The lexical semantics of derived statives

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Abstract

This paper investigates the semantics of derived statives, deverbal adjectives that fail to entail there to have been a preceding (temporal) event of the kind named by the verb they are derived from, e.g.*darkened* in *a darkened portion of skin*. Building on Gawron's (2009) recent observations regarding the semantics of extent uses of change of state verbs (e.g., *Kim's skin darkens between the knee and the calf*) and Kennedy and Levin's (2008) theory of change, it is shown, contrary to previous analyses, that a fully compositional semantic analysis is possible, and thus that there is no argument from derived statives for word formation differing from semantic composition above the word level in requiring deletion operations, as in Dubinsky and Simango's (1996) analysis. Further, such an analysis, by contrast with previous ones, both compositional (Jackson 2005b; Condoravdi and Deo 2008) and non-compositional (Dubinsky and Simango 1996), correctly predicts, as shown by a range of arguments, that the meaning of the derived stative contains the meaning of the verb it is derived from and that it therefore contrasts fundamentally with morphologically simple adjectives in the kind of meaning that it has.

1 Introduction: Derived statives and the problems they pose

Deverbal adjectives, adjectives such as those illustrated in (1) that are morphologically derived from verbs, have played a very prominent role in theoretical debates about the lexicon/syntax interface over the last thirty years.

(1) a. The *broken* vase
b. The *darkened* photo
c. The *cracked* pavement

Independent of theoretical backdrop, the central issue since Wasow's (1977) seminal study has been lexicalism, and whether there are productive word formation operations in the lexicon, or whether these can be reduced to independently motivated syntactic operations, as argued by generative semanticists of the time. This debate has been revived in modern linguistic theorizing, as those working in the Distributed Morphology and other non-lexicalist traditions have argued that all productive word formation can be reduced to syntax (Marantz 1997; Ramchand 2008).

The central question is whether there is anything special about word formation. In order to show that there is, one would need to show that there are operations attested in word formation that are demonstrably unattested in syntax above the word level, or vice versa. Although not explicitly, at least implicitly, a common thread in the argument structure and lexical semantic literature is that certain meaning altering word formation operations involve the removal of atoms of linguistic meaning in the derivation of one lexeme from another, i.e., that the so-called "Monotonicity Hypothesis" (Rappaport Hovav and Levin 1998; Koontz-Garboden 2008, To appear) is false. For example, the most widely accepted analyses of anticausativization (the derivation of an inchoative verb from a causative verb, as in Spanish *romper-se* 'become broken' and *romper* 'cause to become broken') treat it as a phenomenon whereby the meaning of the inchoative verb is derived from its causative counterpart via deletion of a CAUSE operator (Grimshaw 1982; Reinhart 2002; Härtl 2003; Reinhart and Siloni 2005; Kallulli 2006). Similarly, as discussed below, deverbal adjectives that fail to entail that there was an event of the kind named by the verb they are derived from giving rise to the state they name have been prominently analyzed by Dubinsky and Simango (1996) as involving deletion of the change meaning component of a change of state (COS) verb, leaving behind the stative sub-component. In another example more recently, Rothstein (2004:130) analyzes the derivation of a particular kind of activity verb from accomplishment verbs as entailing the deletion of all but the activity sub-component of the accomplishment.

In the domain of compositional semantics above the word level, it is generally believed (at least outside of the domain of propositional attitudes, Cresswell 1985; Chierchia 1989) that semantic operations take the meanings of their operands as wholes in the composition of larger meanings (see e.g., discussion in Dowty 2007). In this way, the kinds of operations described immediately above are not of the kind that semanticists working outside of the lexical semantics and argument structure tradition would generally expect to occur. If it is true, then, that semantic composition above and below the word level genuinely differ in this way, this would constitute a powerful argument against non-lexicalist theories of syntax. By contrast, if it can be shown that semantic composition below and above the word level operate in a similar fashion, it raises the question whether the division between these two levels is a genuine one.[1]

The goal of this paper is not to make any definitive pronouncements on this issue, but rather, the more modest goal of contributing to its exploration by way of empirical study of one particular phenomenon for which it has previously been claimed that the semantic side of word formation makes use of a deletion operation. The phenomenon in question, mentioned already

[1] See Ramchand (2008) for similar discussion.

briefly above, is that of derived statives, deverbal adjectives that seemingly fail to entail that there was an event of the kind named by the verb preceding the state named by the adjective. More concretely, most deverbal adjectives, such as those in (2), clearly entail that there was an event of the kind named by the verb giving rise to the state they name.[2]

(2) a. Given a choice between the two versions of the photo, Jane prefers the **darkened** one.
b. Smith earned his billions off of the booty in a **sunken** ship he discovered at the bottom of the ocean.
c. There's a **broken** vase on the floor.

For example, it is entailed by (2a) that the *darkened* photo has undergone some kind of (most likely digital) darkening process that has lead to its current darkened state. Similarly for (2b) and a sinking event, and (2c) and a breaking event. This is precisely what would be expected on any theory where the meaning of an adjective like *darkened* is derived from the meaning of a verb like *darken*, as transparently expected given the morphological direction of derivation. By contrast, however, there are uses of these very same adjectives embedded in sentences that fail to give rise to these entailments, as evidenced by the data in (3).

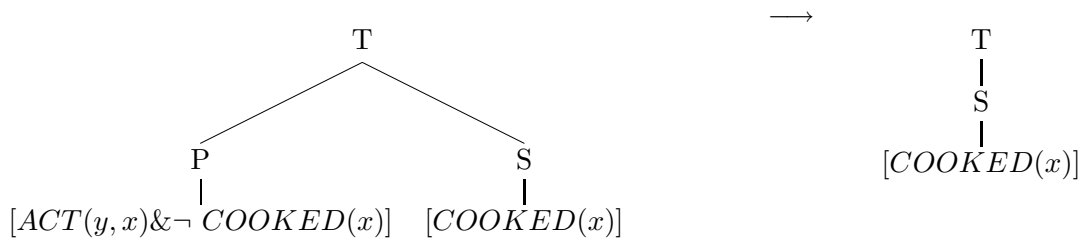
(3) a. He has no scars but there is a slightly **darkened** portion of skin on his right leg, near the femoral artery, which he has had since birth and is in the crude ...
`http://www.adventdestiny.com/forum/archive/index.php?t-2820.html`
b. Lower Knoll, is a **sunken** area of land that is located on the eastern side of the Avenues, area in Exmouth and lies above the Maer Valley.
`http://www.eastdevon.gov.uk/reportdc\_120108\_07.3421.out.jb.pdf`
c. Elementary school writing paper is manufactured with **broken** lines on it. (Itamar Francez, p.c.)

As is made clear by the context, there is no sense in which the *darkened skin* in (3a) has undergone any darkening event, at least as conventionally understood, since the skin has been that way since birth. The situation is the same for a *sunken area of land*, as in (3b), which is essentially a way of talking about a valley which has presumably not undergone any kind of sinking event in the minds of speakers. The same can be said for *broken lines* on a sheet of writing paper, as in (3c). The lines never undergo a breaking event, but are simply manufactured that way.

So-called "stative" uses of deverbal adjectives such as those in (3), then, contrast with "result state" uses like those in (2), precisely in that while the latter entail that there was a preceding event giving rise to the state named by the deverbal adjective, the former seemingly do not. Such uses, as evidenced by the crosslinguistic data in the appendix, are relatively well-known in the typological literature (Nedjalkov 1988), where it is sometimes informally suggested that the meanings of the derived stative forms can be generated through "deletion" of the eventive component of the meaning of a COS verb, leaving behind the stative component. In the lexical semantics/argument structure literature, derived statives have been prominently analyzed in precisely this way by Dubinsky and Simango (1996:771-772), focusing on this kind of phenomenon in Chichewa. Assuming a Pustejovskyan semantics (Pustejovsky 1995), they propose that the meanings of deverbal adjectives in Chichewa are derived through the deletion of the eventive component of the meaning of the verb, leaving behind only the stative core. They illustrate this process as in (4).

[2]Of course, it is not the adjective that entails anything, but rather the sentence it appears in. I use this shorthand, however, for ease of exposition.

(4) Stativization of Chichewa *phika* 'cook', via suffixation of *–ika* in Dubinsky and Simango (1996:771-772)



On this view, then, the meanings of derived statives are on a par with the meanings of morphologically simple adjectives (e.g., *red, dark*, etc.), in failing to entail a preceding event giving rise to the state. Leaving aside the difficult question of how an operation like the one in (4) might actually be formalized, the question I focus on in this paper is whether it is actually empirically correct that the derivation of derived statives, at least in English, really does do away with the eventive meaning component present in the verb the adjectives are derived from. I.e., is it really the case that a deverbal adjective like *darkened* in (3a) lacks an event variable as part of its denotation, and ends up with a meaning on a par with the meaning of the morphologically simple adjective *dark*? In the rest of the paper, I argue that once the notion of event is properly understood, this question can be definitively answered in the negative. More specifically, I argue that derived statives are derived from *extent* uses of COS verbs (Langacker 1986:464; Matsumoto 1996; Talmy 2000:Chapter 2; Gawron 2009). These are particular kinds of uses of COS verbs, like those illustrated in (5), in which the change entailed by the verb, rather than taking place in a temporal domain, takes place instead in a spatial domain.

(5) a. His skin darkens on his right leg near the femoral artery.
b. The valley sinks even further five miles ahead.
c. The line breaks right at the point where you're supposed to begin the sentence.

In (5a), for example, although there is no temporal change, and thus no preceding event if by event one means event of temporal change, there is instead an event of change in space. If one conceives of the leg as an axis composed of a series of points in space, the claim of (5), I argue, building on work by Gawron (2009), is that going along this axis, the degree of darkness changes, so that there are certain points at which the degree of darkness of the leg is non-identical. The situation is similar for the examples in (5b,c). More broadly, the claim is that once we have an understanding of the nature of extent uses of change of state verbs, the semantics of derived statives make more sense. Crucially, it is shown that derived statives are derived compositionally, without resort to deletion operations, from them, and that in fact, a deletion analysis of the kind laid out in Dubinsky and Simango (1996) makes a series of incorrect predictions. Beyond this, the results show that there is no argument for deletion operations in the semantics of word formation from derived statives; instead, the process deriving derived statives from verbs is entirely compositional (and consistent with the Monotonicity Hypothesis), on a par with any normal rule of semantic composition found above the word level.

At the same time, however, the results show that the right analysis of derived statives is one in which the meaning of the verb the derived stative is derived from is maintained in the meaning of the derived stative. Aside from the traditional lexicalist analysis, there is another more recent fully compositional one due to Condoravdi and Deo (2008), in which the derived stative is underspecified in the same way as in the deletion analysis. I show that this analysis too makes the same incorrect predictions; instead, it is the case that the meaning of the verb that the derived stative is derived from is preserved in the meaning of the derived stative itself. Similarly, although these previous lexicalist analyses do not fair well, the results also are shown to argue

against non-lexicalist analyses fashioned around the root (Embick 2004; Jackson 2005b). On these types of analysis as well, the derived stative is not, in fact, deverbal, but instead derived from a more abstract root, and again, the meaning of the derived stative does not include the meaning of the verb, thus making similar incorrect predictions to the deletion analysis. In this way, although the results do not provide any evidence for the view that semantic operations in the lexicon differ from those at the sentential level, neither do they provide evidence for non-lexicalist analyses that have been thus far proposed in the literature. This is, of course, not to say that lexicalist or non-lexicalist analyses of the phenomenon are not possible, far from it; I suspect that either kind of syntactic analysis, of the right kind, could be matched to the semantic analysis provided below, though I leave that particular issue for future work.

I begin by developing in §2 a compositional analysis for derived statives rooted in extent uses of COS verbs and observations about their properties due to Gawron (2009). I then discuss in §3 a series of empirical predictions made by this analysis, showing in §4 that competing analyses of derived statives make the wrong predictions when it comes to these observations. I conclude in §5 by briefly discussing some broader consequences of the analysis and observations as regards the nature of the semantic side of word formation operations.

2 The semantic derivation of derived statives

In this section I lay out the main claim of the paper—that, informally speaking, derived statives are the result of deriving an adjective from an extent reading of a COS verb. More specifically, the denotation of the derived stative morphology, on this analysis, is the same as what would be expected for a result state. This analysis builds on Gawron's (2009) recent discussion of extent verbs, which I summarize in the section that follows. I then go on to formalize the analysis building on Gawron's (2009) observations and Kennedy and Levin's (2008) theory of change, extending this beyond merely temporal change, to spatial change as well.

2.1 Extent verbs

As mentioned briefly in the introduction, the intuition behind the analysis I propose of derived statives is that they are derived from a particular kind of use of change of state verb in which the change is not temporal change, but rather spatial change. Although surprising at first appearance, when one thinks about what change is, it really is not at all surprising. As Gawron notes, "functional change is the existence of some correlation between two ordered domains, and change with respect to time is a special case of that" (Gawron 2009:16). In this way, (6), for example, describes a change in width in the spatial domain; the width of the crack at two points in space is different.

(6) The crack in the (north/south running) M56 motorway widened 5 inches in less than 100 yards.

The two ordered domains with respect to which the change is defined in a sentence like (6) are:

- Width, a linearly ordered set of degrees on a scale defined by the width dimension as in Kennedy (1999:43), inter alia.
- Space, a well-ordered set of points on a scale supplied by context (Gawron 2009:16).

In (6), then, width changes with respect to space, with the width scale provided by the predicate *widened* and the spatial scale of points along the north/south scale along the M56 motorway provided by context. If a width axis (i.e., scale with spatial extent) runs perpendicular through each point along the (north/south) spatial axis (Gawron 2009), then the change is measured by

measuring width at points along the contextually supplied spatial scale, i.e., by examining the degree of width holding at each point along the spatial scale (the axis of change).

Despite the fact that there is a change when conceived of in this way, the change is atemporal—in order to evaluate the truth of (6), we need simply to measure the width of more than one point on the road *at a single moment in time*. Thus, although there is change, there is no *temporal* change, which is how we conventionally think of change. Nevertheless, as Gawron (2009:6) shows, despite being temporally stative, there is linguistic evidence that sentences like (6) are indeed dynamic. First, verbs with extent readings can be modified by adverbial modifiers that require change, as shown by the data in (7).

(7) a. The crack widened nearly half an inch *in ten meters*.
b. The crack *gradually* widened from the north gate to the tower. (Gawron 2009:6-7)

At the same time, if the change is really in the spatial domain and not in the temporal domain, we expect temporal stativity. And, as Gawron (2009:4) notes, there is evidence for this as well, as shown by the facts that extent verbs are odd in the progressive (8) and get non-habitual readings in the present tense (9), both standard diagnostics for temporal stativity (see e.g., Dowty 1979:55ff; Kearns 2000:Chapters 7,9).

(8) a. The lines on that magnificent piece of paper broke/*were breaking every 2 millimeters.
b. The crack widened/*was widening 5 inches in less than 100 yards.

(9) a. The lines on that magnificent piece of paper break every 2 millimeters.
b. The crack widens 5 inches in less than 100 yards.

What these facts show, as Gawron (2009) discusses at length, is that dynamicity and stativity are more complicated than has previously been appreciated. Specifically, dynamicity does not entail non-stativity. There are non-dynamic stative events and dynamic non-stative events, as conventionally held, but crucially there is also a third category: dynamic stative events, precisely the type of event described by extent uses of change of state verbs.[3]

Given that change of state verbs can be used in this way, the null hypothesis would be that adjectives derived from them could be based not only on the temporally dynamic sense of the verb, but on the temporally stative (but spatially dynamic) one as well. This seems to be the case—for most verbs that have an extent use, there seems to be a deverbal adjective with a meaning where the state it names, by contrast with normal deverbal adjectives, need not be preceded by an event of temporal change.[4] These seem to be exactly the kinds of uses

[3]An anonymous reviewer asks whether there might exist also non-stative non-dynamic events. I am inclined to believe that they do not, as least given the understanding of stativity and dynamicity in Gawron (2009):

> To be dynamic means to describe a change and change may occur in either a spatial dimension or in a temporal dimension. When I say of an event property that it is a [+ State] property, I mean that it is static and homogeneous in time ... (Gawron 2009:3)

On this understanding, at least, non-stativity is dynamicity in the temporal domain. As such, non-stativity and non-dynamicity would be mutually exclusive.

As an additional note, I should point out that I am clearly using the term 'event' above as the term 'eventuality' is sometimes used—i.e., as a cover term for both temporally stative and non-stative (=eventive) eventualities.

[4]One counter-example due to Alec Marantz (p.c.) is *fall*, which has clear extent uses, as in (ia), but appears not to have a derived stative used like (ib) based on it.

(i) a. The plateau falls up ahead.
b. ?The fallen area of land up ahead ...

It may simply be the case that a derived stative use of *fallen* like the one in (ib) is morphologically blocked by *cliff*. If so, though, one might expect other derived stative uses of *fallen*. I have yet to find any, though I am as

of deverbal adjectives commonly highlighted as "derived statives." So, while the verb *sink* has extent uses like (10), it also has derived stative uses like those in (11).

(10) The land sinks five kilometers ahead.

(11) a. Lower Knoll, is a sunken area of land that is located on the eastern side of the Avenues, area in Exmouth and lies above the Maer Valley.
`http://www.eastdevon.gov.uk/reportdc_120108_07.3421.out.jb.pdf`

b. It is a five minute walk to Dunster Beach and along the way walkers may be able to make out the sunken area of land which marks the site of the Medieval.
`http://www.west-somerset-railway.co.uk/Dunster.html`

c. Pit, definition 15: Bowling. the sunken area of a bowling alley [presumably constructed that way] behind the pins, for the placement or recovery of pins that have been knocked down.
`http://dictionary.reference.com/browse/Pits`

The same is true for *darken*, as shown in (12) and (13).[5]

(12) Kim's skin darkens between her knee and her calf.

(13) a. The areola, the darkened portion of skin surrounding the nipple, can be created with a medical tattoo.
`http://www.milesplasticsurgery.com/procedures/reconstruction.cfm`

b. He has no scars but there is a slightly darkened portion of skin on his right leg, near the femoral artery, which he has had since birth and is in the crude ...
`http://www.adventdestiny.com/forum/archive/index.php?t-2820.html`

And similarly for *bend*, as shown in (14).

(14) Q: My penis bends. Please help. ... my penis has always had this bend in it, for as long as I remember, so it doesn't seem to me that it occurred as a result of something.
A: If you have no pain ... I would say with almost complete certainty that you have just, for some reason, been born with a bent penis ...
`http://www.the-penis.com/problems4.html`

For each of the deverbal adjectives in (11)–(14b), it is crucially not the case that the state named by the adjective is preceded by an event of temporal change. This does not mean, however, that they are preceded by no event. They are, but by an event of spatial change, precisely the kind of event named by the verbs from which they are derived, as I show below.[6]

My proposed solution to the semantics of derived statives, then, is quite simply that they are derived from change of state verbs in identical fashion to result state uses of deverbal adjectives,

yet unsure if this is a genuine gap or simply a consequence of poverty of data/imagination.

[5] An anonymous reviewer observes that in the examples in (13), the spatial axis provided by context crucially must include not only the portion of skin in question, but also portions of skin with a lesser degree of darkness (i.e., outside of the areola), or else no change can be computed. Although strictly speaking, "the portion of skin" names only that portion that is dark, it invokes a part relation, whereby the part must be a part of some greater portion. As such, although I agree with the reviewer that it is not trivial, I do not believe that there is a problem in context generating a scale with the right points in this particular instance. Much more challenging, I think, is how the scale is provided (and, in fact, what exactly the scale is) in non-spatial (and non-temporal) examples like the reduced fat mayonnaise example in fn. 9. Obviously, further work is required.

[6] One anonymous reviewer objects to the use of the term "precede" for the relation that the state named by the derived stative and the event named by the extent use of a change of state verb stand in. As explained below, however, space is assumed to be ordered on this theory and it is in fact formally the case on the theory I develop below that this state (represented by an interval) is preceded on a spatial scale by a change in space. As such, I believe this terminology is justified.

similar in spirit to Kratzer's 2000 treatment of resultant states, where the key operation is existential quantification of the verb's event variable, and introduction of a stative eventuality argument over which the adjective holds. Derived stative readings of deverbal adjectives are entirely expected, once it is recognized that the input to deverbal adjective formation can be not only the conventional temporal change meaning of a change of state verb, but additionally the kinds of non-temporal change meaning found with extent uses of change of state verbs. When such a meaning is the input to deverbal adjective formation, it is not expected that there will be a temporal event preceding the state named by the deverbal adjective. Nevertheless, as I show below, this does not mean that there is no event variable in the meaning of the deverbal adjective.

2.2 Outline of an analysis of extent verbs

Since I claim that the meaning of deverbal adjectives is derived from the meanings of verbs both in result states and in derived statives, I must first discuss the meanings of the change of state verbs from which these adjectival forms are derived. In this section I do precisely that, paying particular attention to how the contrast between temporal change and spatial change can be captured in Kennedy and Levin's (2008) theory of change.

The ontology I assume is as follows:

- ordinary individuals (type e, variables x,y,z).
- events (a subdomain of the domain of individuals; type v, variables e,e',e'').
- scales are sets of totally ordered points; scales are defined by some dimension.
- T the set of real numbers, each of which represents one of the totally ordered points defining a scale (whether temporal or spatial). The points t_1, t_2, t_3 are among these. i is an interval if $i \subset T$ and for all points if $t_1, t_3 \in i$ then $t_2 \in i$ (cf. Dowty 1979:139).
- "times" (t) are intervals on a temporal scale; "degrees" (d) are intervals on a scale (Kennedy 2007) whose dimension is defined by the lexical content of adjectives and verbs. These are sorts of the more general type *interval on a scale* (p).

With this as a backdrop, the starting point for the analysis is a treatment for simple gradable adjectives, the stative cores of change of state verbs on the Kennedy and Levin (2008) theory, like *wide* in (15).

(15) Kim's smile is wide.

I follow Kennedy (1999) in analyzing the denotations of gradable adjectives as measure functions, functions from times to functions from individuals to a degree on a scale defined by the lexical content of the adjective. Measure functions, then, are not predicates of individuals in and of themselves. On Kennedy's approach, it is the function of degree morphology to take the measure function denotation of an adjective and return a predicate of individuals (Kennedy 2007:5). Informally, what the degree morphology does is to introduce a degree on a scale (lexicalized by the adjective) that the entity must possess (at a particular time) in order for the degree+adjective construction to be predicated of an entity. In many cases degree marking is overt in English (as with comparatives, intensification, etc.). In the case of absolute constructions with gradable adjectives like (15), however, it is not. In such cases, the degree is taken from context—the minimal degree that counts as *wide* for a smile, for example, is not the same as what counts as *wide* for a road. Kennedy (2007:7) proposes the null degree operator in (16),

the positive degree, for absolute constructions like (15) where the standard of comparison is contextually determined.[7]

(16) $[\![pos]\!] = \lambda P \in D_{<t,<e,d>>} \lambda t \lambda x[P(t)(x) \succeq stnd(P)]$

In (16), P is the type of measure functions and *stnd* is a function from measure functions to the contextually standard degree on the scale lexicalized by that measure function. I.e., *stnd* determines what 'counts' as the minimal degree for any particular gradable adjective in any particular context. With this in mind, *pos* in (16) takes a measure function as an argument and returns a function from times to individuals to truth values such that the expression is true if the degree (on the scale lexicalized by the adjective) is at least as great as the contextually determined standard. The derivation in (18) shows how given a measure function denotation for *wide* like (17) and the denotation for *pos* in (16), the composition of the two yields a predicate of individuals that can be predicated of e.g., a time and a smile to yield true just in case the smile is wide enough to be considered wide.[8]

(17) $[\![wide]\!] = \lambda t \lambda x[\iota d[wide'(t)(x) = d]]$

(18) $[\![pos]\!]([\![wide]\!]) = \lambda P \in D_{<t,<e,d>>} \lambda t \lambda x[P(t)(x) \succeq stnd(P)](\lambda t \lambda x[\iota d[wide'(t)(x) = d]]) =$
$\lambda t \lambda x[\iota d[wide'(t)(x) = d] \succeq stnd([\![wide]\!])]$

This is how Kennedy lays out the semantics of gradable adjectives in his work. Gawron (2009:30) observes, however, that gradable adjectives appear in sentences not only where the adjective is meant to hold at a particular interval in time, but at a particular interval in space, as illustrated in (19).

(19) The road is wide at the summit.

Extent uses of adjectives like (19) are at the heart of extent uses of change of state verbs. Gawron's intuition is that much as extent uses of change of state verbs are about change within a spatial domain, extent uses of adjectives like (19) are about an entity possessing a degree on a scale rather than at a particular interval in time, at an interval in space. Gawron's idea is that space, just like time, can be viewed as a set of well-ordered points on an axis (with intervals defined over these).[9]

[7] As Kennedy (2007:7) remarks, (16) can be conceived of either as a morphologically null syntactic head or as a type-shifting operation. I remain agnostic on this question here.

[8] For explicitness, I follow Piñón (2008:192) in recasting Kennedy and Levin's (2008) formalism for measure functions with the iota operator. Truth conditionally the formulae are identical.

[9] As an anonymous reviewer points out, spatial scales are probably more complicated (and certainly less well-understood) than temporal scales, not least because temporal points are ordered linearly, whereas spatial points need not be, as can be seen in examples above involving *bent*, for example. As such, spatial scales are probably best not conceived, as a reviewer rightly points out, as an 'axis', but perhaps rather as some kind of spatial path (defined, e.g., by a spatial path function similar to a temporal trace function). I will, nevertheless, oversimplify in my discussion and assume that they are axial. For the examples I discuss, I do not believe this makes any difference.

What this suggests however, as two reviewers point out, is that much more work on spatial dynamics is needed. While this is certainly true, a full and proper study of spatial dynamics is well beyond the scope of the present study (though see Gawron 2009). Additionally, however, it is worth highlighting that although I focus in this paper on non-temporal change in spatial domains, the phenomenon seems to be more general than simply space. E.g., reduced fat mayonnaise (ia) is manufactured with reduced fat (specifically due to the lack of egg yolk) and in no conventional sense is the reduction of fat either temporal or spatial. The situation is similar for a shortened life expectancy in (ib).

(i) a. Kim eats only reduced fat mayonnaise.
b. Patients with Down Syndrome have a shortened life expectancy.
`http://emedicine.medscape.com/article/1200824-overview`

Measure functions, then, can be defined so as to take either a temporal interval as an argument or spatial intervals, in the cases of extent uses of adjectives like (19).[10] To represent this formally, I propose that measure functions are functions not simply from *times* to entities to degrees, as above, but rather from *intervals on a scale*, whether temporal or spatial, to entities to degrees. The variable p in the denotation for *wide* in (20) represents this underspecification.

(20) $[\![wide]\!] = \lambda p \lambda x[\iota d[wide'(p)(x) = d]]$

I generalize the denotation of positive degree morphology similarly as in (21).

(21) $[\![pos]\!] = \lambda P \in D_{<p,<e,d>>} \lambda p \lambda x[P(p)(x) \succeq stnd(P)]$

With this in mind, the idea for sentences like the one in (19) is that the measure function takes, rather than a temporal interval, a spatial interval, covering the interval of road on a spatial axis defined by the extent of the road at which the summit is located. Given that interval, and the road as an argument, the measure function returns the degree of width the road has at the spatial interval at which the summit is located.

The semantics of change of state verbs, upon which the semantics for derived statives and result states is ultimately constructed, has measure functions like those discussed above as its starting point, combining it with the semantics of change. As with the original definition for measure functions, Kennedy and Levin (2008) define their semantics for change exclusively in temporal terms. The only change I make is to, again, follow Gawron (2009) in recognizing that change can take place not only over temporal intervals, but over spatial intervals as well. In order to define change along either of these two types of scale, I appeal to Kennedy and Levin's (2008) notions of derived measure functions, also known as *difference functions* (from the analysis of comparatives), and *measure of change functions*. A difference function is just like a measure function, but rather than returning a particular degree upon composition with an interval and an entity, it returns a degree representing"...the difference between the object's projection on the scale and an arbitrary degree d (the comparative standard)" (Kennedy and Levin 2008:172). In the analysis of comparative constructions, this arbitrary degree is provided by the comparative

The conclusion suggested by this, I believe, is that the interval argument in the formulae below can be an interval on many kinds of scales, not just spatial and temporal ones. As such, what is really needed is not simply a better understanding of spatial dynamics, but of non-temporal dynamics more generally and how the scale is chosen, particularly in contexts like (ia), where it is not at all obvious. All of this, however, will have to wait for future study.

[10] Gawron (2009:30) argues for a slightly different formalism where the interval actually is no longer an argument of the measure function, so that a measure function is simply a function from an argument to a degree on a scale which is located possibly temporally, possibly spatially, or even both. The motivation for this view is the triad of sentences in (i).

(i) a. The river was 18 feet wide at three o'clock.
b. The river was 18 feet wide at the ford.
c. The river was 18 feet wide at three o'clock at the ford. (Gawron 2009:30)

Gawron argues that on the view where measure functions take a spatiotemporal argument, in order to account for sentences like (ic), "doubly-indexed" measure functions would need to be introduced. He proposes instead to formulate measure functions in terms of events, and then stipulate that events have spatiotemporal parameters that are not part of the meaning of the measure function. I see no problem with this, but I do think what is gained is relatively minimal, since one still has to, as Gawron does, stipulate on which kind of axis the change takes place. So the issue really boils down to whether one stipulates "doubly-indexed" measure functions in adjectival uses like (ic) or stipulates in all particular uses of change of state verbs on which kind of axis the change takes place. This problem, however, is somewhat tangential to the matters ultimately under discussion here, since it doesn't arise in change of state contexts (change can be temporal or spatial, but not both at once), and since this is ultimately the focus of this paper. As such, I choose to stick with measure functions that do take an interval argument, though I do recognize that sentences like (ic) are a complication.

standard introduced in comparative constructions, so that e.g., in a comparative construction with *larger than Boston*, the lower-bound on the scale of size is set at the size of Boston. *Larger than Boston* itself has the denotation of a derived measure function—upon composition with an interval and an entity, it will return a degree representing the difference between the entity's projection on the scale of size and Boston's projection on the scale (and zero, if the entity is equal to or smaller than Boston). The definition for difference functions is stated more formally in (22), based on Kennedy and Levin (2008:172), with the change that I allow difference functions to take spatial intervals as arguments as well as temporal intervals.

(22) Difference functions: For any measure function $\mathbf{m}$ from objects and intervals on a temporal or spatial scale to degrees on a scale S, and for any $d \in S$, $\mathbf{m}_d\uparrow$ is a function just like $\mathbf{m}$ except that:
   a. its range is $\{d' \in S \mid d \preceq d'\}$, and
   b. for any x, p in the domain of $\mathbf{m}$, if $\mathbf{m}(x)(p) \preceq d$ then $\mathbf{m}_d\uparrow(x)(p) = d$

(cf. Kennedy and Levin 2008:172)

Schematically, then, a difference function is as in (23), taking an interval p on a scale, an entity x, and returning a degree *d'* representing the difference in degree between the projection of x and some arbitrary degree d on the scale lexicalized by the measure function m.

(23) $\lambda p \lambda x[\iota d'[\mathbf{m}_d\uparrow(p)(x) = d']]$

Difference functions, in turn, are implicated in the definition of measure of change functions, which lie at the heart of the denotations of change of state verbs on the Kennedy and Levin theory of state change. A measure of change function is a special kind of difference function, where the arbitrary degree d is itself generated by a measure function, with the measure function's scalar argument the starting time/spatial interval of the change event. These are represented schematically in (24).

(24) Measure of change (cf. Kennedy and Levin 2008:173):
For any measure function $\mathbf{m}, \mathbf{m}_{\mathbf{\Delta}} = \lambda x \lambda e[\iota d[\mathbf{m}_{\mathbf{m}(init(e))(x)}\uparrow(fin(e))(x) = d]]$

In the words of Kennedy and Levin, "a measure of change function $\mathbf{m}_{\mathbf{\Delta}}$ takes an object x and an event e and returns the degree that represents the amount that x changes in the property measured by $\mathbf{m}$ as a result of participating in e" (Kennedy and Levin 2008:173). To be more concrete, consider the denotation in (25) of the change of state verb *darken* on this approach.

(25) $[\![darken]\!] = \lambda x \lambda e[\iota d[\mathbf{dark'}_{\mathbf{dark'}(init(e))(x)}\uparrow(fin(e))(x) = d]]$

Recall that the subscripted $_{\mathbf{dark'}}$ is a measure function, which given an interval and an entity returns a degree. In (25), *init* and *fin* are functions that for an event e return the interval on a scale at which e begins/ends. In this way, $_{\mathbf{dark'}(init(e))(x)}$ returns a degree—the degree that x has on the scale of darkness at the beginning of the event e. This degree, in turn, is an argument for the difference function $\mathbf{dark'}_{\mathbf{dark'}(init(e))(x)}\uparrow$, serving to set the lower bound degree of darkness on the darkness scale, i.e., the degree of darkness that holds at the beginning of the event. This difference function takes as arguments $fin(e)$, an interval representing the end of the event e, and x, the entity undergoing the change in degree of darkness. When the interval $fin(e)$ and the entity x compose with $\mathbf{dark'}_{\mathbf{dark'}(init(e))(x)}\uparrow$, the result is a degree d representing the amount of change in darkness that x has undergone from the beginning of the event e to its end. The only way in which I alter Kennedy and Levin's definition is, again, to allow for not only temporal change but for spatial change as well. This is done by allowing that $init$ and fin are functions that return not only temporal intervals of an event, but in the case of an event of spatial

change, spatial intervals. So, for example, in (26), where the event is one of temporal change, the beginning and end of the event are temporal intervals, four and five o'clock respectively.

(26) The sky darkened between four and five o'clock.

In (27), by contrast, the event is one of spatial change; (27) is about the change in degree of darkness between two points on a spatial scale, the axis running along the leg. The beginning of this spatial event is the interval represented in (27) by the knee, while its end is the calf.

(27) His skin darkens between his knee and his calf.

Given these two spatial intervals representing the beginning and the end of the event and the entity *skin*, the measure of change function in (25) representing the denotation of the verb *darken* returns the degree representing the degree to which the color of skin changes between the two intervals in space, i.e., from the beginning of the event to its end.[11]

On this analysis, then, whether the COS verb names an event of spatial or temporal change is a consequence of the kind of interval the verb's meaning composes with—spatial change if a spatial interval, temporal change if a temporal interval. The COS verbs discussed to this point all allow both types of change, and this is accounted for by allowing the measure of change function to compose with either type of interval. It is not the case, however, that all change of state verbs allow both temporal and spatial change readings. Verbs of cooking (Levin 1993:243-244), for example, although they clearly allow temporal change readings (28a), they seem not to allow spatial change readings, as evidenced by the data in (28b).

(28) a. The side of beef is cooking between the rib and the joint.
b. #The side of beef cooks between the rib and the joint.

The sentence (28a) is perfectly acceptable in a context where at the moment of speaking the entire portion of beef between the rib and the joint is in the process of undergoing a change from being raw to being cooked. This is a change in the state of the meat defined over time. By contrast, (28b) is unacceptable in a context where the side of beef has different degrees of cookedness at different points along it, i.e., so that the joint has a larger degree of cookedness than the rib. More to the point, (28b) is anomalous because the present tense requires temporal stativity, and *cook* has no temporally stative use akin to the extent uses of the COS verbs discussed above.[12] The same is true for other cooking verbs; they are only acceptable in eventive frames. As previously discussed, on the proposed analysis, extent readings arise as a consequence of the ability of a verb to take either a temporal or spatial interval. I assume that it is a lexical property of any given verb (or verb class) that it can/can't take certain kinds of interval arguments. More formally, the lexical semantic root (Levin and Rappaport Hovav 2003) of a

[11] Unfortunately, the calculation is not always as straightforward as it is above, as noted by an anonymous reviewer. Consider, for example, *sunken* in (11). Part of the denotation of *sunken* will be, at least on this theory, a measure function **sink'**, which, like any measure function, takes an interval and an entity and returns a degree. But in the case of **sink'**, it looks like the degree returned by the measure function can only be calculated relative to some idealized higher point which will have to be determined contextually. I.e., a point cannot be sunk without being sunk relative to something, relative to some context. But measure functions are not supposed to be context sensitive in this way. This is a problem not so much for the theory I propose here for derived statives, but for the Kennedy and Levin (2008) approach to adjectives and state change more generally, since on this theory, context sensitivity is not introduced into the meaning of the adjective itself, but rather constructionally, so that this particular measure function should not be context sensitive in this way. This issue clearly merits further thought, but I do not think it should be seen necessarily as a problem for my claims about derived statives specifically, since in principle these should be compatible with any theory of adjectives and state change, so long as they incorporate some kind of approach to spatial change.

[12] Of course, the English present is fine with eventive verbs with a habitual reading, which is irrelevant for consideration of the matter at hand.

verb (e.g., $\mathbf{dark}'$ in *darken* above) says that the p argument can be temporal, spatial, only temporal, etc. While the roots of verbs like *darken* allow for a spatial interval argument, the roots of verbs of cooking do not. A consequence of this is that the ability to take a particular kind of interval argument should be maintained across all derivationally related lexemes having the same root. Since derived stative readings crucially depend on the verb the deverbal adjective is derived from being able to take spatial intervals as arguments, the analysis predicts that while some change of state verbs have derived stative derivatives, others do not. This prediction is borne out and discussed in detail in §3.4.

A final point worth bearing in mind is that measure of change functions, as can be seen clearly above, are functions to *degrees*, not to truth values. Like measure functions, the denotations of adjectives, these are combined with degree morphology to turn them into functions to truth values (Piñón 2008; Kennedy and Levin 2008). As with adjectival degree morphology, there is a "positive degree" which introduces a contextual standard, when no overt standard is present.[13] The denotation of the verbal positive degree is given in (29). The derivation in (30) shows how upon composition with the positive degree, the denotation of *darken* yields a function from ordinary individuals to events to truth values.

(29) $[\![pos_v]\!] = \lambda g \in D_{m_\Delta} \lambda x \lambda e[g(x)(e) \succeq stnd(g)]$

(30) $[\![pos_v]\!]([\![darken]\!]) = \lambda x \lambda e[[\iota d[\mathbf{dark}'_{\mathbf{dark}'(init(e))(x)}\uparrow(fin(e))(x) = d]] \succeq stnd([\![darken]\!])]$

In this way, a sentence such as (31) will be true on this theory iff there exists an event in which the degree to which the room darkened is at least as big as the degree required contextually for something to be considered to have darkened.

(31) The room darkened.

2.3 Adjectives derived from extent verbs

With the preceding as background, it is now possible to lay out the formal analysis of result states and derived statives. I treat deverbal adjectives, following Kennedy and McNally (2005), type-theoretically as measure functions, just like any other adjective. So, adjectives like *darkened*, whether they have a derived stative or a result state reading, say something about the degree d of darkness holding of an entity x at a particular interval p, just like any other adjective. What is special about deverbal adjectives is that they're deverbal—they inherit the event structure of the verb that they are derived from (Kennedy and McNally 2005). As such, the interval at which the degree holds is preceded by a change of state event giving rise to that degree. The semantic difference between a result state use of a deverbal adjective like (32a) and a derived stative use like (32b), I propose, comes about as a consequence of the nature of this change of state event preceding the stative interval.

(32) a. In the last days of the campaign, ads had run in many of these districts that used darkened photos of Jindal and ominous intonations.
`http://americantaino.blogspot.com/2007_03_25_archive.html`

b. He has no scars but there is a slightly darkened portion of skin on his right leg, near the femoral artery, which he has had since birth ...
`http://www.adventdestiny.com/forum/archive/index.php?t-2820.html`

With result states, the interval p is temporal, so that the adjective is saying something about the degree of darkness holding at a particular interval of time. Further, it is preceded on the

[13] Again, this could be viewed either as the denotation of a null functional head or as a type-shifting operation. It makes no difference in the context of this discussion.

temporal scale by an interval at which the degree of darkness holds to a lesser degree. With derived statives, by contrast, the interval p is spatial, so that the adjective says something about the degree of darkness holding at a particular interval in space (e.g., at the peak of the mountain, a place on the body, etc.). Further, this interval is preceded on the scale by an interval *on a spatial scale* at which the degree of darkness holds to a lesser degree.

Formally these intuitions can be fleshed out in a manner much like that in Kratzer's (2000) analysis of result states, where she argues that the process of result state formation is characterized by existential quantification of a verb's event argument and introduction of a stative eventuality argument, representing the adjectival state. The denotation for adjectivizing morphology in (33) does precisely this.[14] One difference between (33) and Kratzer's (2000) stativizer is that where Kratzer introduces a stative eventuality argument, I introduce an interval, the interval at which the result state/derived stative obtains.[15]

(33) $[\![-ed]\!] = \lambda g \in D_{m_\Delta} \lambda p \lambda x[\iota d[\exists e[g(x)(e) = d \wedge fin(e) \supset\subset p \wedge \neg\exists e'[\exists d'[g(x)(e') = d' \wedge init(e') = fin(e) \wedge fin(e') = p]]]]$

The denotation for adjectivizing *–ed* takes the meaning of a change of state verb (necessarily a change of state verb given the subcategorization for a meaning of the measure of change function type) and returns a measure function, albeit one of a very special kind—one where the degree value returned by the measure function is a difference value, and the interval argument is constrained in some very specific ways.[16]

In exactly what ways and with what results is seen best by considering the result of composition of (33) with the denotation of an actual change of state verb, as seen by the derivation of the meaning of *darkened* in (34).

(34) $[\![darkened]\!] = [\![-ed]\!]([\![darken]\!]) =$

[14] In (33) $\supset\subset$ is the abut relation, so that for two intervals p and p', $p \supset\subset p'$ iff the final point of p immediately precedes the initial point of p'.

[15] I use an interval rather than a stative eventuality argument crucially (a) in following Kennedy and McNally's (2005) proposal that the meaning of deverbal adjectives is also a measure function and (b) because deriving the meaning of derived statives is transparent—they involve a spatial interval rather than a temporal interval, as seen below. Still, I have little doubt that an analysis built around the same intuitions as this one could be developed with a stative eventuality argument.

[16] As can be seen clearly above, I assume that the adjectivizing *–ed* takes the meaning of an intransitive COS verb as the input to deverbal adjective formation. But there do exist both result states (i) and derived statives (ii) that are derived from unambiguously transitive verbs.

(i) a. The freshly killed chicken ...
b. The recently bought toaster ...

(ii) The raised portion of skin on the palms and fingers of the hand and sole and toes of the foot ...
`http://www.theenglishe.com/samples/693.pdf`

The derivation of forms like these will involve a related denotation for the adjectivizing morphology. Specifically, in addition to the semantics proposed above for *–ed*, there will also have to be as part of the denotation that operates on transitive verbs, a reduction operation, whose semantic nature requires detailed investigation that goes beyond the scope of this paper. In previous work, it has been assumed that this involves a kind of deletion operation (Mchombo 1993; Dubinsky and Simango 1996; Meltzer 2009), specifically, deletion of the external argument present in the lexical representation of the transitive verb. For reasons laid out in Koontz-Garboden (To appear), I am skeptical of deletion analyses generally, and there are many alternatives that need to be considered, from reflexivization (Chierchia 2004; Koontz-Garboden 2009a) to a severed external argument (Kratzer 2000). This issue, however, is largely tangential to the concerns in this paper, which are about the (non-)eventivity of derived statives, not whether they have an external argument or not, and whatever the right way of dealing with the external argument of transitive verbs may be, the semantics I propose for derived statives and result states, and the difference between them as that of entailment of preceding spatial versus temporal change should remain intact.

$\lambda g \in D_{m_\Delta} \lambda p \lambda x[\iota d[\exists e[g(x)(e) = d \wedge fin(e) \supset\subset p \wedge \neg\exists e'[\exists d'[g(x)(e') = d' \wedge init(e') = fin(e) \wedge fin(e') = p]]]]](\lambda x \lambda e[\iota d[\mathbf{dark'}_{\mathbf{dark'}(init(e))(x)}\uparrow(fin(e))(x) = d]]) =$
$\lambda p \lambda x[\iota d[\exists e[\iota d'[\mathbf{dark'}_{\mathbf{dark'}(init(e))(x)}\uparrow(fin(e))(x) = d'] = d \wedge fin(e) \supset\subset p \wedge$
$\neg\exists e'[\exists d''[\iota d'''[\mathbf{dark'}_{\mathbf{dark'}(init(e'))(x)}\uparrow(fin(e'))(x) = d'''] = d'' \wedge init(e') = fin(e) \wedge fin(e') = p]]]]]$

In (somewhat simplified) prose, $[\![darkened]\!]$, derived from the composition of (33) with the denotation of the verb *darken*, is a function from intervals p on a scale (whether temporal or spatial) to individuals x to the degree d representing the difference in darkness in x from the beginning of an event e to the end of e, where the end of e abuts interval p, and there exists no event of change in degree of darkness of x between the end of e and p. This final constraint guarantees that the degree of darkness of x reached by the end of the event of change e is identical to its value at p, the result state/derived stative interval.

As already discussed, like all other adjectives, deverbal adjectives on this analysis denote measure functions, and as such do not themselves denote predicates of individuals. Instead, they are made predicates of individuals by the same degree morphology found with other adjectives. In (35) is the same denotation given in (21) for *pos* used with morphologically simple adjectives. The derivation in (36) shows how it composes with the denotation of a deverbal adjective to give rise to a predicate of individuals, absent other degree morphology.

(35) $[\![pos]\!] = \lambda g \in D_{<p,<e,d>>} \lambda p \lambda x[g(p)(x) \succeq stnd(g)]$

(36) $[\![pos]\!]([\![darkened]\!]) =$
$\lambda g \in D_{<p,<e,d>>} \lambda p \lambda x[g(p)(x) \succeq stnd(g)](\lambda p \lambda x[\iota d[\exists e[\iota d'[\mathbf{dark'}_{\mathbf{dark'}(init(e))(x)}\uparrow(fin(e))(x) = d'] = d \wedge fin(e) \supset\subset p \wedge \neg\exists e'[\exists d''[\iota d'''[\mathbf{dark'}_{\mathbf{dark'}(init(e'))(x)}\uparrow(fin(e'))(x) = d'''] = d'' \wedge init(e') = fin(e) \wedge fin(e') = p]]]]]) =$
$\lambda p \lambda x[\iota d[\exists e[\iota d'[\mathbf{dark'}_{\mathbf{dark'}(init(e))(x)}\uparrow(fin(e))(x) = d'] = d \wedge fin(e) \supset\subset p \wedge$
$\neg\exists e'[\exists d''[\iota d'''[\mathbf{dark'}_{\mathbf{dark'}(init(e'))(x)}\uparrow(fin(e'))(x) = d'''] = d'' \wedge init(e') = fin(e) \wedge fin(e') = p]]]] \succeq stnd([\![darkened]\!])]$

Predicated of an interval p on a temporal scale and of an individual x, a sentence headed by (36) is true iff the degree of change in darkness of x from the temporal beginning of an event e to its end prior to p (at which the same degree of darkness still holds) is greater than the contextually determined standard. Crucially, the interval p at which a particular degree of darkness holds must be preceded by an event of change ending immediately prior to p and that brings about the degree of darkness that holds at p. That a result state meaning is generated in this instance is a consequence of composition with a temporal, rather than a spatial, interval. And as a consequence of composition with this kind of interval, there must be a temporal change prior to p. I.e., $init(e)$ and $fin(e)$ must pick out temporal intervals. This is forced if p is temporal by the condition that $fin(e) \supset\subset p$, the abut relation holding between two intervals only if they are intervals on the same scale. I.e., abut cannot hold between an interval on a temporal scale and an interval on a spatial scale. That $init(e)$ picks out a temporal interval in such a case is guaranteed by the difference function—it allows the calculation of a degree of difference only if $init(e)$ and $fin(e)$ are intervals on the same scale. Therefore, if p is temporal, and $fin(e) \supset\subset p$ then $init(e)$ must also be temporal, and a result state meaning is generated. I.e., it must be the case that p is preceded by an event of temporal change.

By contrast, if p is spatial, then $fin(e) \supset\subset p$ guarantees that $fin(e)$ is also spatial, i.e., an interval on a spatial scale, and as a consequence $init(e)$ too must be spatial. And in this kind of case the spatial interval p at which a particular degree of e.g., darkness holds will necessarily be preceded by an interval over which a spatial change takes place. Crucially, however, this change is a spatial change, not a temporal change, so there is no inference of temporal change.

As I have shown above, and show further below, however, this does not mean, as has been presumed in the literature, that there is no preceding event of change. If there were, it would be predicted that e.g., *darkened* with a derived stative meaning has the same kind of meaning as the morphologically simple *dark*. The analysis given here predicts this not to be the case, as may be obvious from looking at the denotation of a morphologically simple adjective like those discussed in §2.2 and of deverbal adjectives as discussed in this section. I discuss this prediction in detail in §3 below, showing it to be borne out by the facts.

What I hope to have accomplished in this section is to simply lay the formal groundwork of the analysis, showing that once extent uses of change of state verbs are recognized, as I believe they must be by any theory of change of state meaning in light of Gawron's (2009) observations, it is predicted that deverbal adjectives derived from verbs with such meanings can have stative meanings where a special kind of non-temporal change is predicted to precede the stative interval in the denotation of the adjective. In the sections that follow I show that this analysis makes a series of predictions that stand it in contrast with alternative analyses of derived statives and which are borne out by the facts.

3 Consequences of the analysis

3.1 Prediction 1: There is a preceding event

A first prediction made by the claim that derived statives, at least in English, are derived compositionally from extent uses of COS verbs, is that derived statives, despite failing to entail there to have been a prior event of temporal change, do not have meanings on a par with the meanings of morphologically simple adjectives. As discussed at some length above, morphologically simple adjectives on this theory denote measure functions, with no internal event structural complexity. They do not entail that there was an event preceding the interval at which they hold. This contrasts with the situation for both result states and derived statives on the proposed theory, both of which entail that there was an event preceding the interval at which they hold. The contrast in denotations assigned by this theory to e.g., the morphologically simple adjective *wide* and the deverbal result state/derived stative denoting *widened* can be seen clearly in (37a,b) respectively.

(37) a. $[\![wide]\!] = \lambda p \lambda x[\iota d[wide'(p)(x) = d]]$

b. $[\![widened]\!] = \lambda p \lambda x[\iota d[\exists e[\iota d'[\mathbf{wide'}_{\mathbf{wide'}(init(e))(x)}\uparrow(fin(e))(x) = d'] = d \wedge fin(e) \supset\subset p \wedge \neg\exists e'[\exists d''[\iota d'''[\mathbf{wide'}_{\mathbf{wide'}(init(e'))(x)}\uparrow(fin(e'))(x) = d'''] = d'' \wedge init(e') = fin(e) \wedge fin(e') = p]]]]]$

While *wide* never entails that there was an event preceding the interval at which the state holds, *widened*, whether it has a result state meaning or a derived stative meaning, is always predicted to, given the denotation in (37b). The difference between result state meanings and derived stative meanings, as discussed above, is not in the denotation—both have the same denotation, the one in (37b). The difference is instead in whether (37b) is saturated by a temporal interval or a spatial interval. Regardless, it is predicted that use of (37b) will entail that the interval at which the state holds is preceded by an event of change, whether temporal or spatial.

If these contrasts in meaning genuinely exist, they should be easily detectable by contradiction tests. Firstly, a sentence headed by a morphologically simple adjective should be able to be followed by another that denies there to have been an event of temporal change preceding the interval at which the state holds. Similarly, if the derived stative interval is really preceded by an event of spatial change, but not by one of temporal change, the same should be true for derived statives. The data in (38a,b) respectively show that this is indeed the case, while the

data in (38c) show that they contrast with result states in precisely this way; since a result state entails there to have been an event of temporal change preceding the interval at which the result state holds, denying that there was such an event gives rise to a sharp contradiction.

(38) Continuation by denial of preceding event of temporal change
  a. I65 is wide at Lafayette city center and this portion of the road has had the same width for its entire existence.
  b. I65 is widened between Gary and Lafayette city center and this portion of the road has had the same width for the entire duration of its existence.
  c. #Because of the previous frequency of accidents, the state hired a road crew, and after a few short months the US had a widened I65. In fact, the road has had the same width for its entire existence.

Although a derived stative like the one in (38b) does not entail an event of temporal change, this does not mean, as discussed at length above, that no event is entailed. Instead, it simply entails there to have been an event of spatial change rather than an event of temporal change. As such, denial of the existence of such an event gives rise to contradiction, as shown by the data in (39a). Again, since morphologically simple adjectives do not entail there to have been any kind of preceding event at all, denial of a preceding event of spatial change does not give rise to a contradiction, as shown in (39b). And finally, although result states do entail there to have been a preceding event, since it is a preceding event of temporal, rather than a spatial, change, denial of a preceding event of spatial change also fails to give rise to a contradiction, as shown in (39c).

(39) Continuation by denial of preceding event of spatial change
  a. #I65 is widened at Lafayette city center. In fact, it's of the same width for its entire extent.
  b. I65 is wide at Lafayette city center. In fact, it's of the same width for its entire extent.
  c. Because of the previous frequency of accidents, the state hired a road crew, and after a few short months the US had a widened I65. It was of the same width for its entire extent, so as not to confuse drivers.

Contradiction tests thus clearly diagnose the presence of a preceding event of spatial change in the denotation of deverbal adjectives, by contrast with morphologically simple adjectives. The presence of this event entailment in the denotation of deverbal adjectives is a direct consequence of its verbal origin. With at least some change of state verbs (more on this below), the verb can describe change in a temporal *or a spatial* domain. As such, the naive prediction of compositionality is that an adjective derived from such a verb could name a state preceded by an event of either temporal or spatial change. This naive prediction, as shown by the contradiction tests above, is correct.

3.2 Prediction 2: Adverbial modification

Embick (2004:357), building on Kratzer's (2000) discussion of German, observes that in English, certain state-denoting words contrast with one another in their ability to be modified by an adverb, e.g., *opened* versus *open* in (40) and (41).

(40) a. The package remained carefully opened.
  b. *The package remained carefully open. (Embick 2004:357)

(41) a. the carefully opened package

b. *the carefully open package (Embick 2004:357)

According to Embick, this contrast follows from *opened* having an event variable, which can be modified by an adverb, as part of its denotation. In this way, it contrasts with *open*.

Given that on the analysis developed above derived statives have an event argument while morphologically simple adjectives do not, the same kind of prediction is made—derived statives, despite their not entailing there to have been an event of temporal change, do entail there to have been an event of change, in contrast with morphologically simple adjectives, which denote simple measure functions and lack an event variable as part of their denotation. So, to the extent an adverb can be found that doesn't presuppose that there was an agent, and can modify an event of spatial (as opposed to temporal) change, the analysis developed above predicts the same kind of contrast observed in (40) and (41) between derived stative/morphologically simple adjective minimal pairs.

The adverb *gradually* seems to exhibit the right kind of behavior. Unlike an adverb like *carefully*, it does not require the event it modifies to have an agent. Also, as shown in (42), it can be an adverbial modifier in sentences headed by verbs naming a spatial change.

(42) a. The road gradually widens between here and West Lafayette.
b. The sky gradually reddens at the horizon.
c. The sky gradually darkens, owing to the storm clouds up ahead.

Although the contexts have to be fairly specific, *gradually* can also modify derived statives, as evidenced by the data in (43). By contrast, morphologically simple adjectival counterparts of the derived statives in (43) are decidedly odd when modified by *gradually*, as shown in (44).[17]

(43) a. As can be seen in figure 11.3, this is also evidenced by **the gradually brightened transparent space** from the granule shell to its center with increased granule size.
`http://books.google.com/books?id=SMqLKaWT_loC&lpg=PT209&ots=1HYsTKO6T1&dq=`
b. For those of you less inclined to take such a large fashion leap, Jessica Bennett offers a chic take on a classic peep toe wedge that may be just for you. Her 'Kava' style stands at three-and-a-half inches in height, and features a super cool, sloped heel that ends in an off-center peep toe. This unique touch, combined with **the gradually darkened heel** makes these demure peep toe wedges flirty, yet sophisticated.
`http://www.articlesbase.com/fashion-articles/essential-guide-to-peep-toe-wedge-1075852.html`
c. **The gradually darkened** sky overhead holds the eye in the picture.
`http://www.photosig.com/go/users/userphotocritiques;jsessionid=azavb0y3mWn-UzCk6o?id=14252`
d. Although these verb senses (generally meaning 'to gather, collect, or combine') are recorded almost 100 years earlier, they probably developed from two specific noun senses: 'a club-shaped structure; a knob or bunch' (1707) and 'a club-shaped knot in which the hair was worn' (1785). These uses of the noun obviously refer to **the gradually thickened and rounded end** of the heavy stick used as a weapon.
`http://www.randomhouse.com/wotd/index.pperl?date=20010605`

(44) a. ?the gradually bright transparent space
b. ?the gradually dark heel
c. ?the gradually dark sky

[17] *Google* searches, furthermore, fail to turn up plausible examples, by contrast with the derived statives, for which there are indeed plausible examples, as evidenced by the naturally occurring examples in (43).

d. ?the gradually thick end

This contrasting behavior in modifiability is predicted by the analysis laid out above. While deverbal adjectives have as part of their denotation the event variable of the verb they are morphologically derived from, morphologically simple adjectives have no such event variable. Modification by an adverb like *gradually* is crucially contingent on the presence of an event variable.[18] As such, the fact that derived statives, despite failing to have temporal event inferences, can be modified by this adverb, shows that they must have an event variable, consistent with the analysis laid out above, and by contrast with morphologically simple adjectives.[19]

3.3 Prediction 3: Morphological syncretism in derived statives and result states

On the analysis of deverbal adjectives developed above, the denotation of deverbal adjectivizing morphology is the same for both derived statives and result states; the semantic difference between the two is simply a consequence of the kind of interval the function takes as an argument. As such, the naive prediction would be that crosslinguistically, there would be a syncretism between derived stative forming morphology and result state forming morphology. Systematic crosslinguistic work on this topic remains to be carried out, but based on data in the Appendix from Chichewa (Dubinsky and Simango 1996), Indo-Aryan (Condoravdi and Deo 2008), and Pima (Jackson 2005b), among others, it certainly appears that syncretism in this area is not uncommon.[20]

[18]This is because the event variable is required, on this and most theories, in order to have a dynamic event, i.e., an event of change (whether static or non-static, on this theory). E.g., in the semantics laid out in §2 without an event variable, there can be no beginning and no end of the event. And without these intervals there can be no event of change. What *gradually* requires specifically of an event (whether temporal or spatial) is that the rate of change be such that it can be considered gradual. I.e., that the manner in which the change is carried out from the beginning interval to the final interval be relatively deliberate and incremental, rather than abrupt and sudden.

[19]There remains outstanding the question of how exactly the compositional semantics of modification is done. On the analysis laid out above, derived stativization effects an existential quantification of the event argument, thus making it inaccessible to adverbial modification. This suggests that composition with the adverb may well take place before stativization, as in Kratzer (2000), Embick (2004), Jackson (2005b), and others, though it would have to be the case that the modification is effected on an object that has something more like a verbal meaning than a bare stative root meaning, since the adverb needs access to the event argument, which is not part of the state-denoting root, on the analyses of at least Embick (2004) and Jackson (2005b), though cf. Kratzer (2000). I leave open and for future work what the syntactic analysis of derived statives is, and whether they are in fact syntactically complex, as might be concluded on the basis of these modificational facts. My objective in this section is simply to show that they can indeed appear with event-oriented adverbial modifiers, which shows that there must be an event argument as part of their denotation, as in the analysis developed above, and by contrast with morphologically simple adjectives.

[20]Mateu (2009), building on Alexiadou and Anagnostopoulou (2008), claims that (Modern) Greek participles in *–tos* are genuine derived statives that fail to inherit the event implications of the verb from which they are derived. The argument comes from contrasts in the behavior of participles in *–tos* and those in *–menos*, the latter claimed to derive genuine result states. I remain unconvinced by the argument, though, because the diagnostics are not event diagnostics, but rather agentivity diagnostics. They include the ability to be modified by the manner adverbials *well/carefully*, the ability to be modified by instrumental PPs, and the ability to control into purpose clauses, none of which *–tos* participles can do, but which *–menos* ones can. All of these diagnostics, however, although they do require an event, also require an agent. So, although use with them certainly would entail event-hood, inability does not entail a lack of event entailments, but rather a lack of agentivity entailments (given that there are any number of events that are non-agentive). A better kind of diagnostic would be one, as used above, that explicitly denies that there was an event giving rise to the state (e.g., *the bent tree branch has never undergone a bending event*), since this is insensitive to agentivity and does not diagnose a state as lacking a prior event simply because that event was not brought about by an agent. See DeLancey (1984) and Alexiadou et al. (2006) for further discussion of the fact that agentivity and eventivity are different notions.

3.4 Prediction 4: COS verbs lacking extent uses lack derived stative derivatives

A final prediction of the analysis of derived statives whereby they are derived from extent uses of COS verbs is that not all COS verbs necessarily have derived stative derivatives. Instead, verbs that disallow extent uses are predicted to lack adjectival derivatives with derived stative readings, since these are derived from the extent use of a COS verb. If a particular COS verb lacks an extent use, which is formally attributed on the analysis above to the lexical semantic root having a sortal restriction on the kind of interval that it can take (i.e., only temporal ones), on this theory there can be no derived stative use of an adjectival derivative, since a derived stative meaning similarly requires composition with a non-temporal, spatial interval, which is precluded by the same lexical semantic root that the adjective inherits from the meaning of the verb it is derived from.

The facts bear this prediction out. Consider, e.g., the COS verb *cook*. As shown by the data in (45), this verb does not have a derived stative reading; it necessarily requires there to have been an event of temporal change preceding the interval at which the state holds.

(45) #The portion of meat between the rib and the joint is cooked, but has never been cooked.

The prediction of the extent verb analysis, then, is that this verb should not have extent uses. The data in (46) show that this is precisely the case; (46a) can only have the meaning that the portion of meat between the rib and the joint underwent a temporal change. Similarly, (46b) is unacceptable on a non-habitual reading, where e.g., the side of beef has differing degrees of cookedness at points between the rib and the joint.

(46) a. The side of beef is cooking between the rib and the joint. (→ there is temporal change; that portion undergoes temporal change)
b. #The side of beef cooks between the rib and the joint.

The observation is that *cook* is only acceptable in eventive frames. As predicted, then, there is no derived stative sense of *cooked*; i.e., (45) is contradictory. Because *cook* has only a temporal change sense, a deverbal adjective based on it has only a result state reading. As discussed in §2.2, I take this to mean that the verb's lexical semantic root subcategorizes for a temporal interval argument, rather than having an interval argument underspecified in a manner such that it can be either temporal or spatial, as is the case for COS verbs allowing extent readings.

This state of affairs holds not just of *cook*, but of cooking verbs more generally. The data in (47) show, for example, that a sentence headed by a verb of cooking when followed by a clause denying there to have been any temporal event of change gives rise to a contradiction. In this way, cooking verbs contrast with extent uses of COS verbs discussed above, whose adjectival derivatives allow precisely this kind of behavior.

(47) #Kim prefers to eat only fried/sauteed/baked/boiled/fricasseed/steamed meat that has not been fried/sauteed/baked/boiled/fricasseed/steamed.

Similarly, the data in (48) show that cooking verbs lack non-habitual uses in the present tense, again, a use which is found with extent uses of COS verbs, as evidenced above by the data in (8b) and (9b).

(48) #The side of beef fries/sautees/bakes/boils/fricassees/steams between the rib and the joint.

Similarly, the verb *kill* and manner of killing verbs more generally (Krohn 2008; Koontz-Garboden and Beavers 2011) also systematically disallow derived stative derivatives, as shown

in (49) and (50), and lack extent uses, as shown by (51).

(49) #Kim has congenitally drowned lungs.

(50) #A congenitally killed/electrocuted/drowned/asphyxiated/beheaded/poisoned/suffocated/crucified knee/head/etc.

(51) #Kim drowns midway through his lungs.

The data discussed in this section, then, show that the extent verb analysis correctly predicts that only COS verbs that allow spatial change have adjectival derivatives with derived stative readings. As is seen below, other analyses of derived statives do not fare well on this, or in fact on any of the other predictions discussed above.

4 Comparison with previous approaches

In this section I discuss previous approaches to derived statives developed in the literature, paying particular attention to how they fare with respect to the predictions and data discussed in §3. Although some of these approaches are each very different from one another in their formal details, they all share with one another the making of incorrect predictions with respect to these facts, and thus all stand in contrast with the analysis developed above.

4.1 Deletion analyses

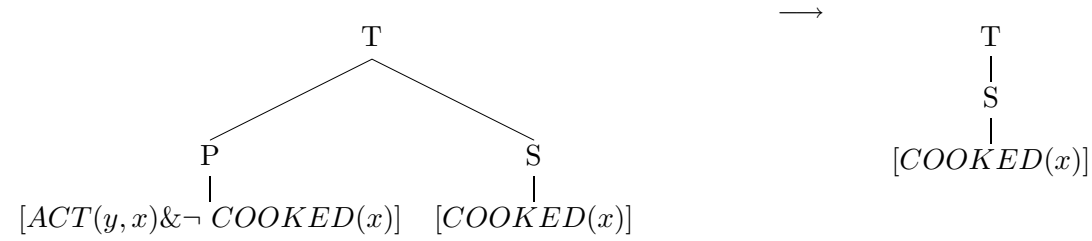
Assuming a Pustejovskyan lexical conceptual semantics (Pustejovsky 1992), Dubinsky and Simango (1996) analyze derived statives as the result of a process that "alters the LCS ... by removing the process ... to yield a stative predicate" (Dubinsky and Simango 1996:771-772). Similar kinds of analysis, though often in less formal detail, are proposed throughout the typological and descriptive literature, as in e.g., Mačavariani (1988:268), who suggests that "the stative derivation results in a formal as well as a semantic deletion of the agent ...". Dubinsky and Simango's analysis is exemplified in (52) for the Chichewa *phika* and the stativizing suffix *–ika*.[21]

(52) Stativization of Chichewa *phika* 'cook', via suffixation of *–ika* in Dubinsky and Simango (1996:771-772)

[21] Although they exemplify their analysis with the word for *cooked*, they provide no data suggesting that *phikika* 'cooked' can actually have anything other than a result state meaning. The only example they give of a genuine derived stative, as opposed to result state, meaning is in (i).

(i) *Nthambi ndi* **yo-pind-ika** *ngakhale si-i-na-pind-idwe.*
branch is AGR-bend-STAT even.though NEG-AGR-PAST-bend-PASS
'The branch is [in a state of being] bent, event though it was not bent.' (Chichewa; Dubinsky and Simango 1996:772, fn. 19)

As the reader will no doubt notice, the data in (i) seem quite amenable to the extent verb based analysis proposed above, given that the sentence is about a state preceded by a spatial change. Although it is impossible to say for sure without additional data whether Chichewa really does require access to a deletion-style analysis, the data in (i) certainly make the case more for the analysis proposed above than they do for a deletion analysis like the one proposed by Dubinsky and Simango (1996).



Without laying claim to what exactly the facts of Chichewa are (though see fn. 21), or how an operation like the one in (52) might be formalized, at least when applied to English derived statives, the deletion analysis makes a series of incorrect predictions.

First, if derived stativization is a process that removes the eventive component of a change of state verb leaving behind its stative core, then it is expected that the process can apply to any and all change of state verbs, since all of them would meet the structural description for such a rule. As seen in §3.4, however, it is simply not the case that all change of state verbs, at least in English, have derived stative counterparts, and although detailed work with native speakers will be required to substantiate this for other languages, one suspects that it is not the case for other languages either. In any event, at least for English, it is clear that a deletion analysis incorrectly predicts derived statives with all COS verbs and that the data do not bear this prediction out. The absence of derived stative readings based on e.g., verbs of cooking and manner of killing, then, is one piece of counterevidence for a deletion theory of derived statives like that of Dubinsky and Simango (1996).

Since, on the deletion theory, the meaning of a derived stative is simply the stative core of a COS verb, and since with deadjectival COS verbs this stative core actually has a morphologically simple name, i.e., morphologically simple adjectives, a deletion theory predicts that a derived stative of a COS verb should be identical in meaning to the morphologically simple adjective that the COS verb is derived from. A deletion analysis predicts, for example, that the meaning of English *wide* and *widened*, on its derived stative use, are identical. Again, this is because the meaning of *widen* is simply the meaning of *wide*, plus the semantics of change. And what stativization does on this theory is to remove the change meaning, leaving behind simply the stative core, i.e., the meaning of *wide*. Two additional incorrect predictions derive from this aspect of the deletion analysis. First, since the analysis has it that the eventive component of the verbal meaning is removed as part of the process of derived stativization, and the analysis predicts that the meanings are identical to those of morphologically simple adjectives, the analysis predicts that derived statives and morphologically simple adjectives should show identical behavior with respect to adverbial modification. More specifically, since derived statives on this theory would lack any eventive event structure component, the analysis predicts that it should not be possible to find eventive adverbial modifiers with derived statives, just as is the case with morphologically simple adjectives. As the data and discussion in §3.2 show, this prediction is incorrect—derived statives can in actual fact be modified by eventive adverbial modifiers, so long as they are of the right kind (e.g., *gradually*).

A second prediction that follows as a consequence of the claim of the deletion analysis that morphologically simple adjectives and derived statives of deadjectival verbs have identical meanings is that with both it should be possible to deny that there was a prior event, whether spatial or temporal, preceding the state named by the adjective/derived stative. Data from contradiction tests discussed in §3.1, however, show this prediction also to be false. Derived statives and morphologically simple adjectives on this diagnostic show contrasting behavior. While it can indeed be denied with a morphologically simple adjective that there was an event of spatial change preceding the interval at which the state named by the adjective holds, doing so with a derived stative gives rise to a contradiction. Quite independent of whether the extent

verb analysis is correct or not, this shows quite clearly that the meanings of morphologically simple adjectives and of derived statives are not identical, and that the deletion analysis, as a consequence, cannot be the right analysis of derived statives. The facts simply are not consistent with a deletion analysis of derived stativization.

4.2 Root-based analyses

Another kind of analysis of derived statives has it that derived statives, rather than being deverbal, are derived directly from a morphological root with underspecified, purely stative meaning. Jackson (2005b) builds on Embick's (2004) syntactic analysis of English participles to develop an analysis of derived statives and result states along these lines in the Uto-Aztecan language Pima. The analysis is based on the following leading ideas:

- Change of state verbs are built up from primitive state denoting morphological roots.
- These roots have the same kind of denotation as morphologically simple adjectives in a language like English.
- The Pima stativizing suffix *–s* has two separate denotations: (a) one for deriving derived statives (53a) and (b) one for deriving result states (53b) (where P ranges over the meanings of roots, R over verbalized roots, e over events, and s over stative eventualities).

(53) Jackson's two denotations for Pima stativizing *–s* (Jackson 2005b:196)[22]

a. $[\![-s_{der.\ state}]\!] = \lambda P[\lambda e[P(e)]]$

b. $[\![-s_{res.\ state}]\!] = \lambda R[\lambda s[\exists e[R(s)(e)]]]$

The derived stative denotation on this analysis, then, results from composition of derived stative *–s* in (53a) directly with a root. Because the root has no event structural complexity, denoting nothing more than a simple state, like an adjective, the resulting derived stative does not entail there to have been an event preceding the derived stative interval. This contrasts with result states, whose denotation results from composition of result state *–s* in (53b) with an eventivized root, i.e., a root in the context of an eventivizing little v and other functional elements that give it a change of state denotation. What is stativized by the result state morphology, then, is actually a change of state denoting stem, with all of its event structural complexity, which is inherited by the result state. The result state morphology, in addition to introducing a stative eventuality argument, existentially binds the event argument of the change of state stem it operates on, giving for the result state a denotation which entails there to have been a change of state event, of a kind named by the stem operated on, preceding the result state interval.

Although this analysis is formally quite distinct from deletion analyses, it makes many of the same incorrect predictions and raises some curious questions. First, as discussed above, on this analysis change of state verbs are constructed compositionally and in the syntax on the basis of a state-denoting root core, as is common in the Distributed Morphology literature within which Jackson's work is situated. This includes not only change of state verbs for which the stative core is actually attested as a morphologically simple adjective (e.g., *red*, *large*), but those for which it is not as well (e.g., *break*, *crack*).[23] As a consequence, since there is

[22] Jackson (2005b:196) actually assumes a third, perfectivizing denotation for *–s* as well. I leave that aside here. Note that e in (54) ranges over eventualities, not just events, and will ultimately have to be restricted to stative eventuality arguments, one way or another, though Jackson conjectures "perhaps via a presupposition" (Jackson 2005b:196).

[23] See e.g., Embick (2004), though Embick (2009) for a revision of this position, and for a proposal to capture the fact within DM that certain COS verbs in language after language fail to have morphologically simple adjectival counterparts (Koontz-Garboden 2005, 2006, 2009b). See Koontz-Garboden (2010) for a rejoinder.

a stative morphological core for all change of state verbs, and since the derived stativizer in (53a) is designed precisely to compose with such roots, this analysis, like the deletion analysis, predicts that derived stativization should be possible with all change of state verbs. As has been shown above, this prediction is incorrect for English. And in fact, Jackson himself observes that it is incorrect for Pima as well, in noting that despite the fact that many roots upon which change of state verbs are built can directly take the derived stativizing morphology, not all of them have pure derived stative readings upon suffixation (but rather, some have result state interpretations).

> There are event resultatives [=stativized roots] without an overt verbalizing suffix ... which cannot receive a derived stative interpretation; only a subset of resultatives without such verbalizing suffixes have a derived stative interpretation. (Jackson 2005b:141)

Jackson's observation is that if before stative suffixation with *–s* applies, a root has been overtly verbalized, then the meaning of the stativized form is necessarily a result state. It is only when a bare root is suffixed by *–s* that a derived stative meaning can arise. However, crucially, derived stative meanings arise in only a subset of these cases, contrary to the prediction of a root-based account like Jackson's. Obviously more would need to be known about exactly which meanings occur with which roots and in which morphological forms to know if the Pima facts support the extent-verb based analysis laid out above, but the situation does seem promising. And for English, the facts are clear—derived stative meanings arise in just those instances where the deverbal adjective is derived from a verb that allows an extent verb reading. Applied to English (and to Pima, given Jackson's comments above), the root-based analysis clearly overpredicts—it predicts derived stative readings with all roots that can form change of state verbs, contrary to fact.

Additional incorrect predictions of the root-based analysis when applied to English follow as a consequence of the fact that this analysis gives identical meanings to morphologically simple adjectives and to derived statives. Since both morphologically simple adjectives and derived statives are derived from the same root, and since neither derivation alters the meaning of the root, the two are guaranteed to have the same denotation. While knowing whether this is genuinely the case in Pima and in other languages with derived statives requires additional work, the data discussed above show clearly that this is not the case in English. Both the contradiction tests discussed in §3.1 and the adverbial modification facts discussed in §3.2 show that deverbal adjectives with derived stative meanings, at least in English, contrast in in their meaning with morphologically simple adjectives, contrary to the prediction of the root-based theory.

Another prediction of this analysis concerns the nature of the morphological marking of derived stativization and result stativization. On this analysis, by contrast with the analysis laid out above, there are separate lexical entries for the derived stativizer and the result stativizer, each having a denotation quite different from the other, as can be seen by investigating them in (53a,b) respectively. While the derived stativizer takes the meaning of a root and basically returns it without any modification, the result state morphology takes a root/stem and existentially quantifies its event argument. Given these two different denotations, the implicit claim of this analysis is that it is accidental that derived stativization and result stativization are marked morphologically identically in Pima. As such, the null hypothesis would be that crosslinguistically, derived stativization and result stativization would much more commonly be marked differently than identically. As stated above, a vast amount of work needs to be done in order to know whether this is the case or not, so it is impossible at this stage to say with certainly whether this prediction is in fact incorrect. It seems worth noting, however, that at

least in the cases I am aware of, it is much more commonly the case that the two are marked identically than non-identically, and this is certainly the case in English.

A final issue regarding the root-based analysis concerns the reason for the existence of derived stativizing morphology at all. In actual fact, many morphologically simple Pima roots can be used in their morphologically unmarked form, i.e. without *–s*, but with a a stative meaning, as noted by Smith (2006) and Jackson (2005b) himself:

> Some adjectives can be attributive or predicative without change in morphology. (Smith 2006:2)

> Most adjectives in Pima do not require any additional morphology to occur predicatively .... (Jackson 2005b:173)

This is illustrated by the data in (54).

(54) a. *D at o ge* **ge'e** *gogs.*
COP AUX:PF IRR CRTN big dog
'It's going to be a big dog.' (Smith 2006:1)

b. *Hoogi 'o pi* **moik**.
leather AUX:IMP not soft
'The leather isn't soft.' (Smith 2006:2)

If state-denoting roots can, in fact, appear with the stative denotation assigned to their lexical entry in their morphologically unmarked form, then this begs the question what exactly the function of the derived stativizer *–s* on this analysis actually is. If roots can have their stative meaning without it, then why bother having it at all in the cases in which it is present? Given that *–s* does not alter the meaning of the root in any way, the only answer can be that some roots can be used as free syntactic words in their morphologically simple form, while others cannot, hence *–s* suffixation with the latter group. But this would actually go against the fundamental DM premise assumed by Jackson that all roots are precategorial, and must merge with a functional head, even if phonologically null, to become free-standing words. An alternative answer that might be given in the context of DM is that the functional head realized by *–s* has another allomorph which is phonologically null. But if that is the case, then it certainly seems curious that the phonologically null variant is found with words having exactly the kind of property concept meanings that tend to be morphologically simple in their stative guise in language after language (Koontz-Garboden 2005, 2006, 2010; Embick 2009).

Exactly the same question arises when this analysis is applied to English. Consider e.g., *dark* versus *broken* in its derived stative guise. The morphologically simple adjective *dark* occurs with the kind of meaning that the root-based analysis assigns to derived statives, namely, a simple stative one. If derived stative *broken* is also built up morphologically from a root, and has a simple stative meaning, as proposed by this analysis, why must it be suffixed in order to realize the simple stative denotation of its morphological root while *dark* needn't be? Worse, as noted immediately above, why does this morphological pattern repeat itself in language after language? Stated in terms consistent with the idea in the DM framework that *dark* actually might be suffixed by phonologically null morphology, with derived statives, why doesn't the root just compose with the same word-deriving morphology that morphologically simple adjectives are constructed from, since the roots that both groups of words are constructed from have the same kind of simple stative denotation? In other words, in addition to predicting the wrong kinds of meanings for derived statives like *broken*, the analysis also makes the morphologically odd claim that words with certain kinds of stative meanings (Dixon's 1982 property concept

meanings) are more likely than words with other stative meanings to be suffixed by morphology of a particular phonological shape, namely null. Given the arbitrariness between form and meaning, this seems highly unlikely to be the case.

In sum, the root-based analysis when applied to English incorrectly predicts that derived statives have the same kind of meanings as morphologically simple adjectives, specifically in lacking as part of their meaning the event structure of the verb that they are derived from. As a consequence of this, they are incorrectly predicted to behave identically to morphologically simple adjectives on event structure diagnostics like those discussed above. The analysis also makes some predictions regarding morphology, both related to syncretism and markedness, that although less clearly incorrect, look likely to be. This, of course, is not to say that a root-based DM-style analysis of derived statives is impossible; in fact, I suspect the analysis I laid out above could be easily implemented in a DM framework, simply by giving the deverbal adjectivizing morphology the kind of denotation I do above and by having it operate on fully formed verbs, rather than on roots (though this still won't solve all of the morphological problems highlighted above). The crucial point is that the derived stative must inherit the meaning of the verb it is derived from, which is certainly possible in the context of such an analysis.

4.3 Condoravdi and Deo 2008

A final approach to deverbal adjectives, and derived statives more specifically, is presented by Condoravdi and Deo (2008), who are concerned with giving a formal analysis to the Indo-Aryan stativizer *–ta*, which, among other functions, derives adjectives from verbs with both derived stative and result state denotations.[24] This leads them to develop an analysis of deverbal adjective semantics, which although they make no claims of generality, could easily be applied to the meanings of English and other deverbal adjectives, and in fact, shares much with the theories laid out above.

The essence of Condoravdi and Deo's (2008) analysis lies in their treatment of the semantics of change of state verbs, from which derived statives and result states are derived. On their view, change of state verbs don't have a single lexical entry. Rather, they are all systematically polysemous, having "purely eventive denotations" at the same time that they have "denotations that pair the eventive component with the stative component of their meaning" (Condoravdi and Deo 2008:12-13). They illustrate this idea with the verb *yoke*, assigning it the two denotations in (55), a purely eventive one (55a), as well as the event/state pair in (55b) (x and y variables over ordinary individuals, e over events, s over stative eventualities).

(55) The two denotations of *yoke* in Condoravdi and Deo (2008:13)

a. $\lambda y \lambda x \lambda e[\text{put-yoke-on}(e) \wedge \mathit{Agent}(e, x) \wedge \mathit{Patient}(e, y)]$

b. $\langle \lambda e[\text{put-yoke-on}(e)], \lambda y \lambda s[\text{have-yoke-on}(s)(y)] \rangle$

When used as a verb, the lexical entry in (55a) is drawn upon. In composition with the stativizer *–ta*, however, (55b) is drawn upon, the idea being that "... *–ta* maps paired properties to [their] stative component" (Condoravdi and Deo 2008:13). When this happens, they claim that the denotation of the *–ta* suffixed verb, in the case of e.g., *yoke*, is as in (56).

(56) $\lambda y \lambda s[\text{have-yoke-on}(s)(y)]$

I.e., what *–ta* does is to operate on the paired meaning, extracting only the stative member of the pair. What this means, according to Condoravdi and Deo, is that:

[24] This suffix also has perfect and perfective meanings which Deo (2006) and Condoravdi and Deo (2008) explore in detail. These functions, however, according to Condoravdi and Deo (2008) involve different denotations, and are of no concern here.

> The eventive component of the meaning of the original predicate is not made available for semantic composition. Any implications about the existence of an event of the relevant type resulting in the truth of the stative predication are inferential. (Condoravdi and Deo 2008:13)

In this way, they capture their generalization that *–ta* suffixed adjectives can have derived stative meanings, or in the words of Condoravdi and Deo, that "...the *–ta* form does not entail the existence of a prior event of the type denoted by the corresponding verb" (Condoravdi and Deo 2008:3).

Without being able to lay claim to whether the facts of the Indo-Aryan *–ta* would bear out the theory proposed here or not,[25] at least when applied to the English data considered above, treating deverbal adjectivization as a process on a par with what Condoravdi and Deo (2008) propose for Indo Aryan *–ta* leads to a series of incorrect predictions, much like those already seen for other theories discussed above. First, since the meanings of change of state verbs are pairs as described above, and since this is precisely the input to stativization, this theory predicts, like both the deletion theory and the root-based theory, that there should be derived stative meanings derivable from all kinds of change of state verbs. As we have seen above, however, this is not the case. The flip side of this is that it will not be the case for any change of state verb that its deverbal adjective actually entails a prior temporal change. As they state (e.g., in the quote above), any implication of a prior change is only inferential on their analysis. As we have seen above, however, there are certain verbs whose deverbal adjectival derivatives, at least in English, have a clear entailment of prior temporal change. Equally problematic, like the root-based analysis and the deletion analysis, Condoravdi and Deo's theory predicts synonymy between morphologically simple adjectives and deverbal adjectives derived from deadjectival verbs, e.g., between *wide* and the derived stative reading of *widened*. As already discussed at length, this prediction is false; although the derived stative reading of *widened* does not entail a prior *temporal* change, this does not mean either that it entails no change at all or that it is synonymous with its morphologically simple adjective counterpart. Facts from adverbial modification and contradiction tests discussed above show clearly that it is not.

Like the other theories discussed above, then, Condoravdi and Deo's (2008) makes a series of empirically incorrect predictions. Only the theory proposed in this paper, whereby derived statives are derived from extent uses of change of state verbs correctly captures the previously unnoticed empirical observations made above.

5 Concluding remarks

The core empirical issue of concern in this paper has been instances of deverbal adjectives in which the sentence they appear in fails to entail there to have been an event of the kind named by the verb giving rise to the state named by the adjective. Contrary to what is explicitly claimed and predicted by several other analyses of this phenomenon, at least in English, these adjectives do, in fact, inherit the meaning of the verb they are derived from. At the same time, previous observers of the phenomenon who have noted that there is "no event" giving rise to the state named by the adjective are not completely wrong, either. While there is indeed no temporal event preceding the stative interval at which they hold, I have shown there to be a preceding event of *spatial* change. Corresponding to this observation, all deverbal adjectives showing this phenomenon have verbal counterparts showing extent uses of the change of state meaning they encode. I.e., they can encode events not only of temporal change, but of spatial change as well. Once it is appreciated that not all events of change are measured temporally,

[25] The facts given in Condoravdi and Deo (2008) underdetermine the analysis of derived statives, which wasn't the primary goal of their paper.

but can be measured out spatially as well, and that derived statives have verbal counterparts that show just this kind of use, it is possible to make sense of derived statives compositionally. In fact, I showed that they can be derived from their verbal counterparts, compositionally, in exactly the same way that normal result state uses of deverbal adjectives are derived, using the same adjectivizing operator. What gives rise to a derived stative versus result state meaning is simply the kind of interval the change is measured out over—a spatial or a temporal one.

The point of departure for this paper was the nature of semantic composition below the word level more generally and whether it is compositional or not. As discussed at the outset, there is a small but persistent set of phenomena in the lexical semantics and argument structure literature that has been argued to require word formation rules whose semantic reflex is the deletion of semantic primitives (contra the Monotonicity Hypothesis). To the extent that such operations exist, i.e., that the semantics of word formation really is different below and above the word level, this would be an argument against non-lexicalist theories of syntax, which predict there to be no difference between semantic composition in word formation and sentential syntax. What I have shown here is that there is no such argument from derived statives—they can be accounted for fully compositionally, consistent with a theory of word formation whereby the semantic side of these operations is fully compositional. This, of course, does not entail that non-lexicalist theories are right in reducing word formation to the principles of syntax. The facts are certainly also consistent with a lexicalist theory. What it does show, though, is that at least so far as derived statives are concerned, contrary to what has previously been assumed, the word formation operation giving rise to them is fully compositional, as must necessarily be the case on a non-lexicalist theory. Whether there are other phenomena that necessitate the assumption of fundamentally different kinds of semantic operations below and above the word level remains an open question.

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Appendix: Derived statives crosslinguistically

Derived statives are crosslinguistically common, having received explicit attention in the studies in Nedjalkov (1988), where Nedjalkov and Jaxontov (1988) in their crosslinguistic survey observe a distinction between two types of deverbal state denoting words, one which they dub *resultative* (=*result state*) and the other which they dub *stative*.

> "...the term resultative is applied to those verb forms that express a state implying a previous event. The difference between the stative and the resultative is as follows: the stative expresses a state of a thing without any implication of its origin, while the resultative expresses both a state and the preceding action it has resulted from... sometimes the past passive participle [otherwise a resultative] may be a stative"(Nedjalkov and Jaxontov 1988:6)

As suggested by Nedjalkov and Jaxontov, derived statives do not appear at all to be peculiar to English.[26] In this appendix I lay out data from secondary sources for several languages where the author in question claims the deverbal state-denoting form to have properties that make it sound like a derived stative.

Chichewa

- The stative involves suffixation of one of three allomorphs (*–k–, - -ik–, –ek–*) to a transitive verb (Mchombo 2004:95).

  (57) *Maúta a-na-pink-ik-a.*
  6.bows 6SM-PST-bend-STAT-FV
  'The bows got bent.' (Mchombo 2004:95)

- Semantically, it is claimed that the stative does not entail there to have been either a causing agent (Mchombo 2004:96) or a causing event (Dubinsky and Simango 1996:772, fn. 19), as exemplified by (58).

  (58) *Nthambi ndi* **yo-pind-ika** *ngakhale si-i-na-pind-idwe.*
  branch is AGR-bend-STAT even.though NEG-AGR-PAST-bend-PASS
  'The branch is [in a state of being] bent, event though it was not bent.' (Chichewa; Dubinsky and Simango 1996:772, fn. 19)

Chinese

- In Chinese *–zhe* is used to derive result states (Jaxontov 1988).
- It also has derived stative uses as well.

  > Chinese sentences having a resultative [=result state] as their predicate mostly denote states which by their very nature could have arisen only as a result of deliberate activity of an agent ... However there are sentences in which the resultative obviously denotes a state as such, unrelated to any preceding action (Jaxontov 1988:132).

  (59) *Xìxìde zhītiáo shang, guá-she l`üsé de shìz*
  thin branches from hung green DE persimmons
  'Green persimmons hung from thin branches.' (Jaxontov 1988:132)

- "Obviously, while persimmons did hang from the branches, they hadn't been hung there" (Jaxontov 1988:132).

Indo-Aryan

- According to Condoravdi and Deo (2008) (and many others before them), Indo-Aryan languages have a suffix *–ta* that derives state denoting words from change of state verbs (on the relevant use of *–ta*; their "lexical *–ta*" or "reading one"; Condoravdi and Deo 2008:3).

[26] Though the examples in the literature genuinely showing absence of temporal change are relatively few. This is also true of the data below, and as such not all of the examples are entirely convincing cases of derived statives.

> Despite the restriction to change of state verbal roots with an associated result state, the *–ta* form does not entail the existence of a prior event of the type denoted by the corresponding verb ... (Condoravdi and Deo 2008:3)

- "In [(60)], the *–ta* form predicates of the tree the state of being fixed/established in a certain location, and it certainly does not imply any event that resulted in coming about of this state" (Condoravdi and Deo 2008:4).

(60) *káḥ svid vṛkṣó* **níṣṭh-ito** *mádhy-e árṇas-o yá-m̐*
which indeed tree.NOM.SG fix-PERF.M.SG middle-LOC.SG sea-GEN.SG which-ACC
taugryó nādhi-táḥ paryáṣasvaj-at
taugrya.NOM.SG supplicate-PERF.M.SG cling-IMPF.3.SG
'Which tree (was it) that *was fixed* in the middle of the sea, to which Taugrya (the son of Tugra), supplicated, was clinging to?' (RV.1.182.7; Condoravdi and Deo 2008:4)

- "[(61)] is part of a characterizing description of Maruts (minor storm deities), which enumerates stable attributes of these deities rather than describing a result state obtaining from a prior event. The visors are understood as being in a spread-out position without there being a prior event by which they come to be in such a position" (Condoravdi and Deo 2008:4).

(61) *agníbhrājas-o vidyút-o gábhastiy-oḥ śíprā-ḥ*
fire.glowing-NOM.PL lightening-NOM.PL hand-LOC.DU visor-NOM.PL
śīrṣá-su **víta-tā** *hiraṇyáyī-ḥ*
head-LOC.PL spread-PERF.M.PL golden-NOM.PL
'Lightenings glowing with fire are on your hands; visors wrought of gold *are spread* on your heads.' (RV.5.54.11; Condoravdi and Deo 2008:4)

- These same forms, as implied above, can also have clear result state meanings: "The plain stative reading of *–ta* forms contrasts with their result stative reading, asserting the existence of a prior event and the result state it brings about" (Condoravdi and Deo 2008:5).

(62) *ayáṁ hí te śunáhotre-ṣu sóma índra tvā-yā́*
this FOC you.GEN.SG S-LOC.PL soma.NOM.SG indra.VOC you-DAT.SG
páriśik-to *mád-āya*
sprinkle-PERF.M.SG delight-DAT.SG
'This Soma juice *has been sprinkled* among the Sunahotras, in love, for your delight, Indra.' (RV 2.18.6c; Condoravdi and Deo 2008:5)

Pima

- Pima has a suffix *–s* that has been described as a:

> ... suffix added to active verbs and gerunds to form stative verbs [which mean] 'be in a (specified) state as a result of action.' (Saxton et al. 1983:51)

(63) *Haahag '0 veesko 'iig-s.*
leaf 3.SUB.IMP everywhere fall-STAT
'The leaves are fallen (and scattered) everywhere.' (Jackson 2005b:120)

- As Jackson (2005a, 2005b) notes, however, in some instances, an event preceding the state is not entailed.

  (64) *Voog 'o gahi nod:-s.*
  road 3.SUB.IMP sideways turn-STAT
  'The road turns to the side.' (Jackson 2005a:3)

- Jackson hints at a lexical semantic generalization about which roots allow/disallow derived stative readings with their *–s* derivatives that goes in line with the theory laid out above:

  > With intransitive verbs that do not lexicalize a path of motion or a spatial position, suffixation with the *–s* results in a verb which denotes (*sic*) an object that is characterized by the action of the verb ... (Jackson 2005b:119)

- To the extent that the above is correct (and more would need to be known about the behavior of individual verbs), then Pima is similar to English in allowing derived statives with COS verbs that have extent-like uses.

Others

- Languages for which it is claimed that there are derived statives, but for which data are presently lacking: Ancient Greek (Perel'muter 1988), Chukchee (Nedjalkov et al. 1988:155), Evenki (Nedjalkov and Nedjalkov 1988), Huave (Kim 2008:197). Data in Doron (2009) on Hebrew also look reminiscent of the facts discussed in this paper.

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