Two Sources of *again*-ambiguities:
Evidence from Degree-Achievement Predicates*

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Abstract. This paper provides evidence that *again*-ambiguities derive from two distinct sources, with the precise nature of a particular ambiguity being dependent on the particular type of predicate (Result-State or Degree-Achievement) present in the sentence. Previous research has focused primarily on sentences containing Result-State predicates (e.g. *to open*) rather than Degree Achievements (e.g. *to widen*), and has located the source of the ambiguity in the scope that *again* takes with respect to BECOME in a syntactically decomposed predicate. I argue that entailment facts preclude such an analysis from applying to sentences containing Degree Achievements and *again*. Instead, I propose that Degree Achievement predicates should be decomposed into comparative structures, and that the ambiguity in such sentences arises from the scope *again* takes with respect to a comparative Degree Phrase, rather than a BECOME operator.

1   Introduction

The proposal that certain morphologically simple words should be realized as multiple syntactic objects in order to explain paraphrasabilty and to capture certain entailment patterns originated in the late 1960s and early 1970s with the Generative Semantics (GS) movement; since Dowty [3], an analysis of this type has often been referred to as a 'lexical decomposition' account. Evidence brought forth for a decompositional analysis came in part from purported ambiguities found in sentences containing (i) an adverbial such as *again*, and (ii) an achievement-type verb. That is, it was claimed that there are two readings available for a sentence such as (1).

(1)   The door opened again.

In one reading of this sentence, termed the *repetitive* reading, the door is understood to have opened previously; in the other reading, termed the *non-repetitive* or

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restitutive reading, the door is understood to have merely been in an open state before (though it need not ever have been opened before).

According to a GS-style analysis, the ambiguity found in (1) is said to result from the scope of *again* with respect to elements in a decomposed predicate (see [1], [3], [8], [9]). A sentence like *The door opened* is said to be decomposable into two propositional levels: the level of the small clause, and the level of BECOME plus the small clause. This leaves two possible attachment sites for *again*, shown below, which correspond to the two readings for (1).

(2)   a. [again [BECOME [the door open]]]   *repetitive*
        b. [BECOME [again [the door open]]]   *non-repetitive*

Intuitively, a repetitive reading includes a non-repetitive one; if the door was previously opened, it follows that the door was previously open. Evidence that there are two distinct readings comes from the fact that when *again* is preposed, as in (3), only a repetitive reading is available.

(3)   Again, the door opened.

This entailment between readings will turn out to be crucial in the discussion that follows. As it turns out, a BECOME-*again* analysis of an *again*-ambiguity always predicts such an entailment to hold between readings. Thus, such an analysis is problematic when we consider sentences containing Degree Achievement (DA) predicates and *again*; such sentences do demonstrate an ambiguity, but it is one in which neither reading entails the other. Examples of DA predicates include many deadjectival verbs, such as *widen*, *narrow*, *lengthen*, *shorten*, as well as predicates such as *grow* and *shrink*.

Consider the sentence below, which contains the DA predicate *widen*.

(4)   The river widened again.

Like (1), the sentence in (4) has both a repetitive and a non-repetitive reading. The repetitive reading is true only if the river widened previously. The non-repetitive reading of (4) (called the *counter-directional* reading by von Stechow [9]) is true only if the river narrowed previously. Crucially, neither reading entails the other. The sentences in (5) highlight both of these readings.

(5)   a. The river widened two months ago, and this month it widened again. (*rep.*)
        b. The river narrowed last month, but this month it widened again. (*non-rep.*)

To demonstrate more precisely the nature of the two readings, consider the following set of situations.

Table 1.

	Sit. 1	Sit. 2	Sit. 3
April 1st	12m	10m	10m
May 1st	12m	11m	12m
June 1st	10m	11m	10m
July 1st	12m	12m	12m

In situation 1, the river narrows between May 1st and June 1st, and widens between June 1st and July 1st; in such a situation the non-repetitive, but not the repetitive, reading is true. In situation 2, the river widens between May 1st and June 1st, keeps a constant width for the month of June, and then widens between June 1st and July 1st; in such a situation, only the repetitive reading is true. We thus see that the two readings have distinct truth-conditions. Note that we can, however, have a situation in which both readings are true; situation 3 is such a case.

In general, we find a similar pattern of non-entailing readings for all sentences containing an atelic DA predicate and *again*; for more discussion on telicity and DA predicates, see [6], [7]. As §2 will demonstrate, the lack of entailment between readings in sentences like (4) shows clearly that the source of the ambiguity for such sentences cannot be explained in terms of the relative scope of *again* and a BECOME operator. In §3 it will be argued that the correct decomposition of DA predicates does not contain a BECOME operator, but instead contains a comparative structure. The ambiguity found in (4) will then be accounted for in terms of the scope *again* takes with respect to the comparative Degree Phrase in the decomposed predicate.

2   BECOME and *again*

In what follows, a semantics relativized to time intervals is assumed [2], [3].

(6)   A *time interval* is a subset i of a dense linear order T of moments t_n such that
          $\forall t_1, t_3 \in i$ where $t_1 < t_3$, if $t_1 < t_2 < t_3$, then $t_2 \in i$ (from Bennett & Partee [2])

Only closed time intervals are assumed below; note that it is possible for an interval to contain only one moment. Intervals are ordered as follows:

(7) i [<] i' iff for all t in i and all t' in i', $t < t'$ (from Bennett & Partee [2])

The BECOME-*again* analysis of *again*-ambiguities requires that predicates like the verb *open* be decomposed into BECOME and a small-clause containing a stative predicate, which denotes a stative property of intervals. Stative properties are defined as follows.

(8) P is a *stative property of intervals* only if
          i. $P(i)$ can be true of a single-moment interval
          ii. $P(i)$ is true of an interval i containing $n > 1$ moments only if
                    $\forall i' \subseteq i$, $\phi(i')$ is true   (from Dowty [3])

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An example of a stative property is the property denoted by the adjective *open*.

(9) $\|open_{ADJ}\| = [\lambda x.\lambda i: \forall t \in i, x \text{ is open at } t]$

Also assumed here is the standard meaning for BECOME from Dowty [3].

(10) $\|BECOME\|^{g,i}$ (P) is defined only if $\exists i' \mid P(i') = 1$ where defined,
        $\|BECOME\|^{g,i}$ (P) = 1 iff $P(beg(i)) = 0$ & $P(end(i)) = 1$

Finally, the denotation assumed for *again* is based on von Stechow [9]. *Again* introduces presuppositional content in the form of a definedness condition.

(11) $\|again\|^{g,i}$ (P) is defined only if
        (i)   P(i) is defined
        (ii) $\exists g, h \mid g < h$ & $end(h) \leq beg(i) \mid P(g) = 1$ & $P(h) = 0$

        where defined:
        $\|again\|^{g,i}$ (P) = 1 iff P(i) = 1

The definition given above for *again* differs from the standard one in that it allows $end(h) \leq beg(i)$, rather than requiring $h < i$. More will be said on this below.

   A simple example demonstrates how *again* introduces presuppositional content into the truth-conditions of a sentence.

(12) $\|[again [the door is open]]\|^{g,i}$ is defined only if
        $\exists g, h \mid g < h$ & $end(h) \leq beg(i)$ &
        $\forall t \in g$, the door is open at t
        $\exists t \in h$, the door is not open at t

        where defined, is true iff
        $\forall t \in i$, the door is open at t

Under these assumptions, the sentence *The door is open again* asserts that the door is open, and presupposes both that it was open then closed prior to its current state of being open.

   It can be demonstrated that the BECOME-*again* analysis predicts an entailment between readings, no matter what stative property is in the scope of BECOME. The following proof shows that this is the case. The claim that we prove is the following.

(13) $\forall S$, if $\| S \| = $ a stative property, then
        [again [BECOME [S]]] *entails* [BECOME [again [S]]]

Proof:
We assume that the repetitive reading assertion and presupposition are met. Let a, b, c be arb. chosen intervals, and P an arb. chosen stative property such that

(i) $c < b$ & $end(b) \leq beg(a)$
(ii) $\neg P(beg(c))$ & $P(end(c))$ (i.e. BEC(P)(c))
(iii) $P(beg(b)) \vee \neg P(end(b))]$ (i.e. $\neg$BEC(P)(b))
(iv) $\neg P(beg(a))$ & P($end(a)$)   (i.e. BEC(P)(a))

Given these assumptions, we can automatically find intervals that satisfy the presupposition of the non-repetitive reading. Note that it is important for P to be a stative predicate, since we rely on the fact that it can be true of single moment intervals when defining the intervals d and e below.

Let $d = end(c)$. Let $e = beg(a)$. Then,
(i) $d < e$ & $end(e) \leq beg(a)$
(ii)   P(d) & $\neg$P(e)
(iii) $\neg P(beg(a))$ & P($end(a)$)

The above proof shows that whenever we have intervals that satisfy the repetitive reading of an *again*-sentence, we automatically have intervals that satisfy the non-repetitive reading. This is the case regardless of what stative predicate is in the scope of BECOME; hence, we can say that the fact that a repetitive reading entails a non-repetitive one is a direct consequence of the BECOME-*again* analysis.

The revision to *again* mentioned above is what allows for the proof to go through. However, it is important to stress that the main argument does not crucially depend on this revision. First of all, the revision does not change the truth-conditions of *again*-sentences in any noticeable way. Second, if we adopt the standard definition of *again* rather than the revised one, the repetitive reading of (1) will not logically entail the non-repetitive reading, but it will still *practically* entail it. The repetitive reading of (1) asserts that the door became open; thus, for the reading to be true the door must thus be closed at the beginning of the topic interval. The repetitive reading presupposes (i) that the door became open before the topic interval, and also (ii) that between these two openings it did not become open. However, the negation of BEC(P)(i) is $P(beg(i)) \vee \neg P(end(i))$; it thus does not follow from the fact that something did *not* become open that thing became *not* open. With both versions of *again*, the repetitive reading is predicted to be true in a situation where the door did not actually close until the very beginning of the topic interval, i.e. for a situation in which the door was only fully closed for a single moment. Thus, taking the standard definition of *again* rather than the revised one, the entailment will fail only in a situation in which the door is closed for precisely one moment; in such a case the repetitive reading, but not the non-repetitive one, will hold. Since such situations do not play any role in what follows, the revised version of *again* will be adopted for the remainder of the discussion.

3 Degree Achievements and *again*

As we saw above, there is no entailment between the two readings of *The river widened again*; the BECOME-*again* analysis thus cannot apply to this sentence. Von Stechow [9] assumes that the decomposition of a sentence like (4) does contain a BECOME operator, along with a comparative structure. While he derives the correct presupposition for the non-repetitive reading (i.e. a reading which only presupposes a previous narrowing), he derives the incorrect presupposition for the repetitive reading; his analysis predicts that the repetitive reading of a sentence like (4) can only be uttered truthfully in a situation that includes both a previous widening and a narrowing. His account thus predicts that (4) cannot be uttered truthfully in a situation like situation 2 in table 1; it also predicts that a sentence like (4) demonstrates the same kind of entailment as (1). Both of these results are intuitively incorrect.

The account argued for here follows von Stechow [9] in assuming that DA predicates are decomposed into comparative structures, but holds that this decomposition does not contain BECOME at all. The proposed structure is shown in (14).

(14)   The river widened.
        at END [the river is [more than [at BEG it is *wh* wide]] wide]

The assumptions regarding comparatives adopted here are based on Heim [5], with a maximality semantics for *more*/*-er* and an 'at least' semantics for gradable adjectives.

(15) $\| more \|^{g,i} = [\lambda f_{<d<et>>}.\lambda g_{<d<et>>}: max\{d \mid g(d) = 1\} > max \{d \mid f(d) = 1\}]$
        (to be slightly amended below)

(16) $\| wide \|^{g,i} = [\lambda d.\lambda x: \forall t \in i, x$ is at least d wide at $t]$

The structure in (14) also contains two sentential operators BEG and END, which shift the interval of evaluation to, respectively, the initial and final moment of the index interval.

(17)   a. $\|at\ BEG\|^{g,i} (P) = 1$ iff $P(beg(i)) = 1$
        b. $\|at\ END\|^{g,i} (P) = 1$ iff $P (end(i)) = 1$

The structure in (14) is uninterpretable as is, since $\|more\|$ requires two predicates of degrees as input. However, following Heim [5], if we assume that a comparative DegP – like an object quantifier – raises for interpretation, the structure becomes interpretable (also assuming null-operator movement in the *than*-clause). The interpretable structure is shown in (18), along with the derived truth-conditions.

(18)   more than [*wh* 2 at BEG it is d_2 wide] [1 at END the river is d_1 wide]

        $\| (18) \|^{g,i} = 1$ iff
        $max\{d \mid$ river is d-wide at $end(i)\} > max\{d \mid$ river is d-wide at $beg(i)\}$

Given this analysis, the sentence *The river widened* can be paraphrased as 'the river is wider at the end of the interval than at the beginning of the interval'.

Heim [5] proposes that certain ambiguities can be explained by allowing a comparative DegP to scope above or below certain elements; the elements she considers are the intensional verbs *require* and *allow*. The ambiguity displayed in a sentence like (4) can be explained in a similar fashion, with *again* being the relevant element which DegP can scope over. The pre-LF structure for (4) is shown below.

(19)   *The river widened again*
         before LF movement:
         <u>again</u> [at END the river is [more than at BEG it is *wh* wide] wide]

The DegP in (19), like that in (14), must move for interpretation. However, there are now two possible movement sites for DegP to move to: above *again*, or below. If DegP moves below *again*, the repetitive reading of (4) is derived; if it moves above *again*, the non-repetitive reading is derived. The repetitive reading is shown below.

(20)   *repetitive reading*
         <u>again</u> [more than [*wh* 2 at BEG it is d_2 wide] [1 at END the river is d_1 wide]]

         $\|(20)\|^{g,i}$ is defined only if:
         $\exists g,h \mid g < h$ & $end(h) \leq beg(i)$ &
         $max\{d \mid$ river is d-wide at $end(g)\} > max\{d \mid$ river is d-wide at $beg(g)\}$
         $max\{d \mid$ river is d-wide at $end(h)\} \leq max\{d \mid$ river is d-wide at $beg(h)\}$

         Where defined, is true iff
         $max\{d \mid$ river is d-wide at $end(i)\} > max\{d \mid$ river is d-wide at $beg(i)\}$

The truth-conditions derived for (20) assert that the river widened over the topic interval *i*, and presuppose only that the river also widened at some time *g* prior to *i*. The presupposition is silent as to whether the river narrowed or stayed at the same width during the interval *h* between *g* and *i*. This is the desired result for the repetitive reading, as it allows the sentence to be true in both situation 2 and situation 3 in table 1.

We turn now to the non-repetitive reading of (4), where the DegP moves above *again*.

(21)   *non-repetitive reading*
         more than [*wh* 2 at BEG it is d_2 wide] [1 <u>again</u> at END the river is d_1 wide]]

Roughly, this reading can be paraphrased 'at the end of *i* the river is again wider than its width at the beginning of *i*'. Notice that, in the non-repetitive LF, *again* scopes over a clause containing an unbound variable of degrees, i.e. over the trace left by DegP movement; *again* thus introduces its definedness condition over the clause in the DegP only. Assuming predicate abstraction limits input degrees to ones that

satisfy the presupposition (see Heim & Kratzer [4] p.125), the denotation for the lamda-abstracted function is as follows.

(22) $\| 1$ again [at END [river is d_1 wide]] $\|^{g,i}$ is defined only for degrees d such that
          $\exists g,h \mid g < h$ & $end(h) \le beg(i)$ &
          (i) the river is d-wide at $end(g)$
          (ii) the river is not d-wide at $end(h)$.

          where defined, is true of a degree d only if
          the river is d-wide at $end(i)$

This function will only have a non-empty domain if the river narrowed sometime prior to the beginning of the topic interval i, as can be deduced from conditions (i) and (ii) in (22). To see examples how this follows, consider again the following situations.

Table 1.

	Sit. 1	**Sit. 2**	**Sit. 3**	**Sit. 4**
April 1st	12m	10m	10m	12m
May 1st	12m	11m	12m	12m
June 1st	10m	11m	10m	10m
July 1st	12m	12m	12m	10m

Let g be the interval between April 1st and May 1st, h be the interval between May 1st and June 1st, and i be the interval between June 1st and July 1st. In situations 1, 3 and 4, the function in (22) will be defined for all degrees in the half-open interval (10m-12m]; in situation 2 it will not be defined for any degrees. In situations 1 and 3, the function will be true of all degrees for which it is defined. In situation 4, it will be not be true of any degrees for which it is defined.

    The situations in which the domain of the function in (22) is non-empty (situations 1, 3 and 4) thus match those situations in which the presupposition of the non-repetitive reading is intuitively satisfied. In order to derive the correct presupposition for the entire sentence (i.e. in order to have the presupposition in the DegP project), we need to assume that the comparative morpheme has a definedness condition which requires that its two input <dt> functions are also defined. This condition is shown below.

(23) $\|more\|(f)(g)$ is defined iff $\exists d \mid f(d)$ is defined & $\exists d \mid g(d)$ is defined

Note that this condition seems seems to be independently needed, as comparative sentences appear in general to allow for presupposition projection in both the matrix and the DegP clause. For example,

(24)   My boat is longer than your boat.
         presupposes
         I have a boat & you have a boat

Assuming the above definedness condition for *more*, the truth-conditions for the non-repetitive reading come out as follows:

(25) $\| (21) \|^{g,i}$
         is defined only if:
         $\exists d, \exists g, h \mid g < h$ & $end(h) \leq beg(i)$ &
         the river is d-wide at $end(g)$ &
         the river is not d-wide at $end(h)$

         Where defined, is true iff
         $max\{d \mid$ river is d-wide at $end(i)\} > max\{d \mid$ river is d-wide at $beg(i)\}$

These truth-conditions contain the presupposition only that the river narrowed sometime before the beginning of *i*. As such, the sentence is predicted to be true in situations 1 and 3, which correctly matches speaker intuitions. The DegP scope account thus correctly derives a repetitive and a non-repetitive reading for (4), neither of which entails the other.

4   Conclusion

The DegP scope account presented above derives the correct truth-conditions for both readings of the sentence in (4), which can be seen as a general case of a sentence containing a Degree Achievement predicate and *again*. A number of conclusions follow from the above discussion. First of all, it is clear that not all *again*-ambiguities can be explained by the BECOME-*again* scope analysis, since not all ambiguities demonstrate the entailment between readings that such an analysis predicts.

Second, the *again*-ambiguity found in sentences with DA predicates like *widen* can be explained in terms of the position a comparative DegP takes with respect to *again*, if we assume that DA predicates are decomposed into the comparative structures proposed in §3. This account follows Heim [5], where it is proposed that DegP can scope above certain elements. If the current proposal is on the right track, *again* should be added to this list of elements.

Finally, the fact that DA predicates give rise to a different type of *again*-ambiguity than result-state predicates provides strong evidence that the two types of predicates have different internal structure. In particular, the specific ambiguity found in sentences with DA predicates demonstrates that such predicates cannot contain a BECOME operator.

While the above discussion has shown it to be quite plausible that *again*-ambiguities have different sources in different sentences, it is left to future work to determine whether a more general account of *again*-ambiguities can be provided which can apply to all of the various cases.

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