The English Progressive and the Finnish Partitive as Predicate Modifiers: A New Solution to the Imperfective Paradox

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Abstract

In this article I want to present a new approach to the semantics of the English progressive and show how the same ideas can also be applied to the semantics of the Finnish partitive case. In nearly all formal semantical theories of the progressive I am familiar with the progressive is formalized with the aid of a sentential operator. I suggest that if we formalize the progressive as a predicate modifier instead, we can solve many of the problems that have plagued previous theories of the progressive. I will start from Dowty’s classic theory of the progressive, show what defects have been found in it and show how it can be corrected.

1 Introduction

In this article I want to present a new approach to the semantics of the English progressive and show how the same ideas can also be applied to the semantics of a syntactic construction in my native language, the Finnish partitive case. In nearly all formal semantical theories of the progressive I am familiar with - with the exception of Landman’s theory [13] - the progressive is formalized with the aid of a sentential operator. I suggest that if we formalize the progressive as a predicate modifier or a propositional functor modifier instead, we can solve many of the problems that have plagued previous theories of the progressive. This approach is very natural because syntactically the progressive is a part of the verb phrase or of the verb, and verbs and verb phrases are most naturally analyzed as predicates or functors when natural languages are formalized in symbolic logic.

I will show that this approach has also the virtue that if we take the progressive to be a predicate or functor modifier we can actually define this operator by using concepts (such as selection functions) that have been used in the analysis of other natural language phenomena. We do not have to introduce any new

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primitive into the metalanguage in order to explain the progressive, as many semanticists like David Dowty do. This is clearly a gain in economy, and therefore supports my thesis.

I will start from the classical theory of the progressive presented by David Dowty in [6] and in [7] that has become the starting point of most modern discussion of the semantics of the progressive. Dowty discovered what is called the imperfective paradox and presented a solution to it.

Dowty’s solution has been criticized by many later researchers, for instance by Lascarides in [14] and Verkuyl in [23]. Lascarides calls the intuitive strategy Dowty uses the Eventual Outcome Strategy and argues that it leads to contradiction or triviality. Lascarides presents a theory of his own to replace Dowty’s theory, in which he assumes that in order to give the truth-conditions of progressive sentences we have to take account of contextual, pragmatic considerations. This assumption that pragmatic considerations are necessary is one shared by many semanticists today - for example, Tedeschi agrees [19, page 254] with Lascarides here and so does Asher [1, pages 456,483].

It seems to me that Lascarides’s and Asher’s criticisms of Dowty’s theory of the progressive are valid, though I will also show that other criticisms, the criticisms of Verkuyl, are not valid (as criticisms of Dowty’s theory of the progressive - Verkuyl does point out successfully weaknesses in other sides of Dowty’s theory of aspectuality). However, I will argue that Dowty’s theory can be mended so that it can withstand the criticism of Lascarides without taking into account any pragmatic considerations\(^1\). Therefore this article has wider methodological implications, as it supports the view that semantics is more autonomous with respect to pragmatics than is usually thought today. I will argue that the Eventual Outcome Strategy is basically correct, though the formal tools Dowty used to implement it were not wholly adequate.

Of earlier theories, my theory will be most similar in its basic ideas to that of Landman, but I need not presuppose as big an ontology as Landman does. Landman uses [13, pages 19,22] individuals, worlds, times, events and relations between events and functions from events to individuals as independent primitives. I will show that we can treat the progressive adequately without having to assume events as primitive, particular entities in the Davidsonian manner. This is of course no argument against the existence of events as primitive, particular entities since such events could be needed for any number of other purposes. I

\(^1\)This should not be understood so that I would claim that pragmatic considerations would be wholly irrelevant to the interpretation of the progressive. All I claim is that they are not needed to solve the problems they have been used to solve by semanticists like Lascarides or Tedeschi or Asher. It is often claimed in discussions about the interpretation of conditionals that selection functions are context-dependent, since the similarity criteria used in judging the similarity of worlds vary from context to context. Since I will be using selection functions in the interpretation for the progressive, it would follow from this that the interpretation of the progressive would also be context-dependent. I do not want to deny that this may indeed well be the case. Likewise, the quantification over projectible properties and intervals I will use is probably, like all kinds of quantification, often contextually restricted. Unlike the kind of contextual dependence Lascarides appeals to, these kinds of context-dependence are familiar, much investigated phenomena (though much about them still remains obscure).
will in this article suspend judgement on the question of the existence of events so conceived. I will just drop events from Landman’s model structures and use instead properties that can be defined using the rest of the elements of those structures. Therefore my theory offers an answer to the imperfective paradox discovered by Dowty within essentially the same theoretical framework Dowty himself would have accepted (Dowty did not accept events as primitives; see [6, page 58, footnote 7]).

In this article I can only discuss theories of the progressive that have been developed within the framework of possible world semantics. Much work on the progressive has also been done within situation semantics (for example in [8]), and I do not want to deny its value; I want only to show that the progressive can also be successfully treated in possible world semantics if it is taken to be a predicate modifier.

2 The Imperfective Paradox

The Imperfective Paradox consists of the fact that in examples like Example 1 and Example 2, the first sentence implies the second, but in examples like Example 3 and Example 4 the first sentence does not imply the second.

EXAMPLE 1  John was pushing a cart.
EXAMPLE 2  John pushed a cart.
EXAMPLE 3  John was drawing a circle.
EXAMPLE 4  John drew a circle.

We must find a way of explaining why the two sentences differ in this way. Even more fundamentally, we must explain what is it that makes it true that John was drawing a circle, if it is not the fact that he drew a circle.

According to Lascarides, The Eventual Outcome Strategy starts from the intuitive idea that a sentence of the form x is Ving is true if there is something going on, whatever it is, such that if it continues uninterrupted, the outcome will be that x VS. For example, the first sentence in Example 3 is true at a time if there is something going on, whatever it is, such that if it continues uninterrupted, the outcome will be that Max draws a circle. Dowty tries to express this idea but as Lascarides shows, his theory gives rise to conflicts and tensions. However, this alone is no reason to conclude that the whole intuitive idea is wrong.

I will show that the Eventual Outcome Strategy must be strengthened so that we add the condition that what is going on must somehow involve x essentially.

In the terms of traditional grammar, the Finnish partitive can be used either as the case of the subject or the object. When it is used as the case of the object a phenomenon similar to the Imperfective Paradox can be observed in the case of the Finnish partitive. As Fred Karlsson [11, page 80] notices:
The object is in the partitive if the action expressed by the verb does not lead to any "important" result (i.e., the action is irresultative). In English this use of the partitive often corresponds to the progressive form of the verb (be + ing).

Example 3 would be translated to Finnish as Example 5 but Example 4 would be translated as Example 6. Both sentences have the same form of the verb "piirtää", "piirsi", which is the third person singular past tensed form of the verb. The difference between the sentences rises from the fact that in the first the noun "ympyrä", standing for circles, appears in the partitive case as "ympyrää", while in the second it appears in the accusative case as "ympyrän". It must be noticed that the Finnish has no word corresponding to the English indefinite and definite articles. Rather, definiteness and indefiniteness are expressed by different means (such as word order, case, congruence etc.) in different contexts, seldom as unambiguously as in English, as seen in the fact that Example 5 could also serve as a translation of "John was drawing the circle." and Example 6 as a translation of "John drew a circle."

**EXAMPLE 5**

*John piirsi ympyrää.*  
John drew circle-part.  
John was drawing a/the circle.

**EXAMPLE 6**

*John piirsi ympyrän.*  
John drew circle-acc.  
John drew a/the circle.

From examples like this it would seem that the Finnish partitive has one meaning that is somehow similar to that of the English progressive. Therefore if I succeed in this article in developing a semantic theory for the English, I can also apply it to the semantics of the Finnish case system.

This is highly desirable, since in the tradition of Finnish linguistics no attempt seems to have been made to construct a wholly formal semantics for any part of the very rich Finnish infectional system. What semantical theory there has been has been very informal and therefore inexact. The defects of such an inexact theory can be seen in the quotation above. It is not quite correct to say that the object is in the partitive if the action expressed by the verb does not lead to any important result. Indeed, Karlsson himself sees that this characterization is not very exact as evidenced by his using scare quotes around the word "important". Even if Max does not succeed in drawing the circle, the fact that he was drawing a circle can lead to important results. Max may, for example, injure his wrist while drawing the circle. The same holds of the Finnish partitive sentence as it is equivalent with the English progressive one.

Rather, the most we can say is that the object is in the partitive if the action expressed by the verb phrase does not lead to *that* result to which it would lead in the case which we would express by using the corresponding verb phrase in which the object would be in the accusative. This means, of course, that the action does not lead to the result in question at the time we speak of, not that it does not lead to that result ever.
a necessary condition for when the partitive and progressive can be used, not a sufficient one, and is therefore not very informative. We surely cannot say of everyone whenever he does not draw a circle that he is drawing a circle, even if the "action expressed by the verb" is occurring (say if he is drawing a square) and the same holds for the Finnish sentence with the partitive. I suggest that the analogy Karlsson points out between the progressive and partitive provides the key to the meaning of the partitive. To get a sufficient condition for when the partitive can be correctly used we need to appeal to the Weakened Eventual Outcome Strategy, just as in the case of the English progressive. A sentence with a partitive object is true just in case there is something going on (essentially involving the subject of the sentence) such that if it continues uninterrupted, the outcome will probably be such as is described with the corresponding sentence with the accusative object.

The Finnish partitive has also other meanings that do not correspond to the meaning of the English progressive. Most importantly, as seen in [11, page 77] and in [11, page 81] the partitive is used, both when it occurs as the case of the subject of the sentence and when it occurs as the case of the object of the sentence, to express an indefinite, non-limited quantity of something, if the noun phrase to which it is applied is a divisible noun, such as a mass term or a plural noun, a group noun or some abstract nouns. In the case of such nouns the use of the nominative or accusative case is in contrast to that of the partitive and expresses a definite, limited quantity of something. This use of the Finnish partitive is roughly similar to that of lack of article and indefinite article in English, with some differences such as that the English opposition between definite articles and indefinite articles or lack of articles also operates in the case of indivisible nouns, unlike the Finnish opposition between accusative/nominative and partitive cases. I think it can be analysed formally by using a theory of generalized quantifiers, such as Verkuyl [23] develops in his theory of aspectuality, as I will briefly indicate at the end of this article.

When a divisible noun is used as the object of the sentence, the sentence seems to me to be ambiguous, since it can either both express whatever the

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3It is argued in [9] that the case of the Finnish object is always an aspectual marker and can therefore be given a unified, aspectual description. It seems indeed to be true that the Finnish case of the object does always affect the aspect of the sentences in which it appears, and this is an important discovery. However, it does not follow from this that the Finnish partitive could be given a unified semantic description, since in some cases, besides expressing what Heinämäki calls unbounded aspect, it also expresses an indefinite quantity of something, while in others it only expresses unbounded aspect. That the partitive does not always express any kind of indefiniteness is clear already from the possibility of such sentences as "Metsästäjä ampui tätä karhua" which would be translated as ‘The hunter shot at this bear’ in which the noun phrase "tätä karhua” ‘this bear’ clearly refers to a perfectly definite bear yet is in the partitive. These two functions are very different and it is vital to distinguish them (The distinction between bounded and unbounded aspect is analogous to the distinction between homogenous and heterogenous relations made by Dowty).

4It is somewhat controversial how close the use of the two Finnish cases is to that of definite and indefinite articles. Norman Denison argues in [5] that the distinction in Finnish is normally that between definite and indefinite, not between specified and non-specified, as it is in languages having articles. However, I do not think Denison makes at all clear how he understands this distinction between specified and definite semantically.
English progressive does and express an indefinite quantity of the denotation of the noun, or express only one of these things. For example, Example 7 can be translated into English in three different ways, as seen below.

**EXAMPLE 7**

Matti piirsi ympyriä.
Matti drew circles-part.
Matti drew circles.
Matti was drawing circles.
Matti was drawing the circles.

It must be noted that the partitive need not always have a non-trivial meaning. It has a non-trivial meaning only in linguistic contexts where it is in semantic opposition with other cases. It is in semantic opposition with other cases when an expression that occurs in the partitive can be replaced with the accusative form of the same expression so that the resulting sentence is still grammatical but has a different meaning. This is often not the case - e.g. the complements of numerical quantifiers must always occur in the partitive, and if they are replaced with the accusative or nominative the result is not grammatical. The same holds when a partitive is used as the complement of a negative verb phrase, the complement of some propositional attitude verbs used in the ascriptions of emotions (e.g. of "rakastaa", love) or the complement of some prepositions. When the partitive is not in semantic opposition with other cases, it is semantically empty. In a compositional semantics some meaning must nevertheless be assigned to it, and in these cases its meaning can be stipulated to be the identity function.

### 3 The Theory of Dowty

Dowty, like most of the semanticists that have given formal theories of the semantics of the progressive (including besides Dowty at least Cresswell, Verkuyl [23] and Vlach [24] and Lascarides), uses interval semantics in his theory of the progressive. In his semantics the truth of formulas is made relative to both intervals and possible worlds, or more exactly pairs of them. Dowty calls pairs of intervals and worlds indices.

There are many versions of interval semantics. Dowty follows a reductive approach, in which intervals are understood as continuous sets of instants. There are also approaches where intervals are taken as primitive and instants defined with their aid. In any case, most interval semantics make use of two relations between intervals, whether primitive or defined, and I will introduce them here. $I \subseteq J$ means that interval $I$ is contained in $J$, as the first year of the twentieth century is contained in the twentieth century. $I < J$ means that $I$ precedes (i.e. is prior to) $J$, as the nineteenth century precedes the twentieth.

The intuitive idea from which Dowty starts is [7, page 148] that a progressive sentence is true at a time if the most natural course of events would lead to the corresponding simple present tense sentence being true. To formalize this idea,
Dowty introduces into his metalanguage a new primitive function $\text{Inr}$, that associates with each index a set of *inertia worlds*. These, he says, are to be thought of as worlds which are exactly like the given world up to the time in question and in which the future course of events after this time develops in ways most compatible with the past course of events.

Dowty treats the progressive as a sentential operator which forms a sentence out of a sentence. Dowty gives [7, page 149] the following truth-conditions for progressive sentences.

\[ [\text{PROG } \phi] \text{ is true at } \langle I, w \rangle \text{ iff for some interval } I' \text{ such that } I \subset I' \text{ and } I \text{ is not a final subinterval for } I', \text{ and for all } w' \text{ such that } w' \in \text{Inr}(\langle I, w \rangle), \phi \text{ is true at } \langle I', w' \rangle. \]

Dowty accounts for the difference between the two sentences Example 1 and Example 3 by the different lexical semantics of the verbs ”push” and ”draw”. Dowty shows by decomposing the meanings of the verbs that the first expresses a homogeneous relation, while the second does not. A relation or property $R$ can be said to be homogeneous iff for all intervals $I$ and worlds $w$ and sequences of individuals $a$ if $a$ belongs to the extension of $R$ at $I$ in $w$ $a$ belongs to it at all (sufficiently big) subintervals of $I$ in $w$. Dowty uses Zeno Vendler’s [22] famous division of verbs into four classes, though he modifies it in important respects, since he does not accept Vendler’s idea [22, page 102] that achievements and accomplishments are instantaneous. The first of the two verbs, ”run” is a process verb, while the second is an accomplishment verb.

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Note: Vendler applied his classification of aspect to verbs and the relations they express, but later it has been often objected that it should really be applied to bigger syntactic units. Many semanticists apply aspectual distinctions exclusively to sentences or propositions. I agree that we can speak meaningfully of the aspect of sentences and propositions, but it seems to me vital that we should also be able to speak of the aspect of verbs and verb phrases (and also intermediate syntactic categories like V$^1$ in X-bar syntax, if such categories are needed) and their denotations. Vendler’s fourfold classification can probably be applied meaningfully only to verbs and verb phrases (and V$^1$s etc.), but the distinction between homogeneous and heterogeneous can be applied over the board, though often only in analogous, not strictly synonymous senses. A verb phrase (or V$^1$), just like a verb, is homogeneous iff it expresses a homogeneous property or relation, (though a verb phrase can only express a property, not a relation of higher adicity) but in the case of a verb phrase whose head is a transitive verb what kind of property it expresses depends not only on the aspect of the verb but also on what kind of set of properties the noun phrase that is its other immediate constituent expresses. A proposition $p$ can be said to be homogeneous iff for all intervals $I$ and worlds $w$ if $p$ is true at $I$ in $w$ $p$ is true at all (sufficiently big) subintervals of $I$ in $w$. A sentence is homogeneous iff it expresses a homogenous proposition. Whether a sentence is homogenous depends partly on the aspect of the verb phrase that is its immediate constituent.
but also on what kind of set of properties the noun phrase that is its immediate constituent expresses. Processes are homogeneous, while accomplishments are not. Dowty supposes that if a person runs at an interval, he must also run at all its subintervals, while if a person builds a house at an interval, he need not build a house at any of the subintervals of that interval. This assumption is quite natural. Building a house can take for example a year, and if a person builds a house in a year, he does not build it in the first month of that year, nor need he build any other house at that month.

4 Some Objections to the Theory of Dowty and Alternative Theories

I do not have the time here to go through the elaborate objections of Lascarides to Dowty’s theory in detail. I will present a simplified argument against Dowty’s theory based on some observations made by Lascarides that are also used by Asher that are already sufficient to show that Dowty’s theory needs some repairs. Lascarides shows that Dowty’s function $\text{Inr}$ cannot be well-defined.

Lascarides notices that intuitively, it should be possible that the sentences Example 8 and Example 9 are true simultaneously. However, this is impossible in Dowty’s theory.

EXAMPLE 8 Max is winning the race.

EXAMPLE 9 John is sabotaging the race.

To see that a situation where both sentences are true is possible, suppose that Max is running ahead of all the other participants in the race, while John is planting a bomb in the race-tracks.

We can easily show, however, that supposing both sentences are true at any interval $I$ at any world $w$ leads on Dowty’s theory to a situation where all progressive sentences are true. Let us suppose both sentences are true. Since Example 8 is true, for all the worlds $w' \in \text{Inr}(I, w)$ John wins the race, and since Example 9 is true, for all the worlds $w' \in \text{Inr}(I, w)$ Max succeeds in sabotaging the race. However, if Max succeeds the race is never completed and therefore John cannot win. It follows that $\text{Inr}(I, w)$ must be empty, and therefore anything is trivially true in all inertia worlds, since there are no such worlds. Therefore all progressive sentences are true. However, this is clearly absurd.

Lascarides admits that if the function $\text{Inr}$ would be defined relative to the semantic interpretation of formulae - which I will gloss as propositions - as well as intervals and worlds, the problem could easily be avoided. However, she argues that Dowty has no non-circular way to pick out a suitable formula. However, if we take the progressive to be a predicate modifier we can find a range of suitable propositions, namely the propositions true at the interval in question that essentially involve the individual to which the predicate is applied.
To be sure, we have no way of singling out one of them uniquely. However, we need not do this. There is no need to suppose that there must always be exactly one unique course of events that is more natural than any other. Rather, there can be many courses of events that are equally natural from different points of view, though there can also be unlikely, unnatural courses of events. We can quantify over them and say that if a simple present tense sentence is true in all the worlds contained in the value of the modified function given any of these propositions as an argument then the corresponding progressive sentence is true.

I can only sketch Lascarides's own alternative to Dowty's theory very briefly. Lascarides's own theory works with a different interpretation of accomplishments and achievements (which Lascarides lumps together under the name of events) than Dowty's. Lascarides divides propositions into event propositions, process propositions and state propositions. While Dowty thinks that the simple present tense sentence "Max builds a house" is true at the interval comprehending all the times at which Max is building the house, Lascarides thinks (as Vendler himself originally thought) that it is true only at the minimal interval when the house finally gets ready. Since states and processes can according to Lascarides be true at bigger than minimal intervals, this theory would separate processes from achievements and accomplishments as effectively as Dowty's theory does. Lascarides also tries to distinguish processes and states by a condition involving closed and open intervals that I unfortunately cannot go into.

It is hard to be sure which interpretation of accomplishments and achievements is better. While my intuitions on the whole tend to favor Dowty's idea and I will use it in this article, I do not want to commit myself definitely to it. It would be easy to modify the truth-conditions I give to the progressive in this article so that they would fit in with Lascarides's theory of events rather than Dowty's.

Lascarides, however, thinks that a progressive sentence does not determine a proposition independently of extra-linguistic context. It is this claim of Lascarides (shared by Tedeschi [19, page 254] and many others) that I want to challenge in this article. Lascarides thinks that the process proposition a sentence like "Max is building a house" expresses only has to satisfy the condition that for all intervals \(i\) and worlds \(w\) such that the sentence "Max builds a house" is true at \(\langle i, w \rangle\) there is a closed interval \(j\) s. t. \(i\) is the final bound of \(j\) and the process proposition is true at \(\langle j, w \rangle\). Apart from this, the proposition the progressive sentence expresses could be almost anything.

Nor does Lascarides say much about just how extra-linguistic context contributes to determining the proposition expressed by a progressive sentence. Contextual factors appear in his theory as a deus ex machina that somehow miraculously plug the gaps in his theory. Thus his theory leaves quite open the possibility that in some contexts the sentence "Max is building a house" could express the same proposition as "Max is alive", since if you finish building a...

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5 The theory of Lascarides utilizes ideas developed by Moens and Steedman and is formalized in a logic, IQ, developed by B. Richards and others.
house you must have been alive while building it. I can say no more than that this seems absurd to me. Intuitively it seems clear to me that a progressive sentence can be used to express a definite proposition in the absence of any such contextual factors. While I have no conclusive objection to the theory of Lascarides other than this intuition, it seems clear to me that it cannot be held satisfactory unless and until Lascarides supplements it with a detailed pragmatic theory of exactly how context contributes to determining the proposition.

There are some additional problems connected with the progressive that have been brought out by Fred Landman. Landman considers [13, pages 10-18] the following three examples:

**EXAMPLE 10** Mary was crossing the street when the truck hit her.

**EXAMPLE 11** Mary was crossing the Atlantic.

**EXAMPLE 12** Mary was wiping out the Roman army.

The first example is similar to those presented by Asher and Lascarides. The sentence can be true though in all worlds where nothing unexpected happens the truck hits Mary and she never crosses the street. However, the second example would not be considered to be true in a situation where Mary is not a very good swimmer and she swims for an hour and then sinks. On the other hand, it might be considered true in a world where Mary is just as bad a swimmer but she manages to make it across the ocean because of divine intervention. However, the third example would not be considered true in situations where Mary is a woman with normal strength and skill fighting the Roman army and succeeding in killing a few Roman soldiers. We need a theory that agrees with these intuitions.

Henk J. Verkuyl has also directed criticisms towards Dowty’s theory of aspect that he thinks also affect Dowty’s theory of the progressive. Verkuyl makes [23, page 206] a rather startling claim. He claims that the imperfective paradox does not exist at all! His argument for this claim is curious. He claims that Dowty uses the Imperfective Paradox as a test separating aspectual classes. He states that there are two versions: Homogeneity and Imperfective. Verkuyl uses the following formulation of the tests:

**Def 1** If V is an activity verb, then x V-ed for y time entails that at any time within y x V-ed was true. If V is an accomplishment verb, then x V-ed for y time does not entail that at any time within y x V-ed was true.

**Def 2** If V is an activity verb, then x is (now) V-ing entails that x hasV-ed. If V is an accomplishment verb, then x is (now) V-ing entails x has not (yet) V-ed.

Then Verkuyl tries to show that neither of the versions of Dowty’s test succeeds in always differentiating between Accomplishments and Activities. However, surely the two tests Verkuyl formulates, though also used by Dowty, have
little to do with the Imperfective Paradox! The first of Verkuyl’s tests does not contain any progressive verb at all. While the second contains a progressive verb, it still does not have anything to do with the imperfective paradox. The imperfective paradox concerns the relation between sentences or propositions of the forms “x was V-ing” and “x V-ed”, not the relation between sentences of the forms “x is V-ing” and “x has not V-ed”. These are surely completely different relations, since apart from the difference of tenses the first is a relation between two positive sentences neither of which contains a negation, while the second is a relation between a positive and a negative sentence. Also, Dowty can scarcely be using the Imperfective Paradox as a test separating aspectual classes when he formulates these tests, since he formulates these tests in his book many pages before even mentioning the Imperfective Paradox! Dowty formulates these tests in [7, page 57], but he first mentions the Imperfective Paradox in [7, page 133].

Therefore even if Verkuyl succeeds in showing that Dowty does not succeed in differentiating between Accomplishments and Activities with the aid of these two tests, this does nothing to show that the Imperfective Paradox does not exist! The paradox itself is formulated by Dowty without appealing at all even to the distinction between Accomplishments and Activities, much less to the two tests. Rather than using the Imperfective Paradox as a test separating aspectual classes, Dowty uses the aspectual classes to solve the Imperfective Paradox! That the distinction between the two aspectual classes can be used in solving the problem is part of Dowty’s proposed solution to the problem, not of the problem. Also, Dowty might be right in claiming that the distinction between the two aspectual classes can be used in solving the problem even if the way he distinguishes the two classes were wholly erroneous.

Therefore while Verkuyl’s arguments may show that something is wrong with Dowty’s theory of aspect in general, they do not even show that anything is wrong with Dowty’s theory of the progressive, but at most that something is wrong with Dowty’s theory of Accomplishments. Dowty’s theory of the progressive can be to a very great extent separated from his general theory of aspectuality and considered alone. However, in this article I am primarily concerned with the theory of the progressive and with the general theory of aspectuality only so far as it influences the theory of the progressive.

I will briefly consider Verkuyl’s argument that Dowty’s criteria do not work. Verkuyl next gives examples of sentences to which the first criterion does not apply. I can only consider two of his sentences because of limitations of space.

**EXAMPLE 13** John has drawn some circles.

**EXAMPLE 14** John has drawn three circles.

Verkuyl argues that since the sentences both contain Accomplishment verbs, they should have the same behaviour with respect to Homogeneity. However, in the first but not in the second one can go into the interval $i$ and meet a proper subinterval $i'$ which satisfies the same predication as $i$ itself.
Verkuyl next gives an example in which he claims the second of Dowty’s criteria does not work. According to him the first of the two sentences below does not entail the second, as the Imperfective test would demand.

**EXAMPLE 15** *John is drawing some circles.*

**EXAMPLE 16** *John has not yet drawn some circles.*

In the case of the latter example, one must notice that Dowty himself remarked that the test (originally proposed by Kenny) must be used with caution. Dowty remarked that

we must give a wide scope reading to any quantifier occurring within 

\( \phi \) to apply the test appropriately.

Verkuyl does not seem to notice this. If we give the quantifier "some" a wide scope reading, the test becomes that if John is drawing some circles then he has not yet drawn *those* circles. This is clearly true. Therefore Verkuyl’s second objection to Dowty’s theory of Accomplishments fails.

Nevertheless, it seems to me that in his first example Verkuyl has indeed shown a defect in Dowty’s theory of aspectuality, though not in his theory of the progressive. The reason for this defect is also clear. The reason why Dowty’s theory cannot analyze the sentences correctly is that it does not contain any account of plurality and therefore cannot strictly speaking analyze them at all.

However, this is surely not as serious an objection to the theory of Dowty as the objection of Lascarides, since the theory of Dowty was not intended to handle plural expressions. No theory can account for all phenomena. It is one think for a theory not to account for some phenomena (which defect surely is found in every theory) and another for it make false predictions, as Lascarides showed Dowty’s theory to do. Dowty’s two criteria yield quite correct results if their use is restricted to singular sentences.

The crucial question is whether Dowty’s theory can be expanded by adding a theory of plurality to it so that it can explain the phenomena in question. Verkuyl surely does nothing to show that it cannot. In the last section of this article I will provide some evidence that it can be done, though obviously I cannot prove it fully within the limits of this article. I will provide such evidence by starting from a theory of aspectuality basically like that of Dowty and adding a treatment of plurality to it, and showing that we can then account for the difference between sentence Example 13 and Example 14 and indeed more simply than in Verkuyl’s own theory. Verkuyl’s theory of aspectuality does incorporate a very sophisticated logic of plurality and so far it is superior to that of Dowty. However, this does not mean that Verkuyl’s theory of the progressive would be superior to or even equal to that of Dowty.

In fact, I will show that Dowty’s theory of the progressive is far ahead of Verkuyl’s, even given the error Lascarides pointed out in it. Indeed, unlike the theory of Lascarides, of which I could only show that it was at best seriously incomplete, Verkuyl’s theory of the progressive can even be refuted quite conclusively. This is, indeed, hard to see, since Verkuyl presents his theory of the
progressive only as part of the culmination of his entire theory of aspectuality, his logic PLUG+, which is not only extraordinarily complex (which is probably necessary given the variety of phenomena it deals with) but also very tersely presented.

The sentence Verkuyl uses as an example is the following.

**EXAMPLE 17** Judith was eating three sandwiches.

Verkuyl gives [23, page 352] the following formalization for it:

\[
\exists I \exists I_R \exists J \exists V [V = ([[Judith]] \cap \{ j_i \} \cap \exists W [W \subseteq [[sandwich]]] \wedge |W| = 3 \wedge \exists QpsW [Q = \cup_{i \in J} \{ U \cap [[sandwich]] : ([[eat]])(J)(i)(U)(V)])] \wedge I \subseteq J \wedge I = \text{Ent}^+(I_R) \wedge \text{Tense}_<(I_R)(i*)].
\]

It is obviously impossible for me to explain this formula in detail. However, I will go through it and Verkuyl’s associated theory swiftly. Verkuyl takes this sentence - like the simpler sentence ”Judith ate three sandwiches” - to be constructed from a tenseless sentence ‘Judith eat three sandwiches’ which speaks about about a relation between the singleton of Judith, two sets of intervals, and the set of three sandwiches. To this is added (in accordance with Chomskyan theories) a constituent called INFL, that adds to it tense information by relating it to the time of utterance, in this case \(i^*\). Intervals, however, are taken to be just sets of numbers, natural or real numbers, not real stretches of time as in the theory of Dowty (Verkuyl actually stresses this often). \(I, I_R\) and \(J\) in the formula above are such sets of intervals, that is to say, sets of numbers. Tenseless sentences are interpreted as sets of such intervals. Tensed sentences, however, are interpreted as truth-values. Verkuyl compares the relation between these interpretations to that between the score of Beethoven’s piano sonata in C sharp minor and its performance in real time. Verkuyl takes like Dowty the progressive to be a sentential modifier. It is applied to the basic tenseless proposition before INFL.

The basic idea in Verkuyl’s theory of aspect is that possible intervals during which Judith would eat three sandwiches can be partitioned into intervals, during which Judith eats some subset of these three sandwiches. This idea is needed to account for the interaction of aspect with distributive and collective readings of various sentences. For instance, Judith might first eat one sandwich and then the remaining two during the same interval (taking first one bite from the first, then one bite from the next, then returning to the first, and so on, or he might eat first one sandwich, then after it was finished the second, and only after this was finished the third. The variable \(J\) in the formula above refers to such a set of intervals into which the time of eating is partitioned. \(W\) in the formula is taken to stand for the set of three sandwiches Judith was eating. \(QpsW\) means that \(Q\) is a partition of the set \(W\) coresponding to the partition of intervals \(J\). \(Q\) partitions the set of three sandwiches to the sets of sandwiches Judith would eat simultaneously. \(\text{Ent}^+\) is a relation that associates sets of real numbers with sets of natural numbers, and thus relates two representations of intervals, continuous and discrete ones. \(I \subseteq J\) means that \(I\) is a subset of \(J\),
a subset during the intervals contained in which Judith would be eating some subset of the sandwiches. It could, for example, be the singleton of the interval during which Judith eats the first sandwich, or the set of two intervals during the first of which she eats the first sandwich and during the second of which she eats the second. $Tense < (I_R)(i^*)$ means that all the intervals in the set $I_R$ are earlier than the time of utterance $i^*$. Somehow the interval $I^*$ and the intervals in $I_R$ are (rather arbitrarily, it seems to me) taken to be or to represent a real time, the time of utterance, though in order for this formula to make sense it must also be a set of numbers just like the other intervals contained in $I$ and $J$ that Verkuyl says need not represent any intervals of real time. According to Verkuyl the progressive sentence is true if some intervals belonging to the partition $J$, which are contained in $I$, are actualized in the real world. Verkuyl himself says [23, page 323] the following about his formalization of Example 17:

This does not say anything about the possibility for Judith to have completed the eating of three sandwiches. Only, one is left in the dark about whether or not this happened. The only thing one can derive from the score-proposition associated with $j$ is that had it been actualized in real time it would have yielded a terminative eventuality.

If this is all that is needed for a progressive sentence to be true then the following will surely be true whenever Judith killed a fly.

**EXAMPLE 18** Judith was destroying everything in the universe.

A possible interval during which the tenseless score proposition [[Judith destroy everything in the universe]] would take place can be partitioned into four intervals such that during the first interval Judith kills one fly, during the next she destroys the planet Jupiter, during the next she smashes a couple of galaxies, and during the last she annihilates everything else. Now if we formalize Example 18 analogously to the way Verkuyl formalized Example 17 we can take the set of intervals $I$ to be the singleton of the interval during which Judith kills the fly and the formalization gives truth-conditions according to which Example 18 is true since Judith killed a fly. Surely if the score proposition [[Judith destroy everything in the universe]] had been actualized in real time it would also have yielded a terminative eventuality, a very terminative eventuality indeed! However, obviously if Judith killed a fly, we would not say she was destroying the universe!  

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6I must add that it seems to me there is another just as plausible interpretation of Verkuyl’s formula as the one he himself gives - or even more plausible. It seems to me that it would be more consistent to hold that Verkuyl’s formula can only be true if the intervals contained in $J$ also represent intervals of real time just as well as those in $I_R$. The interpretation we would get in this case would say that Judith has eaten or will eat three sandwiches at some interval part of which is earlier than the present. Unfortunately, this is not much better than the earlier interpretation, since Example 17 can be true even if Judith never eats any of the three sandwiches. This seems to me to show conclusively that in order to mend Verkuyl’s theory of the progressive we would have to add to the semantics of PLUG+ a set of possible worlds besides the set of intervals and make it fully intensional.
5 A New Theory

The most novel idea of my theory is to use PROG as a predicate or functor modifier. However, this leaves open the question of what kind of predicates it modifies (even if we leave event predicates out of account). If we are working in a higher-order language, there are both first-order predicates and various kinds of higher-order predicates. We must ask what order of predicates the verbs of natural languages should be formalized as.

In the theory of plurality there is wide though far from universal agreement that in order to formalize collective readings of sentences with a plural main verb we must suppose that verbs serve as predicates of sets (a kind of theory among whose oldest representatives is [3] and which was perhaps most famously defended by [12]). For instance in the case of the sentence "Three men build a house" the verb "build" would be predicated of the set of three men in question. In order to account for the collective reading of such sentences as "Three men are building a house" we must suppose that the progressive operator modifies this predicate of sets.

Usually the same analysis of verbs as predicates of sets is applied to singular verbs to the sake of uniformity, as by Landman and as in Verkuyl’s PLUG-grammar. I will follow this approach to show how the fruitful ideas of Dowty and Verkuyl can be combined, though I do not think it has any decisive advantages over the alternative approach where plural verbs are taken to be a a higher type than singular ones. I do not think the difference between these two approaches goes very deep, but rather that it is a question of convenience which of them to use.

In order to deal with the progressive of both singular and plural verbs we must demand that if if $P$ is a monadic second-order predicate then $\text{PROG}(P)$ is also a monadic second-order predicate, and therefore if $Q$ is a first order predicate terms, $\text{PROG}(P)(Q)$ is a well-formed formula (or a first order predicate term). If we treated only singular phrases or gave a different treatment to singular and plural phrases, we could demand that if $P$ is a monadic predicate (or functor) then $\text{PROG}(P)$ is also a monadic predicate (or functor), and therefore if $a$ is a singular terms, $\text{PROG}(P)(a)$ is a well-formed formula (or a singular term).

I will now formalize both the English sentence Example 3 and the Finnish sentence Example 5 I used before as Formalization 2. The use of λ-abstraction is necessary here because the existential quantifier must occur within the scope of the progressive operator since no circle John builds need exist in the actual world even if Example 3 is true. As usually in set-theoretic notation, $|Y|$ stands for the cardinality of the set $Y$ and $\{x\}$ for the singleton of set $x$ and $X \subseteq Y$ means that $X$ is a subset of $Y$.

Formalization 2 $P(\text{PROG}(\lambda X)((\exists Y)(Y \subseteq \|\text{circle}\| \land |Y| = 1 \land (\forall x)(x \in X \rightarrow (\forall y)(y \in Y \rightarrow \text{draw}(X,y))))(\{\|\text{john}\|\})).$

This formalization is obviously equivalent with the following first-order formalization:
Formalization 3 \[ P(\text{PROG}(\lambda x)((\exists y)(\|\text{circle}\|)(y) \land \text{draw}(x, y))((\|\text{john}\|))). \]

The Finnish sentence Example 5 has at least the two following formalizations below. Here we begin to get some use of using the higher-order formalization of verb and noun phrases.

Formalization 4 \[ P(\text{PROG}(\lambda X)((\exists Y)(|Y| > 1 \land Y \subseteq \|\text{circle}\| \land (\forall y)(y \in Y \rightarrow (\forall x)(x \in X \rightarrow \text{draw}(x, y))))(\|\text{john}\|)). \]

Formalization 5 \[ P((\exists Y)(|Y| > 1 \land Y \subseteq \|\text{circle}\| \land (\forall y)(y \in Y \rightarrow (\forall x)(x \in \{\|\text{john}\|\} \rightarrow \text{draw}(x, y))))). \]

I will use as my basic semantic framework an interval semantics with a set \( E \) of individuals and a set \( I \) of intervals and a set \( W \) of possible worlds similar to that used by Dowty but with one difference: While Dowty took moments of time as primitives and defined intervals as sets of moments, I will here adopt a less reductive approach and take intervals as primitives. Also unlike both Dowty and Verkuyl I will not suppose that the set of intervals has the same kind of structure as sets of real numbers or sets of natural numbers. It seems to me that in order to deal with the progressive we need not suppose anything about the metric structure of time, but purely topological concepts are enough. I will suppose there are two relations between intervals; \( i \leq i' \) means that interval \( i \) precedes interval \( i' \) and \( i \sqsubseteq i' \) means that \( i \) is a subinterval of \( i' \). I will suppose of these relations only that they are partial orders and satisfy such obvious topological conditions as that if \( i \leq i' \) and \( i' \sqsubset i' \) then \( i \leq i'' \) (see [21] for a full enumeration and discussion of such conditions).

I will model propositions as (characteristic functions of) sets of pairs of intervals and worlds (if we were formulating a logic of belief this conception of propositions would of course not be satisfactory, since it would lead to logical omniscience) and properties and relations as functions from sequences of individuals or sets of individuals to propositions. I will take the intensions of predicates to be properties in this sense and the intensions of sentences to be propositions in this sense.

However, in order to avoid trivializing the truth-conditions we will give to progressive sentences completely, we must exclude excessively gruesome properties and relations from consideration. For instance, we must exclude such properties as "being persons who build a house sometime during this century" from consideration. One of the most difficult problems of scientific methodology concerns the question of what predicates and properties are projectible (see for example [18]), Goodman’s new riddle of induction. No matter how and on what basis this division is carried out
actualism. A subjectivistic theory, on the other hand, might say that projectible properties and relations are those that correspond to concepts that are psychologically basic for human beings. If we choose a subjectivistic theory of projectibility, then the semantics of the progressive would also contain a subjectivistic element. Nevertheless, it would also contain strong realistic elements, and would thus differ from wholly conceptualistic semantics., such a division must somehow be made if we are to make any sense of non-demonstrative inference. I propose that we use this distinction in the semantics of the progressive. Properties and relations must be such functions as could be expressed by projectible predicates. However, this idea can perhaps offer us at least some structure to use in our semantics. John Pollock has argued [17, page 424] that the class of projectible predicates should be closed under conjunction, but not under disjunction or negation 7. This idea seems correct to me and I think the idea can also be extended to properties no predicates actually express. Therefore transforming it into set-theoretical notation I will suppose that for all projectible relations \( A_1 \) and \( A_2 \), \( A_1 \cap A_2 \) is also projectible.

It has often been objected that Dowty’s definition of homogeneous predicates is probably too strong while his definition of heterogeneous predicates is correspondingly too weak. For example, a person can be said to push a cart at an interval even if he takes short pauses to catch his breath. We can define a weaker concept of homogeneity and a stronger concept of heterogeneity. A relation or property \( R \) can be said to be \emph{weakly} homogeneous iff for all intervals \( I \) and worlds \( w \) and sequences of individuals \( a \) if \( a \) belongs to the extension of \( R \) at \( I \) in \( w \) \( a \) it belongs to it at some subintervals of \( I \) in \( w \), including some initial and final subintervals of \( I \) in \( w \). Naturally, a relation is \emph{strongly} heterogeneous iff it is not even weakly homogeneous.

There are other aspectually significant classifications of relations besides the division into homogeneous and heterogeneous Dowty uses. Relations can be divided into punctual and non-punctual. A relation \( R \) is punctual if there are intervals \( i \) and worlds \( w \) and sequences of individuals \( a \) such that \( a \) belongs to the extension of \( R \) at \( i \) in \( w \) and \( i \) has no subintervals (or perhaps more exactly no subintervals big enough to be noticable with unaided senses). This concept can perhaps be used to explain why the progressive can occur with some statives but not others. Dowty suggests [7, page 176] that the progressive can not be used with verbs standing for punctual relations. While most statives like “understand” are punctual, others like ”stand still” are not, since an object that is standing still and one that is moving can have exactly similar momentaneous states 8.

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7Pollock actually uses a dyadic concept of projectibility, speaking of a property being projectible with respect to another property. However, I do not think that is necessary.

8Dowty is not himself sure of this solution, and presents a couple of alternative solutions that supplement it. It may be that an appeal to particular events, which I have argued is unnecessary elsewhere in the semantics of the progressive, would be useful with regard to this particular problem, since one of the alternative solutions Dowty explores, one proposed originally by Gregory N. Carlson, is based on a distinction between object-level and stage-level predicates, where stage-level predicates are predicates of particular events or have an argument ranging over particular events. It must be noted that what verbs can occur in the
Using the notion of projectible properties, we can define one notion that Dowty has already used [7, page 146] as a primitive in his theory and that is also used as a primitive very widely in multimodal logics that include temporal logic and other logics such as the logic of conditionals (as for example in [20]). Let \( w \sim_i w' \) mean that the two worlds \( w \) and \( w' \) are exactly similar at interval \( i \) and at all intervals preceding \( i \). This relation can now be defined so that \( w \sim_i w' \) iff for all intervals \( i' \) s. t. \( i' \leq i \) for all individuals \( a \) a exists in \( w \) iff it exists in \( w' \) at \( i' \) and has exactly the same projectible properties in \( w' \) as in \( w \) at \( i' \). We can now systematically exclude such properties as "being a person that builds a house sometime during this century" from consideration. Properties like this can be called future-looking. Let us say that \( A \) is future-looking if for some world \( w \) and interval \( i \) \( A \) holds of \( x \) at \( i \) in \( w \) but for some \( w' \) s. t. \( w \sim_i w' \) \( A \) does not hold of \( x \) at \( i \) in \( w \). It follows immediately from our definition that projectible properties are not future-looking. In fact, the set of properties quantified over in the semantics of the progressive will probably have to be restricted a lot more strictly, so the definition below must be understood as only the first stage in the analysis of the progressive.

Dowty’s function \( Inr \) is a lot like the selection function used in the semantics of conditionals, except that its first argument has been left out. I will show that if we formalize the progressive as a predicate modifier we can replace the function \( Inr \) with the usual selection function. This is obviously a gain in economy, since the selection function is needed in the semantics of natural languages anyway. It is not only useful in the semantics of conditionals, but Dowty himself has used it in defining a causation operator (following Lewis) and has used this causation operator in the lexical decomposition of accomplishment verbs.

There are many competing theories of conditionals using different kinds of selection functions. There are probably three most important theories, those of Robert Stalnaker, David Lewis and Donald Nute [16]. Stalnaker uses a selection function whose values are worlds, while both Lewis and Nute use selection functions whose values are sets of worlds. I will use a selection function of the latter kind here. One reason for this choice stems from the fact that Dowty also uses such a selection function in his theory of causation [7, pages 101-103] that he uses in his theory of aspect. Since the theory of the progressive is closely connected with the theory of lexical aspect, it is desirable to develop it so that it can be integrated with a good theory of aspect as easily as possible. Dowty’s theory of aspect is, however, a classic theory on which most of the progressive is basically a syntactic question (like the similar question when the Finnish object or subject can occur in the partitive). While there may be some semantic explanations for what regularities there are in such syntactic phenomena (and the suggestion of Dowty is certainly as good as any offered for the occurrence of progressives with statives), such syntactic phenomena are certainly not wholly regular and all of their irregularities need not have any semantic explanation (or indeed any systematic explanation at all), but must be treated by primitive subcategorization rules in the lexicon. In any case, these kinds of questions concern the interface of syntax and semantics and are therefore not central in the semantics of the progressive, where the vital question is how the progressive contributes to the truth-conditions of sentences in which it (for whatever reason) can appear, and in this article I concentrate on this question.
present theories of aspects are based at least partly. I do not want to make a
decision, however, between the theories of Lewis and Nute, so I only impose on
the selection function such minimal conditions as both Lewis and Nute agree
are necessary 9.

Neither Lewis nor Nute take temporal factors into consideration in their
basic semantics for conditionals. It is of course wise to abstract from complicat-
ing temporal considerations when trying to figure out the very basics of the
semantics of conditionals. If we want to apply the semantics of conditionals
to the theory of conditionals, however, we have to modify their theories. The
arguments of the selection function have to include not only propositions and
worlds, but also temporal intervals 10.

Let \( s \) be a selection function such as is used in a temporalized version of David
Lewis's or in Donald Nute's theories of conditionals. That is to say, it associates
with every proposition (understood as a set of world-interval pairs) and world-
interval pair a set of worlds. Intuitively for all \( p, i, w \) and \( w', w' \in s(p, i, w) \) iff
\( w' \) is one of the worlds most similar to \( w \) at \( i \) in which \( p \) is true or sufficiently
similar to \( w \) at \( i \) and \( p \) is true in it

\footnote{Asher uses in his truth-conditions for the progressive a function \( * \)
that associates with every world and proposition \( p \) the normal \( p \) worlds. This
function is similar to the function \( s \) I use. However, there are crucial differences.
Asher's function is not relativized to intervals. Also, the worlds in \( s(p, i, w) \) need
not all be normal worlds; if an exceptional, very unlikely or even miraculous
event occurs in \( w \) and \( p \) is true in \( w \), then \( w \) belongs to \( s(p, i, w) \) and the
unlikely or miraculous event occurs in \( w \). Thus a miraculous event can occur
in worlds contained in \( s(p, i, w) \) and they can be far from normal. However, in
most cases all the worlds in \( s(p, i, w) \) are normal, so in most cases the predictions
of my theory agree with those of Asher's. I also agree with Asher that there
is a vital connection between the use of progressives and default reasoning.
However, I think this connection could also be explored in my system (though
I cannot do that in this article) since there is also a vital connection between
conditionals and default reasoning, especially if our theory of the similarity
criteria of worlds is more like that of Nute, for whom the preservation of laws
(including probabilistic ones) is more important than the preservation of singular}

\footnote{In both Lewis's and Nute's semantics the first argument of the selection function is a
sentence. However, this way of formulating the semantics has been objected to by Theo
Janssen in [10] because it needlessly breaks compositionality. While there are reasons to
doubt whether natural or even logical languages have to be strictly compositional it is certainly
better to use compositional semantics when such semantics is adequate and does not demand
an exorbitant price in increased complexity. Therefore it is better to make the first argument
of the selection function a proposition than a sentence.

\footnote{Such a temporal relativization of selection functions has of course already been explored
often, most famously by Richmond Thomason and Anil Gupta in [20]. However, Thomason
and Gupta start from Stalnaker's theory of conditionals, while I want to expand either Lewis's
or Nute's theory to a temporal setting. Therefore I have to improvise in giving the semantics
of temporal conditionals. However, I will follow Thomason and Gupta in using the framework
of branching time in the semantics of temporalized conditionals. Thomason and Gupta do
not use interval semantics; however, Tedeschi has already shown how to combine interval
semantics with branching time in [19].}
facts, than that of Lewis, for whom the preservation of singular facts is more important.

This selection function must at least satisfy the three following minimal conditions. Of them the first two are conditions accepted by both Lewis and Nute adapted to a temporal framework, while the last is a modification of a condition used by Thomason and Gupta [20, page 301], the condition of Past Predominance.

1 For all \( w_2 \in s(p, i, w_1) \) \( p \) is true in \( \langle i, w_2 \rangle \).

2 If \( p \) is true in \( \langle i, w_1 \rangle \), then \( w_1 \in s(p, i, w_1) \).

3 If there is \( w' \) s. t. \( p \) is true in \( \langle i, w' \rangle \) and \( w \sim_I w' \), then for all \( w'' \in s(p, i, w) \), \( w'' \sim_I w \).

If \( a \) is a singular term, then I will symbolize the extension of the term \( a \) at an interval \( i \) in the world \( w \) as \( |a|_{i,w} \). If \( P \) is a predicate, I will symbolize the extension of \( P \) at the interval \( i \) in the world \( w \) as \( |P|_{i,w} \). I will use \([\phi]\) to stand for the set of those worlds in which \( \phi \) is true.

Since the semantic framework I must draw upon has grown rather massive, I must introduce some abbreviations in order to prevent formulations from swelling to an unmanageable size. Let \( W(A, X, i) \) stand for the set of those indices \( \langle w, i' \rangle \) in which the set of individuals \( X \) possesses the property \( A \) at \( \langle i, w \rangle \). Let \( W(p, i) \) stand for the set of those indices \( \langle w, i' \rangle \) in which \( p \) is true at \( \langle i, w \rangle \).

After this extensive discussion of our semantic framework I can at last give my provisional proposal for the truth-conditions of the progressive.

\[ \text{PROG}(P)(X) \text{ is true at } \langle i, w \rangle \text{ iff } P \text{ is not punctual and for some property } A \text{ that is projectible and homogeneous and for some interval } i' \text{ such that } |X|_{i,w} \text{ has } A \text{ in } \langle i, w \rangle \text{ and } i \subseteq i' \text{ and } i \text{ is not a final subinterval for } i', s(W(A, |X|_{i,w}, i'), i, w) \neq \emptyset \text{ and for all } w'' \in s(W(A, |X|_{i,w}, i'), i, w), P(X) \text{ is true at } \langle i', w'' \rangle. \]

It is easy to see that the problem Lascarides and Asher noticed in Dowty’s theory does not arise on our theory. Suppose again that both Example 8 and Example 9 are true at \( i \) in \( w \). This means that there is a property \( P \) Max has at \( i \) in \( w \) such that if he continues to have it for a longer interval \( j \) he wins the race, and there is another property \( Q \) John has at \( i \) in \( w \) such that if he continues to have it for a longer interval \( k \) he sabotages the race. However, the two properties \( P \) and \( Q \) need not be such that it is possible for both of them to be instantiated in the same world for any interval \( j \) long enough for either the race to be won or the race to be sabotaged. Therefore neither \( s(W(P, Max, j), i, w) \) nor \( s(W(Q, John, j), i, w) \) need be empty, and therefore even if both are true some progressives can be false.

The examples presented by Landman can be handled in a way very similar to the one in which Landman himself solves them. In the first case there are worlds sufficiently close to the actual world where Mary succeeds in crossing the street if she continues to walk as she intends to, since it requires only small changes in the world for the truck-driver to notice her or change his speed or direction for
some other reason. However, in the third case there are no worlds sufficiently close to the actual world where she succeeds in wiping out the entire Roman army, no matter what properties she continues to have for a longer interval in such worlds. It takes a far bigger change to the actual world to make all the troops in the Roman army fight so badly that she succeeds in killing them all than for a single truck to change direction. Thus for example if \( m \) is Mary and \( r \) is the Roman army then for all properties \( A \) and intervals \( i' \) the set of worlds \( w' \in s(W(A, \langle m, r \rangle, i'), i, w) \) such that Mary wipes out the Roman army in \( w' \) at \( i' \) is empty. Therefore it follows from the truth-conditions I have given above that the progressive sentence Landman considers is false.

Likewise in the second example without divine intervention there are no worlds sufficiently close to the actual world where Mary crosses the Atlantic. However, if we assume that a divine intervention occurs in the actual world (supposing that the assumption is at all coherent, which many atheists would of course deny!), then there are such worlds. In this case there are worlds sufficiently close to the actual where she keeps trying to swim where she crosses the Atlantic, since the actual world is such and is closer to itself than any other world.\(^{11}\)

As to the difference between Example 1 and Example 3, Dowty’s explanation seems quite plausible to me and I can obviously adopt it in my theory of the progressive at least if I use Dowty’s original concepts of homogenenity and heterogeneity.

### 6 A Possible Objection

In this section I will consider two possible objections to the basic idea of my theory that can be found in the literature.

Most of the literature gives no reasons for taking the progressive to be a sentential operator. Cresswell, however, has in [4, page 71] given an argument why it should be a sentence rather than a predicate modifier. Cresswell considers the sentences Example 19 and Example 20.

**EXAMPLE 19** *Every boot is being polished.*

**EXAMPLE 20** *Someone is polishing every boot.*

According to Cresswell, Example 19 should have a reading in which, at any particular moment within the interval, only one boot is being polished at the moment. I do not think Cresswell means that Example 19 should have a reading which *implies* that at any particular moment within the interval, only one boot is being polished at the moment. This seems to me obviously false. Rather, I think he means that Example 19 should have a reading which would be *consistent* with the fact that at any particular moment within the interval,\(^{11}\)
only one boot is being polished at the moment. This seems a natural demand.
Cresswell also claims that Example 20 should have a reading in which the same
person need not polish all boots.

It is indeed true that the most natural formalization of the sentence in a
first-order approach, shown below, does not yield such a reading.

Formalization 6 \((\forall x)(\text{boot}(x) \rightarrow (\exists y)(\text{PROG}(\text{polish})(y, x)))\).

However, if we use a higher order approach in which we have abstraction
operators and can form complex predicates, such as Montague Grammar or
Cresswell’s own lambda-categorical languages, we can find a reading of the de-
sired type even if we assume that the progressive is a predicate modifier. The
following reading is the simplest one fulfilling the first of Cresswell’s criteria.

Formalization 7 \((\exists x)(\text{PROG}(\lambda y)((\forall z)(\text{boot}(z) \rightarrow \text{polish}(y, z))))(x))\).

This reading is not yet wholly satisfactory, however, since it implies that
the same person polishes every boot. However, surely this sentence should, just
like Example 20, have also a reading in which the same person need not polish
all boots. However, if we allow ourselves to use set variables, we can find a
reading that satisfies this desideratum also. As I have argued above, we need
set variables anyway in order to deal with plural verbs and nouns, so there is
nothing ad hoc in appealing to them here. Let \(X\) and \(Y\) be higher order set
variables.

Formalization 8 \((\exists X)(\text{PROG}(\lambda Y)((\forall x)(\text{boot}(x) \rightarrow (\exists y)(Y(y) \land \text{polish}(y, x))))(X))\).

Intuitively, this formula says that there is a set that has a property such that
if it continues to have that property for long enough, then every boot will be
polished by some member of that set. This is surely a plausible formalization
of Cresswell’s sentence \(^{12}\) that fulfills both of his criteria, since if every boot is
being polished there is surely such a set, namely the set of all people engaged
in polishing the boots. However, if we formalize the progressive passive sentence
in this way, should not we formalize the corresponding non-progressive sentence
Example 21 as Formalization 9 ?

EXAMPLE 21 Every boot is polished.

Formalization 9 \((\exists X)(\forall x)(\text{boot}(x) \rightarrow (\exists y)(X(y) \land \text{polish}(y, x))))\).

This may seem an unnecessarily complex formalization. However, it can be
defended by pointing out that it is quite likely that Example 21 has an implicit
plural subject, since the plural subject can be made explicit in sentences like
Example 22, which can be formalized as Formalization 10.

\(^{12}\)Even this formalization has the defect that it implies that every boot is polished by
a single person, and leaves out the possibility that many persons might polish some boot
together. A still better formalization would be \((\exists X)(\text{PROG}(\lambda Y)((\forall x)(\text{boot}(x) \rightarrow (\exists Z)(Z \subseteq Y \land \text{polish}(Z, x))))(X))\).
EXAMPLE 22  Every boot is polished by the hotel workers.

Formalization 10  \((\forall x)(\text{boot}(x) \rightarrow (\exists y)(\text{hotelworkers}(y) \land \text{polish}(y, x))))\).

Cresswell also claims that Example 20 should have a reading in which the same person need not polish all boots. Again, we can get such a reading whether we treat the progressive as a sentential or a predicate operator, and in this case we could get such a reading even in a first-order approach. The following formalization can most simply express such a reading.

Formalization 11  \((\forall x)(\text{boot}(x) \rightarrow (\exists y)(\text{PROG}(\text{polish})(y, x))))\).

7  A More Exact Formulation of Our Theory

After having explained the basic ideas of my theory and defended it against objections, I must sketch a more exact formalization for it. The semi-formal semantic rule above gives contextual truth-conditions to the progressive modifier, and therefore treats it as a synsemantic expression. However, if the formal language in which we work has an abstraction operator, we can also define the progressive modifier explicitly so that it is treated as an autosemantic expression, an expression with an independent meaning of its own.

I will formalize my theory in a language that is a slight modification of the version of Montague’s IL that Dowty uses. This is a version of intensional simply typed \(\lambda\)-calculus. One novelty that Dowty introduces to IL is that he quantifies explicitly over temporal intervals. Among the additions that I will make to the basic syntax of the language is that I add to it a new type (of real numbers), a conditional operator and a projectibility predicate. I will also define within the language (without any need to introduce new primitives) many of the concepts Verkuyl uses in his theory\(^{13}\).

The model structures are of the form \(\langle E, I, w, J, \leq, \sqsubseteq, s, \mu \rangle\) where the components of the structures are such as described in Section 5.

It is not possible within the limits of this article to formulate all the rules of this language exactly, but I will give a brief overview of them. The language has a set of constants \(\text{Con}_a\) for every type \(a\) and a denumerable supply of variables \(\text{Var}_a\) for every type \(a\). The basic types are \(e, t\) and \(i\) and \(r\), where \(e\) is the type of individuals, \(t\) is the type of truth-values and \(i\) the type of intervals and \(r\) the type of real numbers. If \(a\) and \(b\) are types, \(\langle a, b \rangle\) is a type, the type of functions from entities of type \(a\) to those of type \(b\). \(\text{ME}_a\) stands for the set of meaningful expressions of type \(a\).

If verb phrases were taken to denote sets of individuals, then noun phrases, whose arguments the denotations of verb phrases are, would have to denote sets

\(^{13}\text{I will take one of Verkuyl’s concepts, that of the cardinality of a set, as a primitive, but only for the sake of simplicity; it could also be defined (since we are operating in a type-theoretic framework and concerned mostly with the cardinality of entities of one type, sets of individuals) by using the classic definitions of Whitehead and Russell’s Principia Mathematica, but the definitions would be very space-consuming.}\)
of sets of individuals in an extensional framework and sets of properties in a Montagovian framework, that is to say, entities of type \( \langle \langle s, (e, t) \rangle, t \rangle \). Since I take verb phrases to denote sets of sets, as Verkuyl does, noun phrases would denote entities of type \( \langle \langle (e, t), t \rangle, t \rangle \) in an extensional framework like Verkuyl’s PLUG-grammar. In an intensional framework such as I use here they will denote sets of properties of properties, that is, entities of type \( \langle \langle s, \langle (e, t) \rangle, t \rangle \rangle, t \rangle \).

For every type \( a \), \( D_a \) is the set of possible denotations of type \( a \). It is defined recursively; \( D_e \) is the set of individuals \( E \), \( D_t \) the set of intervals \( I \), \( D_{s,a} = \{1, 0\} \), where the numbers represent the two truth-values and \( D_{(a,b)} = D_b \alpha \) and \( D_{(s,a)} = D_a^{\text{WxI}} \). \( \| \alpha \|_{\mathfrak{A}, w, i, g} \) stands for the denotation of expression \( \alpha \) with respect to an interpretation \( \mathfrak{A} \), world \( w \), interval \( i \) and value assignment \( g \). I will use \( \| \alpha \|_{\mathfrak{A}, g} \) to stand for the intension of expression \( \alpha \) with respect to an interpretation \( \mathfrak{A} \) and value assignment \( g \). \( g(x/u) \) is the assignment that is exactly like \( g \) except for the possible difference that \( g(u) = x \).

Dowty incorporates the formation rules into the semantic rules and I will follow his example. \( \text{PRES}(\alpha) \) means intuitively that \( \alpha \) is a past interval and \( \text{PRES}(\alpha) \) that \( \alpha \) is the present interval. \( \text{AT}(\alpha, \phi) \) means that \( \phi \) is true at time \( \alpha \).

**S 1** If \( \alpha \in ME_{(a,b)} \) and \( \beta \in ME_{a} \) then \( \| \alpha(\beta) \|_{\mathfrak{A}, w, i, g} = \| \alpha \|_{\mathfrak{A}, w, i, g} \cdot \| \beta \|_{\mathfrak{A}, w, i, g} \).

**S 2** If \( \alpha \in ME_{a} \) and \( u \in \text{Var}_{b} \), then \( \lambda u \alpha \in ME_{(b,a)} \) and \( \| \lambda u \alpha \|_{\mathfrak{A}, w, i, g} = \{ \langle x, \| \alpha \|_{\mathfrak{A}, w, i, g(x/u)} \rangle | x \in D_b \} \).

**S 3** If \( \phi \in ME_{t} \) and \( u \in \text{Var}_{a} \), then \( \forall u \phi \in ME_{t} \), and \( \| \forall u \phi \|_{\mathfrak{A}, w, i, g} = 1 \) iff for all \( x \in D_a \| \phi \|_{\mathfrak{A}, w, i, g(x/u)} = 1 \).

**S 4** If \( \phi \in ME_{t} \), then \( \neg \phi \in ME_{t} \), and \( \| \neg \phi \|_{\mathfrak{A}, w, i, g} = 0 \) iff \( \| \phi \|_{\mathfrak{A}, w, i, g} = 0 \). (Similarly for \( \wedge, \vee, \rightarrow, \leftarrow \) and \( \equiv \).)

**S 5** If \( \alpha \in ME_{t} \) then \( \text{PAST}(\alpha) \in ME_{t} \) and \( \| \text{PAST}(\phi) \|_{\mathfrak{A}, w, i, g} = 1 \) iff \( \| \alpha \|_{\mathfrak{A}, w, i, g} = i \).

**S 6** if \( \phi \in ME_{t} \) and \( \alpha \in ME_{t} \) then \( \text{AT}(\alpha, \phi) \in ME_{t} \) and \( \| \text{AT}(\alpha, \phi) \|_{\mathfrak{A}, w, i, g} = 1 \) iff \( \| \phi \|_{\mathfrak{A}, w, i, g} \alpha > \| \phi \|_{\mathfrak{A}, w, i, g} \).

**S 7** If \( \alpha \in ME_{t} \), then \( \text{PRES}(\alpha) \in ME_{t} \) and \( \| \text{PRES}(\alpha) \|_{\mathfrak{A}, w, i, g} = 1 \) iff \( \| \alpha \|_{\mathfrak{A}, w, i, g} = i \).

**S 8** If \( \alpha \in ME_{(s,a)} \), then \( \forall \alpha \in ME_{a} \) and \( \| \forall \alpha \|_{\mathfrak{A}, w, i, g} = \| \alpha \|_{\mathfrak{A}\langle (w, i) \rangle} \).

\( \text{PROJ}(\alpha) \) will mean that \( \alpha \) is projectible and \( (\phi \Rightarrow \psi) \), will stand for the conditional if \( \psi \) then \( \phi \). The projectibility predicate \( \text{PROJ} \) can be applied to any term that can stand for properties, and in Montague semantics these are terms of such types as \( \langle s, (a, t) \rangle \), that is to say, terms standing for functions from possible worlds to sets of entities of any type \( a \). \( \alpha \leq \beta \) will mean that \( \alpha \) is a smaller number than \( \beta \). \( t_i \leq t_j \) will mean that the interval \( t_i \) is contained in the interval \( t_j \).
S 9 If \( \alpha \in ME_{(s, (a, t))} \) then \( PROJ(\alpha) \in ME_t \) and \( \| PROJ(\alpha) \|_{a,w,i,g} = 1 \) if and only if \( \| \alpha \|_{a,w,i,g} \in J \).

S 10 If \( \phi, \psi \in ME_t \), then \( \phi \Rightarrow \psi \in ME_r \) and \( \| \phi \Rightarrow \psi \|_{a,w,i,g} = 1 \) if and only if \( s(\| \phi \|_{a,g}, i, w) \neq \emptyset \) and for all \( w' \in s(\| \phi \|_{a,g}, i, w) \) \( \| \psi \|_{a,w',i,g} = 1 \).

S 11 If \( \alpha \in ME_{(a, t)} \) for any type \( a \), then \( |\alpha| \in ME_r \) and \( \| |\alpha| \|_{a,w,i,g} = r \) if and only if \( r \) is the cardinality of \( \| \alpha \|_{a,w,i,g} \).

S 12 If \( \alpha, \beta \in ME_r \), then \( \alpha \leq \beta \in ME_i \) and \( \| \alpha \|_{a,w,i,g} = \| \beta \|_{a,w,i,g} \).

S 13 If \( t_1, t_2 \in ME_i \) then \( t_1 \preceq t_2 \in ME_i \) and \( \| t_1 \|_{a,w,i,g} = \| t_2 \|_{a,w,i,g} \).

Adopting notations eclectically both from Dowty [7, page 355] and Verkuyl [23, page 288], with modifications, I will use \( x, y, \) etc. to stand as abbreviations for individual variables - that is to say, variables of type \( c, t, t_1, t_2 \) etc as temporal variables, i.e. variables of type \( i, X, Y, \) etc. for variables ranging over sets of individuals, i.e. variables of type \( \langle c, t \rangle \), and \( P, Q, \) etc. for variables ranging over properties of sets of individuals, i.e. variables of the type \( \langle s, \langle s, (t, e, t) \rangle \rangle, t \rangle \) and \( P \) as a variable ranging over properties of properties of sets of individuals, i.e. a variable of type \( \langle \langle s, (s, (t, e, t)) \rangle, t \rangle \), \( t \rangle \).

We can now define the set-theoretical notation used by Verkuyl. We can define the subset relation for any expressions \( \alpha \) and \( \beta \) of any type \( \langle a, t \rangle \). I will restrict this relation to hold only between non-empty sets. We can also define the singleton of any entity of any type. In the definition schemas below \( u \) and \( v \) will stand for variables of type \( a \).

Def 3 \( \alpha \subseteq \beta =_{def} (\forall u)(\alpha(u) \rightarrow \beta(u)) \land (\exists u)(\alpha(u)) \).

Def 4 \( \{ \alpha \} =_{def} (\lambda P)(P = \alpha) \).

We can also define what it is for properties to be homogeneous and punctual and for an interval to be a final subinterval of another interval:

Def 5 homog =_{def} (\lambda P)(\langle \forall u \rangle(\forall t_1)(AT(t_1, P(u)) \rightarrow (\exists t_2)(t_2 \preceq t_1 \land AT(t_2, P(u))))).

Def 6 punct =_{def} (\lambda P)(\langle \forall u \rangle(\forall t_1)(AT(t_1, P(u)) \rightarrow (\exists t_2)(t_2 \preceq t_1))).

Def 7 fsub(t_1, t_2) =_{def} t_1 \preceq t_2 \land (\neg (\exists t_3)(t_3 \preceq t_2 \land \neg t_1 \preceq t_3)).

We can now define the progressive operator or rather the progressive operators. In the formula below \( P \) and \( Q \) are schematic metavariables standing for any variables of type \( \langle s, \langle a, t \rangle \rangle \), while \( u \) is a variable of the corresponding type \( a \) and \( i \) and \( j \) are variables of type \( i \).

Def 8 \( PROG =_{def} (\lambda u)(\neg \text{punct}(P) \land (\exists Q)(\exists t_1)(PROJ(Q) \land \text{homog}(Q) \land \forall Q(u) \land (\forall t_2)(\text{PRES}(t_2) \rightarrow t_2 \preceq t_1 \land \neg \text{fsub}(t_2, t_1) \land AT(t_1, \forall Q(u)) \Rightarrow AT(t_1, \forall P(u))))). \)
I will also define a new auxiliary concept. Let $\text{Min}(t, \phi)$ mean that $t$ is a minimal interval at which the formula $\phi$ is true.

**Def 9** $\text{Min}(t, \phi) \overset{\text{def}}{=} \text{AT}(t, \phi) \land \neg(\exists t_1)(t_1 \leq t \land \neg t_1 = t \land \text{AT}(t_1, \phi))$.

We can now give a compositional semantics for the English progressive.

The progressive can be split up to two parts, the auxiliary verb "be" and the progressive suffix "ing" attached to the main verb. The translation of the auxiliary verb is simple. For example, the following can be a translation of its past tensed form:

**Formalization 12** $\lambda Q \lambda x (\exists t_1)(\text{PAST}(t_1) \land \text{AT}(t_1, \bigvee Q(x)))$.

Since the progressive suffix can be attached to either intransitive or transitive verbs, we can avoid postulating two meanings for the suffix only if if we take a progressive verb phrase such as "is building a house" to have a discontinuous constituent "build a house" to which the progressive suffix would be attached by a RWRAP-operation (such as was first proposed by Emmon Bach in [2]). The translation of the progressive suffix in this case is quite simple; the following will do$^{14}$.

**Formalization 13** $\lambda P \lambda X \bigvee \text{PROG}(P)(X)$.

Instead of letting verbs denote functions from sets of intervals and intervals to sets constructed from individuals as Verkuyl does, I will suppose that the denotations of verbs have only sets constructed from individuals as their arguments and introduce the intervals by means of quantification and Dowty’s operator AT. I suggest the verb "draw" is translated by a constant $\text{draw}'$ of type $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$. Intuitively $\text{draw}'(X, y)$ means that the members of $X$ draw $y$ working together. If $X$ is the singleton of some individual $x$, $\text{draw}'(X, y)$ naturally means that $x$ draws $y$ alone. It would be desirable to decompose the constant $\text{build}'$ further with the aid of such operators as Dowty's $\text{CAUSE}$ if this is possible, but I cannot go into this matter here. I must, however, suppose that the following meaning postulate (that would follow from a full decompositional analysis) holds for "draw": $\parallel \text{draw} \parallel_{\lambda w, i, g}^A$ is heterogeneous, that is, for all $X$ and $x$ and $i$ and $w$ and $g$ if $\parallel \text{draw} \parallel_{\lambda w, i, g}^A(X, x) = 1$ then for no $i'$ s. t. $i' \neq i$ and $i' \sqsubseteq i$ $\parallel \text{draw} \parallel_{\lambda w, i', g}^A(X, x) = 1$.

Putting the translations of "was" and "build" and the progressive suffix together with the aid of function application and using $\alpha$-conversion and $\beta$-conversion to simplify the result we get the following translation for the verb phrase "was drawing".

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$^{14}$If we wanted to avoid discontinuous constituents we would have to say that the meaning of the progressive suffix attaching to transitive verbs is far more complex, since transitive verbs are interpreted as functions from generalized quantifiers to sets. The translation of the progressive suffix attaching to transitive verbs in the present version of IL would then be $(\lambda R)(\lambda P)(\lambda X)(\bigvee \text{PROG}(\bigvee R(P))(X))$, where $R$ is a variable of type $\langle \langle s, \langle e, t \rangle, t \rangle \rangle$, $\langle e, t \rangle$ and $S$ a variable of type $\langle s, \langle \langle e, t \rangle, t \rangle \rangle$.
Formalization 14 \((\lambda X)(\exists t_1)(PAST(t_1) \land AT(t_1, PROG(\lambda Z)(\exists Y)(Y \subseteq X \land (\forall y)(Y(y) \rightarrow draw'(Z, y))))(X)).\)

The translation of the noun phrase ”a circle” in the higher-order approach is the following (compare with Verkuyl’s treatment of ”a child” at [23, page 162], which I have simplified considerably, since I suppose that referring to partitions of intervals is necessary only in the case of plural noun phrases):

Formalization 15 \((\lambda Q)(\exists Y)(Y \subseteq circle' \land |Y| = 1 \land (\forall Q)(Y(y) \rightarrow draw'((Z, y))))(X)).\)

Putting these together with the aid of function application and using \(\alpha\)-conversion and \(\beta\)-conversion we get the following translation for the verb phrase ”was drawing a circle”:

Formalization 16 \((\lambda X)(\exists t_1)(PAST(t_1) \land AT(t_1, PROG(\lambda Z)(\exists Y)(Y \subseteq circle' \land |Y| = 1 \land (\forall y)(Y(y) \rightarrow draw'(Z, y))))(X)).\)

The translation of the noun phrase ”John” is the following.

Formalization 17 \(\lambda P \lor P(\{\text{john}'\}).\)

Putting these together with the aid of function application and using \(\alpha\)-conversion and \(\beta\)-conversion we get the following translation for the sentence ”Max was building a house”:

Formalization 18 \((\exists t_1)(PAST(t_1) \land AT(t_1, PROG(\lambda Z)(\exists Y)(Y \subseteq circle' \land |Y| = 1 \land (\forall y)(Y(y) \rightarrow draw'(Z, y))))(\{\text{john}'\})).\)

We must next consider the translation of the Finnish partitive suffixes. This is clearly a more difficult problem. How can the progressive operator that modifies predicates corresponding to the verbs of natural languages yet attach as a suffix to nouns? I see only one possible answer. While the stems of the Finnish nouns can be of the same type \(\langle e, t \rangle\) as English verbs, the inflected forms must be of a completely different type. The inflected forms of Finnish nouns must have as their denotation not a set of sets of individuals, but a function from the intensions of relations to such sets. That is to say, they must be of the type \(\langle s, \langle e, t \rangle, t \rangle\). This means that Finnish noun suffixes must be of the type \(\langle s, \langle \langle e, t \rangle, t \rangle, \langle s, \langle e, t \rangle, t \rangle, \langle (e, t), t \rangle \rangle\).

The following seems to me to be the right formalization for the meaning the partitive suffix has when the noun phrase with which it is combined occurs as an object and is an indivisible noun.

Formalization 19 \((\lambda P)(\lambda R)(\lambda X)(\forall t_1)(PAST(t_1) \land AT(t_1, PROG(\lambda Z)((\forall t_1)(PRES(t_1) \rightarrow (\forall y)(Y(y) \rightarrow draw'(Z, y))))(X)).\)

Here \(Q\) is a variable of type \(\langle s, \langle e, t \rangle, t \rangle\) and \(R\) is a variable of type \(\langle s, \langle \langle e, t \rangle, t \rangle \rangle\).

The whole word ”ympyräitä” would then have the following translation into IL:
In order for this strategy to work we must suppose that the inflected forms of Finnish verbs are of the type \(\langle\langle s, \langle\langle s, \langle\langle e, \langle e, t \rangle \rangle, t \rangle \rangle, t \rangle \rangle, \langle\langle e, t \rangle \rangle \rangle, \langle\langle e, t \rangle \rangle \rangle, \langle\langle e, t \rangle \rangle \rangle \rangle \). This is a type of a horribly high level, but if we are to seek a compositional semantics for Finnish case suffixes, I see no alternative to using it.

For example, the Finnish past tense verb form "rakensi" could have the following translation, where \(M\) is a variable of type \(\langle\langle s, \langle\langle s, \langle\langle e, \langle e, t \rangle \rangle, t \rangle \rangle, t \rangle \rangle, \langle\langle e, t \rangle \rangle \rangle, \langle\langle e, t \rangle \rangle \rangle, \langle\langle e, t \rangle \rangle \rangle \rangle, \langle\langle e, t \rangle \rangle \rangle \rangle\):

\(\text{Formalization 21} \ (\lambda M)(\lambda X)((\exists t)(\text{PAST}(t) \land AT(t, (\exists M(\text{build}')(X))))).\)

Using these formalizations we could show (though I have no space to go through the derivations here in detail) that Example 5 has (after \(\beta\)-conversion) the same final translation as Example 3 of which it is a translation. Example 7, however, has at least the following two formalizations:

\(\text{Formalization 22} \ (\exists t_1)(\text{PAST}(t_1) \land AT(t_1, \text{PROG}(\lambda Y)(\exists Y)(Y \subseteq \text{circle}' \land |Y| > 1 \land (\forall t_1)(\text{PRES}(t_1) \rightarrow \text{Min}(t_1, (\forall y)(Y(y) \rightarrow (\exists t_2)(t_2 \leq t_1 \land AT(t_2, \text{draw}'(\{matti\})))((\{matti\}))))))).\)

\(\text{Formalization 23} \ (\exists t_1)(\text{PAST}(t_1) \land AT(t_1, (\exists Y)(Y \subseteq \text{circle}' \land |Y| > 1 \land (\forall t_1)(\text{PRES}(t_1) \rightarrow \text{Min}(t_1, (\forall y)(Y(y) \rightarrow (\exists t_2)(t_2 \leq t_1 \land AT(t_2, \text{draw}'(\{matti\})))((\{matti\}))))))).\)

References


