Decomposing definitenes: Abstract for SALT 2016

Dylan Bumford

New York University

Abstract This presentation argues for a particular semantic decomposition of morphological definiteness. I propose that ⟦the⟧ comprises two distinct compositional operations. The first builds a set of witnesses that satisfy the restricting NP. The second tests this set for uniqueness. The motivation for decomposing the denotation of the definite determiner in this way comes from split-scope intervention effects. The two components — the selection of witnesses on the one hand and the counting of witnesses on the other — may get executed at different points in the composition of a constituent, and this has non-trivial semantic consequences when other operators inside the DP take effect in between them. In particular, I analyze well-known examples of mutually recursive definite descriptions like 'the rabbit in the hat' (when there are two rabbits and two hats but only one rabbit in a hat and only one hat with a rabbit in it) as examples of definites whose referent-introducing and referent-testing components are interleaved rather than nested. I further demonstrate that this picture leads to a new theory of so-called *relative superlative* descriptions like 'the kid who climbed the highest tree' (when there is no highest tree, per se, only a highest tree-climbing kid), a theory which explains the previously mysterious role of the definite determiner in licensing such readings.

Overview. In this talk, I argue that $[\![the]\!]$ is composed of two distinct semantic operations. The first builds a set of witnesses that satisfy the restricting NP. The second tests this set for uniqueness. The motivation for decomposing the semantic contribution of the definite determiner in this way comes from intervention effects. I argue that the two components — the selection of witnesses on the one hand and the counting of witnesses on the other — may take scope at different levels within a phrase, and that this has non-trivial semantic consequences when yet other operators inside the DP take action in between them. For this talk I restrict attention to interactions between definite determiners and superlative adjectives. Examples of the sort of intervention effects I will be interested in, which I will call *relative readings* following the literature on superlatives, are given in (1).

(1)   a.   the dog in the truck
         ✓the dog in the truck with a dog in it

      b.   the five dogs in the three trucks
         ✓the five dogs in the three trucks that have dogs in them

      c.   the dog in the biggest truck
         ✓the dog in the biggest truck with a dog in it

What is interesting about these examples is that they may be used felicitously even when the embedded description is not uniquely instantiated. For instance, even at a Texas tailgate with many dogs and many trucks, (1a) can successfully pick out a particular entity as long as it's the only dog in a truck, hanging out in the only truck with a dog in it. Likewise, lack of a unique biggest truck simpliciter may not disrupt the felicity of (1c), as long as there's a particular *dog-laden* truck that's bigger than any other, and a particular dog in that truck. I will argue that cases like these are naturally understood as arising from logical forms in which the existential and quantificational sub-computations of definiteness come apart.

Analysis. Fig. 1 depicts the general shape of definite descriptions that may be split by intervening material. At the heart of the fragment I will propose is a compositional dynamic semantics in the style of, e.g., Groenendijk & Stokhof 1991, Muskens 1996, Brasoveanu 2007. The definite article interacts with the dynamics in two ways.

Fig. 1: Schematic semantics for 'the', with
$$\mathbf{some}_v := \lambda P \lambda g. \{\langle x, g^{v \mapsto x}\rangle \mid P\,x\},$$
$$\mathbf{1}_v := \lambda m \lambda g.\, m\,g, \;\; \mathbf{if}\; |\{g\,v \mid \langle \cdot, g\rangle \in m\,g\}| = 1$$
$$f \circ g := \lambda m.\, f\,(g\,m)$$

Like an *indefinite*, 'the' nondeterministically allocates a discourse referent to some variable of its input context. Then like a numeral (or negation, or quantifier, or modal), it tests that across its output contexts the entity assigned to that variable is determinate; i.e., that all outputs agree on the value of that variable. Moreover, just as 'the' tests for consistency across outputs, superlatives may test outputs for maximality with respect to some ordering. For instance, 'biggest' will pit outputs against one another with respect to the size of the value they assign to some index, filtering out all but the maximal such assignments. So-called *relative readings* of superlatives, as in (1c), emerge when properties imposed by intervening lexical material constrain the set of assignments that the superlative compares.
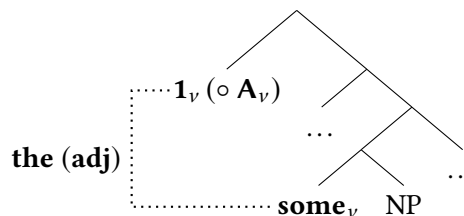
Applications. Haddock (1987) observed that in the context of a model like Fig. 2, the description in (2) successfully refers to the rabbit R2, despite the fact that there are multiple salient hats and multiple salient rabbits in the scene.

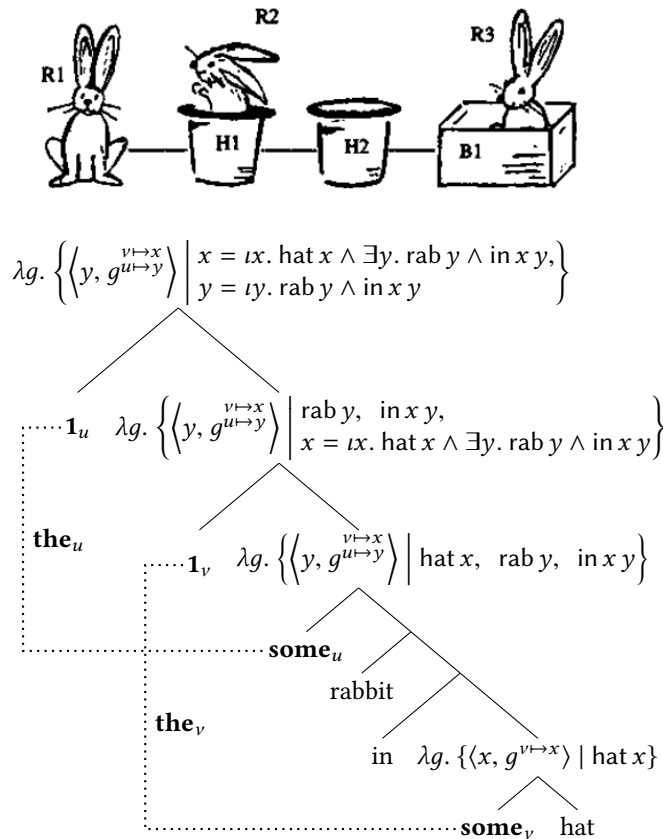(2)   the rabbit in the hat   [Haddock 1987: (1)]

$$\lambda g. \left\{ \left\langle y,\, g^{u \mapsto y}_{v \mapsto x} \right\rangle \,\middle|\, \begin{array}{l} x = \iota x.\, \text{hat}\, x \wedge \exists y.\, \text{rab}\, y \wedge \text{in}\, x\, y, \\ y = \iota y.\, \text{rab}\, y \wedge \text{in}\, x\, y \end{array} \right\}$$

$\mathbf{1}_u$ $\lambda g. \left\{ \left\langle y,\, g^{u \mapsto y}_{v \mapsto x} \right\rangle \,\middle|\, \begin{array}{l} \text{rab}\, y, \ \text{in}\, x\, y, \\ x = \iota x.\, \text{hat}\, x \wedge \exists y.\, \text{rab}\, y \wedge \text{in}\, x\, y \end{array} \right\}$

$\mathbf{the}_u$

$\mathbf{1}_v$ $\lambda g. \left\{ \left\langle y,\, g^{u \mapsto y}_{v \mapsto x} \right\rangle \,\middle|\, \text{hat}\, x, \ \text{rab}\, y, \ \text{in}\, x\, y \right\}$

$\mathbf{some}_u$

rabbit

$\mathbf{the}_v$

in $\lambda g. \{ \langle x,\, g^{v \mapsto x} \rangle \mid \text{hat}\, x \}$

$\mathbf{some}_v$ hat

Fig. 2: Relative reading of (2)

I propose that this way of understanding the complex description corresponds to a semantic structure in which the indefinite and uniqueness components of the two determiners are interleaved. Up to the two uniqueness tests, composition proceeds as if the two definite determiners were fact standard, discourse-referent-introducing indefinite determiners. In fact, this the crux of the analysis, and the reason to insist on dynamic entries for the determiners. The complement of the first test, $\mathbf{1}_v$, is the function that sends an assignment g to the set of outputs $g^{u \mapsto y}_{v \mapsto x}$ where x is some hat, and y is some rabbit *in that hat*. In other words, at this point, each output assignment effectively isolates a portion of the model satisfying the simultaneous constraints hat x, rabbit y, and in $x\, y$.

As a result, checking that each of these outputs agrees on the value of v is tantamount to checking that there is exactly one *rabbit-containing hat*. Subsequently, checking that each of these outputs agrees on the value of u is tantamount to checking that that enrabbited hat is inhabited by just one rabbit. In other words, the net effect is to guarantee the existence of a unique pair $\langle x, y \rangle$ such that x is a hat, y is a rabbit, and y is in x, which is exactly the felicity condition of the whole complex description. In this fashion we achieve the kind of polyadic definiteness that DPs of this form seem to evoke without giving up any of the normal principles of compositionality. The two definite determiners mean what they always mean; they both contribute discourse referents, and they both ensure that their referents are uniquely instantiable within the model. The only thing that is unusual about these constructions, from the standpoint of the current proposal, is that those pieces take scope over different subportions of their syntactic contexts. Moving the $\mathbf{1}_v$ test anywhere inside the complement of $\mathbf{some}_u$ would result in standard (*absolute*) reference conditions: the unique rabbit in the unique thing in the scene which is a hat.

The relative readings of definite plurals, as in (1b) are are structurally analogous to the Haddock case above, except that the uniqueness test is swapped for a maximality test $\mathbf{M}_v$: only those assignments that map v to an entity that is not a proper part of any entity that any other assignment maps v to are kept. Numerals then introduce their own cardinality filters, executed immediately prior to the maximality test of the hosting definite. For instance, $\mathbf{3}_u$ checks that

3

across a set of outputs, no more than three atoms are used to build the various pluralities. If that test succeeds, the maximality filter imposed by the definite will throw away all but those assignments that map u to the full triplet of available entities.

Scaling up to absolute and relative superlatives is just a matter of generalizing the maximization filter used for plurals. For simplicity, I take comparative adjectives to denote partial orders. For instance, $[\![\text{bigger}]\!] := \lambda xy.\, \text{size}\, x > \text{size}\, y$. Superlative adjectives lift these comparative orders into filters on outputs by excluding any assignments that fail to map the relevant discourse referent to an order-maximal value. For instance,

$$[\![\text{biggest}_v]\!] \equiv \mathbf{S}_v := \lambda m \lambda g.\, \{\langle \alpha, h \rangle \in m\, g \mid \neg \exists \langle \beta, h' \rangle \in m\, g.\, [\![\text{bigger}]\!]\, (h\, v)\, (h'\, v)\}.$$

The relative reading of 'the rabbit in the biggest hat' is then derived from exactly the same LF as the relative reading of (2). The only difference is that the $\mathbf{1}_v$ test is composed with the superlative test: $[\mathbf{1}_u\,[\mathbf{1}_v \circ \mathbf{S}_v\,[\mathbf{some}_u\,[\text{rabbit in}\,\mathbf{some}_v\,\text{hat}]]]]$. In this configuration, $\mathbf{S}_v$ will only compare rabbit-containing hats because any output still alive by the time $\mathbf{S}_v$ is reached will have to satisfy the constraints of its complement; they must assign v to a hat and u to a rabbit in that hat.

Discussion and related work. Relative uses of definite descriptions as in (2) are well-known, but not very well studied. Haddock (1987) and van Eijck (1993) offer dynamic analyses in the same spirit as the one here, but they are both silent about crucial compositional issues, most notably how to "delay" the effect of the embedded definiteness test until information from higher up in the tree has been accommodated. Champollion & Sauerland (2010) addresses this issue by postulating an inverse-linking structure for the LFs of these constructions, together with a theory of presupposition accommodation. The problem is that, in removing the dynamic ties that bind variables together, this analysis does not predict the properly *polyadic* reference conditions that Haddock (1987) established, viz., that there be exactly one *pair* $\langle x, y \rangle$ with x a hat, y a rabbit, and y in x. Instead, they predict a condition that I'll argue is too weak: $\exists! x.\,\text{hat}\, x \wedge \exists! y.\,\text{rab}\, y \wedge \text{in}\, x\, y$ (there's a single one-rabbit hat).

The fragment I'll present combines these intuitions about scope and dynamic reference restriction, and embeds it in a standard continuation-passing theory of composition (Barker & Shan 2014). The only innovation is a split-scope lexical entry for 'the'. This lexical entry also anticipates the availability of relative numerals and relative superlatives. And in contrast with most scope-based treatments of superlative ambiguities (e.g., Heim 1985, 1999, Hackl 2009, Sharvit 2015), there is no need to stipulate anything like definiteness-deletion in the presence of '-est' movement. In fact, there's no need to postulate '-est' movement at all. The superlative adjective is just a test on outputs — like plural morphology and cardinal numerals — that the definite article uses to filter out potential assignments of values to variables.

Yet, because the fragment is dynamic, the choices for discourse referents are incrementally restricted at each step of semantic composition. So the point at which the superlative filter is evaluated fully determines which individuals it quantifies over (namely, only the ones that are still live candidates for referents). Thus the restriction of, say, trucks in (1c) to just those with dogs in them, is still a matter of semantics, unlike *in situ* theories of relative superlative readings (e.g., Farkas & Kiss 2000, Sharvit & Stateva 2002, Coppock & Beaver 2014).

Time permitting, I will also discuss the formal relationship between this scope-based approach to output-testing denotations, and recent *postsuppositional* approaches to similar cardinality-testing vocabulary (e.g. Brasoveanu 2012, Henderson 2014).

References

Barker, Chris & Chung-chieh Shan. 2014. *Continuations and natural language*, vol. 53 Oxford Studies in Theoretical Linguistics. Oxford University Press.

Brasoveanu, Adrian. 2007. *Structured nominal and modal reference.* New Brunswick, NJ: Rutgers University dissertation.

Brasoveanu, Adrian. 2012. Modified numerals as post-suppositions. *Journal of Semantics* http://dx.doi.org/10.1093/jos/ffs003.

Champollion, Lucas & Uli Sauerland. 2010. Move and accommodate: A solution to haddock's puzzle. In Olivier Bonami & Patricia Cabredo Hofherr (eds.), *Empirical issues in syntax and semantics 8*, 27–52.

Coppock, Elizabeth & David Beaver. 2014. A superlative argument for a minimal theory of definiteness. In Todd Snider, Sarah D'Antonio & Mia Wiegand (eds.), *Proceedings of semantics and linguistic theory (SALT) 24*, 177–196.

van Eijck, Jan. 1993. The dynamics of description. *Journal of Semantics* 10(3). 239–267.

Farkas, Donka & Katalin E. Kiss. 2000. On the comparative and absolute readings of superlatives. *Natural Language and Linguistic Theory* 18(3). 417–455.

Groenendijk, Jeroen & Martin Stokhof. 1991. Dynamic predicate logic. *Linguistics and Philosophy* 14. 39–100. http://dx.doi.org/10.1007/BF00628304.

Hackl, Martin. 2009. On the grammar and processing of proportional quantifiers: *most* versus *more than half.* *Natural Language Semantics* 17(1). 63–98. http://dx.doi.org/10.1007/s11050-008-9039-x.

Haddock, Nicholas J. 1987. Incremental interpretation and Combinatory Categorial Grammar. In *Proceedings of the 10th international joint conference on artificial intelligence*, vol. 2, 661–663. Morgan Kaufmann Publishers Inc.

Heim, Irene. 1985. Notes on comparatives and related matters. Unpublished manuscript, University of Texas at Austin. http://semanticsarchive.net/Archive/zc0ZjY0M.

Heim, Irene. 1999. Notes on superlatives. Unpublished manuscript, MIT. http://semanticsarchive.net/Archive/TI1MTlhZ/.

Henderson, Robert. 2014. Dependent indefinites and their post-suppositions. *Semantics and Pragmatics* 7(6). 1–58. http://dx.doi.org/10.3765/sp.7.6.

Muskens, Reinhard. 1996. Combining Montague semantics and Discourse Representation. *Linguistics and Philosophy* 19(2). 143–186. http://dx.doi.org/10.1007/BF00635836.

Sharvit, Yael. 2015. The onliest np: Non-definite definites. In Ulrike Steindl (ed.), *Proceedings of west coast conference on formal linguistics (WCCFL) 32*, 171–190.

Sharvit, Yael & Penka Stateva. 2002. Superlative expressions, context, and focus. *Linguistics and Philosophy* 25(4). 453–505.