(11) “It is possible to interpret nouns as standing for kinds of states, having logical forms resembling those of verbs. For example, it is possible to interpret ‘Giraffe(x)’ as being short for
\[ \exists s [s \text{ is a state of being a giraffe} \& \text{Theme}(s, x)] \]

I know of no objection to this. But I also know of no evidence in its favor. If states are used in this way, then they are just excess baggage in a theory of language.” Parsons(1990:187)

Modification argument for nouns

(12) a. John was a Catholic with great passion in his youth.  
    b. John was a Catholic in his youth.  
    c. John was a Catholic with great passion.  
    d. John was a Catholic.
"We observe the inference patterns characteristic for event related adverbial modification, i.e. (12)a entails (12)b-d and both (12)b and (12)c entail (12)d." Jäger(2001)

Modification argument for nouns based on time travel

(13) a. Socrates is a philosopher under 1.7 meters tall. ≈ Parsons(2000:87)
b. Socrates is a philosopher.
c. Socrates is under 1.7 meters tall.

Only predicative NPs:

(14) “a predicate NP like other VPs, has a Davidsonian argument. The assumptions I am making raise the issue, of course, of the other main role of common nouns, namely that of being restrictors of quantifiers in quantificational NPs like every man. Clearly, we do not want to say that nouns in their role as quantifier restrictors have a Davidsonian argument. The purpose of having a Davidsonian argument is that tense and adverbs can operate on it. But nouns, qua quantifier restrictions, do not take adverbs or tense. To the extent that nouns in argument position enter into temporal relations, they do so in a radically different manner than VPs (cf., e.g., Enç 1981).” Chierchia(1995:206)

Temporal interpretation in nominals, Davidsonian nouns

(15) In Tonhauser(2007a), temporal interpretation indeed works differently in noun phrases and verb phrases. For nouns, there is no tense. Nevertheless, temporal anchoring is recorded in the same way for nouns and verbs, as a relation between times and eventualities.

Jack is making a fire.

∃e∃x∃s∃t[Make(e,Jack, x) & τ(e) ⊆ NOW & Fire(s, x) & NOW < t & t ⊆ τ(s)]

Tonhauser(2007,2008,2011) studied temporal suffixes in Paraguayan Guarani noun phrases, arguing that they are not tenses. Thomas(2014) studied one of those suffixes, –kue, as it occurs in Mbyá, a closely related Guarani language. He argues that –kue is a tense marker.

N-state Hypothesis – Neo-Davidsonian nouns

(16) Underived nouns are 1-place predicates of states

Notes

• Davidson’s modifier argument for treating verbs as event predicates is reviewed in detail in Landman (2000:1-17) and Parsons (1990:§2.1), a.o..

• Dowty(1989) argues that a Neo-Davidsonian analysis is correct for nouns but not for verbs. Schein(1993) argues for a Neo-Davidsonian analysis of verbs based very different kinds of facts to do with scope of quantifiers and plural noun phrases. See Williams(2015) for broad discussion of the topic.

• Maienborn (2011:§5) is a critical review of the evidence for underlying states including a reply to Jäger’s adverb argument in (12). Maienborn differentiates between Davidsonian states denoted by verbs such as sit, stand, sleep and Kimian states denoted by stative verbs like know, weigh, and own, as well as any combination of copula plus predicate. Kimian states are defined as “abstract objects for the exemplification of a property P at a holder x and a time t”. Kimian states crucially are not located in space, which Maienborn takes to be a defining feature of eventualities.

Sentence semantics with state denoting nouns

(17) A baby cried.
    ∃x ∃e[Cry(e) & Agent(e,x) & Baby(x)]

now becomes:

(18) A baby cried.
    ∃s ∃e[Cry(e) & Baby(s) & Ag(e, s)]
Thematic roles relate eventualities

(19) \( \text{Ag}(e,s) \iff \text{the individual in state } s \text{ is the agent of } e. \)

Stative main predicates — relating states to states

(20) One box is heavy.
    \( \exists s \exists s' [\text{Heavy}(s') \& \text{Box}(s) \& \text{In}(s', s)] \)

A state in a state?

One state could be in another state. If a certain paranoid state lasted for two hours, then at the beginning of the two hours the paranoid state was itself in an initial state. And, we can use the stative predicate \( \text{lasted for two hours} \) to describe a state that the paranoid-state was in. But that’s not what’s going on in (20).

Participant sharing

(21) **Participant sharing:** \( \ominus \)

For any two states, \( s \) and \( s' \):

\( (s \ominus s') \iff \forall u((u \text{ is in } s) \leftrightarrow (u \text{ is in } s')) \)
‘any participant in \( s \) is a participant in a \( s' \) and vice-versa.’

(22) One box is heavy.
    \( \exists s \exists s' [\text{Heavy}(s') \& \text{Box}(s) \& \ominus(s', s)] \)

Extending \( \ominus \) to non-statives

(23) A baby cried.
    \( \exists s \exists e [\text{Cry}(e) \& \text{Baby}(s) \& (\text{Ag}(e) \ominus s)] \)

(24) \( \text{Ag}(e) = \text{the state of being an agent of } e. \)

Non-statives may use just \( \ominus \) for one argument of the verb

(25) A cork popped.

\( \exists s \exists e [\text{Pop}(e) \& \text{Cork}(s) \& (e \ominus s)] \)

(26) A man touched a tree.
    \( \exists s \exists s' \exists e [\text{Touch}(e) \& \text{Man}(s) \& \text{Tree}(s') \& (\text{Ag}(e) \ominus s) \& (e \ominus s')] \)

(27) \( \text{Touch}(e) \leftrightarrow e \) is an event in which something is picked.
    \( e \) doesn’t include the picker.

Analyzing verbs of perception, Clark and Jäger(2000) “assume that for each participant \( x \) of an event \( e \), there is a unique subevent \( e_x \) of \( e \) that has \( x \) as its only participant.”

Some composition:

(28) \[ a = \lambda Q \omega \lambda P \omega \exists x [P(x) \& Q(x)] \]

becomes

(29) \[ a = \lambda Q \epsilon \lambda P \epsilon \exists x [P(s) \& Q(s)] \] (N-state)

A neo-Davidsonian syntax for \( A \) barrel is heavy (excluding copula and tense)

(30)

\[
\begin{align*}
\text{AP} & \sim \lambda s' [\ominus(g(t))(s') \& \text{Heavy}(s')]] \\
\lambda \text{ExistP} & \sim \lambda s [\exists s' [\ominus(s)(s') \& \text{Heavy}(s')]] \\
\exists s & [\text{Barrel}(s) \& \exists s' [\ominus(s)(s') \& \text{Heavy}(s')]] \\
\exists s & [\text{Barrel}(s) \& \exists s' [(s \ominus s') \& \text{Heavy}(s')]]
\end{align*}
\]
Summary

- DPs quantify over states.
- Thematic relations are relations between eventualities.
- The simplest thematic relation is participant sharing, denoted ‘∈’. It holds between eventualities that share participants.

Notes

As relations between eventualities, thematic roles are like some aspectual markers and adverbs. From Altshuler (2016):

- the semantic function of the perfect (at least on some of its uses) is to describe an event’s final state
- ‘now’ picks out the most prominent state which is understood to result from a prominent event.

Counting

Ingredients for counting statements – states are proxies for individuals

(31) a. Four dogs barked.
   b. *Dog(S) ⇔ (∀s ∈ S → Dog(s)) & |S| ≠ 0
   c. ∃S [4(S) & *Dog(S) & ∀s ∈ S → ∃e [Bark(e) & (Ag(e) ∈ s)]]

Normally, counting states and counting objects comes to the same thing. But not always:

   b. Four thousand ships passed through the lock last year. "
   c. 12,000 persons walked through the turnstile yesterday. "
   d. National Airlines served at least two million passengers in 1975.
   e. Clements struck out 15 batters in a row in the game last night.

- (32)a has a reading according to which there were 23,000 events of a book being lent by the library in 1987. Krifka (1990) calls this an event-related reading. (32)a could be true on this reading even if there are fewer than 23,000 books in the library.
- (32)b can be true on an event related reading even if there were fewer than 4000 ships in the worlds, as long as there were four thousand events of passing through the lock by a ship last year.

This type of reading is discussed in papers by Barker, Doetjes & Honcoop, Krifka, Moss and Musan cited in the references. We’ll look at the phenomenon from the viewpoint of the N-state hypothesis.

Substates

In the quote from Parsons in (8), “Mary’s state of being a doctor” presupposes that there is one doctor state for each doctor. But there is the state, s1, that Mary was in during the first few years after medical school. There’s another state, s2, that Mary is in that extends all the way up to the present. s1 is a substate of s2.

In (32)b., we’re describing ship-states that last only as long as it takes to pass through the lock.

Contemporality

(33) (s ⊕ s’) iff s and s’ begin at the same time and end at the same time.

(34) Four thousand ships traversed.

∃S [4000(S) & *Ship(S) & ∀s ∈ S → ∃e [Traverse(e) & (Ag(e) ⊕ s) & (Ag(e) ⊔ s)]]
**Default assumption**

If nouns can have substates in their extension, what guarantees that there were 4 dogs described in (31)? If just Fido barked, there are 4 dog-states that Fido is in that make the formula in (31)c true. It must be that by default we assume:

(35) Default condition for state domains of quantification

For any two states $s$ and $s'$ in the domain of quantification: $(s \oplus s')$

**N-state and common sense do not disagree**

Whenever the default condition is met, there is a 1-1 correspondence between states and their participants (for count nouns – see below). Under those conditions, for simple cases like *Four dogs barked*, the N-state grammar reduces to the normal intuitive framework, according to which ordinary common nouns denote sets of individuals. There is no conflict between the N-state hypothesis and the common sense intuition that normally what we count are individuals.

**Default condition and maximal states**

In simple cases, the default condition is met by assuming maximal states. A maximal state is not a proper substate of any other state.

**Another kind of event-related reading – counting simultaneous, same-participant states**

In all the examples in (32), an individual could get counted more than once, because it was in different substates at different times. Sometimes, an individual can be in two distinct states of the same kind simultaneously.

A person playing two games of chess might be in two simultaneous states in the extension of *player*.

A person taking two courses might be in two simultaneous states in the extension of *student*.

Here are examples of event related readings of this kind:

(36) During her career, she has taught over 100 courses serving over 2,058 students. (written on a desk at Smith College in Northampton, MA)

(37) At our last chess tournament, we had 30 players who paid $10 per game, so that was $300. (we didn’t serve 30 meals, because some people played several games – a few people played two games at the same time).

(38) Antonia is doing a PhD in math and a PhD in Roman history. How do we count her when asked: *How many PhD candidates do we have here?* – It might depend on the interrogator’s purpose (creating forms for each candidate to fill out vs. preparing food for each to eat)

**Why co-temporality is needed when the default assumption (35) is dropped**

(34) Four thousand ships traversed.

$$\exists S [4000(S) & *Ship(S) & \\
\forall s [s \in S \rightarrow \exists e [Traverse(e) & (Ag(e) \oplus s) & (Ag(e) \ominus s)]]]$$

**We don’t want:**

(39) $$\exists S [4000(S) & *Ship(S) & \\
\forall s [s \in S \rightarrow \exists e [Traverse(e) & (Ag(e) \ominus s)]]]$$

because as soon as one ship passes the lock, there are a gazillion ship-states that that ship is in that make true:

(40) $$\exists e [Traverse(e) & (Ag(e) \oplus s)]$$
Anaphora to sub-states

Definite DP anaphors

(41) The library lent out 23,000 books in 1987 as well as 11,000 CDs and DVDs. More than half of the books were returned on time.

The second sentence in (41) has an event related reading according to which more than half of the lendings resulted in on-time returnings. The books refers to the book substates introduced in the first sentence.

Pronouns (Križka 1990:§4.4; Barker 1999:685,689; Moss 2012)

(42) 19 people tried to break in last year.
They all gave up when the alarm went off.
⇒ alarm went off 19 times.
⇒ 19 thieves

(43) PersonBreakIn = {s : Person(s) & ∃e TryBreakInLastYear(e) & (Ag(e) ⊗ s) & (Ag(e) ⊘ s)}

(44) They all gave up.
∀s [s ∈ PersonBreakIn → ∃e [GiveUp(e) & (Ag(e) ⊗ s)]]

We do not want:

(45) ∀s [s ∈ PersonBreakIn → ∃e [GiveUp(e) & (Ag(e) ⊗ s) & (Ag(e) ⊘ s)]]

(45) is no good: the states that temporally coincide with the break-in, don’t coincide with the giving ups.

But now we have a different problem. (44) doesn’t require a different giving up for each break-in. The formula allows that one thief might have tried twice and given up only once. We want a looser temporal relation – not coincide but rather something like ‘immediately follows’.

This is a general problem of ∀∃ formulas (see Rothstein 1995 for treatment of this problem with respect to temporal adverbials, eg John visits his mother every time she phones him).

Carlson’s puzzle – cotemporality needed even with default assumption

“Bob Welch is the pitcher in a baseball game against the New York Yankees. One member of the Yankees is Reggie Jackson. Jackson bats twice before being taken out of the game - on the first occasion he strikes out, and on the second occasion, he does not strike out (he walks). On Jackson’s first time at bat he is the third batter for the Yankees in the ballgame; on his second turn at bat, he is the Yankee’s twelfth batter. Hence, Welch struck out the third batter, but walked the twelfth batter. He did not walk the third batter, nor did he strike out the twelfth batter.” Carlson(1982:172)

(46) ∃s ∃e [3rd-Batter(s) & StruckOut(e) & (e ⊗ s) & (e ⊘ s)]
(47) ¬∃s ∃e [12th-Batter(s) & StruckOut(e) & (e ⊗ s) & (e ⊘ s)]

Without co-temporality (the last conjuncts), (46) and (47) would be contradictory.

Co-temporality in modification

Frame-setting locatives (Maienborn 2005, Higginbotham 2005, Maienborn to appear)

In (48) below, in the garden is a Davidsonian modifier, like softly in A baby cried softly. Maienborn contrasts the modification in (48) with the PPs in (49)-(50)

(48) Carol played in the garden.
(49) The dress was wet on the clothesline.
(50) Carol was nervous in the car.

“Carol’s nervousness is not in the car. Likewise, the wetness of the dress, as opposed to the dress itself, is not on the clothesline…The interpretations
that are available for (49) and (50) are not those in which a state – being wet, or being nervous – is located in some place, but rather those in which two states, one spatial and the other not, are said to be temporally related, with the time of the locative including or at least overlapping the time of the other.” Higginbotham (2005:353-4)

Analyzing (49) – first pass following Higginbotham:

(51) $\exists x, s, s' [\text{Wet}(s) \& \text{Dress}(x) \& \text{In}(s, x) \& \text{OnTheClothesline}(s') \& (s \oplus s') \& (s \odot s')]$

adding definiteness

(52) $[\text{The x: Dress}(x)] [\exists s, s'[\text{Wet}(s) \& \text{In}(s, x) \& \text{OnTheClothesline}(s') \& (s \oplus s') \& (s \odot s')]$

adding N-state

(53) $[\text{The x: Dress}(x)] \phi(x) \iff 
\exists x \text{Dress}(x) \& \phi(x) \& \forall y [\text{Dress}(y) \rightarrow y = x]$

adding definiteness

(54) $[\text{The } s'': \text{Dress}(s'')] [\exists x, s'[\text{Wet}(s') \& (s \oplus s'') \& \text{OnTheClothesline}(s') \& (s \oplus s') \& (s \odot s')]$

NOTE: Given the Default condition in (35), if there is a unique dress, there’s a unique dress state.

Depictives (following Keshet 2010 and references therein):

(55) A man boiled a lobster alive

$\exists s \exists s' \exists e [\text{Boil}(e) \& \text{Man}(s) \& \text{Lobster}(s') \& (\text{Ag}(e) \circ s) \& (e \odot s') \& (s \odot s'') \& (e \odot s'')]$

- Recall: Boil describes the event that the lobster alone is involved in.
- Assume that boil alive forms a constituent

Depictives hold at the beginning of the main event

The lobster is presumably not alive throughout the boiling.

Maybe Boil describes the just the beginning of the event. ($\approx$ Keshet (2010:419)

Bruening (2015) alternative: if it’s a causative structure, the depictive describes the causing and the lobster has to be a participant in the causing.

NP modifiers

(56) a. A sick dog was barking.

b. $\exists s [\text{Dog}(s) \& \exists s' [\text{Sick}(s') \& (s \odot s') \& (s \odot s')] \& \exists e [\text{Bark}(e) \& (\text{Ag}(e) \circ s) \& (\text{Ag}(e) \odot s)]$

- by transitivity, the sickness overlaps the barking.
- this example shows that the default assumption can’t be that we use only maximal states. The state picked out in b. is a substate of the lifetime dog state.

Is co-temporality ($s \odot s')$ required between verb and argument? (Enç 1986)

“Suppose that the president is giving a party for people who were held hostage in Iran. John will attend this party. We want (12) to be true if John meets all the hostages.

(12) John will meet every hostage at the president’s party

If we give every hostage wide scope over tense, we will be saying something about present hostages. If we give tense wide scope over every hostage, we will be saying something about future hostages. Again, these are the only available alternatives under traditional
analyses. This gives the wrong results, since we are talking about past hostages. But there is no past tense in (12), and therefore we will not get the reading we want. Note that (12) may be followed felicitously by "and he will ask them how it feels not to be hostages anymore." In one breath, we may refer to these individuals as hostages and claim that they are no longer hostages, without uttering a contradiction.” Enç 1986:409

(57) $\forall s [\text{Hostage}(s) \rightarrow \exists e \text{ Meet}(e) \land (e \ominus s) \land (e \equiv s)]$

See also, example (44) above, where we didn’t want co-temporality between verb and argument.

Musan(1995) discovered an interaction between quantifier type and co-temporality, according to which co-temporality can be dropped in Enç’s (12) because it crucially uses the strong quantifier every. Tonhauser(2007a:§3.5) disagrees with Musan’s explanation for the correlation.

Is co-temporality $(s \ominus s')$ required between noun and modifier?

Kusumoto examples

(61) “[There are 20 fugitives in the state of Massachusetts now. Half of them were doing time in Massachusetts and the other half were from Connecticut.]

a. The fugitives who were doing time in Massachusetts were all in the Concord jail.

b. # The fugitives doing time in Massachusetts were all in the Concord jail.

The first sentence has a sensible interpretation where the individuals that are now fugitives but were doing time earlier were in the Concord jail when they were doing time. This interpretation is not available to the (b) example.” Kusumoto(2005:354)

KKS analysis: intersective modification

(62) Noun and modifier (adjective, participle, PP) both have time (or time-world) arguments. Co-temporality is the result of intersective, predicate modification.

Musan(1995) discovered an interaction between quantifier type and co-temporality, according to which co-temporality can be dropped in Enç’s (12) because it crucially uses the strong quantifier every. KKS relate the intersective modification analysis of co-temporality with Musan’s analysis of weak quantification. Tonhauser(2007a:§3.5) disagrees with Musan’s explanation for the correlation.

Davidsonian NP modification

Intersective modification is not compatible with the idea that nouns and adjectives have state arguments, even if states are not the only arguments of nouns.

(63) ASSUMPTION: To be in a state of sickness is not the same as being in a canine state. sick and dog couldn’t have a state in common.

1 Alexis Wellwood (pc)
If cotemporality is indeed required between noun and modifier, then cotemporality has to be included in the rule of Predicate Modification giving us for example:

\[(64)\ \text{professor in kindergarten}\]
\[
\lambda s [\text{Prof}(s) \& \exists s' \text{ InKindergarten}(s') \& (s \odot s') \& (s \propto s')]
\]

But is co-temporality always present in NP modification?

\[(65)\ \text{Every hostage at the president’s party will be interviewed by a reporter.}\]

\[(66)\ \text{The hostages attending the president’s party were treated like heroes.}\]

\[(67)\ \text{A reporter found 7 drunk passengers from Flt 101 in a bar in Berlin and she interviewed them.}\]

\[(68)\ \text{Past participles} \quad \text{melted ice, freed slave, discharged soldier, child described in the story}\]

\[(69)\ “\text{It seems the dead president can pick out an individual who is dead now and was a president in the past.”}$$\text{Enç}(1986:fn13)$$\]

### Summary
- When we count, we count states.
- A default condition requires one state per individual. So we usually count individuals by counting states.
- Where the default condition is not in force, we count substates tied to events via co-temporality (and possibly other relations).
- Eventualities introduced in modification structures are also tied together with co-temporality.
- Left open: rules governing the deployment of co-temporality

### Previous accounts of ‘overcounting’
- Stages (temporal slices of ‘ordinary objects’) (Carlson, Musan, Barker, Moss).
- Challenges: followups that keep track of events (44) (Barker,Moss); simultaneous states ((36)-(38))
- Measure functions: 4000 ships is a 1-place measure predicate, like 1 kilo, that measures the shippyness of some events. (Krifka)
- Challenge: anaphora (41),(44).

### Time's arrow and NP modification

In Kusumoto and Keshet’s infelicitous examples ((59), (61)b), the noun time follows the modifier time:

\[
\begin{align*}
\text{in kindergarten} & \rightarrow \text{professor} \\
\text{doing time} & \rightarrow \text{fugitive}
\end{align*}
\]

In (65)-(69), the noun time precedes modifier time:

\[
\begin{align*}
\text{hostage} & \rightarrow \text{attending/at the president’s party}
\end{align*}
\]

\[
\begin{align*}
\text{passenger} & \rightarrow \text{drunk} \\
\text{ice} & \rightarrow \text{melted} \\
\text{president} & \rightarrow \text{dead}
\end{align*}
\]
Part II: Ways of being plural

A. Collective nouns (a.k.a group nouns)

Collective noun: tension between collective interpretation and grammatical number

(1) “A collective noun is defined in the NED [New English Dictionary by Murray, Bradley, Craigie. Oxf. 1884] as “a substantive which (in the singular) denotes a collection or number of individuals.” We may accept this definition (though it does not always agree with practice followed in that dictionary), and give as examples a library = ‘collection of books’, a train (railway-carriages), a forest (trees), a nation (men and women), an army (soldiers). All of these may be used with such words as one (one library) or that; and we may use them in the plural: libraries, trains, etc.” Jespersen (1914)

Differences between singular collective noun phrases and plural noun phrases

(2) The army is big. doesn’t mean The soldiers are big.

(3) a. *The orchestra looked at each other.
   b. The players looked at each other.

(4) a. *Both of the couple will be healthy.
   b. Both of the men will be healthy.

N-state way of splitting the difference

(5) Soldier(s) ⇔ s is a state of being a soldier. The sole participant in s is an individual soldier.
   s is a state of being an army. The sole participant in s is a collection of individuals that together form an army

(7) soldiers ~ *Soldier

(8) *Soldier(S) ⇔ ∀s ∈ S → Soldier(s) & |S| ≠ 0

(9) Summary

the army refers to a state
the soldiers refers to a set of states.

• Jespersen’s ‘collection intuition’ has to do with the entities participating in an army state vs. the entities participating in soldiers states.

• The grammatical number facts have to do with the number of states referred to. The army – one state, the soldiers – multiple states. Each-other, both ((3)(4)) have to do with state-count

Comparing theories: Plural objects

(a) “A plural definite (the cards) denotes an individual sum or plural object.” (Link 1983).

(b) Following (9), there could be plural objects, but they would be described with collective nouns. If so, the deck refers to a state whose participant is a plural object, but the cards refers to a set of states.

Honing intuitions about collective and plural noun phrases: weight and size of temporally extended objects

(10) At the beginning of the weekend, Jack makes up some cookie batter, he bakes some cookies and he puts the cookies in a pile on the kitchen table. Friends come and go and eat some of the cookies. As the pile gets smaller, Jack makes more batter, bakes more cookies and adds to the pile. Friends keep helping themselves. At the end of the weekend, Jack eats the last cookie.

We can now inquire about:
The pile of cookies that was on the kitchen table over the weekend.

The cookies that Jack made over the weekend

What was the weight of ___?
What was the total weight of ___?
What was the weight of ___ at 10:00am on Saturday morning?

For the pile, only the last question makes sense.
For the cookies, the first two questions make sense, the last one is odd.
Similar results obtain with questions of size (How big was ___ What was the size/volume of ___).

The pile is an object that comes into existence at the beginning of the weekend and goes out of existence by the end. Its weight changes and we respond to questions of weight accordingly.

Notes

• Some properties “extend” from the members of the collective to the collective itself: a happy flock of penguins is a flock of happy penguins. Compare: a big flock of penguins is not a flock of big penguins.

• See de Vries(2017) and references therein for more on the relation between collective nouns and nouns describing members of the collective.

B. Mass Nouns

Mass and count nouns: examples

(13) count nouns: cloud, table, lentil, triangle, movie, fact
mass nouns: traffic, furniture, rice, poetry, evidence
nouns that readily go in both categories: rope, light, noise

(14) Distributional criteria\(^2\) for distinguishing count and mass nouns

\(^2\) Introductions to research on mass nouns include Gillon(2012), Koslicki(2006), Lasersohn(2011), Nicolas(2016), and Salvatore Florio & David Nicolas’ ESSLLI course in room D.

• Mass nouns do not combine (directly or with partitive of-the) with: one, two, several, few, a few, many, both, every, each, numerous.

• Count nouns usually sound funny with: how/too/as/very/that/not {much, little}

• Singular mass nouns can be freely used without a determiner. Singular count nouns cannot\(^3\).

• Count nouns must be plural when combined with: all (the), enough, more, most, alot of, pseudopartitive (e.g. 2 lbs of ___)

Similarities between mass and plural-count

Distribution

• The last two diagnostics put together mass and plural-count to the exclusion of singular-count.

Cumulative reference

(15) Cumulative inferences

SCENE: A counter with cups of coffee on it, some on the left and some on the right.

a. The coffee on the left is hot and the coffee on the right is hot.
   \(\therefore\) The coffee on the counter is hot.

b. The cups on the left are white and the cups on the right are white.
   \(\therefore\) The cups on the counter are white.

\(^3\) Bare singular count nouns can’t be freely used without determiners, but they can be so-used in certain contexts (Stvan 2007 and Le Bruyn, de Swart and Zwarts 2011). *He owns home is bad but He’s at home is good. For the distribution and interpretation of bare NPs across languages, see Dayal(2011).
When we characterize the inference patterns in terms of reference, the connection to plurality is more apparent:

Assume ‘the NP’ refers to some thing in the extension of NP. Then in the conclusion, we appear to refer to some thing in the extension of NP that includes two other things in the extension of NP.

So For plural-count and mass NPs, if \( x \) and \( y \) are in the extension of NP, then there is a \( z \) in the extension of NP that includes \( x \) and \( y \).

Weight and size of temporally extended objects

Recall, Jack’s weekend cookie making, described in (10). We contrasted questions of weight and size for the cookies vs. the pile. If we now ask the same questions about:

(16) The batter that Jack made over the weekend.

The results pattern with the plural and not the collective in allowing overall weight and not weight-at-a-time.

Discreteness intuitions

Many mass nouns intuitively describe collections of discrete objects. This intuition sometimes makes its way into dictionary definitions that employ plural count nouns:

(17) rubble Waste fragments of stone, esp. as constituting the rubbish of decayed or demolished buildings (OED)

(18) lumber Timber sawn into rough planks or otherwise roughly prepared for the market. (OED)

(19) traffic vehicles, ships, persons moving along a street, through an air lane, over a water route, … (dict.com)

(20) Synonymies based on discreteness intuition (data from Gillon 2012)

<table>
<thead>
<tr>
<th>Mass noun</th>
<th>Count noun</th>
<th>Mass</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>advice</td>
<td>suggestions</td>
<td>advice</td>
<td>les conseils</td>
</tr>
<tr>
<td>ammunition</td>
<td>bullets</td>
<td>asparagus</td>
<td>asperge</td>
</tr>
<tr>
<td>clothing</td>
<td>garments</td>
<td>dandruff</td>
<td>les pelicules</td>
</tr>
<tr>
<td>company</td>
<td>guests</td>
<td>la vaisselle</td>
<td>dishes</td>
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<tr>
<td>footwear</td>
<td>shoes</td>
<td>equipment</td>
<td>les équipements</td>
</tr>
<tr>
<td>infantry</td>
<td>foot soldiers</td>
<td>furniture</td>
<td>les meubles</td>
</tr>
<tr>
<td>luggage</td>
<td>suitcases</td>
<td>le raisin</td>
<td>grapes</td>
</tr>
<tr>
<td>pottery</td>
<td>pots</td>
<td>lightning</td>
<td>les éclairs</td>
</tr>
<tr>
<td>underwear</td>
<td>undergarments</td>
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<td>les recherches</td>
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<tr>
<td>weaponry</td>
<td>weapons</td>
<td>software</td>
<td>les logiciels</td>
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<tr>
<td></td>
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<td>sunstroke</td>
<td>les insolations</td>
</tr>
</tbody>
</table>

Readings

- Collective readings

(21) a. The lentils are coated with plastic.
   b. The rice is coated with plastic.

(22) a. The molecules in the flask are in equilibrium. (Burge 1977)
   b. The hydrogen in the flask is in equilibrium.

- Bare mass and plural-count have same range of readings (examples from Lasersohn 2011)

(23) a. Water leaked into the floor  \langle existential reading \rangle
   b. Raccoons were stealing my corn.
   c. Water is wet \langle generic reading \rangle
d. Raccoons are sneaky  

e. Water is common  

f. Raccoons are extinct  

(kind reading)

Morphology: plural marking on mass nouns

(24) amends, annals, ashes, belongings, bowels, brains, canned-goods,  
carbs, clothes, coffee-grounds, contents, directions, dregs, droppings,  
dues, earnings, effects, entrails, feces, feelings, fireworks, fumes,  
goods, good manners, groceries, guts, instructions, intestines,  
leftovers, odds, openers, outskirts, preparations, proceeds, remains,  
seconds, shenanigans, suds, supplies, the 1920’s (decade names),  
valuables, winnings

a mass noun may be plural in one language and singular in the another:

(25) décombres ‘rubble’, lie ‘dregs’

(26) máyim ‘water’, šmarím ‘yeast’ (Hebrew, plural)

Notes
According to Laycock 1972, Burge 1977, Chierchia 1998, mass nouns are  
lexical plurals.

How mass nouns are different from plural count nouns

• First two diagnostics in (14) concerning determiners:

(27) a. There were hundreds of clouds in the sky.  
b. *There were hundreds of fumes in the room.

(28) a. several facts  
b. *several evidence

(29) a. *too much poems

See Smith(2015: §2.4.1) for syntactic account of facts like in (29).

• Contexts that require count plural noun phrases are contexts that reject  
mass noun phrases:

(30) a. *The pottery was sold to one person each.  
b. *The pottery was each painted a different color.  
c. *The pottery was both painted green.  
d. *The pottery matches each other.

(31) *Your directions contradicted each other.

(32) She described those years one after another.  
?She described the 1920’s one after another.

But coordination of mass noun phrases are ok

(33) Your directions and her directions contradicted each other.

Count requires numerical measure function

Quantifiers such as alot-of, more, enough, most are measurement based.  
The kind of measurement varies across examples:

alot of gold (volume, weight)  
alot of light (lumens)  
alot of rope (length)  
alot of furniture (number of pieces, degree of usefulness)

(34) If a measure-based quantifier combines with a plural-count NP,  
cardinality measure is used. Mass NP allows a range of measures.
Evidence for (34)

*That is a lot of lights* is a comment about number of lights. Compare: *that’s a lot of light*

*That is a lot of cherries* is a comment about number of cherries. Compare: *that’s 2lbs of cherries.*

Discrete mass nouns and number

Bale and Barner (2009) say that discrete mass nouns of the kind in (20) above also require cardinality measurement. McCawley (1975) disagrees. Bale and Barner discuss experiments showing a strong preference for numerical measures. Grimm and Levin (2012) discuss experiments showing contexts in which non-numerical measures are preferred.

Summary: Mass noun phrases pattern with count-plural in some ways but not in others. We need a theory that explains how they are plural, without identifying them as count-plural.

N-state proposal

First, some more plural semantics – distributive readings

(35) Four dogs barked.

*Dog(S) ⇔ (∀s ∈ S → Dog(s)) & |S| ≠ 0)

∃S [4(S) & *Dog(S) & ∀s ∈ S → ∃e [Bark(e) & (Ag(e) ⊃ s)]]]

(36) The boxes are heavy.

*Box(S) ⇔ (∀s ∈ S → Box(s)) & |S| ≠ 0)

[The S: *Box(S)] ∀s ∈ S → ∃s’ [Heavy(s’) & (s’ ⊃ s)]

(37) [The S: *Box(S)] φ(S) ⇔

∃S’ *Box(S) & φ(S) & ∀S’ [*Box(S’) → s’ ⊆ S]

Collective reading of the boxes are heavy, updating participant sharing

(38) The boxes are heavy.

[The S: *Box(S) ∃s [Heavy(s) & (s ⊃ S)]]

(39) Participant sharing II

If s is a state and S is a set of states:

(s ⊃ S) ≡ ∀u [u in s → ∃s’ s’ ∈ S & u is in s’])

‘any participant in s is a participant in a state in S and vice-versa.’

Multi- and single participant states, defining [+count]

On the collective reading in (38), ‘Heavy’ holds of a multiparticipant state.

On the distributive reading in (36), ‘Heavy’ holds of several single-participant states.

defining [+count]

Mary is the sole participant of her state of being a doctor. The noun doctor only describes single-participant states. Similarly for dog, ship, army, soldier and box. And these are all count nouns.

(40) A count noun is a noun that describes only single-participant states

Participant closure and cumulativity

(41) A predicate P is PARTICIPANT-CLOSED iff for any set of states S the following is true:

∀S [s ∈ S → P(s)] → ∃s’ [P(s’) & (S ⊃ s’)]

• By (40), a count noun cannot in general be participant closed.
• A mass noun could describe multi-participant states, so it could be participant closed and let’s assume:

(42) Any mass noun is a participant-closed predicate.

Now we can define a notion of cumulativity that applies to mass and plural-count:

(43) A predicate is cumulative iff

For any \(m_1\) and \(m_2\) in the extension of \(P\), there is an \(m_3\) in the extension of \(P\) and the participants involved in \(m_3\) are all and only the participants involved in \(m_1\) and \(m_2\).

For mass nouns, \(m_1\), \(m_2\) and \(m_3\) range over states.
For plural-count nouns, \(m_1\), \(m_2\) and \(m_3\) range over sets of states.

• A full account of the inferences likes those in (15) involve cumulativity of the main predicate (hot, white) as well.

• The data in (23) may succumb to an analysis in terms of cumulativity, if bare NP interpretation requires the presence of a maximal element in the NP extension. See Dayal 2011 for general discussion and references.

Discreteness intuitions: luggage vs. suitcases

(44) *Suitcase(S) ⇔ \(\forall s[s \in S \rightarrow s \text{ is a state of being a suitcase}] \& |S| \neq 0\)

(45) Luggage(s) ⇔ Every participant in \(s\) is a suitcase

pile is a collective, count noun:

(46) Pile-of suitcases(s) ⇔ \(s\) is a pile state. Its sole participant is a collection of suitcases forming a pile.

(47) a. The suitcases are small.
b. The luggage is small.
c. The pile of suitcases is not small.

Plurality seekers (eg each, one by one, one another) and coordination

(48) *The milk touched each other.
(49) The milk and the soap touched each other.

• Reciprocals, each, one by one\(^4\) require set-denoting antecedents.
• DP conjunction forms plurality-denoting expressions.

Details on (49)

(50) [The s: Milk(s)][The s′: Soap(s′)] TouchEachOther({s,s′})

(51) [The s: Milk(s)]φ(s) ⇔ 

\[\exists s \text{ Milk}(s) \& \phi(s) \& (s \ominus \{s': \text{ Milk}(s')})\]

Plurality seekers don’t care if the mass noun is grammatically plural:

(52) *Your directions contradicted each other.
(53) Your directions and her directions contradicted each other.

Morphology: plural marking on mass nouns

(54) Acquaviva(2008), Alexiadou(2011)

\[\text{High Plural} \quad \text{Low Plural}\]

\[
\begin{array}{c}
\text{NumP} \\
\text{n} \\
\sqrt{\text{Book}} \quad [n, \emptyset] \\
\text{books} \\
\end{array}
\quad
\begin{array}{c}
\text{n[PL]} \\
\sqrt{\text{DREG}} \\
\text{n[PL]} \\
\text{dregs} \\
\end{array}
\]

\(^4\) Brasoveanu and Henderson (2009)
• The plural marker indicates the possible presence of an element in the extension of the sister that involves multiple participants.

• Num requires its sister to be a [+COUNT].

Situating the proposal in the Mass Count Landscape

• Kinds of theories: ‘predicate extension’ ‘entities’

(55) An entities theory is a theory in which mass nouns and count nouns describe different kinds of things.

(56) A predicate-extension theory is a theory in which mass nouns and count nouns are distinguished in terms of properties of the whole extension.

◊ These categories are not mutually exclusive.

Example of a whole predicate theory

(57) Only mass nouns are cumulative in the following sense:\n
“A mass noun like water is frequently assumed to hold true of all and only the individual portions of water – with no assumption that an individual ‘portion’ must be physically separated in any way. Thus, water will hold of the water in the top half of my glass, as well as the water in the bottom half, the water in the top three quarters and the water occupying the glass as a whole. Nor need portions be physically contiguous; the water in two separate glasses may be considered together as a portion of water, of which the noun water holds true. Assuming that for any two portions A and B, there is a portion A+B consisting of them, we may stipulate that mass nouns are cumulative, holding of A+B whenever they hold of A and of B.” Lasersohn(2011:1137)

Example of an entities theory

(58) “A different approach to semantically distinguishing count and mass nouns is to regard the mass nouns as holding of portions of material, while count nouns hold of more abstract objects constituted of that material (Link 1983).” Lasersohn(2011:1138)

Characterizing N-state

(59) The N-state proposal is an entities theory.

It is not always clear whether to classify a theory as ‘entities’ or ‘predicate-extension’. Kamp and Reyle’s discussion: predicate-extension or entities?

(60) Here is an excerpt from: Kamp and Reyle (1993:400-401):

It is a widely accepted view that the denotations of plural count nouns (books, stones, clouds, words,...) differ from those of mass nouns (sand, water, money, information, ...) in that the former, but not the latter, can be decomposed into indivisible parts of the same description. Thus, a collection of books has a (unique) decomposition into the individual parts, viz. the books that make up the collection, but there is no obvious way in which the water in the glass on the table in front of you could be divided into “minimal” portions of water. Evidently this is not a distinction that holds in a strict and literal sense. For instance, a heap of sand would appear to have a unique decomposition into atomic parts no less than a heap of stones - viz. that which decomposes it into grains of sand that make up the heap. Even the denotations of a noun like water, i.e. quantities of water such as, say, the water in the glass - seem to allow for a unique partition into

5 See Rothstein(2010:§3) for why this will not ultimately work as definition of mass noun.

6 Mass nouns and count nouns differ syntactically in that only the former occur in the singular without an article. Thus we can say Water was in short supply or Money talks, but we can't say Book was interesting or Sentence was grammatical. In Water was in short supply and Money talks water and money have the grammatical status of NPs (they are the subjects of their respective sentences). Such NPs show striking similarities with bare plurals such as dollars in Dollars no longer buy everything or potatoes in Potatoes were in short supply.
smallest parts that are water, viz. the water molecules which constitute the given quantity.

Such examples show the claim that the denotata of plural count nouns can be decomposed into indivisible parts, while those of mass nouns cannot, to have only a conceptual validity. We language users tend to think of the denotata of plural count nouns as divisible in this sense, and of the denotata of mass nouns as resisting such a decomposition, although we know (through common sense or natural science) that for the denotata of mass nouns division must eventually come to an end, too.  

One way of articulating this difference is to say that the denotata of NPs containing count nouns are composed of atoms - "minimal" elements that cannot be partitioned into smaller elements of the same kind - whereas the denotata of NPs involving mass nouns are not so composed.

... Each count noun α has an extension which consists (i) of atoms - i.e. things that belong to the extension of α but cannot be subdivided into parts that also belong to the extension of α (these are the entities in the extension of the singular form of α); and (ii) non-atoms, entities that - again in the sense just alluded to - belong to the extension of the plural form of α and which can be decomposed, in a unique way, into atoms all of which belong to the extension of α. Thus the atoms are what we earlier termed the indivisible entities, and the non-atoms are the divisible ones.

- In this quote, atom is a relational term: x is an atom with respect to α. Even though it is relational, it’s used intransitively. Compare: only members are allowed above the fifth floor. Same for (in)divisible

- atom is used intransitively and maybe non-relationally in the plurals literature where part has a specialized meaning.

(61) Hypothesis: mass nouns do not combine with numerals because one may divide their denotations in any arbitrary fashion into any number of parts, so there is no basis for counting.

Considerations

- complex mass NPs like water covering the floor, since some water could easily cover the floor without all its parts covering the floor (Lasersohn 2011:1138)
- count nouns that describe entities for which division is also arbitrary (area, time interval), banyan trees (Elder 2008:437), 2 hundred books (Ionin & Matushansky 2006)
- languages where mass nouns combine with numerals – partitions are contextually provided (Deal 2017, Lima 2014)
- counting in the verbal domain (she ran twice)
- Landman (2011) is a theory where counting criteria are central, includes discussion of previous counting criteria theories

Other mass count issues

Quantification
Patterns of lexicalization
Cross-linguistic variation
Acquisition

With mass nouns and collectives, there are competing intuitions. Semantically they seem plural, but the grammar distinguishes them from true plural nouns. A somewhat similar situation obtains with ‘simple event nominals’. They seem to be event descriptions, but the grammar distinguishes them from true nominal event predicates.

Event Nominals

“The term ‘event’ (or ‘eventive’) nominals is often the subject of some misunderstanding, or at least suffers from variable definitions depending on whether it is taken in the syntactic tradition where eventivity is correlated
with particular structural properties, or from a (lexical-) semantic point of view where a much larger class of nominals would be considered as ‘eventive’.” Roy and Soare (2013)

**Contexts for event reference:** __took 2 hours, during________

(62) The party/the inspection of the documents took two hours.
(63) Jack was on the phone during the examination of the refugees/during the party.

Grimshaw (1990) distinguishes:
‘simple event nominals’ (party)
‘complex event nominals’ (examination of the students).

(64) In/for PP
The examination of the students in less than two hours
*The party in/for less than two hours.

(65) Frequent, constant + singular-N
The frequent examination of the students by the teachers
*The frequent party

(66) Pluralization
*Several examinations of the students by the teachers
Several parties

Roy and Soare explain the difference

(67) complex event nominals have event arguments, simple event nominals “take an individual as argument (rather than an event); it just happens that for simple event nominals that individual variable is an abstract entity, conceptually an event (rather than a concrete object as with table, book, and so on).” Roy and Soare (2013)

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**N-state way of splitting the difference**

(68) party describes events in the same way that dog describes dogs – via the states those entities are in.

(69) Party(s) ⇔ s is a state of being a party. The sole participant in s is an event of partying.

(70) Examination(e) ⇔ e is an event of examining.

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**References**

Tonhauser (2007a) *The Temporal Semantics of Noun Phrases: Evidence from Guaraní (Paraguay)*, Stanford PhD.