COMMENTS ON NEGATIVE POLARITY ITEMS IN DEFINITE DESCRIPTIONS

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1. Introduction

Negative Polarity Items (NPIs) may be licensed in the restrictors of determiner phrases, depending on the properties of the determiner. For example, *any* is licensed in the restrictor of *no* and *every*, but not *some*.

(1)   No students who have any books on NPIs are selling them.
        Every student who has any books on NPIs are selling them.
        *Some students who have any books on NPIs are selling them.

This paper will specifically address the issue of NPIs occurring in the restrictors of definite descriptions. A common view is that NPIs are acceptable in the restrictors of plural definite descriptions, but not of singular descriptions, cf. Lahiri 1998. The following example is from Guerzoni & Sharvit 2007.

(2)   The students who have any books on NPIs are selling them.
        *The student who has any books on NPIs is selling them.

The NPIs that are acceptable in these environments are plain or weak NPIs, like *any* and *ever*; but not strong NPIs, like *in years*, punctual *until* and *either*, which show a more restricted distribution.

(3)   a. *The students who have been to France in five years returned.

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      b. *The students who each arrived until 5pm left early.
      c. Bill hasn't been to France.
           *The students who have been to France either always remind him.

In this paper, we will address challenges to this empirical generalization about number as well as to the standard analysis (Lahiri 1998, Cable 2002, Guerzoni & Sharvit 2007) of that generalization in terms of Strawson entailment (von Fintel 1999). The merits of the standard analysis will be compared with an alternative based on a revision to the structure of the domain of individuals (cp. Homer 2010). Ultimately, the evidence pulls in different directions. We sketch avenues for further investigation.

2. Theoretical Background

I will make the following basic assumptions about NPI licensing: (i) that it is environment based (Heim 1984, Zwarts 1996, Gajewski 2005), (ii) that downward entailment (DE) is the central notion of a theory of licensing and (iii) that DE-ness can be defined across categories.

(4)   Environment based licensing condition
        An NPI α must be contained in a constituent β such that
        the function $\lambda x. [\![\beta[\alpha \backslash v_1]]\!]^{[1 \to x]}$ is downward entailing.   (Gajewski 2005)

(5)   Cross-Categorial Entailment
        If α and β are type t, then $\alpha \vDash \beta$ iff $\alpha = 0$ or $\beta = 1$
        If α and β are type $<\sigma, \tau>$, then $\alpha \vDash \beta$ iff
            For each $x \in D_\sigma$, $\alpha(x) \vDash \beta(x)$

(6)   Downward Entailment
        A function F of type $<\sigma,\tau>$ is downward entailing if and only if
        For all α, β of type σ s.t. $\alpha \vDash \beta$: $F(\beta) \vDash F(\alpha)$ (cf. Ladusaw 1979)

A revision to this (somewhat) standard theory is proposed in von Fintel 1999 to account for licensing in cases where DE-ness appears to fail, as in (7). *Only Bill* licenses NPIs, but the inference from (7)b to (7)c is intuitively invalid.

(7)   a. Only Bill smokes anything.
        b. Only Bill smokes.
        c. Only Bill smokes cigars.

In this case and others, von Fintel identifies the issue as a presupposition that interferes with intuitions of DE-ness. For example, on a classic analysis, *only x is P* presupposes that x is P. Consequently, von Fintel defines an alternative notion of entailment that he uses to state the licensing conditions on NPIs. Strawson entailment, as von Fintel dubs it, is weaker than classical entailment; it only considers cases in which both terms of the entailment are defined, cf. (8).

(8)   Generalized Strawson Entailment

If α and β are type t, then α ⊨_S β iff α = 0 or β = 1
If α and β are type <σ, τ>, then α ⊨_S β iff
        For all x s.t. x∈dom(α) and x∈dom(β), α(x) ⊨_S β(x)

(9)   Strawson Downward Entailment
       A function F of type <σ,τ> is downward entailing if and only if
       For all α, β of type σ s.t. α ⊨ β: F(β) ⊨_S F(α)

This accounts for licensing in ((7) by removing the interference of presupposition from the assessment of DE; all terms are taken to be defined. That is, if we take it for granted that Bill smokes cigars (the presupposition of (7)c), then (7)c does follow from (7)b.

3. Application of Strawson Entailment to Definite Descriptions

Plural definite descriptions do not appear to license downward inferences. However, when Strawson reasoning is applied, they do. We assume a standard analysis of the definite article, based on the work of Sharvy 1980 and Link 1983. On this analysis, a plural definite description carries an existential presupposition about its restrictor, whereas a singular definite description carries a presupposition of existence and uniqueness. Consider the intuitively invalid downward inference in (10). If we add the presupposition of the conclusion, as required by Strawson entailment, we see that the arguments does become valid, cf. (12).

(10)   The students arrived.
        #∴The French students arrived.

(11)   a. ⟦ the ⟧(P) = σ(P)   (Cf. Link 1983)
        b. σ(Q) is defined only if ⊔Q ∈ Q
           When defined, σ(Q) = ⊔Q

(12)   The students arrived.
        There are French students.
        ∴The French students arrived.

However, as has been pointed out (Lahiri 1998, Giannakidou 2002), so do singular definite descriptions, cf. (13). This seems to make the unfortunate prediction that singular definite descriptions should license NPIs, contrary to the judgment we saw in (2).

(13)   The student arrived.
        There is a unique salient French student.
        ∴The French student arrived.

However, Lahiri 1998 observes further that singular definite descriptions – unlike plural definite descriptions – are also Strawson <u>upward</u> entailing (UE):

(14)   The French student arrived.
        There is a unique student.

∴The student arrived.

(15)   The French students arrived.
        There are students.
        #∴The students arrived.

Consequently, Lahiri proposes that Strawson DE-ness is not sufficient for licensing. An NPI must be contained in an environment that is Strawson DE and not Strawson UE. The relevance of non-UE-ness was proposed by Progovac (1994). We can rewrite our licensing principle as follows:

(16)   An NPI α must occur in an environment E such that E is Strawson DE
        w.r.t. the position of α and E is not Strawson UE w.r.t. the position of α.

4. Challenges to this Picture

This account works well to derive the generalization that plural descriptions license NPIs but singulars do not. There have, however, been several challenges to this picture. Questions have been raised about how the theory works. Sentences and contexts have been found where it is claimed that plural definite descriptions do not license NPIs. Similarly, examples have been uncovered in which NPIs appear to be licensed in singular definite descriptions. Finally, theoretical questions have been raised concerning the role of Strawson entailment in the theory of NPI licensing.

4.1 Hoeksema's criticism

Hoeksema 2008 objects to the claim that plural definite descriptions are not Strawson UE as it is formulated by Guezoni and Sharvit 2007. Guerzoni and Sharvit paraphrase the relevant argument as follows below. Note the difference in how the Strawson premise is stated in (15) and (17).

(17)   The French students came late
        There is a unique salient group of students
        ∴ The students came late

Hoeksema objects that if there is a unique salient group of students, then surely it must be the group of French students made salient by the premise. If that is so, then it does follow that the students came, since the group of students comprises no individuals other than the French students.
        I believe this is just a matter of an infelicitous paraphrase on Guerzoni & Sharvit's part. The presupposition derived by the analysis of the definite article in (11) is better paraphrased as saying that there are salient students. From this perspective, Hoeksema's objection no longer goes through, as seen in the discussion of (15) above.

4.2 Plural definite descriptions not licensing NPIs

A more serious objection comes from Hoeksema's observation concerning the lack of licensing by plural definite descriptions in predicate position. Consider the following examples.

(18)   a. *Bill is the student who ever tried to grasp this theorem.
        b. *John and Bill are the students who have ever tried to grasp this
           theorem.

                                                            Hoeksema 2008

The ungrammaticality of (18)b in particular appears to be a serious objection to the standard theory sketched above. Compare these with the sentences in (19), which have very similar meanings, but very different logical forms.

(19)   a. Bill is the only/one/tallest student who ever tried to grasp this theorem.
        b. John and Bill are the only/tallest students who have ever tried to grasp
           this theorem.[2]

Homer 2010 suggests another context in which a plural definite description might fail to license NPIs. He suggests that even when definite descriptions occur in argument position they may not license NPIs depending on the surrounding discourse context.

(20)   Context: A number of students present at the party wanted to leave as
        soon as possible.
        a. —A: What happened, why is the party deserted?
        b. —B: *I forgot their names now, but the students who had any desire to
               leave the party left.
        c. —B': *The students who had any desire to leave the party, namely
               Sarah, Byron and Michael, left.

                                                            Homer 2010

In this example, before the description is introduced some context is presented that is meant to guarantee the existence of members of the definite descriptions restrictor. Homer suggests that this confirmation of the existence presupposition interferes with licensing. We will discuss his analysis of these cases below.

4.3 Singular definite descriptions licensing NPIs

On the other side of things, many authors have identified what they consider to be clear cases of NPIs licensed in the restrictors of singular definite descriptions.

(21)   a. The student who has ever attempted this proof knows how hard it is.
                                                            Hoeksema 2008
        b. The mayor with any sense will control the school board.

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[2] A reviewer observes that similar examples with numerals also appear to license NPIs, (i). This may be related to the `exactly' interpretation of the numeral.
(i)   John and Bill are the two students who ever tried to grasp this theorem.

Rothschild 2009
            c. The student who receives any books on NPIs sells them.
Homer 2010
Hoeksema and Rothschild, in particular, suggest that the role of genericity is crucial to the licensing in these cases. None of these sentences is about a particular individual, but instead generalizes over individuals that meet the description. Hoeksema suggests that it is important that genericity removes the existential presupposition of the definite. Homer instead focuses on the apparent disappearance of the uniqueness presupposition.

4.4 Questions for the role of Strawson entailment in NPI licensing

In addition to these empirical concerns, question have been raised about Strawson entailment is the right relation to use in licensing conditions. The use of Strawson entailment neutralizes the effect of presupposition on downward entailment. Homer 2009, 2010 argues that there are many cases in which presuppositions – both of interveners and 'licensers' – do interfere with licensing. Gajewski 2011 questions the consequences of adopting Strawson entailment for the theory of strong NPIs licensing.

4.5 Homogeneity

Luka Crnic (p.c.) has pointed out to us that there is another potential problem with the Lahirian view on the contrast in licensing in singular and plural definite descriptions. Many authors have described what they call a homogeneity presupposition of distributive definite plurals, see for example Löbner 2000. This reputed presupposition accounts for all-or-nothing effects in distributive predication. A distributive definite often seems to be interpreted as a universal, yet the negation of such a definite is typically stronger than the negation of a universal, cf. (22).

(22)   a. Bill graded the papers. (≈ Bill graded all the papers)
         b. Bill didn't grade the papers. (≈ Bill graded none of the papers)

Such presuppositions are often stated as in (23) below.

(23)   Homogeneity Presupposition
         P_{dist}(the NP) is defined only if every NP is P or no NP is P

If such a presupposition is indeed part of distributive predication, then Lahiri's argument no longer goes through: plural definite description would also be Strawson upward entailing, just like singular definites. The argument below is indeed Strawson valid.

(24)   Bill graded the semantics papers.
         Bill graded all the papers or Bill graded none of the papers.
         ∴Bill graded the papers.

One way out of this is to adopt a view according to which all-or-none effects in definite predication are not due to a presupposition. Fortunately, there have been many recent advocates of alternative approaches to homogeneity that do not involve presupposition. Malamud 2012

proposes a decision-theoretic approach to variability in the interpretation of definite plurals and Spector 2013 proposed to derive homogeneity from the Strongest Meaning Hypothesis and supervaluation. Either of these approaches would put homogeneity outside the scope of Strawson entailment, hence preserving the non-Strawson UE character of definite plurals. A downside of such an approach would be the negative effect it would have on theories that crucially used homogeneity as a part of a theory of NPI licensing such as Gajewski 2007 and Romoli 2013.

5. Failure of Licensing in Predicate Definites

In this section, we address the issue of the failure of licensing in predicate definites. We show that these examples do not necessarily pose a problem for the standard Strawson account. Hoeksema's contrast is repeated below.

(25)   a. The students who have ever attempted this proof know how hard it is.
        b. *Bill and Fred are the students who have ever attempted this problem.
        c. *The award winners are the students who have ever attempted this
            proof.

First, we would like to point out that similar differences in NPI licensing have been observed between argumental and predicative uses of a noun phrase. Landman (2004) reports the contrast in (26) involving quantificational noun phrases headed by *at most n*. The argumental use licenses NPIs; the predicative use does not.

(26)   a. At most 3 scientists who ever got the Nobel Prize were at the party.
        b. *The guests were at most three scientists who ever got the Nobel Prize.

As Landman observes, this is not completely surprising since in predicate position the expression *at most n NP* appears to be upward entailing rather than downward entailing. For example, (27)a entails each of (27)b-d, but appears not to entail (27)e. The truth of (27)e requires the guest to have won the Nobel – that doesn't follow from (27)a.

(27)   a. The guests were at most seven distinguished linguists.
        b. The guest were distinguished linguists.
        c. The guest were linguists.
        d. The guests were at most seven linguists.
        e. The guests were at most seven Nobel laureate linguists.

For Landman, this behavior in predicate environments follows straightforwardly from his analysis of indefinite determiners as intersective modifiers.

(28)   a. $\llbracket$ at most two $\rrbracket = \lambda X.|X| \leq 2$
        b. $\llbracket$ at most two students$_{pred}$ $\rrbracket = \lambda X.|X| \leq 2$ & *student(X)

In order to allow argumental noun phrases to be built from such predicate denotations, Landman 1998, 2000, 2004 formulates an argument forming typeshift (AF). This type shift is composed of

existential closure and maximalization, as defined in (29). This derives a left downward entailing meaning for the generalized quantifier.

(29)   For any predicate-type denotation NP:
        a. $EC[NP] = \lambda P.\exists x[\ NP(x)\ \&\ P(x)]$ existential closure
        b. $MAX[NP] = \lambda P.\ NP(\sqcup(\lambda x.\ NP(x)\ \&\ P(x)))$ maximalization
        c. $AF[NP] = \lambda P.\ EC[NP](P)\ \&\ MAX[NP](P)$ argument formation

Specifically, application of AF to (28)b gives the meaning in (30)a which simplifies to (30)b if we assume a **0** element.

(30)   a. ⟦ at most two students$_{arg}$ ⟧ $= \lambda P.\exists x[\ |x| \leq 2\ \&\ P(x)]|\ \&$
                                                    $|\sqcup(\lambda X[\ |X| \leq 2\ \&\ *student(X)\ \&\ P(X)])| \leq 2$
        b. $= \lambda P.|\sqcup(\lambda X[\ |X| \leq 2\ \&\ *student(X)\ \&\ P(X)])| \leq 2$

Such an analysis does not appear open to us for the case in (25), given the implausibility of an intersective predicate analysis of the definite article. However, the shift between an argumental and a predicative type may well play an important role in our phenomenon as well.

(31) $IDENT(⟦\ the\ students\ ⟧) = \lambda x.\ x = ⟦\ the\ students\ ⟧$ (cf. Partee 1987)

It is clear at the very least that downward entailing inferences do not hold for plural definite descriptions in predicate position, not even when we apply Strawson entailment.

(32)   a. Mary, Bill and Fred are the students in this class.
        b. Mary, Bill and Fred are the students in this class that have cats.

(33)   Mary, Bill and Fred are the students in this class.
        There are students in this class that have cats. (Strawson premise)
        #∴Mary, Bill and Fred are the students in this class that have cats.

In the case of the inference in (33), it may be that the students that own cats are Bill and Fred, while Mary does not own a cat. So, a Strawsonian would point to the failure in (33) and claim success.
        In this section, we have shown that counterexamples based on definite plurals in predicate position are not necessarily threats to a Strawsonian account of NPI licensing in definite descriptions. Still we need to know exactly what is responsible for the difference between the good cases and the bad. The definite descriptions denote the same plurality in cases like (25)a and (25)b. It must be the environment in which it finds itself that makes a difference. This idea is explored in the next section.

6. Collective Predication and NPI licensing

When NPI-licensing in definite descriptions is discussed, it is typically done so in the context of descriptions used as arguments of distributive predicates. That is, examples typically use predicates that have the following property.

(34)   For any individuals x, y s.t. $y \leq_i x$: if P(x), then P(y).

Predicate position is not the only position in which a definite plural description fails to license Strawson downward inferences. Consider the case of various kinds of collective predicates.

(35)   The boxes <u>outweigh</u> the truck.   Mixed
         (There are wooden boxes.)
         ∴ The wooden boxes outweigh the truck.

(36)   The students <u>dispersed/gathered</u> after the rally.   Collective
         (There are semantics students.)
         ∴ The semantics students dispersed.

(37)   The students are <u>numerous/many in number</u>.   'Genuinely'
         (There are semantics students.)   collective
         ∴ The semantics students are numerous/many in number.

None of these inferences sounds valid to my ear or the ears of my informants. So now we must ask what the judgments are for NPIs contained in plural definite descriptions saturating the arguments of these predicates.

(38)   a. The boxes that have ever held sprockets outweigh the truck.

(39)   a. The students with any sense dispersed after the rally.
         b. The students who had any grievances assembled in the hall.

(40)   a. The students with any knowledge of French are numerous.
         b. The students that have ever failed my class are many in number.

My informants show variability in their judgments of these sentences.[3] As far as we can tell, though, these sentences are not significantly better or significantly worse than the cases of licensing that involve distributive predicates. These data seem to support a theory of licensing in definites that does not depend on the predicate the definite is an argument of – in contrast to what we concluded from the case of predicate licensing.

There is, however, another aspect of distributive/collective predication that we should consider. In particular, predication is dependent on the contextual determination of a cover (Schwarzschild 1996). A cover is a contextually salient way of grouping the individuals in a

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[3] Luka Crnic (p.c., class notes) drew the opposite conclusion from examples that he has tested including (i), his judgment:
(i) *The girls who read any of the books were a good team.
Notice that *be a good team* is a collective predicate that disallows intermediate distributive readins. See the next footnote.

domain into pluralities. Could it be subtle shifts in this contextual variable that are responsible for the apparent failure of Strawson downward entailingness? It is argued convincingly in von Fintel 1999 that contextual parameters must be held constant when assessing DE-ness.

In a theory like Schwarzschild's both collective and distributive predication are relativized to a cover as in (41). A set of pluralities is a cover if the sum of all the pluralities in the cover is equal to the sum of the individuals in the domain. On a collective reading, the contextual cover contains a single cell that is a part of the subject denotation. Intermediate distributive readings are derived by including subpluralities in the cover, but not atoms.

(41) $[\![$ The NPs Part$_{Cov1}$ VP $]\!]^g$
$\forall x[\ x \in g(Cov_1)$ and $x \sqsubseteq \sigma(*NP) \rightarrow x \in VP]$

(42) Collective reading: $\sigma(*NP) \in g(Cov_1)$ and there is no $x \sqsubset_i \sigma(*NP)$ s.t. $x \in g(Cov_1)$
Intermediate distributive reading: $\exists x,y[\ x \neq y\ \&\ x,y \sqsubseteq_i \sigma(*NP)\ \&\ x,y \in g(Cov_1)\ ]$

To see what relevance covers have for NPI licensing, we need to think about what presuppositions the Part operator might carry about the cover. It seems plausible to me to assume that there is a felicity condition on covers that requires them to contain at least one subplurality of the argument of the predicate.

(43) Part$_{Cov}$ (VP)(x) is defined only if there is some y s.t. $y \in Cov$ and $y \sqsubseteq_i x$

Suppose now that we hold the cover constant and add the presupposition about the cover as a Strawson premise.

(44) The students Part$_{Cov}$ are numerous.
<u>Semantics students exist &</u> <u>for some $y \sqsubseteq_i$ the semantics students, $y \in Cov$</u>
∴ The semantics students Part$_{Cov}$ are numerous.

Now the conclusion does follow. The Strawson premise requires that a subplurality of the semantics students be a member of the cover that is used to assess the first premise. So, a cover that meets these conditions would be one where a subplurality of the semantics students is the only subplurality of the students in the cover. You can think of such a scenario as one where *the students* is construed as referring to the semantics students. Alternatively, the cover could contain a subplurality of the semantics students as well as some other distinct subplurality of the students. This may be viewed as a variety of intermediate distributive reading of the first premise.[4] In any case, the inference in (44) is valid.

We should also check that the environment is not upward entailing. It is not, as seen below.

(45) The semantics students Part$_{Cov}$ gathered.
<u>There are students and, for some $y \sqsubseteq_i$ the students, $y \in Cov$</u>

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[4] This raises an interesting question about cases where intermediate distributive readings are not allowed as in (i):

(i) The students are a good team.

#∴ The students Part$_{Cov}$ gathered.

The case of a definite NP involving a collective predicate in restrictor is still more complicated. As shown in (46), NPIs are grammatical in this environment. Nevertheless, (46) can carry an 'intermediate' reading, according to which there are several groups of students each of which gathered at some time and the sum of all these group students got arrested; it does not have a 'unique-group' reading in which there is only one group of students that gathered at some time point and got arrested (the 'unique-group reading).

(46) After the rally, the students who ever <u>gathered</u> got arrested.

The SDE account together with Schwarzchild's (1996) theory of covers predicts that in this case the restrictor of a definite plural is SDE; e.g., the inference in (48) goes through. On the other hand, an SUE inference as in (49) is not supported, as shown in (49).

(47)   a. [the [students who Part$_{Cov'}$ gathered]] [Part$_{Cov''}$ got arrested]]
         b. $\forall x[x \in g(Cov'')$ and $x \sqsubseteq \sigma(\lambda y.$ *student(y) and $\forall z[z \in g(Cov')$ and $z \sqsubseteq y \rightarrow$
                                                            z gathered])$\rightarrow x$ got arrested]]

(48)   {x: x gathered willingly}⊆{x: x gathered}
         The students who Part$_{Cov'}$ gathered Part$_{Cov''}$ got arrested.
         There are students who gathered willingly, and for some y such that y⊑the
              students who gathered willingly, y∈g(Cov″).   _____ (Strawson Premise)
         ───
         ∴ The students who gathered willingly got arrested.

(49)   {x: x gathered willingly}⊆{x: x gathered}
         The students who Part$_{Cov'}$ gathered willingly Part$_{Cov''}$ got arrested.
         There are students who gathered, and for some y such that y⊑the
              students who gathered, y∈g(Cov″).   _____   (Strawson Premise)
         ───
         ∴ The students who gathered got arrested.

It is then predicted that NPIs are grammatical in this environment.
      The absence of the 'unique-group' reading however is not captured under this account. Assuming that in the premise in (49) g(Cov′) contains only one single cell of students that gathered willingly, an SUE inference is still not guaranteed.
      In sections 4 and 5, we saw that NPIs are not licensed in definite plurals in predicate position. There we suggested that this may be because in this position definite plurals do not license even Strawson downward entailing. In this section, we observed that NPIs do appear to be licensed in definite plurals that are arguments of collective predicates. In this environment, definite plurals do not appear – at first blush – to be Strawson downward entailing either. This would be a blow for the classic Strawson account. We have argued, however, that if the role of the contextual parameter of plural prediction, known as the cover, is taken into consideration, definite plurals in these environments may in fact be Strawson downward entailing.

7. Is there a non-Strawsonian account of these facts?

In the previous section, we have argued that a Strawsonian account of licensing in definites may have answers to the empirical criticisms that have been leveled against it. Questions remain about the overall role of Strawson entailment in a theory of NPI licensing, cf. Homer 2010. In the next section, we consider the possibility of a non-Strawson account of the facts. To properly answer that question, it will be useful to directly address the question of what is doing the licensing when an NPI is licensed in a definite description.

We must address the issue of how the licensing is accomplished. Depending on one's assumptions about licensing, an NPI in the restrictor of a definite description could be licensed within the DP or at a higher propositional level.
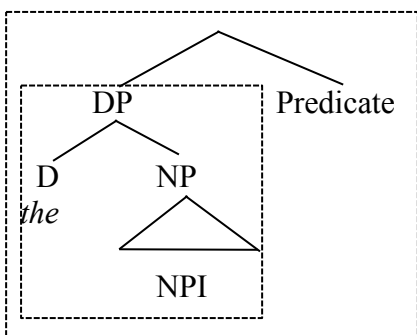
The notion of entailment that is typically used in the statement of licensing principles is defined in Boolean terms with the base for induction being truth values.

(50)   Cross-Categorial Entailment
        If α and β are type t, then $\alpha \vDash \beta$ iff $\alpha = 0$ or $\beta = 1$
        If α and β are type $<\sigma, \tau>$, then $\alpha \vDash \beta$ iff for all $x \in D_\sigma$, $\alpha(x) \vDash \beta(x)$

This excludes licensing from occurring at the DP level. Instead, if any licensing is to occur, it must be in a constituent that includes the predicate that the definite description is an argument of. We will return to this point below.

We could, however, amend our definition of entailment to include the i-part relation among individuals in the domain D_e. This is suggested as a possibility in footnote 11 of Guerzoni and Sharvit 2007.

We must decide on what direction of the i-part relation corresponds to entailment. Guerzoni and Sharvit suggests that a plural individual entails its parts. This lines up well with a generalization that conjunctions entail their conjuncts.

(51)   Cross-Categorial Entailment
        If α and β are type t, then $\alpha \vDash \beta$ iff $\alpha = 0$ or $\beta = 1$
        If α and β are type e, then $\alpha \vDash \beta$ iff $\beta \leq_I \alpha$
        If α and β are type $<\sigma, \tau>$, then $\alpha \vDash \beta$ iff for all $x \in D_\sigma$, $\alpha(x) \vDash \beta(x)$

This kind of plain entailment in (51) supplemented with a new base clause based on the i-part relation between individuals will not help to explain licensing – for the same reason that (50)

does not. If you consider the case where the restrictor is empty (and of course ∅ is a subset of every set) then the definite does not refer and entailment as defined in (51) does not hold. Instead we must add this to the definition of Strawson entailment.

(52)   Cross-Categorial Strawson Entailment
        If α and β are type t, then α ⊨$_S$ β iff α = 0 or β = 1
        If α and β are type e, then α ⊨$_S$ β iff β ≤$_I$ α
        If α and β are type <σ, τ>, then α ⊨$_S$ β iff
                for all x ∈ dom(α)∩dom(β), α(x) ⊨ β(x)

Under this view plural definite descriptions are self-sufficient for licensing. That is, licensing may take place at the DP level.
        Consider that, given this definition of Strawson entailment based on the i-part relation, the following downward entailment relation holds. Verifying that such a theory allows licensing of NPIs in definite descriptions independent of the character of the predicate involved. This presents an alternative account of the facts about collective predicates, though such an account would raise questions about the predicate cases.

(53) For any predicates P, Q of type <s,<e,t>> s.t. P ⊨$_S$ Q,
        λw.⟦ the ⟧(*Q(w)) ⊨$_S$ λw.⟦ the ⟧(*P(w))

To take a concrete example, consider that the following entailments hold under these new definitions:

(54)   a. ⟦ semantic student ⟧ ⊆ ⟦ student ⟧
        b. for all w in which there are semantics students:
           ⟦ the semantics students ⟧^{w} ≤$_i$ ⟦ the students ⟧^{w}
                That is, ⟦ the students ⟧^{w} ⊨ ⟦ the semantics students ⟧^{w}

Note that for (52) to work we had assess DE-ness at an intensional level. This is the result of our choice to use a notion of entailment defined over denotations. We could correct this if we changed to a notion of entailment between expressions based on models.
        We will see below in section 9.1 that such an individual-based approach may fit well with a non-Strawson account of the licensing facts. Before considering such an account lets return to the potentially problematic case of NPIs licensed in singular definite descriptions.

8. NPIs in singular definite descriptions

Typically, singular definite descriptions bar NPIs from their restrictors. However, it has been noted that this ban is not categorical. Singular definite descriptions permit NPIs when the description is used as a generic.

(55)   a. The student who has ever attempted this proof knows how hard it is.
                                        Hoeksema 2008
        b. The mayor with any sense will control the school board.

Rothschild 2009
c. The student who receives any books on NPIs sells them.[5]
Homer 2010

About these cases, it has been claimed (Hoeksema 2008, Rothschild 2009) that the definite appears to lack an existence presupposition in this case or that it lacks a uniqueness presupposition (Homer 2010).

Rothschild 2009 points out that the closely related sentence in (56) also license NPIs in the restrictor of its apparently upward entailing subject.

(56)   A mayor with any sense will control the school board.

In this case, it is not difficult to understand the indefinite as lacking quantificational case of its own and servings as the restrictor of a generic operator.

Questions remain, however, about the singular definite generic case. How is it possible for the presuppositions associated with singular number and the definite determiner to get out of the way for licensing. As Homer 2009 has observed, the presupposition of a definite description may intervene for licensing.

At this point, it will be helpful to look into analyses of the singular definite generic. The construction has raised vary thorny problems for compositional interpretation. Yet there are at least two prominent accounts on the market: Chierchia 1998 and Dayal 2004. For convenience, we will focus on Chierchia's.

Chierchia 1998 proposes that the singular definite generic can receive a reasonable analysis in his theory by means of some type-shifting operations. The first operation is a massifier, converting a count noun extension to a mass noun extension. The definite article applies to this. Chierchia argues that the reflex of singular number in cases of mass nouns marked with singular is a group-forming operator g that converts the mass sum to an atom. Chierchia's 2010 more recent version of this idea about number in mass descriptions is discussed below.

(57)   a. The tiger roars.
        b. $Gen_{x,s}$ [member-of(x, g(ι MASS(tiger))) $\wedge$ C(x,s)] [roar(x,s)]

The structural analogies between plural and mass domains suggests that such an analysis could explain the licensing of NPIs in singular definite generics. This view is further bolstered by the observation that in fact (singular) mass definite descriptions do license NPIs as well as definite plurals.

(58)   a. The gravel that has ever been used at a superfund site is being buried.
        b. The wine that touched any of these barrels was thrown away.
        c. The food with any nutritional content is being put into long-term storage.
                                                                    (Gajewski, to appear)

Whether this analysis depends on the individual-based view of entailment or may be compatible with the conservative Boolean view depends on the interpretation of the group-forming operator

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[5] Note the difference in tense between this example and Guerzoni and Sharvit's 2007 example in (2).

and whether it introduces an existential presupposition. We will leave this detail for further research.

In a more recent version of Chierchia's account, Chierchia (2010) proposes that mass nouns denote singleton properties, true only of the totality of instantiations of the substance.

(59) $[\![$ wine $]\!]^w = \lambda x.\ x = w_{max,w}$ where $w_{max,w}$ is the totality of wine in w

A consequence of this is that mass nouns will always satisfy the presuppositions of the singular. Such an analysis may pave the way for a version of Chierchia's approach that will license NPIs in singular definite generics without resorting to entailment between individuals.

The upshot of this section is that there may be a reasonable approach to licensing in singular count definite descriptions that is compatible with the Strawson account of licensing in definites. This approach depends on an analogy between generic singular count descriptions and mass descriptions, as sketched by Chierchia. We leave the details for further research.

9. Including Zero

As noted above, questions have been raised about the role of Strawson entailment in NPI licensing. This raises the further question of whether these facts can be accounted for without Strawson reasoning. One possible way towards such an account is to include the **0** element in the domain of individuals. This will effectively remove the existence presupposition of definite plurals. This means that plural definite descriptions can create environments that are downward entailing *simpliciter*. Such a suggestion is made in Homer 2010, following a suggestion of Schlenker p.c. to Homer.

Landman 2004 argues for the inclusion of a **0** element in the domain of individuals and indeed in the extension of all pluralized predicates. Landman makes the following assumptions. Crucially the supremum operator ($\sqcup$) assigns **0** to the empty set.

(60) $\sigma(Q)$ is defined only if $\sqcup Q \in Q$
        When defined, $\sigma(Q) = \sqcup Q$

(61)   The domain of individuals D_e is a complete atomic Boolean algebra with a
        set of atoms A and a bottom element **0**.
        a. Singular noun denotations are subsets of A.
        b. Pluralized predicates all contain **0**.

(62)   a. Pluralization
        $*P=\{x \in D: \exists Z \subseteq P: x = \sqcup Z\}$
        b. $\sqcup \emptyset = 0$

The inclusion of **0** in all pluralized predicates gets rid of the existence presupposition of plural definite descriptions. Even when the numberless noun extension is empty, the plural description containing it will denote; it denotes **0**. Furthermore, since the pluralized predicate that applies to the definite will also include **0**. This opens the door to trivial truth of all plural definite description statements.

This seems like an unpalatable conclusion. Landman 2004 corrects for this by assuming that there is a pragmatic principle that opposes triviality. Landman proposes that one way to comply with this maxim is contextual restriction of the plural predicate to exclude **0**.

(63)   Avoid Triviality

(64)   a. <u>Contextual restriction of plural definites</u>
           ⟦ the students ⟧ = σ(C∩*student)

        b. In some contexts, **0** ∉ C

This approach to plural definite descriptions could be combined with a strictly Boolean definition of entailment or with one that includes the i-part relation as discussed above.

9.1 Entailment between individuals

The point is that if **0** is included in the domain in this way, then plural definite descriptions are plainly downward entailing in their restrictors – unless context intervenes to remove the **0** element. That is, within Landman's system the following holds even when P or Q is empty.

(65)   For any P, Q ⊆ A such that P ⊆ Q:
        σ(*P) ≤$_i$ σ(*Q)

(66)   σ(*Q) ⊨ σ(*P)

(67)   <u>Cross-Categorial Entailment</u>
        If α and β are type t, then α ⊨ β iff α = 0 or β = 1
        If α and β are type e, then α ⊨ β iff β ≤$_I$ α
        If α and β are type <σ, τ>, then α ⊨ β iff for all x ∈ D$_σ$, α(x) ⊨ β(x)

It is important to note that this account has no effect on the case of singular definite descriptions. Singular nouns are assumed to be subsets of the atoms A, which the **0** element is not.

(68)   Suppose the singular noun *boy* has an empty extension, i.e. ⟦ boy ⟧ = ∅
        a. Then ⊔⟦ boy ⟧ = **0**
        b. But, ⊔⟦ boy ⟧ ∉ ⟦ boy ⟧, since 0 ∉ ∅

So, singular definites are still presupposition failures when their restrictor is empty and thus not downward entailing.

The main consequence of this is that a plural definite description could potentially license NPIs in its restriction without regard for the properties of its surrounding environment. This makes the case of collective predicates easy. However, it potentially encounters difficulty with predicative cases.

(69)   *Bill and Fred are the students who have ever attempted this problem.

This theory could prevent licensing in this case by showing that the **0** element <u>must</u> be excluded for some reason. At this time, we can think of no such reason that predicate uses of plural definite descriptions would have to exclude **0**. Another possibility would be to suggest that in copula constructions there is no constituent that includes a Linkian definite article but excludes the identity relation required by the copula. For example, one might think of the relevant type shift as lexical.

(70)   a. ⟦ the$_{pred}$ ⟧ = $\lambda P_{<e,t>}.\lambda x.\ x = \sigma(P)$
       b. Bill and Fred are the semantics students.

Under such an assumption, the predicative definite is not downward entailing with respect to its restrictor. For example, (71)b is a subset of (71)a; but (71)c is not a subset of (71)d.

(71)   a. ⟦ student ⟧ = {a, b, c}
       b. ⟦ semantic student ⟧ = {a, b}
       c. ⟦ the$_{pred}$ students ⟧ = { a⊔b⊔c }
       d. ⟦ the$_{pred}$ semantics students ⟧ = { a⊔b }

Another potential difficulty for this theory is that it may predict that plural definite descriptions should license strong NPIs as well. If one takes anti-additivity as indicative of strong NPI licensing, definite descriptions turn out to be AA on this approach.

(72)   A function F is anti-additive iff $F(A \lor B) \Leftrightarrow F(A) \land F(B)$

(73)   For any $P, Q \subseteq A$:
       $\sigma(*(P \cup Q)) = \sigma(*P) \sqcup \sigma(*Q)$

However, as observed in the introduction, definite descriptions do not license strong NPIs in their restrictors under any circumstance.

(74)   a. *The students who have been to France in five years returned.
       b. *The students who each arrived until 5pm left early.
       c. Bill hasn't been to France.
          *The students who have been to France either always remind him.

9.2 Zero and Boolean entailment

The use of the 0-element could be combined with a theory that uses classical Boolean entailment and requires the predicate to be taken into account in any licensing in the restrictor of a definite description. If the denotation of a distributive predicate contains the **0** element, then the restrictor of the definite description will be downward entailing. For collective predicates, inclusion of the **0** element alone will not suffice. As far as we can see such a theory predicts ungrammaticality in this case. For the same reason, this theory gets the case of predicate uses correct.

Conclusion

At this point, no theory explains all the facts. A Strawson-entailment based theory that uses Boolean entailment explains many of the data. It successfully accounts for the lack of licensing in predicate position, while allowing for licensing in apparently non-DE environments like arguments of collective predicates. Following Chierchia, an account of singular generic definites may be also accomplished. An alternative theory allowing a 0 element into the domain of individuals faces difficulties in preventing licensing in predicate environments and preventing licensing of strong NPIs.

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