

INTERPRETIVE RULES AND THE
DESCRIPTION OF THE ASPECTS*

0. INTRODUCTION

It appears clear by now that where generative semanticists have severe (if not insurmountable) problems with finding a calculus that provides the basic representations for the sentences generated by their grammar, interpretive semanticists are bound to meet problems of a comparable size in construing their semantic component. Interpretivists are inclined to think that—problems of formalizing adequate systems of representation being equal or comparable—they are better off, since their close-to-surface syntax provides a more reliable anchorage for semantic investigation than the other way around. In my opinion, it is a rather unfortunate habit among some interpretivists to relegate a semantic account of descriptive phenomena to future research, confining themselves to what sometimes is called 'pure syntax'. The close interdependency of syntax and semantics requires that if things are expelled from the semantic component, a specific proposal be made with regard to the semantic account. One can not simply declare one's own 'pure syntactic' proposal superior to others if one does not explicitly provide semantic rules.

Therefore, Jackendoff (1972, 1974, 1975) is a relief to those who are following the developments in the interpretive framework at close quarters, because his work is based upon the insight that the close interdependency between semantic and syntactic factors in sentential structure should be accounted for in a systematic way.

* This article is a partly shortened, partly extended and partly revised version of Verkuyl (1974). I have left out what can be considered as direct answers to Daalder (1974) since her paper was written in Dutch. Daalder (1974) offers an alternative (interpretive) approach to the description of aspects in Verkuyl (1972). Her strictly syntactic description of the subject matter, however, tends to obscure the real nature of the phenomena under analysis. Consequently, I tried to find out how the data of Verkuyl (1972) would fit into the framework of Jackendoff (1972) that had become available in the meantime, especially since this framework incorporates Gruber's system of thematic relations.

I would like to thank Frederiek van der Leek for translating the part that remained unchanged and for correcting my English for (most of) the rest of the article. I would also like to thank Johan van Benthem for his very helpful comments on the logical part of this article as well as Jaap Hoepelman for some valuable suggestions.

It is my purpose in this article to confront the interpretivist framework – more specifically Jackendoff's – with a reasonably clear set of data and explanations. In Verkuyl (1972) an attempt was made to describe the so-called aspects (or perhaps more accurately 'Aktionsarten'). It was shown that aspects are not properties inherent to verbs, rather that aspectual information is composed of information contained by the verb together with certain constituents of a nominal nature. The description was formulated in terms of the Gruberian branch of generative semantics, i.e. the framework sketched in Gruber (1967).

Now, Jackendoff's semantic component incorporates the system of thematic relations developed by Gruber (1965, 1967). Thus, the results of Verkuyl (1972) can easily be translated into Jackendoff's framework. Hence, this framework can be checked on whether it can deal with the phenomena described in Verkuyl (1972). As a matter of consequence I shall explore the interpretivist possibilities for construing a system of semantic rules that can account for the aspectual phenomena in question. It will lead to a certain type of interpretive rule which has a translational function.

As far as I can see, the interpretive framework à la Jackendoff (1972) makes it necessary to distinguish three main phases in the process of interpreting semantic information:

(a) the phase during which preterminal deep structures are formed (autonomous syntax);

(b) the phase during which the deep-structural representation is translated into a so-called functional-semantic representation consequent on the insertion of lexical material;

(c) the phase during which the functional-semantic representation is translated into the (symbolic-logical) representation by which the aspects of meaning that are to be expressed systematically (i.e. the logical form of sentences), can be brought out.

The tripartition is interpretive once one proceeds from (a) via (b) to (c). (It is my belief that the reversed direction can be called generative semantic in spite of the heterogeneous character of the rules involved.)

The way (a) is related to (b) is made reasonably explicit in terms of the above-mentioned system of thematic relations. Jackendoff no more than outlines, however, the way in which (b) is related to (c). I shall pay much attention to this relationship.

In Section 1 the first part of the interpretivist apparatus for the description of sentences containing durational adverbials will be given in accordance with Jackendoff's theoretical framework. Section 2 is concerned with thematic relations and their importance for the description of the aspects. Section 3

describes how interpretive rules must operate with respect to sentences containing durational adverbials, given the apparatus sketched in 2 and given the information accounted for by the system of thematic relations. Only then can one have the hope of getting anywhere near to measuring the complexity of the complete system involved. Section 4 is concerned with some problems concerning a tense-logical representation of the non-durative aspect.

1. THE INTERPRETIVIST APPARATUS FOR THE DESCRIPTION OF SENTENCES CONTAINING DURATIONAL ADVERBIALS

In 1.1. the syntactic organization is discussed, in 1.2. the semantic component as proposed in Jackendoff (1972) is given in outline; in 1.3. one of its sub-components, the functional component is described in more detail since it is relevant for the description of the aspects.

1.1. *The Interpretive Syntax for Sentences Containing Durational Adverbials*

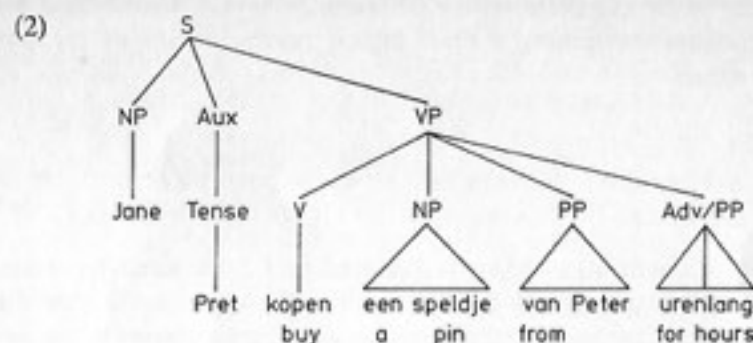
Consider the following sentences:

- (1a) Jane kocht een speldje van Peter.
Jane bought a pin from Peter.
- (1b) Jane kocht urenlang een speldje van Peter.
Jane bought a pin from Peter for hours.

Sentence (1a) can be said to contain a nondurative aspect as its combination with the durational adverbial *urenlang* (for hours) gives the resulting sentence (1b) a frequency reading: the latter sentence means that Jane bought a pin from Peter repeatedly during a period of several hours. In Verkuyl (1972) a great many sentences have been under analysis, but in this article I shall mainly confine myself to the sentences (1a) and (1b). My purpose is to start with their syntactic deep structure and to finish with their representation after all interpretive rules have operated.

Though Jackendoff gives an extensive account of adverbials, he does not discuss durational adverbials explicitly. Therefore we are forced to make conjectures. Comments on adverbials of time such as *six o'clock*, *yesterday*, etc. suggest that they are localized within the VP. Since durational adverbials surely have no higher status in the syntactic hierarchy than adverbials of time, it appears reasonable to locate them as also being generated by the rule expanding the VP. Structure (2) is certainly compatible with the rules proposed in Jackendoff (1972) and slightly modified in Jackendoff (1974). It should be noted here that word order does not affect the composition of the

aspect of a sentence. Consequently, it is not necessary to assume an SOV-order for Dutch. Structure (2) represents the deep structure of (1b), as would be generated by the system of base rules in Jackendoff (1972).



The underlying structure of sentence (1a) is like (2) but without *Adv*. Note in passing that the syntactic structure underlying (1b) does not contain overt information concerning the frequency by this sentence. In a close-to-surface-syntax this can hardly be expected.

As far as I can see structure (2) does justice to Jackendoff (1972; 1974) with respect to his analysis of adverbials like *urenlang* (for hours). For a better understanding of the problems rising in connection with the description of the aspects, we must strip (2) of its lexical material. The skeletal structure that remains is the input of the lexicalization rules. In Section 1.3. I shall discuss how these rules work. In the following section the organization of the heterogeneous semantic component will come up for discussion.

1.2. The Semantic Component for Sentences Containing Durational Adverbials

The conception of the representation of sentence meaning as consisting of rather heterogeneous elements, induces Jackendoff (1972) to postulate four subcomponents:

(a) *the functional component*: its rules operate, just as Katz' and Fodor's model, on the lexical information and the sentence structure. Their output is called 'functional structure', roughly comparable to the predicate-logical representation;

(b) *the coreferential component*: reflexivization and pronominalization are, among other things, taken care of here;

(c) *the modal component*: in this component rules are operative concerning the modal aspects of the meaning of sentences;

(d) *the focus and presupposition component*: this component designates what information in the sentence is, resp. is not, shared by speaker and hearer.

Each of these components contains rules that have an interpretive function, i.e. they derive information from the syntactic organization of the structures generated by the base component and they see to it that this information is given a formal representation. That is, the information contained in the syntactic base structure, the lexical information and the referential, modal and focus information are successively 'translated' into expressions of a rich, in any case complex, auxiliary language. The semantic rules that effect this 'translation', do not, as transformations do, have syntactic structured P-markers as output: they construct a semantic interpretation "by a process of accretion, each rule adding more information on the basis of syntactic structure at some level of derivation and (in some cases) the portion of the semantic interpretation already derived" (Jackendoff, 1972, 378). The ordering among the components is induced by the levels of syntactic derivation at which they operate. Thus the rules under (d) are ordered later than those under (a) since the designation of focus requires rules that operate on structures at the end of their derivation, whereas rules from (a) operate on syntactic deep structures. The further away one operates from (a), the less structural kinship there is between the base structures and their semantic representations. Coreference relations, for instance, are accounted for independently of the functional structure.

Adverbial phrases are dealt with, if I understand Jackendoff correctly, in the functional component only after more elementary functional rules have operated on what one might call the 'propositional kernel' of the sentence under analysis. Applied to sentences (1), this means that the projection rules first form the functional structure of the (1a)-part of sentence (1b). Only afterwards do they operate on adverbial phrases as well; they combine the adverbial part of (1b) with its (1a)-part. It will be clear that at this point a very intriguing problem arises: where does the frequency come in? It should be noted here that it is possible for functional structure that has been formed, to be changed (vide Jackendoff, 1972, 107).

The apparatus from (a)-(d) is completed by well-formedness conditions on semantic representations. They operate as a filter. This filter could be used to block sentences like *He killed his victim for hours*, *The bomb exploded until 9 o'clock*, etc. at least their single-event reading (vide Verkuyl, 1972). That is, wellformedness conditions can take over the task of the selection restrictions in Chomsky (1965). Jackendoff is not very specific about them.

Finally, it should be noted that Jackendoff does not claim that the four subcomponents suffice. A richer variegation may be necessary; for example,

a truth conditional extension of the first component seems compatible with Jackendoff's organization of the semantic component.

1.3. *The Functional Component and the Lexicon*

The functional component corresponding to Katz and Fodor (1963) and to later proposals of Katz, operates on deep structural syntactic relations (Subject of, Object of, Adjunct to, etc.) on the one hand, on lexical items generated in that structure on the other. The lexicon is given a central part to play by Jackendoff, much more so than in Chomsky (1965). He calls the semantic configuration which is the output of his rules, the 'functional structure' because he thinks of verbs as semantic functions (in the logical sense) of one or more variables, where the readings of the syntactically associated NP's provide the semantic values for the variables (Jackendoff, 1972, 15, 1975). This approach is hardly new, but similar to that of generative semanticists. It is therefore interesting that Jackendoff as far as this aspect of his semantic description is concerned, closely follows Gruber (cf. Gruber, 1975). That is, he analyzes verbs into subfunctions representing their causative, directional, etc. elements. The verbs are given an internal functional structure in the semantic representation. Naturally, Jackendoff is also confronted with the problem of the relative ordering of these subfunctional elements, a problem well-known to linguists like Gruber, Postal, McCawley, Lakoff and Fillmore, whom he follows fairly closely, be it in a different component. In other words, how is one, when analyzing predicates into subpredicates, to account for the hierarchy between those subpredicates?

The linguists mentioned above represent these functional substructures in terms of syntactic configurations. Jackendoff (1972, 14) does admit that the functional structure correspond to that aspect of semantic representation "that is perhaps most closely linked to syntactic structure". He says however:

The semantic interpretation of a sentence, then, is to be viewed as a collection of information of various sorts about different aspects of the meaning. To say that because of its complexity, this view is inferior to a position claiming that all meaning can be represented as functional structure is only to assert prejudice. Again it must be emphasized that the decision is empirical; it must be based on the relative adequacy of the linguistic theories which entail these views of semantic representation (1972, 17).

The following questions arise in connection with the complex character of an interpretive semantic component: what makes it imperative for something to be or not to be structured functionally? When may one jump across to another non-functional or semi-functional component? What are the empirical data that could bring about the decision to represent something in

a non-functional way? I consider it an appropriate strategy to first try and see if a functional structure is at all possible. Since Jackendoff does not describe in detail how his interpretive rules work on sentences containing durational adverbials, I shall try myself to make the rules of the functional component operate on sentences like (1a) and (1b), doing so in a manner that I consider to be truly representative for interpretive descriptive practice. Not until this has been done, can it become clear how aspectual information must be accounted for within this framework. We shall discuss the first stage of the interpretive process, i.e. the account of the (1a)-part of (1b), in the following lines of this section and in section 3 that part of (1b) that concerns the durational adverbial will be discussed.

As mentioned above, the verb is given a central part to play and naturally this has important consequences for the lexicon. The central position of the lexicon is closely bound up with the localistic approach essential to Gruber's work. Roughly, this approach comes down to the classification of predicates in 'motional' and 'non-motional' predicates. The arguments of the predicate, represented by the NP's associated with the verb play the part of 'Source', 'Goal', 'Moving Object', etc. if the movement in question is (or can be thought of as) linear. With non-motional verbs such terms as 'Location', 'Entity in rest', etc. are used. Gruber calls both the NP that refers to the moving object of the movement and the NP that refers to the entity in rest the Theme-NP or the Theme. The name 'Theme', of course, accounts for the use of the term 'thematic relations'. This system corresponds partly with Fillmore's case system. For a more elaborate description of the thematic system, see Jackendoff (1972, 25-46) and Gruber (1965; 1967); for some problems connected with it see Freidin (1975) and Rosenberg (1974).

I shall first explain in more detail the analysis roughly outlined above in so far as this is necessary for a better understanding of the implications of the incorporation of thematic relations into the functional component for the description of the aspects.

Let us therefore return to the skeletal structure (2) and to the lexical material to be inserted by the lexicalization rules. The functional component derives the thematic relations from the generated structure through the verbal entry: the entry for the verb is the pivot on which everything hinges as far as the correlation is concerned of the well-known grammatical relations with the thematic relations. In sentences like (1) the verb *kopen* (buy) is specified syntactically as far as strict subcategorization is concerned along the lines of Chomsky (1965). However, Jackendoff allows of V's having many sisters which do not play a part in strict subcategorization. I shall discuss this point

here, though it is important to realize that the number of thematic relations is determined by restrictions on the constituents subcategorizing the verb.

Thematic information is included in the entry of *kopen* (buy) as well. I shall describe the course of events in two separate moves, exactly the way Jackendoff does. I shall do so in some detail, since it is necessary for a precise exposition of the role thematic relations play in the description of the aspects.

The first (preliminary) lexical specification of the verb *kopen* (buy) that Jackendoff gives, is shown in (3). *Kopen* (buy) is in (3) subcategorized as a motional verb with the Agent-NP as subject: the Subject-NP is an Agentive NP because *kopen* (buy) is a verb the movement of which (the transfer, that is) is caused by the buyer. The Agent-NP at the same time functions as Goal, i.e. as the end of the transfer-movement. The thing that moves from seller to buyer, is symbolized by the Theme-NP; in (1a) the Theme-NP is *a pin*. The initial point of the transfer is the Source-NP, *Peter* in the case of (1a). In sentences containing such a phrase as *voor een gulden* (for a guilder) the fourth NP is of importance: this NP represents that which moves from the Agent-NP to the Source-NP. With this secondary movement the tables are turned. This is new as compared to Katz (1972, 342) who does not recognize a hierarchical relation between the two transfers. Of course, this type of semantic analysis is well-known in the literature (Gruber, Fillmore, Katz, etc.). However, Jackendoff's approach is new in so far as it uses strict-subcategorizational information contained by the lexical entry of V to connect thematic relations with grammatical relations.

(3)	<div style="padding: 5px;"> <p><i>kopen/buy</i> +V +NP — NP(van NP/from NP)(voor NP/for NP)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Agent</td> <td style="width: 25%;">Theme</td> <td style="width: 25%;">Source</td> <td style="width: 25%;">Secondary Theme</td> </tr> <tr> <td>Source</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(Secondary Source)</td> <td></td> <td>(Secondary Goal)</td> <td></td> </tr> </table> <p>BUY(x, y, z, w)</p> </div>	Agent	Theme	Source	Secondary Theme	Source				(Secondary Source)		(Secondary Goal)	
Agent	Theme	Source	Secondary Theme										
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(Secondary Source)		(Secondary Goal)											

Later on, Jackendoff sets right the situation in which the thematic relations, as in (3) are too much seen as syntactic properties of the verb. He replaces (3) by an entry in which the thematic relations are expressed differently, the reason for this being that (3) does not enable him to account for the fact that "the thematic relations play an integral part in the semantic relationship between *buy* and *sell*" (1972, 39). That is, the predicate BUY should be replaced by a predication-frame which makes it possible to

express the close relation between *buy* and *sell*. Jackendoff therefore changes (3) into (4):

(4)	<div style="padding: 5px;"> <p><i>kopen/buy</i> +V +NP¹ ----- NP² (van/from NP³) (voor/for NP⁴)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">CAUSE (NP¹,</td> <td style="width: 10%; text-align: center;">[</td> <td style="width: 20%; text-align: center;">CHANGE possession accompanied by</td> <td style="width: 10%; text-align: center;">]</td> <td style="width: 10%;">(NP², NP³, NP⁴)</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">CHANGE([</td> <td style="text-align: center;">]</td> <td></td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">NP⁴ money], NP¹, NP³)</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">Y</td> <td></td> <td></td> </tr> </table> </div>	CAUSE (NP ¹ ,	[CHANGE possession accompanied by]	(NP ² , NP ³ , NP ⁴)			CHANGE([]				NP ⁴ money], NP ¹ , NP ³)					Y		
CAUSE (NP ¹ ,	[CHANGE possession accompanied by]	(NP ² , NP ³ , NP ⁴)																	
		CHANGE([]																		
		NP ⁴ money], NP ¹ , NP ³)																			
		Y																			

The subcategorial specification informs us, as in (3), about the grammatical (deep structure) relations. Thus NP¹ is the subject of *kopen* (buy). The subcategorial information is, however, denuded of the thematic-semantic information: all thematic relations are expressed with the help of predicate-logical structure. Through the superscripts the NP's from the thematic structure are identified with those from the subcategorial (= syntactic) structure. The semantic specification contained by (4) has the following (more or less) logical form:

$$(5) \quad P(x, [Q(y, v, x)]) \\ [\dots]$$

The 'more or less' refers to the appendage of the upper CHANGE in (4) as well as to the lack of quantifiers. The specification *Possession* is undoubtedly meant to be subcategorial: NP² undergoes a change of owner. Thus, this specification is distinct from, say, *Physical* occurring with real motional verbs. I shall leave NP⁴ out of the discussion so that we need not bother about the logically strange appendix of Q in (5). The variable Y can also be neglected: it accounts for properties of *buy* which are not relevant to our analysis. As far as the logical form (5) is concerned, we can say that the semantic specification of verbs consists of propositional functions whose predicates and variables are arranged by the thematic structure expressed by the verb in question. In (4) P (i.e. CAUSE) is a two-place predicate, whose second argument is the three-place predication whose predicate is CHANGE.

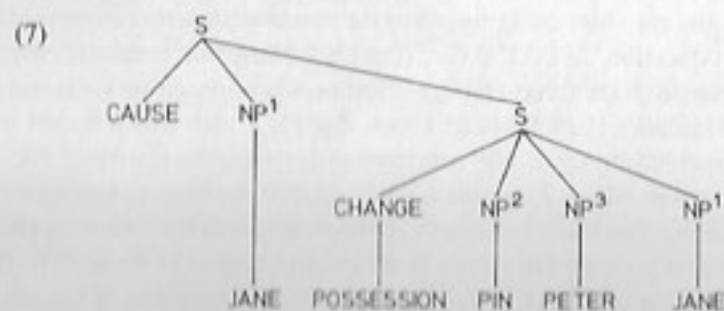
Entry (4) implies the following: *kopen* (buy) is a verb which occurs in a structure in which an Agent-NP¹ functions as deep structural subject, NP² as direct object, and NP³ as Prepositional Object (NP⁴ no longer plays a part in this exposition). The lexical-semantic structure requires the following elucidation: the first argument of CAUSE is always interpreted as Agent-NP. The second argument of CAUSE refers to an event. The meaning of CAUSE is,

according to Jackendoff, "that the individual causes the event, in the special direct sense of 'cause' which is not accurately conveyed by the lexical item *cause*" (1972, 39). The event-argument is analyzed in terms of a motional predicate *CHANGE*, whose first argument is *always* the Theme, its second *always* the Source, and its third *always* the Goal. The entry for *sell* contains a semantic representation identical to that of (4) except for the position of the superscript-NP's: i.e. *sell* and *buy* are synonymous but for the relative position of the arguments.

The attachment of *kopen* (buy) to the pre-lexical predecessor of (2) in order to generate (1a), has the effect that the projection rules as it were suck away the semantic information from entry (4) to the semantic representation of (1a). In this representation the variable contents of NP¹ from (4) is filled by the constant *JANE* (Jackendoff, like Gruber, uses capital letters to distinguish the predicate-logical expression from the phonological form *Jane*). The projection rules now bring about the generation (in a non-technical sense) of a functional structure, which in the case of (1a) looks as follows:

- (6) CAUSE (JANE, [CHANGE
POSESSION] (PIN, PETER, JANE)).

It is clear that (6) is a proposition corresponding to the propositional function represented in (5). Structure (6) is equivalent to (7). Jackendoff himself says that representations like (6) "resemble Gruber's 'prelexical' structures, the lexical entries of Katz [$\cdot \cdot \cdot$], and the deep structures of generative semantics" (1972, 41), the difference, of course, being that within the generative-semantic framework (7) is the input for transformations, whereas Jackendoff maintains that (6) is the output of interpretive rules. We shall see, however, in Section 3 that (6) too is the input to rules that are to change, transform if you wish, (6) into semantically well-formed structures.



This is for instance the case when the phrase *urenlang* (for hours) is added to (1a). Jackendoff does not go into these consequences of his analysis of adverbial phrases.

Summarizing we can say that, as soon as the lexical items have been inserted, the interpretive projection rules have at their disposal the thematic information that is contained in the entry of the verb.

2. THEMATIC RELATIONS AND THE ASPECTS

The choice of thematic relations for the functional-semantic structure largely concurs with the treatment of the aspects in Verkuyl (1972). Very little adaptation is required if one wants to relate the framework developed by the latter to a description in which the appropriate thematic terms are used. This is hardly surprising seeing that I based my work on Gruber (1967).

The schemata (durative and nondurative) developed in Verkuyl (1972, 106) represent an attempt to generalize about a fair number of syntactically divergent structures which from the localistic point of view can be described on the basis of one general principle. Some examples:

- (8a) Peter fietste van de Munt naar de Dam.
Peter cycled from the Munt to the Dam.
- (8b) Peter fietste de hele middag van de Munt naar de Dam.
Peter cycled the whole afternoon from the Munt to the Dam.
- (9a) Jane overhandigde een speld aan Peter.
Jane handed out a pin to Peter.
- (9b) Jane overhandigde een uurlang een speld aan Peter.
Jane handed out a pin to Peter for an hour.
- (10a) Katinka breide een trui.
Katinka knitted a sweater.
- (10b) Katinka breide wekenlang een trui.
Katinka knitted a sweater for weeks.

The (b)-sentences of this very incomplete selection from the cases discussed in Verkuyl (1972) all show similar behaviour: they can at best be interpreted iteratively though special means are required to somehow or other characterize a sentence like *Hij overleed urenlang* (He died for hours) as deviant.

The basic idea of my description of the aspects is that the nondurative aspect is built up from information contained in the verb and certain nominal constituents: the Subject-NP, the Direct Object-NP, some complements and the Indirect Object-NP. My analysis leads to a nondurative schema

which looks as follows:

- (11) *Nondurative Scheme*
 $S_{NP}[\text{SPECIFIED QUANTITY OF } X]_{NP} + VP[V[\text{VERB}]_V + NP$
 $[\text{SPECIFIED QUANTITY OF } X]_{NP} + NP[\text{SPECIFIED QUANTITY OF } X]_{NP}]_S$

Conditions:

- (i) VERB must stand for subcategorial nodes such as MOVEMENT, PERFORM, TAKE, ADD TO, CHANGE, etc.
 (ii) (11) does not apply to negative sentences.

Scheme (11) abbreviates configurations such as NP+V+NP+NP in (9), NP+V+NP in (10), NP+V+QP in sentences like *Greetje wandelde een kilometer* (Greetje walked a kilometre), among others. The label [SPECIFIED QUANTITY OF X] is meant to (roughly) indicate that the 'movement' expressed by the predicates functioning as VERB is bounded. That is, the NP's (or QP's) contain the information that they pertain to a finite quantity of entities. The nondurative aspect is constituted by the combination of information contained by VERB and the restriction that NP's fitting in (11) should pertain to finite quantities of entities. This combination results in the presentation of the event described as a bounded process¹. I shall elaborate this point later on in order to explain in detail what the provisional label [SPECIFIED QUANTITY OF X] is meant to represent.

The Nondurative Scheme (as well as its Durative counterpart) is in the framework of Verkuyl (1972) a kind of filter attached to a transformation: structures that are allowed through are marked with reference to a transformation developing durational adverbials, i.e. Adverbialization (cf. Verkuyl, 1972, 63-4, 85-96; Klooster and Verkuyl, 1972). It can easily be understood that sentence (1b) can pass through (11): in that case it is required that the (1a)-part of (1b) be marked as a pluralized S, so as to obtain the frequency reading of (1b). For more details, as well as for the specific framework, the reader is referred to the above-mentioned literature. As to the conditions on (11): by subcategorial nodes I mean categories of the type occurring in (6) and (7). For example, in sentences containing *spelen* (play) an underlying subcategory PERFORM is adopted. A verb like *breien* (knit), occurring with a so-called Accusativus Effectivus is analyzed as having a subcategory ADD TO. Nodes like PERFORM, MOVEMENT, ADD TO, TAKE, etc.

¹ In this connection it is quite astonishing that Dahl (1975, 453) after wrongly giving the impression that I locate the durative aspect in the Noun Phrase, presents as the right solution a distinction between bounded and unbounded processes. Dahl must have overlooked some pages, at least page 59 in Verkuyl (1972) where the term 'bounded' on this interpretation is discussed as a possible alternative for the term 'specified'.

trigger, as it were, the nondurative aspect. A verb like *haten* (hate) does not trigger a nondurative aspect when occurring with NP's analyzed in term of [SPECIFIED QUANTITY OF X].

Structures passing through filter (11) in the Gruberian framework set up in Verkuyl (1972) can be very easily translated into terms of a functional structure. The result of this translation will necessarily be an extrapolation with respect to sentences like (1b) since Jackendoff does not discuss them.

The (a)-sentences of (8)-(10) can be attributed deep structures which after lexicalization can be projected into functional structures which all fit in with the functional structure scheme (12):

- (12) DO (NP¹, f (NPⁱ, NP^j, NP^k)) (where 1 = i or j or k).

The element DO can be disregarded for the moment since it plays no crucial part in the construction of the aspect. I shall identify it with Jackendoff's CAUSE.

Of much greater importance is the second argument of DO. Variable *f* stands for predicates like TRANSFER, ADD TO, CHANGE, MOVEMENT, etc., i.e. for predicates expressing any kind of movement; *f* is a three-place predicate, though the NP's functioning as arguments need not be present in the surface structure. In the case of agentless verbs DO and its first argument do not occur in (12).

The functional structure of (1a) fits in with scheme (12). However, this scheme is not capable of expressing what [SPECIFIED QUANTITY OF X] is meant to express. An adequate description of the aspectual information contained by (1a) requires that the three arguments of *f* in (12) - and consequently the three NP's in Jackendoff's (6) - be specified somehow.

I shall now attempt to make this clear with the help of a number of graphic representations, so as to show that a lot of subtle though systematic phenomena should be captured in the semantic representation. I shall demonstrate this with the help of an example discussed in Verkuyl (1972, 105):

- (13) Den Uyl overhandigde een uur lang het PVDa-speldje aan
 congresgangers.
 Den Uyl handed out the Labour Party badge to congressgoers
 for an hour.

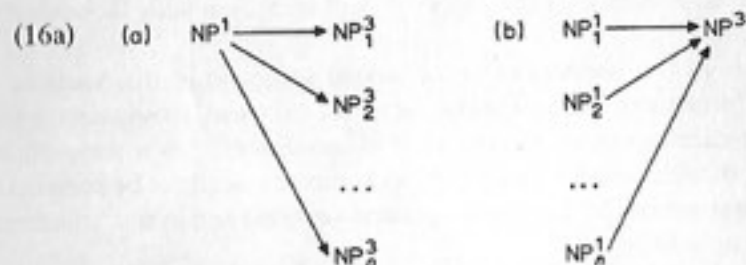
Its counterpart without the durational adverbial and with a singular NP³ is:

- (14) Den Uyl overhandigde het PVDa-speldje aan een congres-
 ganger.
 Den Uyl handed out the Labour Party badge to a congressgoer.

The functional structure of (14) is something like (15):

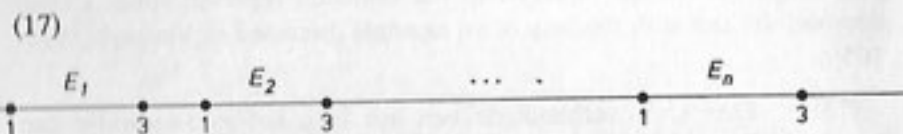
(15) CAUSE (NP¹, [TRANSFER (NP², NP¹, NP³)]).

Structure (15) makes clear that in (14) the referent of NP² is transferred from the referent of NP¹ (Den Uyl) to the referent of NP³ (a congress-goer): there is one event, one badge, one congress-goer and one Agent mentioned by name. Now, if a durational adverbial is added to (14) and if NP³ is changed into the plural form *congresgangers* (congress-goers), as in (13), then a situation arises as sketched in (16a)². A situation like (16b) arises when *Den Uyl* is replaced in (14) by a plural NP, for instance *Meisjes* (girls), NP³ remaining singular:



It is self-evident what happens when both NP¹ and NP³ are plural.

It should be noted here that (16a) and (16b) are only partial representations of the referents of NP¹ and NP³ in their relation to one another in a transfer situation. Removing ourselves further from functional representations like (12), (15) and related forms like (16), we can provisionally represent what is expressed by (13) as in (17):



² Sentence (13) could be considered ambiguous. Thus, *congress-goers* can be taken to refer to a set (joint plural) or to individuals. Note that in both cases the analysis gives a similar result. In the first case, the repetition concerns set of congress-goers (every time another group of arbitrary size), in the second case individuals. However, one could argue that (13) is not ambiguous, rather that (13) is not explicit with respect to the question whether *Den Uyl* gave the badge to an individual or to groups. In this case individuals and groups are taken as unit-classes.

This is short for (18) in which the superscripts of NP¹ and NP³ correspond with Beginning and End of events $E_1 \dots E_n$.

(18) E_1 : TRANSFER (NP², NP¹, NP³₁) at I_1
 E_2 : TRANSFER (NP², NP¹, NP³₂) at I_2
 ...
 E_n : TRANSFER (NP², NP¹, NP³_n) at I_n

where I_i is the temporal interval corresponding with E_i . Observe that in the (non-durative) reading of (13) there is one unique badge which keeps getting back to *Den Uyl*.

Diagram (18) shows that one cannot simply use the functional structure (15) of the single-event reading expressed by (14) to describe sentence (13) which expresses repetition of events.

I shall now further analyze the factors which constitute the Nondurative aspect in the sentences under discussion, summing up what is meant to be expressed by the phrase [SPECIFIED QUANTITY OF X] in (11). The following factors are of importance:

(i) There is an interval on the time axis onto which an event E_i can be mapped linearly: the time it takes for the event in question to take place can, in principle, be measured;

(ii) The temporal interval I_i , corresponding to E_i , has two (potentially) marked boundaries, the initial point t_{B_i} and the terminal point t_{E_i} , with $t_{B_i} < t_{E_i}$. If the boundaries are marked as closed then $[t_{B_i}, t_{E_i}]$ represents the situation in which the interval is (fully) closed: the initial and the terminal point are included, as in (17). In $(t_{B_i}, t_{E_i}]$ the interval is open-closed, with only the terminal point marked; in $[t_{B_i}, t_{E_i})$ it is closed-open;

(iii) In the thematic representation occur at least two NP's which can be characterized as providing the Beginning (Source) and the End (Goal) of the movement expressed by the predicate whose arguments they are. These are the correlates of t_{B_i} , resp. t_{E_i} . In the same manner as the temporal intervals in (ii), the events E_i can be regarded as intervals (to be correlated with them) of which the Beginning and the End may be marked; in *Zij fietste tot de Munt* (She cycled to the Munt) only the End of the event is marked, that is the reaching of some spatial point, in this case some arbitrary border of a square in Amsterdam or some arbitrary point near the centre of this square. Hence the purely locative information (a definite square) is thematically transformed into temporal information concerning the boundary of an event. The event in question can be represented as an interval $(t_{B_i}, t_{E_i}]$. In (8) and (9) both Beginning and End are marked;

(iv) The Theme-NP is another argument of the predicate *f* in (12). With TRANSFER-verbs it cannot be identified with either Beginning or End;

(v) With TRANSFER-verbs such as *hand(over)*, *sell*, and so forth, the Theme is moved by the Agent who (potentially) marks the Beginning of the movement;

(vi) For non-durative aspect there is one necessary condition, saying that at least one of the referents of NP¹ or NP³ is to be correlatable with a marked boundary of a temporal interval corresponding to the event in question. In other words, one of the three situations given in (19a)–(19c) must hold good:

- (19) (a) $\langle\langle t_{B_1}, t_{E_1} \rangle, \langle t_{B_2}, t_{E_2} \rangle, \dots, \langle t_{B_n}, t_{E_n} \rangle\rangle$
 (b) $\langle\langle [t_{B_1}, t_{E_1}], [t_{B_2}, t_{E_2}], \dots, [t_{B_n}, t_{E_n}] \rangle\rangle$
 (c) $\langle\langle [t_{B_1}, t_{E_1}], [t_{B_2}, t_{E_2}], \dots, [t_{B_n}, t_{E_n}] \rangle\rangle$

where the marked boundaries correspond to NP's that are either Singular or Joint-Plural. The latter in connection with the reading of sentence (20):

- (20) Den Uyl overhandigde urenlang het PVDA-speldje aan drie congressgangers.
 For hours Den Uyl handed out the Labour Party badge to three congress-goers.

The three congress-goers apparently function as one-identifiable unit to be correlated with t_{E_i} in the events E_i (see Footnote 2). Note that the ordered set of closed-open intervals (19b) can be correlated with the set of iterated events described in sentence (13). Note also that in that case the temporal distance between t_{B_i} and t_{E_n} in (19b) is an hour. The fourth logically possible situation, namely a series of open intervals, can be left out of consideration here, since it does not apply to nondurative sentences;

(vii) The necessary condition mentioned in (vi) brings about that with TRANSFER-verbs the Theme-NP can in only one case effect a durative interpretation of the sentence. This is the case with a sentence like (21).

- (21) Den Uyl overhandigde een uurlang speldjes aan een congressganger.
 For an hour Den Uyl handed out badges to a congress-goer.

This must be interpreted as one continuous event presented as durative. It is consequently impossible to add to (21) a phrase like *en alle keren dat hij speldjes overhandigde* ... (... and each time he handed out badges ...) without straining what is expressed by (21). It is not impossible to continue (13) with ... *en alle keren dat hij het speldje overhandigde* ... (... and each time he handed a badge ...), as was observed by Johan Kerstens (personal communication):

(viii) Different kinds of iterativity arise in sentences with durational adverbials, depending on the nature of the various NP's. The fact that the Theme-NP in (13) is two-ways interpretable, also adds to our understanding of these aspects. In one reading the Labour Party badge is a unique token (comparable with the Eiffel Tower), in the other reading it is a series of tokens represented by a type-reference: Den Uyl was handing out specimens of a certain thing now to be called 'abstract', which represents itself in tokens by way of a mould or model. In the case of unique token-iterativity the object, as we said before, comes back to the referent of NP¹ before the latter can start with a new E_i . In the case of type-iterativity it is a matter of events of the same kind, the token being a different one each time. In both cases, however, the badges in question are tokens, either unique or a specimen of a mould. Observe that the same two readings are possible when the Theme-NP is pluralized. In a sentence like

- (22) Den Uyl overhandigde een uurlang de PVDA-speldjes aan congressgangers.
 For an hour Den Uyl handed out the Labour Party badges to congress-goers.

it may be a case of a unique set of badges or of a limited number of symbols which are given a concrete form as specimens; in the latter case it is batches of tokens that are being handed over.

The above eight points belong to a domain of analysis which can easily be enlarged. For example, in sentences like (8) we have a verb expressing physical movement: a verb like *fietsen* (cycle) has a thematic structure in which the Agent-NP is at the same time Theme-NP. Verbs like *breien* (knit), occurring in (10), require that the referent of the Theme-NP be not in existence at the moment t_{B_i} and be not complete until the moment t_{E_i} . For a more detailed analysis see Verkuyl (1972). In all these cases one can make a generalization by mapping the internal structure of an event onto a temporal interval as in (19): in that way each of the types of event in question makes such a mapping possible.

In Verkuyl (1972, 55–64, 93–96) I have used the term 'temporalization' for this process, meaning that in the sentential structure there are elements present which see to it that the structure of an abstract entity which is, or can be thought of as, linear, is correlated to the time axis. An example: in the sentence *Het Amadeuskwartet speelde met Leister het klarinetkwintet van Brahms* (The Amadeus quartet played Brahms' clarinet quintet with Leister) an opus by Brahms is referred to. Detached from that sentence this work can be seen as an abstract entity with a linear structure. Each unique performance of the opus temporalizes this linear structure, that is, it makes it

possible for the quintet to be correlated to an interval on the time axis. A sentence in which something is said about the (abstract) piece of music can effect temporalization, as is the case in the above sentence. Not necessarily so, however, compare *I believe that Brahms's clarinet quintet was written during the latter part of his life*. It is no use, therefore, to speak of a Nondurative aspect unless temporalization is expressed in a sentence.

It is clear that the well-known difference between type and token is applicable here. To temporalize means to realize a token from a type, to 'actualize' it, in Van den Hoek's words (1972, 14). Consequently our above findings that, when the Nondurative aspect is being constructed, guarantees for the token-character of an (iterated) event have been built in, have immediate consequences for the description of the aspects: one can turn to the temporal intervals rather than to the non-linear elements of structure (hidden in the variable *Y* in entries like (4)) of the events themselves. This is exactly what an analysis in terms of thematic relations does do.

I shall now sum up what the label [SPECIFIED QUANTITY OF *X*] was meant to express. Given an interval I_i on the time axis with t_{B_i} and t_{E_i} functioning as marked or unmarked boundaries and with something moving from t_{B_i} to t_{E_i} , a threefold quantificational information can be said to be required:

(a) about the length of the interval I_i as well as the nature of this interval. That is, I_i may not be a completely open interval: the interval must be at least half-closed; see (19). Note that this requirement also applies to sentences like *Greetje wandelde een kilometer* (Greetje walked a kilometre);

(b) about the number of entities that may possibly function as Source or Goal; see (16a) and (16b) and (vi);

(c) about the number of entities subjected to the movement; see (vii).

In (i)-(vii) I have attempted to throw some light on the nature of this information and the way it should be accounted for. The label [SPECIFIED QUANTITY OF *X*] is an attempt to generalize: the variable *X* ranges over just those values mentioned in (a), (b) and (c), as I have amply demonstrated in Verkuyl (1972, 40-106). The SPECIFIED refers to restrictions on the number of entities mentioned in (a)-(c).

Of course, the formalization of this analysis should be far more exact. A much more thorough knowledge of the internal semantic structure of NP's is required to make it possible for this analysis to fit the transformational framework. In Verkuyl (1972, 142-55) I have attempted to find out if the Bach/MacCawley analysis of NP's might offer perspectives for a more adequate formal account of [SPECIFIED QUANTITY OF *X*]. A NP-description based - as this one is - on the principle of division in two parts: a part in which quantification information is stored and a part in which the remaining

lexical information is stored, is extremely attractive for the description of the aspects (such a description follows, of course, Quine (1960)). The first part contains different types of quantifiers, depending on the NP's to be generated. Thus definite NP's are given an iota-operator, indefinite NP's an eta-operator, and so forth.

In spite of the fact that I have given only the outlines of this NP-analysis it is, I hope, becoming clear that I intend to relate the exact conditions on the Nondurative aspects to quantifiers that define restrictions on the quantities of the various types of *X* in (a)-(c) above. In the next section I shall try and develop the apparatus that appears necessary to incorporate the information discussed in (i)-(viii) into the functional-semantic framework which led to structure (6) as the functional structure of sentence (1a).

3. INTERPRETIVE RULES FOR SENTENCES WITH DURATION-MEASURING ADVERBIALS

This section is an attempt to further elaborate the consequences of Jackendoff's proposals concerning the semantic representation of a sentence like (1b) *Jane kocht urenlang een speldje van Peter* (For hours Jane bought a badge from Peter). The functional-semantic representation of the (1a)-part of (1b) is (6) which I repeat here for convenience:

$$(6) \quad \text{CAUSE (JANE, } \left[\begin{array}{c} \text{CHANGE} \\ \text{POSSESSION} \end{array} \right] \text{ (BADGE, PETER, JANE))}$$

3.1. The Functional Status of 'Adv'

I shall now try and describe the problems presenting themselves to someone who wants to form the logical representation of (1b) with the help of projection rules and/or other interpretive rules.

Jackendoff assumes that an *Adv* not taking part in the strict subcategorization of the verb, is as it were set apart. That is, *Adv* takes no part in the first stage of constructing the functional structure. This is what Jackendoff says about it: "Let *S'* denote the sentence resulting from removing *Adv* from *S*. *S'* will have the same functional structure as *S*, since *Adv* does not contribute to the functional structure" (1972, 69). Applied to (1b) this means that the *S'* of (1b) is the part identical to (1a). In Verkuyl (1969) I argue that in sentences with a duration-measuring phrase, such as *urenlang* (for hours), *drie uur* (three hours), one should not quantify over points of time but over units of measure (intervals). I also argue that in such cases it is not a question of universal but of numerical quantification, the quantifier specifying the

number of units. In the case of (1b) the temporal unit is 'hour', the number of units n (n 1).

A similar analysis has been proposed by Wunderlich (1970). Bartsch (1972), knowing Wunderlich's work, develops a predicate-logical system of notation which links up with work of Reichenbach. She, too, posits that in the semantical representation there be numerical quantifiers at work, which she calls 'cardinal quantifiers', i.e. as quantifiers specifying the cardinality of a certain set. In her notation the numerical quantifiers are represented as predicates over the cardinality of a set, or rather: as functors. This means that in the case of (1b) a duration is ascribed to a set of events as a set of units of duration (hours), the cardinality of which equals more than 1.

The idea that an element in *urenlang* (for hours) can be analyzed as a functor which, operating S' , produces the specification of a number of measure-units, agrees with Jackendoff's vision on projection rules which he has given so far (if the reader is sympathetic, that is). The way he formulates the rule P_{subject} , for instance, shows that projection rules can be seen as operating on functional structure already built up and as yielding a more extensive functional structure. Whatever the case may be, it is near to impossible not to see the result of a hypothetical projection rule, say $P_{\text{duration-measuring}}$, as a functional structure to which the term 'higher predicate analysis' is applicable: the predicate(s) contained in S' are undoubtedly lower in the structure than the functor operating on S' .

A reasonable way of formulating $P_{\text{duration-measuring}}$ (to my opinion, reasonably along the lines of Jackendoff), appears the following:

- (23) $P_{\text{duration-measuring}}$: If *Adv* contains a morpheme representing a temporal parameter and if *Adv* contains a Noun of the category of the type-I event nouns (like *minute*, *hour*, *year*) as well, embed the reading of S' as an argument of *Adv*.³

The formulation of (23) makes clear that the ultimate semantic representation of sentences with durational adverbials like *urenlang* (for hours) which one might expect in Jackendoff on the basis of the framework he proposed, does not essentially differ from the analysis in Klooster (1972), Klooster and Verkuyl (1972) and Verkuyl (1972) (if we ignore the representation of frequency for the present).

The result of (23) applied to structure (1b) is the functional structure (24).

- (24) FOR HOURS (CAUSE JANE, $\left[\begin{array}{c} \text{CHANGE} \\ \text{POSSESSION} \end{array} \right]$ (PIN, PETER, JANE))

³ Type-I event nouns like *minute*, *hour*, *year*, etc. are to be distinguished from type-II event nouns like *summer*, *evening*, *meeting*, etc. on several grounds. (See Verkuyl, 1969, 1973).

I shall now show that, by penetrating much deeper into the matter, one can improve this outline in such a way that it represents a (more or less) complete change (restructuring) of the functional-semantic representation into a representation on which the ultimate logical-semantic representation of the meaning of (1b) can be based. In other words, rule (23) can be replaced by a set of rules to be described below. It is important here to notice that these rules are necessary to canalize the functional-semantic information of type (6) in such a way that the formation rules of a (logical-semantic) calculus can structure the representation to be developed. If such a canalization is possible, this means among other things that a model-theoretic semantics can be linked up with a transformational description.

3.2. Event-Variables

Structure (6) represents one single event which has taken place in the past. The latter aspect of meaning is not accounted for in (6), however. If we take the tense-element *Pret* to be a time operator and if we take W to denote (6), (6) can be given the following logical form: $P(W)$; P standing for 'It was the case that . . .'. It is, however, impossible to account for the iterativity of the events $E_1 \dots E_n$ from scheme (18) in this way. For this, a representation is required in which can be expressed that it is a matter of quantification over events. In Verkuyl (1972, 156-72) I have pointed out the great usefulness of the distinction made by Reichenbach (1966, 255-74) between so-called thing-predicates and event-predicates. A proposition like 'John slept' can be analyzed in terms of a thing-predicate ('Sleep') which is applicable to an individual John. Normally this is expressed as ' $S(x_1)$ ', short for 'Sleep (John)'. The same expression can, however, be analyzed differently: the expression 'Sleep (John)' is taken to be an event-predicate describing an event v . The expression ' $(\exists v)[\text{Sleep (John)}]^*(v)$ ' can be interpreted as 'An event v took place described as 'John slept'' (of course, if we add the time-operator P to this expression). Bartsch (1972) uses this notation too.⁴

If one wished to describe (1a) in terms of the event-predicate $[W]^*$, the following representation in terms of Reichenbach would be useful:

- (25) $P[(\exists v)[W]^*(v)]$

i.e. an event took place 'Jane bought a pin from Peter'. Thus, a non-iterative

⁴ The proposal concerning the logical form of action sentences in Davidson (1966) appears to be not incompatible with an analysis in terms of thematic relations. Davidson's analysis of (1a), for example, would be something like $P[(\exists v) \text{BUY FROM (Jane, a pin, Peter, v)}]$ (where I omit the quantifier accounting for *a pin*). It is, of course, possible to define thematic relations in terms of the argument places. It seems necessary in this case to analyze the predicate 'BUY FROM' in terms of subpredicates. Davidson's analysis cannot differentiate between *Jane* as Agent or *Jane* as Goal.

structure is given. In order to get from (25) to the (1a)-part of sentence (1b), some provisions must be made. First, however, a transition is to be effected from (6) to the type of representation (25), i.e. from a functional-semantic representation to a representation which belongs to the class of well-formed formulae of a calculus. I shall start from the hypothesis that such a transition is completely successful if all information required to provide the correct logical structure is present in representations of type (6). A less strong hypothesis would lead to the assumption that semantic information may be added 'from outside'.

In order to get from (6) to representations of type (25) a rule is required which yields the propositional form $[W]^*(v)$. It is the predicate CHANGE in W (i.e. (6)) which, in this case, gives the crucial information. Given the predicate CHANGE and three arguments, it is possible to arrive at the correct values of the variable v in (25). Notice that this rule is in fact based on the lexical description of *kopen* (buy) given in (4). It is, after all, a fairly plausible strategy to account for the information that *kopen* (buy) refers to an event, in the entry of the lexical item itself. The following rule can therefore be formulated:

- (26) Functional-semantic representations containing a predicate CHANGE (as appearing in (6)) can be taken as event-predicates occurring with an event-variable v in the propositional form $[E]^*(v)$.

E being a variable one of the values of which is W . Rule (26) translates the information of the type (6) represented in terms of thing-predication into information represented as event-predication. We must also assume a set of values over which the variable v can range. Given the propositional form $[W]^*(v)$, we can assume there to be a set, say G , which is the set of events v described as 'Jane buys a pin from Peter':

- (27) $G = \{v|[W]^*(v)\}$.

In (27) this set is given, only provisionally and without any ordering among its elements. We should require, however, that G satisfies the following three restrictions:

- (28) (a) G may not contain elements except such as can be mapped onto closed intervals on the time axis;
 (b) G must contain at least two elements;
 (c) G may not contain elements which overlap.

I shall try now to show that these restrictions can be accounted for quite naturally within the framework developed so far.

3.3. Closed Intervals

The first restriction on G is crucial for the question whether there is any real chance of such a venture succeeding. The information in (1b) that it is a matter of events with one Source (Beginning) and one Goal (End) and one object moving from Source to Goal, can after all not be added halfway the interpretation process if, that is, one takes the line that the fewer levels a semantic component has the better it is organized.

It looks as if restriction (28a) can be satisfied if the information in (6), i.e. in $[W]^*$, is specified in more detail. For this purpose one must use the information represented by the three types of SPECIFIED QUANTITY OF X mentioned on page 488. If one does accept that in the analysis of aspectual information expressed by sentences like (1b) the information expressed by the label SPECIFIED QUANTITY OF X can be taken as a specification of a certain type of quantifiers specifying certain quantities from a set of entities X , a possible solution for the problem posed by (28a) emerges. I am thinking of the *iota*-operator (Den Uyl, the congress-goer) and the *eta*-operator (a congress-goer). If one takes these operators to be present in the functional-semantic representation – or rather, if one takes the information expressed by these quantifiers to be present – then $[W]^*$ can be sufficiently classified so that requirement (28a) is met.

Having a closer look at the three arguments of CHANGE, we see that each of the three NP's refers to one entity. In accordance with Reichenbach (1966, 264) we can call the NP *een speldje* (a pin) 'an indefinite description' here, i.e. a description of an indefinite individual. Proper names such as *Jane* and *Peter* usually have an exclusive status in logical analysis, but one can consider them to be a special case of definite descriptions, which is what Verkuyl (1972, 142–55) posits: *Jane* can be analysed as 'the x such that x is Jane'.

Concentrating, for the time being, on the second and third argument of CHANGE, resp. PETER and JANE, we see that the information contained in the two NP's can be used to meet requirement (28a): it is PETER which roughly represents what corresponds to a marked initial point of an interval; and similarly JANE can be related to the terminal point. The problem posing itself is: how do we effectuate the above-mentioned translation of (6).

The representation of the NP's *Jane* and *Peter* in the functional representation (6) evidently is very rough. Clearly a more complete version of (6) should contain the complete reading of the NP's in question. Thus the NP

een speldje (a pin) should contain the information that its number is singular and that its article is indefinite. In principle, there are two possibilities as regards the above-mentioned translation of the functional-semantic representation.⁵ The first is that information is represented in the reading of the NP, the origin of which is clearly syntactic, among other things by categories (or if you like, features) such as INDEF, DEF, PLURAL, SINGULAR, and so forth. This information is then canalized by the translation rules into the (syntactic) rules of the calculus which is made the basis of the ultimate semantic interpretation. The second possibility is to have a representation containing quantifiers and variables directly operating in the lexicon. I shall only explore the first possibility here because it does greater justice to the homogeneity of the functional-semantic representation as intermediate stage. In that case rules of the following type are necessary:

- (29) If a NP contains the categories (features) DEFINITE and SINGULAR, then transform the functional-semantic representation of this NP into a representation in which the head noun is embedded where P is situated in the propositional form ' $P(x)$ ' and have an iota-operator bind the variable.

Apart from (29) a rule is required which on the basis of the features INDEFINITE and SINGULAR leads to a similar result, the operator being an eta-operator.

Returning now to (6) we can use rules of type (29) to take the aspectual information mentioned in restriction (28a) along to the logical representation to be formed, since NP¹ and NP³ each contain the categories DEFINITE and SINGULAR. We can now formulate the following rule:

- (30) If the second argument (Begin) and the third argument (End of the movement) of the thing-predicate CHANGE contain information which through rules of type (29) is translated into the logical form ' $(\alpha x)P(x)$ ' (where α stands for the iota-operator or the eta-operator), then introduce in the very next stage of the developing semantic representation an event-predicate $[E]^*_c$, (where c indicates that the predicate pertains to an event corresponding with a closed interval).

⁵ After the final version of this article was written Kroch (1974) came to my notice. Kroch is particularly interested in scope phenomena. Consequently it can easily be understood – he adopts the framework of EST – that the machinery he develops mainly applies to characteristics of surface structure. For example, his scope marking takes place with respect to the order of logical operator words in sentences, such as *some*, *all*, *each*, etc. However, scope marking presupposes a mechanism recognizing operator words in the sentences of natural language. This is exactly the mechanism we need in the present analysis.

This rule applies to (6). Its result is that the event-predicate $[W]^*_c$ is indexed as $[W]^*_c$.

Rule (30) makes it necessary to stipulate that there be a correspondence between the elements of G defined by (30) and the temporal intervals associated with them. That is, it must be the case that:

$$(31) \quad (\forall v_i \in G)(\forall t)(\exists t')(t < t' \ \& \ (\forall u)T(v_i, u) \Rightarrow t \leq u \leq t').$$

In other words, we assume that in the case of (6) the set of points of time corresponding to a v_i to which the indexed event-predicate applies after the operation of rule (30), constitutes a closed interval. The notion 'interval corresponding to v_i ' can be defined as follows:

$$(32) \quad I(v_i) = \{t \mid T(v_i, t)\}$$

that is, an interval corresponding to an arbitrary event v_i is a set of points of time for which $T(v_i, t)$ holds good. The expression ' $T(v_i, t)$ ' is then to be interpreted as ' t is in the interval in which v_i is going on'.

Given (31) and (32) we can easily see that (29) and (30) provide the means for arriving at a representation in which appropriate values can be assigned to the variables v_i , that is, appropriate with respect to the requirement formulated in (28a). Both rules lead us to an account of sentence (1b) *Jane kocht urenlang een speldje van Peter* (Jane bought a pin from Peter for hours) in terms of (19c), as far as the part represented by (6) is concerned.

Similar rules are required to account for sentences in which the nondurative aspect is to be accounted for temporally in terms of (19a) and possibly (19b).

Thus my conclusion as to restriction (28a) is that interpretive rules can differentiate between situations described in (19a)–(19c) and that together with the information contained by the predicate CHANGE they can account for the nature of the aspect in question, though there may be some difficulties with differentiating between the type-reference and the token-reference. I shall return to this point in the last section.

3.4. Repetition

As to (28b) we face the following problem. Theoretically, there are two main approaches to the repetition expressed by sentences like (1b):

- (33) (a) It is possible to generate pluralized S's. Hence the information that (1b) concerns a repetition of events is already available in deep structure. Restrictions are necessary to block the singular event reading of (1b); that is, a singular S may not contain (or co-occur with) a Durational Adverbial.

- (b) It is necessary to restrict the specifications PLURAL and SINGULAR to Noun Phrases. Plurality of S's cannot be accounted for by syntax since the reference of S's should be treated differently from the reference of NP's. Hence some rules are to be added to the semantic component so as to account for the repetition of events.

I shall briefly comment on these two approaches. The first one is explored in the Gruberian framework of Verkuyl (1972); see also Klooster and Verkuyl (1974). Since Jackendoff's framework does not allow for generating plural S's, as far as I can see, I shall not elaborate on this issue.

As to (33b), there are two variants. One is that in removing *Adv* from S in (2) so as to obtain a functional adverbial structure, the resulting S' is given the choice of having a singular or plural reference. The underlying motive for this could be that the removal of *Adv* from S results in a semantic structure containing an argument, namely S', and a (higher) predicate. At that point it appears necessary to decide on the reference of S', since an argument should refer to either one individual or more than one individual, the individual being an event in this case. A structure with a plural S' is to be accepted as semantically well-formed as the semantic representation is being further developed. The structure with the singular S' is marked as anomalous and subsequently it will be filtered out in the semantic component due to the presence of the Durational Adverbial. Note that after the choice as to plural or singular reference of S' has been made, this solution is similar to that in (33a), though different types of rules are used.

The other variant of (33b) is the account given by Daalder (1974). She postulates the need for interpretive rules operating on syntactic features like [-durative] and [+iterative]. I shall demonstrate the principle of this account by applying it to the functional structure developed above. In the present analysis her approach would boil down to a rule operating on the indexed event-variable $[W]_{\alpha}^*$, on the one hand, and *Adv* on the other hand. The (interpretive) rule in question would, informally, read as follows:

- (34) If $[W]_{\alpha}^*$, as produced by rule (30), would be part of the functional structure of a S' which is an argument to (some part of) *Adv*, then S' refers to an interval containing a series of closed intervals as given in (19c).

In this variant, repetition of events seems to be taken as distinct from plurality. That is, 'plurality' would be a term restricted to the referents of NP's, whereas 'repetition' would apply to the referents of events. Daalder

introduces a feature [+iterative] so as to express that the interpretive rule adds information distinct from the feature [+plural].

As far as I can see the above two variants show that, in principle, the interpretive framework can deal with the repetition of events.

3.5. Overlapping Events

As to restriction (28c), namely that the iterated events may not overlap, it could be the case that this restriction is too strongly formulated. A sentence like:

- (35) Den Uyl overhandigde urenlang een speldje aan congresgangers.
For hours Den Uyl handed out a badge to congress-goers.

does not, in fact, exclude the possibility of Den Uyl's handing out different badges to more than one congress-goer at the same time. In this case, however, the condition on the non-overlap holds good for Den Uyl's repeatedly giving a badge to one and the same congress-goer. If there are several congress-goers the individual man-to-man acts of handing out a badge may overlap because Den Uyl can use both hands. If there is one congress-goer among them who receives several badges then he must have received them one after another. In other words, the conditions on the overlap are directly inferable from the representation of the NP's functioning as arguments to CHANGE I may refer back to diagrams (16)–(18) which illustrate my comments on (35).

However, there are some cases which require that the restriction (28c) be mitigated. Sentences like *Roy Schuiten reed urenlang een rondje van 45 seconden* (For hours Roy Schuiten rode a lap of 45 seconds) show that the series of intervals may have an overlap of at most one point. A similar situation is, in fact, not excluded in the situation described by (1b).

Hence we must stipulate that:

- (36) $(\forall v_1 \in G)(\forall v_2 \in G)(\exists t)(T(v_1, t) \& T(v_2, t) \supset v_1 = v_2 \vee$
 $(\forall t')(T(v_1, t') \& T(v_2, t') \supset t = t')$

that is, for every two arbitrary events from G taking place at the same moment of time their being identical holds good or they have one point of overlap. I conclude that restriction (28c) can be dealt with adequately.

3.6. Measuring Cardinality

Given G as the set of events to which Jackendoff's S' in (1b) is related, there are now two methods to arrive at the final output of the interpretive process.

The first method takes us via (32) to a set H of intervals corresponding with the elements of G :

$$(37) \quad H = \{I(v) \mid v \in G\},$$

that is, H is the set of intervals corresponding to the events v which are elements of G . Observe that the interpretive rules operating on S' and *urenlang* (for hours) can be provided with a correct input by this and only this definition. Note that (37) now exactly applies to (19c). *Urenlang* (for hours) predicates a measure for H (or rather: contains a predicate indicating a measure for H). We must now define a measure $F(H)$ as 'the length of the smallest closed interval within which H is contained'. In terms of (19c): the boundaries of the interval H determined by *urenlang* (for hours) are t_{B_1} and t_{E_1} . Thus the representation of (1b) in terms of the interpretive mechanism given here, can be said to be the following:

$$(38) \quad F(H) > 1 \text{ \& the time unit is 'hour'}$$

In words, (38) comes down to: the number of measuring units of the interval formed by the set of closed intervals corresponding to the events v which form part of the set of non-overlapping events described as 'Jane bought a pin from Peter' is greater than 1. If one were to replace *for hours* by *three hours* the first conjunct of (38) would read $F(H) = 3$.

The second method implies that the length to be measured is not predicated over H but over G itself. Take $F(G)$ to be 'the length (in units of time) of the smallest closed interval within which each moment of time is contained at which a v from G takes place'. So in this method we make use of G . In that case the representation of (1b) in terms of the interpretive mechanism applied here, is as follows:

$$(39) \quad F(G) > 1 \text{ \& the time unit is 'hour'}$$

I shall not discuss the question which of the two methods is to be preferred. I have found that both lead to a representation of sentence (1b) to which a truth-conditional semantics can be related. A choice will depend on other factors than those which have been discussed in this article.⁶

4. SOME TRANSLATIONAL DIFFICULTIES

It is clear from the preceding sections that extrapolations from Jackendoff's framework have led to interpretive rules having a translational function.

⁶ In Verkuyl (1973) a distinction was made between Duration-Measuring Adverbials like *urenlang* (for hours) and Duration-Dating Adverbials like *gedurende die week* (lit. for that week). The latter type of adverbials share some properties with adverbials of time like *afdens de vergadering* (during the meeting). I have restricted myself here to DMA's.

(Strictly speaking, the term 'interpretive rule' is wrongly chosen, since the final interpretation of the formulae belonging to the complete output of the interpretive rules of transformational grammar should be dealt with within the framework of formal semantics (i.e. semantics operating upon (uninterpreted) formal calculi)). That is, interpretive rules à la Jackendoff translate functional representation into formulae of a formal language in respect to which formal truth definitions can be given on the basis of an interpretation function operating on the well-formed formulae of this formal language.

Though Jackendoff does not elaborate this point, it is worth mentioning that his thematic analysis seems to deal adequately with a well-known problem in tense logic, namely, how to account for continuous change. Von Wright (1963, 1965, 1966) describes an event as a change or transition from the state which obtains on the latter occasion (end-state). In the case of (14) this analysis would distinguish the initial state 'Den Uyl's having the Labour Party badge' from the end-state 'A congress-goer having the badge'. The operator connecting the two propositions describing the two states of affairs is called ' T ' (interpretable as 'and next'). The problem with Von Wright's T -operator is that it presupposes discrete time (Davidson, 1966; Hoepelman, 1974). That is, no account can be given of the interval between t_{B_1} and t_{E_1} . Von Wright can not sufficiently describe the difference between the interval separating t_{B_1} from t_{E_1} and the interval separating t_{E_1} from t_{B_2} . Hoepelman (1974) uses for the analysis of Russian aspects in terms of formal logic, the tense-logical system developed by Kamp (1968; personal communication with Hoepelman), extending this system with an operator which is to account for continuous change. This Δ -operator comes from Potts who introduces his change-operator as follows: "If 'is coming to' is represented by a monadic operator ' Δ ()', then if ' p ' stands for ' A is Q ', ' Δp ' will represent ' A is becoming Q '. (Potts, 1969, 537). Now, if ' $P(x_1)$ ' stands for 'the door is open', then ' $\Delta P(x_1)$ ' stands for 'the door becomes open'. If we use Kamp's tense-operator H ('it was for sometime up to now the case that . . .'), then the formula:

$$(40) \quad H\Delta P(x_1) \& P(x_1)$$

would account for the situation in which it is true now (for a first time) that the door is open, after becoming gradually open for some time (Hoepelman, 1974, 165).

In Jackendoff (1972, 41) we find an analysis of the verb(s) *open* which can be taken to be a notational variant of an analysis in terms of Potts' operator. *Open* is thematically defined as a change whose initial state is 'not-open' and whose terminal state is 'open'. As far as I can see, the thematic predicate CHANGE can be taken as indicating a continuous process. That is, I think that

Jackendoff is more close to (40) than to Von Wright's analysis. (Of course, there are differences, such as the connective in (40)).

Note that (40) accurately expresses the compositional nature of the terminative aspect, giving the durational information in the first conjunct and the terminal information in the second conjunct.

However, Hoepelman's system is not sufficiently rich to deal with aspects scattered over the sentence. Following traditional literature he restricts himself to assigning aspects to verbs only. This means that his system cannot account for aspectual phenomena described in the preceding sections, that is for sentences containing phrases like *hand a pin*, *walk a mile*, *ride to the Munt*, *knit a sweater*, *play a concerto*, etc. In those cases we cannot have the two identical propositions $P(x_i)$ in the conjuncts of (40).

Therefore, some arrangements should be made so as to make Potts' Δ -operator useful for the description of aspectual phenomena scattered over the sentence.

The second translational problem concerns Anscombe's T -operator, which also plays a role in Hoepelman's system (Anscombe, 1964). Anscombe's T (also interpretable as 'and next') is not a binary operator like Von Wright's T . Anscombe compares the use of her T with the use of *either...or* which can be followed by indefinitely many occurrences of *or*. This property of T could be used to account for the repetition of events expressed by sentence (1b). For instance, if ' p ' is short for 'Jane bought a pin from Peter', then the expression

$$(41) \quad T_2(T_1(p, \sim p), p)$$

would be read as: 'Jane bought a pin from Peter and then₁ Jane did not buy a pin from Peter and then₂ Jane bought a pin from Peter'.

However, it is not clear whether Anscombe's T is to be taken as being specific or nonspecific about the number of occurrences of p . If the number of T 's is equal to the number of actual occurrences of p , then T_n specifies a finite number n of repetitions. If we would describe (1b) in terms of (41) we would know that Jane bought a pin from Peter twice. Of course, we do not want to use Anscombe's T for the analysis of (1b) on this interpretation. It is not clear whether the Kamp-Hoepelman system uses the T -operator to express an unspecified number of occurrences. If so, then (41) should be taken as accounting for at least two occurrences of p . However, this would not exclude an infinite repetition of p . Hence we get problems with measuring the interval $[t_{B_1}, t_{B_2}]$ in terms of the measuring unit 'hour'. Consequently, there are some doubts as to whether Anscombe's T is useful for the description of the aspectual repetition expressed by (1b).

The third translational problem arises with respect to the type-reference and the token-reference of *het PVDA-speldje* (the Labour Party badge) in (14). As far as I know, transformational grammar has not sufficiently accounted for this distinction in terms of the syntactic or semantic apparatus developed hitherto. Note that it also plays a role in sentences like:

- (42) (a) ? Ik heb vaak de boterham gegeten.
 ? I often ate the slice of bread.
 (b) Ik heb vaak het kapje gegeten.
 I often ate the heel.

The first sentence is somewhat strange: one cannot eat the same slice of bread twice on a normal interpretation of (42a). However, one can say (42b) quite naturally. In this case token-reference of *het kapje* (the heel) is possible, most probably due to the fact that the heel can be identified as a structurally identifiable part of bread, whereas an arbitrary slice cannot be identified with respect to the whole. Note that the difference between (42a) and (42b) disappears in sentences like *Ik heb vaak de boterham zien liggen op de tafel* (I often saw the slice of bread lying on the table) and *Ik heb vaak het kapje zien liggen op de tafel* (I often saw the heel lying on the table), where both NP's refer to a particular thing. It will be clear that in the case of (42b) we need a specific operator indicating that *het kapje* (the heel) refers to as many heels as the frequency adverbial indicates; in *Ik heb drie keer het kapje gegeten* (I ate the heel thrice) we know that three heels are involved.

Finally I should like to point out that the present analysis strongly suggests that in our description we need quantification over points of time as well as over intervals as distinct things (see for an opposite view Heinämäki 1974). For example, in cases like *She knitted a sweater* we need to refer to the internal structure of an interval, as we should forbid the existence of the sweater until the very last moment of the interval.

The problems raised in this section should concern linguists in so far as it is necessary to determine at what point in the derivation (including the semantic interpretive process) the relevant information should be accounted for, and how this should be done.

5. CONCLUSION

would conclude by saying that the aspectual phenomena under analysis can be accounted for by Jackendoff's framework, although certainly some extrapolations are necessary. If we do not take into account a truth-conditional extension of Jackendoff's semantics, then the complete derivation of sentence (1b) can be obtained with the help of the following

machinery:

- (43)(a) Syntactic base rules generating the skeletal part of structures like (2). The rules can be found in Jackendoff (1972, 1974).
- (b) Lexicalization rules matching morphemes to skeletal structures. These rules are also well-known.
- (c) Projection rules deriving the functional structure from deep grammatical relations and functional semantic properties of lexical items (Jackendoff, 1972: 378). These rules are outlined in Section 1.3.
- (d) Interpretive rules like (26), (29) and (30) which translate representations into representations.
- (e) Interpretive rules like (34) which account for the relation between the higher predicate contained by *Adv* and its embedded argument(s).

The machinery required to account for the nondurative aspect in (1b) seems quite intricate. In my opinion, one should not reject or support the interpretive approach on account of the complex machinery involved, since neither interpretive semantics nor generative semantics allow for a comparison in terms of numbers of rules. At present, the problem of the cost can only be raised in order to show that descriptive difficulties cannot be solved by relegating them to the area of semantics so as to keep syntax clean, without offering any workable outlook on how they should be accounted for in semantics.

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