# Extent scales are licensed by atomic Incremental Theme objects: evidence from *begin DP*[1]

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**Abstract.** Dynamic event predicates denote ordered change in some scalar property corresponding to the theme participant. In particular, Change of State predicates map onto property scales (e.g. TEMPERATURE), while Incremental Theme predicates are measured out by the extent of their objects. In terms of VP composition, Rappaport Hovav (2008) proposes that property scales are hard-wired into the lexical semantics of verbs (e.g. *heat*), whereas extent scales are licensed by Incremental Theme objects. In this paper, I provide new evidence for this hypothesis. The relevant data come from VPs like *begin the book*, which have only an underspecified Incremental Theme reading. I then turn to examples like *begin eight films*, which are obligatorily distributive. I use this fact to argue for an even stronger hypothesis: extent scales are licensed by *atomic* Incremental Themes.

**Keywords:** scalarity, event structure, lexical semantics, incremental theme predicates, aspectual verbs, complement coercion, partitivity, distributivity.

## 1. Introduction

On the degree-based approach to event structure, event predicates denote ordered change in the value of some scalar attribute (e.g. extent, temperature, location) associated with the theme participant (Hay et al., 1999; Kennedy and McNally, 1999; Kennedy and Levin, 2002, 2008). For instance, the event of painting in (1a) is measured out by the surface area of the wall, the event of cooling in (2a) is homomorphic to the decrease in the temperature of the water, and the event of driving in (3a) is delimited by the progress of the ambulance across the bridge. More generally, Incremental Theme predicates map onto the extent of their theme, Change of State predicates involve property scales such as HEAT or WIDTH, while Path of Motion predicates track the location of some entity on a directed path. By allowing different predicate classes to map onto different scalar attributes, the scalar approach gives us a unified semantics for the VPs in (1)-(3) below.

(1) a. Sarah painted the wall in her living room.
    b. Patrick ate a pizza.

(2) a. The water cooled from 20 °C to 10 °C.
    b. The construction workers widened the road.

(3) a. The ambulance drove across the bridge.
    b. Mary pushed the cart to the supermarket.

I assume that every scalar VP must identify a scalar attribute to be interpreted. However, this still leaves open the question of where this scalar attribute comes from. What is the source of scalarity in VP composition? Which elements introduce extent, property and path scales into

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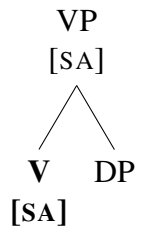
the semantics of complex VPs? Consider the simplest branching VP structure consisting of a verb and its complement. A structure like that presents us with two options: the scalar attribute can be encoded on the lexical head V or on the verbal complement DP. These alternatives are illustrated in (4a) and (4b), respectively.

(4) *The Source of the Scalar Atrribute (SA) in VP Composition*

a.



b.



The purpose of the present work is to defend and extend the hypothesis put forward in Rappaport Hovav (2008), according to which Change of State predicates are composed in accordance with (4a), while Incremental Theme predicates are assigned the semantic representation in (4b).[2] This is to say that property scales, as well as certain other scales which do not measure the extent of the theme, are hard-wired into the lexical semantics of specific verbs, e.g. *cool* → TEMPERATURE, *widen* → WIDTH, *ascend* → ALTITUDE. In contrast, Incremental Theme verbs (*paint*, *eat*) are devoid of any scalar properties. It is only Incremental Theme objects (*the wall*, *a pizza*) which contribute extent scales to the VP as a whole.

The current evidence for this position is threefold. Firstly, Change of State verbs are incompatible with resultative XPs that introduce their own scales (5a), whereas Incremental Theme verbs co-occur with all manner of resultative XPs (5b). Assuming a *one-scale-per-VP* constraint, this suggests that Incremental Theme verbs do not lexicalize any scales of their own. Secondly, verbs like *dim* and *cool* resist object drop (6a), while *scrub*, *read* and *eat* have unergative uses (6b). This can be explained if the presence of a scalar attribute requires the overt realization of the argument bearing that attribute. Finally, degree phrases take the form of VP-level modifiers in Change of State predicates (7a), but they appear as DP-internal modifiers in Incremental Theme predicates (7b)-(7c). This again points to the DP as the structural source of the extent scale.

(5) a. ??We dimmed / cooled / cleared the room empty.
b. We steamed the clothes dry / clean / stiff.

(6) a. All last night we dimmed *(the lights) / cooled *(the room).
b. All last night Cinderella scrubbed / read / ate.
(adapted from Rappaport Hovav, 2008)

(7) a. She warmed the soup more than he did / too much / ten degrees
b. ??Jones wrote the paper more / too much / two sections.
c. Jones wrote more / too much / two sections of the paper.
(adapted from Gawron, 2007, cited in Kennedy, 2012)

[2]Path of Motion VPs inherit their scalar attribute from goal/path PPs. Since my focus is on the properties of Incremental Theme objects, I set Path of Motion predicates aside for the rest of this paper.

In this paper, I provide new evidence for Rappaport Hovav's (2008) hypothesis that extent scales originate on Incremental Theme objects (see also Levin and Rappaport Hovav, 2010, as well as Rappaport Hovav, 2014). The relevant data come from the interpretation of aspectual verbs with DP complements, e.g. *begin/finish the book*. In Section 2, I show that the *begin DP* construction licenses extent scales to the exclusion of any other scalar attributes. Given the absence of a lexical verb in this VP, this is exactly what (8) predicts. A compositional analysis of this construction is provided in Section 3.

(8) Extent scales are licensed by Incremental Theme objects.

In Section 5, I make an even stronger claim: extent scales are computed on *atomic* Incremental Theme objects. I argue that this assumption is necessary to account for the obligatory distributivity of VPs such as *begin eight films*. After presenting a formal analysis of these cases in Section 6, I mention two other puzzles from English and Hindi that find a natural explanation if the strong version of Rappaport Hovav's (2008) hypothesis is adopted.

(9) Extent scales are licensed by *atomic* Incremental Theme objects.

## 2. Evidence from *Begin DP*

Most aspectual verbs, including *begin*, *start*, *finish* and *continue*, can be used with either DP or VP complements (10). Since the core function of these verbs is to map an event onto its initial, medial or final stage, most researchers consider the VP variant to be the primary one (Pustejovsky, 1991; 1993; Egg, 2003; Pylkkänen and McElree, 2006; but see Piñango and Deo, 2016, and the discussion in Section 4 for a different view). This creates the problem of how to derive the DP variant compositionally. Assuming that aspectual verbs have a constant denotation across their DP- and VP-related uses, what licenses the inference to an event of reading or writing in the absence of a lexical verb in (10a)?[3]

(10) a. Patrick began [$_{\text{DP}}$ the book].
b. Patrick began [$_{\text{VP}}$ to read/write the book].
c. Patrick began [$_{\text{VP}}$ reading/writing the book].

While lexical semantics and pragmatics certainly play a role in the interpretation of *begin DP*, it is not the case that sentences like (10a) can refer to any type of event whatsoever. Rather, the possible readings of *begin DP* are subject to the following semantic constraint:

(11) The denotation of *begin DP* is constrained to events which can be mapped onto an extent scale (i.e. underspecified Incremental Theme events).

Starting with the Incremental Theme predicates in (12), we observe that any incremental event described by *begin VP* can also be described by *begin DP*. Thus, *begin mowing the lawn* and *begin the lawn* can be used interchangeably in the context of someone mowing the lawn (12a). The other examples in (12) work in a parallel way. The sentence in (12f) is particularly interesting, as it suggests that the line between Incremental Theme and Change of State predicates is not always clear-cut. An event of cleaning the kitchen can be conceptualized in different

[3]Of course, *reading* and *writing* are not the only interpretive options in (10a). Given a sufficiently rich context, *begin the book* can also be interpreted as referring to the process of *editing*, *scanning* or even *eating the book*. For this last example, imagine that Patrick is the name of a particularly ravenous goat. See Lascarides and Copestake 1998 for a pragmatically-oriented approach to these data.

ways depending on the underlying scale: if we opt for the CLEANLINESS scale, the kitchen as a whole gradually shifts from being dirty to being clean; the use of the extent scale, in turn, implies that the kitchen area becomes incrementally affected by the action of cleaning. By hypothesis, *begin DP* can refer to any event which has an extent-based conceptualization; the existence of alternative conceptualizations is irrelevant for the generalization in (11).

(12) INCREMENTAL THEME PREDICATES
- a. The gardener began (mowing) the lawn.
- b. A broom in hand, the caretaker began (sweeping) the corridor.
- c. The graduate student began (preparing) her handout.
- d. The library printer finished (printing) my thesis in five minutes.
- e. The hikers finished (walking) the Appalachian trial.
- f. The couple finished (cleaning) the kitchen.

Moving on to the Change of State predicates in (13), we see that they cannot be described using the *begin DP* construction. This remains true even when the context is rich enough to license an inference to *warming*, *dimming*, etc. Crucially, all of these events map onto property scales such as TEMPERATURE or BRIGHTNESS. Furthermore, they cannot be reconceptualized as involving extent scales, since the progress of *safe-unlocking* or *spotlight-dimming* is not measurable by the physical extent of the safe or the spotlight, respectively. I conclude that the use of *begin DP* is restricted to Incremental Theme predicates, as hypothesized in (11). This conclusion is further confirmed by the infelicity of the examples in (14) with the lexical verb omitted. Verbs like *cross*, *surround* and *saddle* lexicalize complex path scales, so it is not surprising that they cannot be left out in the *begin/finish DP* construction, which is only compatible with simple extent scales.

(13) NON-INCREMENTAL CHANGE OF STATE PREDICATES
- a. John began ??(warming) his hands by rubbing them together.
- b. Blowing hot air on it, the boys began ??(melting) an ice cube.
- c. It was getting dark outside, so Mary began ??(lowering) the blinds.
- d. At the petrol station, Patrick finished ??(refilling) his car.
- e. Rotating the dial twice, the burglar finished ??(unlocking) the safe.
- f. As the curtain fell, the technician finished ??(dimming) the spotlight.

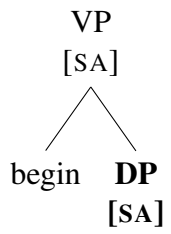
(14) PREDICATES INVOLVING COMPLEX SPATIAL SCALES
- a. Setting off from Spain, Columbus began ??(crossing) the ocean.
- b. Chased by a dog, the postman began ??(climbing) a tall fence.
- c. When the pigeons returned, the child began ??(scattering) the seeds.
- d. The siege began when the army finished ??(surrounding) the city.
- e. Before she mounted it, Angela finished ??(saddling) her horse.
- f. The hikers will finish ??(traversing) the country by early August.

The pattern of data in (12)-(14) is fully consistent with the hypothesis that extent scales are licensed by Incremental Theme objects, while property scales and complex spatial scales are lexically encoded on individual verbs. Specifically, I assume that the structure of *begin DP* is along the lines of (15a), with *begin* merged in the position of the main verb. I further assume that aspectual verbs do not lexicalize any scales, but that a VP headed by *begin* or *finish* needs to identify a scalar attribute to be interpreted. Logically, this leaves us with only one

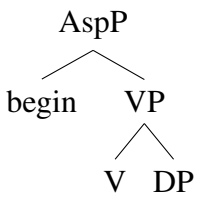
option: the scalar attribute must be introduced by the DP complement. Following Rappaport Hovav (2008), the only scales licensed by DP complements are extent scales, thus deriving the semantic constraint in (11).

(15) *An Aspectual Verb with a Complement DP (left) and VP (right)*

a.




b.




As for the structure of *begin VP*, I assume that *begin* occupies an aspectual projection above the VP. The VP-external position of aspectual verbs allows them to map entire event predicates onto their initial, medial or final stages. For more on the syntax of aspectual verbs, particularly with respect to their status as raising/control verbs, see Perlmutter (1970), Fukuda (2008) and references therein.

## 3. Formal Analysis: Part I

This section turns to the compositional analysis of *begin/finish DP*. I assume a semantic ontology containing objects (type $e$), events (type $s$), degrees (type $d$) and time intervals (type $i$). The domains of objects and events are organized into semi-lattice structures by the operation of sum formation $\sqcup$ and the subpart relation $\sqsubseteq$ (Bach, 1986; Landman, 2000; Champollion and Krifka, 2016). The domain of events is further ordered by the temporal precedence relation $\ll$. Moreover, I assume that all objects can be divided into 'things' and 'matter', with things related to their material substance by the material subpart relation $\sqsubseteq_m$ (Link, 1983). The material subpart relation will be used in Section 6 to measure the amount of 'stuff' that makes up atomic Incremental Theme objects. Finally, for the sake of simplicity, I treat degrees as points on a scale from 0 to 1, though see Kennedy (2001) and Kennedy and McNally (2005) for a more elaborate treatment in terms of positive and negative intervals.

My analysis of *begin DP* builds on Kennedy (2012) and Bochnak (2013) by presupposing the existence of a partitive Incremental Theme morpheme $\text{PART}_{inc}$. As shown in (16a)-(16b), this functional morpheme merges with the direct object in the syntax. Though often phonologically null, $\text{PART}_{inc}$ can also be realized overtly as the measure word *of* in e.g. *eat half **of** the sandwich*. In terms of its semantic contribution, $\text{PART}_{inc}$ maps an object $x$ onto a gradable predicate of events (type $\langle d, st\rangle$). It does so by introducing a measure-of-change function $\mathbf{part}_{\Delta}$, which measures how much of $x$ participates in the event $e$.[4] In a typical Incremental Theme event, the proportion of $x$ involved in the event increases monotonically as the event progresses in time. Together with Kennedy (2012) and Bochnak (2013), I propose that the measure-of-change function $\mathbf{part}_{\Delta}$ is the formal device responsible for introducing extent scales into the semantic representation of Incremental Theme predicates.

(16) a. $[\![\text{PART}_{inc}]\!] = \lambda x \lambda y \lambda d \lambda e.\mathbf{part}_{\Delta}(x)(y)(e) = d$

[4]In the definition of $\text{PART}_{inc}$, the object variable $y$ represents the subpart of $x$ which participates in $e$.

b. $[\![\text{PART}_{inc}\text{ the book}]\!] = \lambda d\lambda e.\exists y[\mathbf{part}_{\Delta}(\mathbf{book})(y)(e) = d]$

c. $[\![\text{read PART}_{inc}\text{ the book}]\!]^{telic}$
$= \lambda e.\exists d, y[\mathbf{read}(e) \wedge \mathbf{part}_{\Delta}(\mathbf{book})(y)(e) = d \wedge d = 1]$

d. $[\![\text{read PART}_{inc}\text{ the book}]\!]^{atelic}$
$= \lambda e.\exists d, y[\mathbf{read}(e) \wedge \mathbf{part}_{\Delta}(\mathbf{book})(y)(e) = d \wedge d > 0]$

The existence of $\text{PART}_{inc}$ leads us to a fully Neo-Davidsonian representation of Incremental Theme predicates, with the object severed from the verb. In (16c)-(16d), the verb *read* denotes a simple property of events (type $\langle s,t\rangle$). It combines with *the book* via a simple rule of Predicate Conjunction (Kratzer, 1996). Note that, without any further specification, the degree argument can be set either to the maximal value, entailing that the entire book was read, or to the minimal one, entailing only that some book-reading activity has taken place. This difference corresponds to the telic and the atelic construal of *read the book*, respectively.

What about the composition of *begin the book*? The original analysis of this construction assumes that the combination of an event-selecting aspectual verb with an object-denoting DP results in a type clash. This type clash can only be repaired by a special lexical or semantic mechanism, e.g. one retrieving the predicate *read* or *write* from the complex lexical entry of *book* (Pustejovsky, 1991, 1993).

The adoption of $\text{PART}_{inc}$ allows for an alternative analysis of *begin the book*, which does not involve a type clash followed by the application of a repair mechanism. Specifically, I assume that the semantic composition of *begin* and *the book* is mediated by $\text{PART}_{inc}$. The result of applying $\text{PART}_{inc}$ to *the book* is a gradable predicate of events, as in (16b) above. After the contextual binding of the degree argument, we end up with a predicate of events whose denotation can be paraphrased as *to incrementally affect the extent of the book in some unspecified manner*. It is this event predicate which serves as an input to the aspectual verb *begin*, on the well-motivated assumption that aspectual verbs take event predicates as arguments (Piñón, 1997). The semantic derivation of *begin the book* is illustrated directly below.

(17) $[\![\text{begin PART}_{inc}\text{ the book}]\!]$
$= [\![\text{begin}]\!]([\![\text{PART}_{inc}\text{ the book}]\!])$
$= \mathbf{begin}(\lambda e.\exists d, y[\mathbf{part}_{\Delta}(\mathbf{bk})(y)(e) = d \wedge d > 0])$

For concreteness, I formalize the denotation of aspectual verbs as in (18), with $\sqsubset_{init}$ and $\sqsubset_{fin}$ denoting the initial/final subevent relation, $\ll$ standing for temporal precedence and $\sqcup$ for the operation of sum formation. The final conjunct is required to ensure that there can be no crying going on before *Adam began to cry* and no drawing of a circle after *Victoria finished drawing a circle*. In other words, initial and final boundaries are defined relative to an event description P. For more details on the semantics of aspectual verbs and on boundary events in general, see the excellent analysis in Piñón (1997).

(18) a. $\mathbf{begin} = \lambda P\lambda e.\exists e'[e \sqsubset_{init} e' \wedge P(e') \wedge \forall e''[e'' \ll e' \rightarrow \neg P(e' \sqcup e'')]]$

b. $\mathbf{finish} = \lambda P\lambda e.\exists e'[e \sqsubset_{fin} e' \wedge P(e') \wedge \forall e''[e' \ll e'' \rightarrow \neg P(e' \sqcup e'')]]$
An event $e$ such that $e$ is the initial/final part of some P-event $e'$ and there is no earlier/later event $e''$ which extends $e'$ into a larger P-event

Overall, the analysis presented in this section provides further support for the existence of $\text{PART}_{inc}$, a functional morpheme merging with the direct object and introducing extent scales

into the semantics of complex VPs. The specific properties of $\text{PART}_{inc}$ not only account for the restriction of *begin DP* to Incremental Theme events, but they also allow us to compute the meaning of this structure compositionally, with no need to invoke a type clash and subsequent repair.

## 4. Comparison with Piñango and Deo (2016)

Before moving on to the atomicity constraint on $\text{PART}_{inc}$, let me discuss briefly an alternative analysis of the *begin DP* construction. The account presented in Piñango and Deo (2016) also predicts the restriction of *begin DP* to underspecified Incremental Theme predicates. However, it does so by relying on a very different set of assumptions. Most importantly, Piñango and Deo (2016) take the non-agentive, 'ordering' use of aspectual verbs to be the basic one:

(19) a. This chapter begins the book. $f_{identity}(\textbf{chap}) \sqsubset_{init} f_{content}(\textbf{book})$
b. A thunderstorm began the morning. $f_{time}(\textbf{thu}) \sqsubset_{init} f_{identity}(\textbf{morn})$
c. This valley ends the famous trail. $f_{space}(\textbf{valley}) \sqsubset_{fin} f_{space}(\textbf{trail})$

Glossing over the formal details, the main idea is that aspectual verbs take two arguments $x$ and $y$, and situate $x$ at the beginning or end of an axis homomorphic to the part structure of $y$. An axis is a one-dimensional directed path structure in any ontological domain, e.g. informational content in (19a), temporal traces in (19b) and spatial intervals in (19c) (Krifka, 1998).

In order to extend this analysis to the agentive *begin DP* construction in (20a), Piñango and Deo (2016) propose that the theme participant *the book* is mapped onto an event $e$ by the inverse thematic function $f_{th}$. Since $e$ is required to be an axis, homomorphic to the part structure of *the book*, it follows that $e$ must be an Incremental Theme event. At the same time, the agent participant *John* is mapped onto another event $e'$ by the inverse thematic function $f_{ag}$. The event $e'$ is then ordered at the beginning of $e$. The *begin VP* construction in (20b) receives a similar analysis, except that the axial event $e$ is contributed directly by the VP.

(20) a. John began the book. $f_{ag}(\textbf{John}) \sqsubset_{init} f_{th}(\textbf{book})$
b. John began reading the book. $f_{ag}(\textbf{John}) \sqsubset_{init} f_{identity}(e)$

While I see no problems with Piñango and Deo's (2016) approach to the non-agentive examples in (19), its extension to (20) suffers from serious drawbacks. There are at least two reasons to think that (19) and (20) should *not* be given a unified analysis.[5] Firstly, the non-agentive constructions have intransitive variants with PP complements (21a), while the agentive ones do not participate in such an alternation (21b). Secondly, in many languages other than English, only the intransitive variant of the non-agentive *begin/finish* is attested, cf. the German data in (22a)-(22b). At the same time, the agentive *begin/finish* construction in German work just like in English (22c). This suggests the agentive and the non-agentive uses of aspectual verbs should be analyzed independently.

(21) a. This book begins with an interesting chapter.
b. #The book began with John.

(22) a. Dieses Buch beginnt mit einem interessanten Kapitel.
this book.NOM begins with an interesting chapter.DAT

[5]Thanks to Matt Husband (p.c.) for pointing out these facts to me.

b. *Ein interessantes Kapitel beginnt dieses Buch.
an interesting chapter.NOM begins this book.ACC
c. Franz begann dieses Buch am Abend (zu lesen).
Franz.NOM began this book.ACC on evening to read

What is more, the semantics assigned to *begin/finish VP* by Piñango and Deo (2016) do not capture the meaning of aspectual verbs correctly. As shown in (20b), they assume that VPs denote events rather than event predicates, and that aspectual verbs apply to these events directly. To see that this approach makes the wrong predictions, consider an event $e$ of John running from 1pm to 3pm. This event comprises two subevents $e_1$ and $e_2$, such that $e_1$ involves John running from 1pm to 2pm, while $e_2$ is the event of John running from 2pm to 3pm. In theory, *begin* should be able to apply to $e_2$ to yield the initial stage of John running from 2pm to 3pm. However, the sentence *At 2pm, John began running* comes out as false in this scenario due to the existence of the previous running event $e_1$. The upshot of this discussion is that the denotation of aspectual verbs must be relativized to the event description provided by the VP (Piñón, 1997). Aspectual verbs cannot apply to events directly. Unlike Piñango and Deo's (2016) account, the current proposal is compatible with aspectual verbs taking event predicates as arguments, as evidenced by the lexical entries for *begin* and *finish* in (18).

In light of the dissociation between the agentive and non-agentive uses of *begin/finish*, as well as the requirement that aspectual verbs apply to event predicates, I conclude that the the $\text{PART}_{inc}$-based proposal is to be preferred over that of Piñango and Deo (2016). While both accounts explain the restriction of *begin DP* to underspecified Incremental Theme predicates, the present one does not suffer from the empirical and theoretical drawbacks surveyed above.

## 5. Evidence from Obligatory Distributivity

In the final part of this paper, I argue that extent scales are computed on atomic objects. The relevant hypothesis is repeated directly below.

(9) Extent scales are licensed by atomic Incremental Theme objects.

The evidence for (9) comes from obligatory distributive readings of *begin* and *finish* with quantified DP complements. The examples in (23)-(24) are constructed on the basis of Egg (2003), who first observed the asymmetry between *begin DP* and *begin VP* in the context of strong quantifiers. For context, assume that Max had made a New Year's resolution to read the collected plays of Shakespeare.

(23) On January 1st, Max began every play by Shakespeare
a. For every play, Max began to read it ($\forall > begin$)
b. *The plural event of Max reading every play began (*$begin > \forall$)

(24) On January 1st, Max began reading every play by Shakespeare
a. For every play, Max began to read it ($\forall > begin$)
b. The complex event of Max reading every play began ($begin > \forall$)

It appears that *begin DP* and *begin VP* do not have the same truth-conditions. While the distributive reading is available in both variants, only *begin VP* can pick out the beginning of a complex event of Max reading every play. Specifically, in a scenario in which Max managed to read only a few pages of *Hamlet* before falling asleep, *Max began every play* comes out as

false, while *Max began reading every play* can be true, provided that Max intends to read all of the plays in the future.

Egg (2003) explains this asymmetry as an effect of Quantifier Raising, which obligatorily applies to the DP *every play* (May, 1985). In the *begin DP* variant, the quantified DP raises over the main verb *begin*, thus invariably outscoping the latter. The *begin VP* structure admits more possibilities: *every play* may raise all the way to AspP, taking scope over *begin*, or it may raise only to the edge of the VP, scoping below the aspectual verb. In this way, the relative scope of *begin* is syntactically constrained by its VP-internal vs. VP-external position, in accordance with the standard generative assumptions about the mapping from syntactic structures to semantic representations at LF.

While Egg's (2003) analysis works for strong quantifiers, it does not extend to weakly quantified nominals, such as cardinal phrases (e.g. *eleven plays*), measure phrases (e.g. *two litres of water*) and pseudopartitive constructions (e.g. *half of the soup*). This is because the latter are not usually analyzed as scope-taking operators subject to obligatory Quantifier Raising. And yet, *begin DP* receives a distributive reading even when its complement is an indefinite cardinal DP:

(25) a. On January 1st, Max began eleven plays by Shakespeare (#but he only started *Hamlet* before he fell asleep).
b. On January 1st, Max began reading eleven plays by Shakespeare (but he only started *Hamlet* before he fell asleep).

A similar observation applies to the pseudopartitive construction *a quarter of his soup* in (26)-(27). The only difference is that the distributive operator must now apply to a mass noun referent, requiring us to impose some kind of partition onto the denotation of *the soup* (see Schwarzschild, 1996, for a cover-based approach to distributivity). The purpose of this partition is to divide the soup matter into a set of discrete and quantifiable units. I assume that the units of soup making up the partition are derived atoms. This allows me to maintain the definition of distributivity as universal quantification over atomic parts.

(26) a. ??Taking his first sip, Patrick began a quarter of his soup.
b. Taking his first sip, Patrick began eating a quarter of his soup.

(27) a. Patrick finished a quarter of his soup.
b. Patrick finished eating a quarter of his soup.

The hypothesis that *begin/finish DP* is obligatorily distributive with weakly quantified DPs accounts for the contrast between (26a) and (27a). What these examples entail is that 25% of the soup units are such that Patrick began/finished each of them. This paraphrase is compatible with the meaning of *finish*, but it is distinctly odd in a situation in which Patrick has only just started eating. To express the idea that Patrick intends to eat only a quarter of his soup (perhaps because he is on a diet), only the *begin VP* construction can be used (26b).

More generally, *begin* and *finish* license different entailment patterns with respect to the part structure of their complement. These patterns are schematized in (28): *begin* is upward-entailing while *finish* is downward-entailing on their arguments. The downward-entailing property of *finish* explains why *finish DP* is always compatible with distributivity. In turn, the

upward-entailing property of *begin* accounts for the strangeness of *begin DP* in non-distributive contexts.[6]

(28) For all $x$ and $y$ such that $y \sqsubseteq x$,
  a. *begin y* asymmetrically entails *begin x*
     e.g. *begin the foundations of the house* ⇒ *begin the house*
  b. *finish x* asymmetrically entails *finish y*
     e.g. *finish the house* ⇒ *finish the foundations / the walls / the roof*

All in all, the oddness of (26a) confirms that aspectual verbs with weakly quantified DP complements are obligatorily distributive. This fact is not predicted by Egg's (2003) Quantifier Raising account. However, it finds a natural explanation if extent scales are computed on atoms, in accordance with the hypothesis in (9). Hard-wired into the measure-of-change function $\mathbf{part}_{\Delta}$, the atomicity restriction requires *begin* to apply individually to each atom in the denotation of *eleven plays* and to each atomic unit in the partition of *a quarter of his soup*.

Interestingly, *begin DP* shares the property of distributivity with the preverbal *half* on its eventive use.[7] The fact that *begin eight films* and *half-watch eight films* pattern together becomes clear when we compare them with *begin watching eight films* and *partially watch eight films* in (29a) and (29b), respectively.

(29) a. On Monday, the critic began / half-watched eight films
     (#but he didn't start the last one until Wednesday)
  b. On Monday, the critic began watching / partially watched eight films
     (but he didn't start the last one until Wednesday)

Note that the clause in brackets is only compatible with a non-distributive construal, whereby *begin* and *partially* take scope over the complex event of the critic watching all eight films. To bring out this reading, imagine that the critic is contractually obliged to watch and review eight films for a weekly magazine. To the extent that this interpretation is not available in the (a) examples, we can conclude that *begin eight films* and *half-watch eight films* are obligatorily distributive.

The pattern in (29) falls into place once we observe that *half* is plausibly VP-internal, while the adverb *partially* is merged VP-externally. With respect to the VP-internal position of *half*, I follow Bochnak (2013) in assuming that *half* originates on the object, as in *watch half of the film*, and then prefixes to the verb at PF, yielding *half-watch the film*. The parallel behavior of VP-internal *begin* and *half* and VP-external *begin* and *partially* is captured by the following generalization:

(30) a. VP-internal items apply to atomic Incremental Theme objects, giving rise to distributive readings with quantified DPs

[6]This account predicts that *begin a quarter of his soup* should be felicitous in a more distributive context. To see that this is the case, imagine that Patrick has eight cans of soup in his cupboard, and that he subsequently opens and tastes two of them. In that scenario, it is true that *Patrick began a quarter of his soup.*

[7]Bochnak (2013) distinguishes between two uses of the preverbal *half*: the eventive *half* 'names the proportion of an event that is complete' (e.g. *John half-ate the apple in five minutes*), while the evaluative *half* 'makes a comment about the degree to which the event described represents a prototypical event of that type' (e.g. *Mary half-crawled into her seat*). I am only concerned with the eventive use here.

b. VP-external items apply to complex event predicates, allowing for non-distributive readings with quantified DPs

As a final refinement, consider what happens when *begin* and *half* take definite plural complements, e.g. *begin / half-watch the eight Oscar-nominated films*. A non-distributive construal becomes available again: (31a) is compatible with a scenario in which the critic began only some of the films on Monday, while (31b) can describe an event of watching exactly four films from start to finish. The hypothesis in (30) can accommodate these data provided that there exists a semantic operation which maps plural individuals (e.g. $\sigma[\lambda X.\mathbf{films}(X)]$) onto corresponding group individuals (e.g. $\uparrow\sigma[\lambda X.\mathbf{films}(X)]$), and that group individuals are derived atoms (Landman, 2000). In (31), the operation of group formation turns the referent of the definite plural into an atomic group, which licenses an extent scale measuring the total runtime of *the eight Oscar-nominated films*.

(31) a. On Monday, the critic began the eight Oscar-nominated films...
b. On Monday, the critic half-watched the eight Oscar-nominated films...
(...but he didn't start the last one until Wednesday)

## 6. Formal Analysis: Part II

What explains the restriction of VP-internal *begin* and *half* to atomic Incremental Theme objects? By hypothesis, the syntactic structure of *begin eight films* and *half-watch eight films* includes the functional morpheme $\text{PART}_{inc}$, which introduces the measure-of-change function $\mathbf{part}_{\Delta}$ into the semantic computation. The $\mathbf{part}_{\Delta}$ is inherently partitive, tracking how much of the object $x$ participates in the event $e$. One way of modelling the part-whole relation is by treating the 'whole' as an atom, and by relating the latter to its parts via the material subpart relation $\sqsubseteq_m$ (Link, 1983). On this view, the atomicity restriction is hard-wired into the meaning of $\mathbf{part}_{\Delta}$, thus deriving all the effects observed in the previous section.

To make this idea more explicit, I propose that $\mathbf{part}_{\Delta}$ is subject to the constraints in (32). According to (32a), the statement $\mathbf{part}_{\Delta}(x)(y)(e) = d$ conveys two pieces of information: firstly, $y$ is the theme participant in $e$; secondly, $y$ constitutes a $d$-sized part of $x$. The definition of the non-eventive partitive function $\mathbf{part}(x)(y)$ further specifies that $x$ must be atomic and that $y$ counts as its material subpart.

(32) a. $\forall x,y,e,d[\mathbf{part}_{\Delta}(x)(y)(e) = d \rightarrow \mathbf{theme}(e) = y \wedge \mathbf{part}(x)(y) = d]$
b. $\forall x,y,d[\mathbf{part}(x)(y) = d \rightarrow \mathbf{atom}(x) \wedge y \sqsubseteq_m x]$

Recall from Section 3 that the meaning of *begin DP* is computed by applying the aspectual function **begin** to the event predicate denoted by $\mathbf{part}_{\Delta}$ after the existential closure of its degree argument. This analysis assigns the semantics in (33a) to the VP *begin the film*.[8] When the singular object is replaced with the plural *eight films*, the distributive operator $^{\text{D}}$ must apply to the latter to ensure that the atomicity restriction on $\mathbf{part}_{\Delta}$ is satisfied. In (33b), distributivity is equated with universal quantification over atoms.[9] As a result, a new event of *beginning a film* is introduced for each atomic film in the denotation of *eight films*.

[8] See (18) in Section 3 for the denotation of aspectual verbs.
[9] See Champollion (2016, 2017) for an overview and alternative approaches.

(33) a. $[\![\text{begin PART}_{inc} \text{ the film}]\!]$
$= \exists e'\ \mathbf{begin}(\lambda e.\exists d, y[\mathbf{part}_{\Delta}(\mathbf{film})(y)(e) = d \wedge d = 1])(e')$
There exists an initial subevent $e'$ of an event $e$ such that $e$ incrementally affects the extent of the film in some unspecified manner.

b. $[\![\text{begin PART}_{inc} \text{ [8 films]}^{\text{D}}]\!] = \exists X.\mathbf{films}(X) \wedge \|X\| = 8$
$\wedge\forall x[x \sqsubseteq_{at} X \rightarrow \exists e'\ \mathbf{begin}(\lambda e.\exists d, y[\mathbf{part}_{\Delta}(x)(y)(e) = d \wedge d = 1])(e')]$
There exists a plural individual X consisting of eight films such that for each film $x$ there exists an initial subevent $e'$ of an event $e$ such that $e$ incrementally affects the extent of $x$ in some unspecified manner.

I do not provide denotation for *half-watch eight films*, but see Bochnak (2013) for the claim that the eventive *half* is a degree modifier, saturating the degree variable of $\mathbf{part}_{\Delta}$. Since the presence of *half* necessarily entails the presence of $\text{PART}_{inc}$, the distributive operator must once again apply to *eight films*.

## 7. Extensions and Future Prospects

If the account above is on the right track, it suggests that future reasearch needs to be more careful in distinguishing between extent scales (licensed by $\text{PART}_{inc}$ VP-internally) and quantity scales (computed VP-externally, perhaps at the level of the lower Asp head, as in Kratzer 2004 and Borer 2005). A dissociation between extent and quantity scales becomes apparent in iterative examples like (34) below. Even though *pizzas* and *sodas* are homogenous predicates, the presence of atoms in their denotations suffices to license the *in X time* adverbial in (34a). I suggest that, in this case, the *in X time* adverbial is licensed by $\mathbf{part}_{\Delta}$ applying to atomic entities. If correct, this entails that Incremental Theme predicates like *eat three pizzas* are doubly delimited, once by the extent scales corresponding to atomic pizzas and once by the quantity scale associated with the numeral *three*.

(34) a. John ate pizzas / drank sodas in ten minutes for an hour straight
b. John ate pizza / drank soda *in ten minutes for an hour straight
(adapted from MacDonald, 2008)

Furthermore, $\mathbf{part}_{\Delta}$ has the right properties to account for non-culminating accomplishments in the Hindi neutral perfective (35a). The difference between Hindi and English is that the former binds the degree argument of $\mathbf{part}_{\Delta}$ existentially (entailing the consumption of some but not necessarily all cake), while the latter sets it to the maximum value by default (implying the consumption of the entire cake). Crucially, the non-maximality of $\mathbf{part}_{\Delta}$ in Hindi is preserved even under the scope of numerals: the sentence in (35b) has a strongly distributive flavor, echoing the obligatory distributivity of *begin five apples* in English.

(35) a. mãẽ ne aaj apnaa kek khaayaa aur baakii kal khaaūūgaa
I ERG today mine cake eat.PERF and remaining tomorrow eat.FUT
'I ate my cake today and I will eat the remaining part tomorrow'
b. amu ne pããc seb khaaye
Amu ERG five apples eat.PERF
'Amu ate five apples' (not necessarily entirely, but each of the apples was affected)
(adapted from Singh, 1998)

I leave the relation between $\mathbf{part}_{\Delta}$ and non-culminating accomplishments in Hindi as a potential avenue for future research.

## 8. Summary

This paper has presented new data in support of Rappaport Hovav's (2008) hypothesis that extent scales originate on Incremental Theme objects in the process of VP composition. The relevant evidence comes from the *begin DP* construction, whose interpretation is restricted to underspecified Incremental Theme events. The absence of other readings is expected if property and complex path scales are hard-wired into the lexical semantics of such verbs as *heat*, *dim* and *cross*.

What is more, I have defended the view that extent scales are formally introduced by the Incremental Theme morpheme $\text{PART}_{inc}$, which combines with the direct object to yield a gradable property of events (Kennedy, 2012; Bochnak, 2013). The adoption of $\text{PART}_{inc}$ into the functional inventory has paved the way for a new analysis of *begin/finish DP*: aspectual verbs, which take event predicates as arguments, can now apply to $[\![\text{PART}_{inc}\ \text{DP}]\!]$ after the degree variable has been existentially closed. In other words, $\text{PART}_{inc}$ has the right properties to mediate the semantic composition of aspectual verbs with DP complements.

Finally, I have pointed out that examples like *begin eight films* and *half-watch eight films* are obligatorily distributive. This observation has led me to propose that the measure-of-change function $\mathbf{part}_{\Delta}$ imposes an atomicity restriction on its first argument. The reason for this restriction is that the meaning of $\mathbf{part}_{\Delta}$ is built on the semantics of partitivity. To model the part-whole relation, I hypothesized that the 'whole' is conceptually represented as an atom, and that it is related to its internal structure via the material subpart relation $\sqsubseteq_m$.

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