# Progressive Aspect and Perfection in Situation Semantics*

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## 1. Introduction

According to Vendler (1967), verbs in English may be classified into four classes on the basis of the criterion of internal temporal structures of an event: namely, activities, accomplishments, achievements, and states. Freed (1979) added a 'series' to the list and Langacker (1982), on the different criterion of trajectories, gave different names: i.e. perfective, imperfective and stative. We see different criteria may give rise to different categories names, but Vendler's classification provides a starting point.

Vendler dichotomised verbs, according as they can have progressive form. One group with the progressive form includes accomplishments and activities, while states and achievements belong to the other group without the progressive form. Dowty noticed that two classes, accomplishments and activities behave differently in their interactions with the progressive aspect. Several linguists including Dowty have tried to resolve this problem within the framework of formal semantics. Let us have a close look at the problems arising in the interaction between the two classes of verbs and the progressive aspect.

The first is how to deal with the so-called 'continuum failure', as Abusch (1985) named it. Someone who *walks, reads* for a particular interval doesn't mean that he walks, reads at every moment in that interval. Furthermore, the sentence *John was building a house* doesn't mean that he was building at every moment. Like this, a 'continuum failure' indicates the absence of the relevant action.

The second is the so-called 'imperfective paradox' (Dowth (1979)). In the case of activities the progressive form and its simple tense counterpart entail each other, while such a relation doesn't exist in the case of accomplishments.

In this paper we will review how linguists have dealt with these problems

and discuss their merits and demerits. Then we will try to suggest a better analysis, on the basis of Barwise & Perry's (1983) situation semantics and many insightful suggestions hinted at in Hinrichs (1983). Hinrichs emphasized the importance of the notion 'INTEND' in the analysis of the progressive form. However, he does not include it in the truth-conditions of PROG. We propose the notion 'INTEND' be inserted into the truth-conditions. In that way, we will claim, formal semantics may incorporate the psychological aspects of meaning. We will give several arguments in order to back up this claim. In the new analysis we will also make use of Meulen's (1985) observations. By so doing, our analysis will suggest how formal semantics may use the psychological aspects in a proper treatment of the problems of 'continuum failure' and 'imperfective paradox'.

The paper is orgainzed as follows. In Section 2, we will review previous studies. In Section 3 we provide some substantial evidences for accepting 'INTEND' as a semantic primitive. In Section 4 we illustrate our analysis with several examples. A summary and conclusion will be given in Section 5.

## 2. Previous Studies

Let us look at the sentence given in (1).

(1) John was pushing a cart.

(2) [PAST [PROG [John pushes a cart]]]

IN Dowty's (1977, 1979) analysis, (2) is a logical representation of (1). This logical form assumes the following: first, the progressive form can be analysed within the framework of the traditional formal semantics; second, the progressive form can be formed with the composition of a PROG operator and a simple sentence; and, their idiosyncratic phenomena related to the progressive form are irrelevant to a particular tense. Accordingly, the meaning of PROG may be specified independently and contribute to the meaning of the whole sentence. These assumptions can predict all the phenomena brought about by an activity verb, but not those by an accomplishment verb as illustrated in (3) and (4).

(3) John was drawing a circle.

(4) John drew a circle.

According to the compositionality principle, (3) should entail (4), but the entailment fails. This problem is called 'imperfective paradox' (Dowty

(1979)). He thinks it is an important problem which one must solve before he analyzes the progressive form. Dowty thinks (1) is different from (3) not in the operator PROG, but in the verbs themselves. 'Push a cart' is an activity, while 'draw a circle' is an accomplishment. An accomplishment verb differs from an activity verb in that the former has a hidden constituent BECOME. Therefore, (1) is represented as [PROG $\phi$] in logical form, whereas (3) is represented as [PROG [BECOME $\phi$]]. As to accomplishment verbs, PROG is true in case [BECOME $\phi$] is true. This hidden BECOME gives rise to the imperfective paradox.

Dowty considers PROG as a modal-temporal operator, the truth-conditions of which must be based on intervals and possible worlds. His notion of interval is that an interval consists of densed linear moments without blank and can be divided into subintervals. He establishes the truth-conditions of PROG on the basis of a subinterval from which the last moment of the interval is excluded.

Dowty discusses the necessity of the notion of possible world. Consider the following sentences:

(5) John will draw (draws, drew) a circle.

(6) John will be (is, was) drawing a circle.

Those who utter (5) assert that a circle exists already or will exist, whereas those who utter (6) believe that the existence of a circle is a possible result of John's action. Then, the meaning of PROG can be shown under the assumption that $\phi$ is true in a possible world.

Dowty's possible world necessary for specifying the truth-conditions of PROG is called an inertia world which consists of interval I' and possible world W'. In this world, the progressive action at the evaluation point will be completed, following the 'most natural course' and the future time branches after the evaluation point. I is a subinterval of I' and W is an actual world which is exactly like W' up to the evaluation point. An inertia world is related to the actual world by means of a function *Inr*. The following is Dowty's truth-conditions of PROG based on these conditions.

(7) [PROG $\phi$] is true at $<$I, W$>$ iff for some interval I' such that I $\subset$ I' and I is not a final subinterval for I', and for all W' such that W'$\in$*Inr* ($<$I, W$>$) $\phi$ is true at $<$I', W'$>$.

(7) can predict the imperfective paradox with the help of the hidden constituent and meaning postulates, but is not good enough to satisfy

Hinrichs (1983). He points out a couple of problems in this analysis. One of them is illustrated with (8):

(8) John was crossing the street when he was hit by a truck.

Under Dowty's analysis, two incompatible informations must be included in the inertia world, which is exactly like the actual world up to the evaluation point. Unless a miracle happens two incompatible events can not be completed in the same possible world.[1] Hinrichs says the best way to avoid such a contradiction is to convert *Inr* to a partial function, but it is impossible, because Dowty's analysis is provided under Montague's framework in which only a total function is assumed. Therefore, the progressive form can be analysed better within the framework of the situation semantics founded on a partial function than within Dowty's framework.

Another problem with Dowty's analysis, as Hinrichs points out, is that some events can be completed through various processes. This contradicts the notion of 'the most natural course'. Let us see (9):

(9) John was making Bill a millionaire.

The processes by which John makes Bill a millionaire are not unique. We can not know which course is the most natural. According to Hinrichs, these problems can be solved easily within the situation semantics.

In situation semantics, meaning is assumed to be systematic relations between an utterance situation and an actual situation. Accordingly all the meaningful situations are captured in terms of situations which consist of individuals, property or relation, and polarity. Sets of situations plus sets of locations constitute a course of events.[2] A course of events is a partial function from locations to situation types. A course of events implies a change of meaning through some locations. A real situation like (9) is represented as in (10)-(11):

(10) John kisses Mary.

(11) e: at *l*, kisses, John, Mary; yes

In (11), that John stands in kissing relation with Mary at *l*, is true, but many other situations are irrelevant except those represented in (11). Such an assumption is possible in situation semantics because all functions are partial in it. Unlike in Dowty's framework a meaningful op-

tion is fixed in terms of systematic relations between situations with the assistance of setting, and constraints. The most important factor in fixing a meaningful option is structural constraints.

Barwise and Perry claim that structural constraints establish systematic relations between situations and that they can fix a meaningful option. B & P's constraints are involvement relations between event-types, as illustrated in the form of (12):

(12) Co: at $l_u$, involves, E, E'; yes

Using (12), the fact that kissing always means touching can be represented as in (13):

(13) Co: at $l_u$, involves, E, E'; yes
E: at $l$, kisses, a, b; yes
E': at $l$, touches, a, b; yes

We see some similarities between the traditional notion of entailment and that of constraints. According to B & P their difference lies in that entailments are the relations between linguistic expressions but that constraints are relations between situations.

Let us now consider how Hinrichs analyzes the progressive form. In his analysis, (14) is represented as (15).

(14) John is writing a letter.

(15) e: at $l'$, intend, John, (write-a-letter, John); yes
at $l''$, piece-of-paper, a; yes
typewriter, b; yes
at $l'''$, put-in, John; yes
where $l'<l''<l'''$

Dowty does not accept 'INTEND' as a primitive because it is not necessary and sufficient,[3] but Hinrichs thinks it is an important notion because a progressive form conventionally implies that an agent has intent. As can be seen, the interval in which an event is in the progress can be divided into several locations, where different situations are related. A certain incomplete event represented in the form of a course of event at the discourse location ($l_d$) can be related to a certain complete event (course of event) by means of structural constraints. Beyond the evaluation point situation sementics does not commit to any supposition about what will come of the action in progress. With these conditions in mind, Hinrichs postulates the

truth-conditions of the progressive form, as in (16):

(16) $\delta_i$ (PROG ($R_n$), $a_1$, ..... $a_n$) = 1 iff there exists an extension $\delta' \subseteq \delta^*$(the complete actual world) such that
(i) I is in the domain of $\delta'$ and no later location is the domain of $\delta'$ and
(ii) there is a constraint C: <at *l*u: *involve*, E, E': l> and $\delta'$ realizes E and $\delta''$ relaizes E' and ($R_n$, $a_1$, ..... $a_n$) = 1 for $l \subset l''$.

(16) is formulated taking Dowty's analysis into consideration. The condition (i) is necessary for Dowty's analysis because he presupposed a hidden constituent BECOME, but we do not see any reason to retain it. An actual situation realized as E and another one realized as E' which doesn't necessarily belong to the actual world are connected with each other through constraints.

In this analysis, Meulen (1985) observes two problems. First, in situation semantics, an event consists of relation, individual and polarity. Then what is PROG ($R_n$)? What is the difference between $R_n$ and PROG ($R_n$)? Relations may be constituents of an event, and they can not be graded or split into parts unless we change the underlying set-theory and introduce a universal part-whole relation between semantic entities. Second, $\delta'$ and E are not specified. As parts of an action are actualized at *l* in $\delta'$, E does not include any indeterminate. Then, for instance, (17) must be represented as in (18):

(17) John was writing a poem.

(18) $\delta'$ = <*l*: PROG (write), j; l>

In (18) a part of a poem must be included. This reflects our intuition. If it doesn't include any part of a poem, how can it be related to a complete poem realized in E'?

On the other hand, Cooper (1985) tried to solve this problem by regarding a progressive VP as unlocated complex properties and BE as a connector between the subject and unlocated complex properties. In addition to these devices, he needs constraints to structure atomic facts and relations between (in)determinate locations. However, Meulen (1985) thinks these devices are not satisfactory because sets of atomic facts are porperly included by other sets of atomic facts set-theoretically in situation semantics. For these reasons the progressive form can solely be accomodated in terms of the universal part-whole relations.

Meulen added another reason for treating the progressive form as a part-whole relation. Look at the sentences in (19)-(20):

(19) Whenever John was crossing the street, Jane was.

(20) Whenever John crossed the street, Jane did.

In (19) two crossings can overlap temporarily and start or end respectively at a different time, but in (20) John's crossing must precede Jane's temporarily. In (19) two crossings overlap and are symmetric, but in (20) John's crossing is introduced as a temporal antecedent for Jane's and two crossings are asymmetric.[4] This difference lies in the representation of the progressive form and its simple tense counterpart. If an incomplete event can be regarded as a part of a complete event, such an entailment naturally follows.

For the reasons put forth above, Meulen thinks more structures are needed in the domain[5] in order to explain the progressive form as a part-whole relation than Montague assumes in his PTQ. She thinks all the semantic entities are made up of parts, out of which new entities can be made. She thinks two operations are in action in the domain; one is the join-operation, $\cup_E$ and the other is the part-of relation $\leqslant_E$. These operations work like

(21) $i \leqslant_E i'$ iff.
$i \cup i' = i'$

Meulen thinks, like Hinrichs, an event consists of relation (Rn), individuals (i), and polarity and that its form is like $<<\mathbf{R}_n, i_1, \ldots\ldots i_n>pol>$. Any individual can be an indeterminate, including relations, and if any one of individuals is an indeterminate in the event, it is a part of an event, an incomplete event. An incomplete event is related to the complete one through the universal part-whole relation. She boasts that such an analysis can explain a cumulative progressive form which neither Hinrichs' nor Dowty's framework can. Let us consider sentence (22):

(22) More and more people are liking Seattle.

In (22) each part is thought to be accumulated into one whole event. Each part can be independent at any stage. Thus the action in progress need not be related to a particular corresponding complete event. Dowty's imperfective paradox does not arise in Meulen's analysis.

Meulen (1984) tries to account for the phenomena by distinguishing between homogeneous referring expressions and heterogeneous referring expressions stipulated by four closure conditions.[6] She thinks the distinction can easily explain the 'imperfective paradox'. However, she does not discuss state verbs and achievement verbs that do not seem to allow progressive

form.

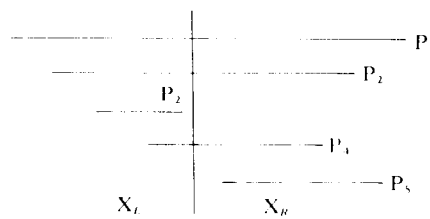
According to Meulen (1984), an activity verb constructs a homogeneous event composed of divisible entities, while an accomplishment verb creates a heterogeneous event made up of indivisible entities. And the problem of 'imperfective paradox' is confined to the heterogeneous event only.

For example, let us see the case of (1) (repeated here for convenience):

(1) John was pushing a cart.

With an activity verb such as 'push', the following figure may show the situation where the whole process is divided into many parts, e.g. $P_1$, $P_2$ ... $P_5$, $X_R$ $X_L$:

(23)




Each part is homogeneous. Therefore, the progressive form in (1) which comprises both $X_R$ and $X_L$ entails the past form 'John pushed a cart' which contains only $X_L$.

On the other hand, sentence (3) which includes an accomplishement verb is an indivisible entity that can not be represented as in (23). This is a heterogeneous event. All parts of the whole event form a descending chain of ever finer processes that go for some finest process, a goal of event. Therefore, the whole does not entail the part, and the only point at which the whole event can be identified is when the goal of that event is completed (in the case of sentence (3), at the moment the circle is completely drawn). After all, by interpreting the activity denoted by the phrase 'push a cart' as a homogeneous event, and the accomplishment denoted by 'draw a circle' as a heterogeneous event, we can predict the 'imperfective paradox'. That is, the 'imperfective paradox' arises in a heterogeneous event only.

On the other hand, according to Meulen (1984), state verbs satisfy only closure condition (i), but achievement verbs make atomic events satisfying conditions (i) — (iv) in all. For instance, the verb 'knock' which makes an atomic event is interpreted on a smallest, indivisible interval, i.e. a moment.

(25) He was knocking on the door for 10 minutes.

Because (25) denotes an activity continuing for the time of 10 minutes, it can be illustrated as in (23). But, while, in the case of (1), the activity does not allow any interval between parts, there may exist such intervals in (25). Meulen's way of analysis is confronted with the problem of the 'empty interval'. This is apparent in (26):

(26) He was building his house.

There may exist many intervals in the process of the activity of 'building his house', and these intervals must also be parts of the whole event. But, can the whole entail the empty part?

Meulen (1984) does not discuss state verbs and achievement verbs which are not considered to allow progressive forms in general. But, as shown in the sentences in (27), achievement verbs (like *win* (27a)), and state verbs (like *understand* in (27b)), can have progressive forms (Mourelatos (1978)):

(27) a. He is winning the race.
b. I'm understanding more about quantum mechanincs as each day goes by.

A perceptual verb doesn't seem to denote a simple state, as shown in (28):

(28) I'm hearing buzzing sounds.

Therefore, the way of analysis adopted by Meulen must abandon the classification of verbs proposed by Vendler(1967). Or it should be modified and extended to be applied to state verbs and achievement verbs, and to incorporate the semantic notion of empty interval in the analysis of progressive form.

In the following sections, we try to solve the above problems with the help of Hinrichs' notion of 'INTEND'. Before providing a formal representation of the notion, we first discuss its importance.

## 3. Intent: Psychological Aspects.

In the previous section, we reviewed previous studies and discussed their merits and demerits. In the course of the discussion, we have implicitly hinted at the necessity of a psychological consideration toward a natural solution of the problem. In this section, we will provide a couple of substantial evidences for the necessity.

(24) He knocked on the door.

But, in the case of (24), the situation is somewhat different.

## 3.1 Empty Interval.

Dowty's notion of time is that time can be divided intervals made up of linear moments. Under this notion empty intervals (or moments) may not be allowed, during which no action occurs. In order to avoid these empty intervals Dowty postulates an additional condition in his truth-conditions of PROG. His extra condition is that [PROG Φ] is true with respect to I, one of subintervals subsumed by I', a large interval. Later, as a possible solution to the problem, Cooper weakens Dowty's notion of time so that a location (a spatio-temporal notion of situation semantics) may exist if an event occurs. The existence of a location depends on whether an event occurs or not. Accordingly, if a location is relevant to an event it exists, and if not it doesn't. Thus irrelevant locations may exist between relevant locations. Under Cooper's analysis, the continuum failure or empty intervals do not bring in any problem. But Cooper does not discuss locations in relation to any psychological relevance.

Let us examine the notion of the 'empty interval', or 'continuum failure'.

(29) John built a house.

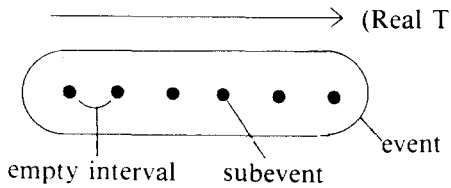
The proposition denoted by (29) can be true even if the activity of 'building' is not taking place at every moment. At the moment when no activity exists, the continuum of action fails. We will use 'empty interval' instead of 'continuum failure', which connotes some undesirable implication. The empty intervals which can appear in (29) are not systematic or regular, but accidental.

These empty intervals are of a different sort, which are regular and systematic. Consider (30):

(30) John knocked at the door.

The event denoted by (30) consists of a series of subevents, among which empty intervals appear regularly as illustrated in (31):

(31)




The empty intervals in (30) are different from those in (29) in regularity and systemacity. Furthermore, even if the empty intervals in (29) are missing, the event can be a whole, while if those in (30) are missing, the event can not be established. In the case of (29), empty intervals are neither necesary nor sufficient parts, but in the case of (30) they are necessary. Speakers evaluate the relevance of all the parts in their minds. The parts are judged not to be of equal status.

Still another kind of empty intervals can arise from the perfective form. Let us take (32) into consideration:

(32) John has seen a lion.

The interpretation of the event denoted by (32) makes use of more than one subevent, empty intervals and the notion of 'relevance' to the present. In (32) empty intervals are neither regular nor systematic. But unlike those in (29), they are necessary parts. In this event, subevents and the notionof 'relevance' are important, but empty intervals are ignored, i.e. not given any psychological relevance.

According to Meulen's analysis of the progressive form, every part of an event is the same in respect of relevance. Such a notion of hers can not accept an empty interval as a part though it satisfies her criterion. As we see, some empty intervals are relevant to the event, but some are not. Meulen hints at the necessity of incorporating psychological aspects into the formal semantics. However, she does not elaborate how this can be achieved.

The traditional formal semantics claims that any semantic entity must be atomic and objective. Meulen tries to attack the atomism with powerful weapons: namely, the part-whole relation and the join-operation in the domain. As we pointed out above, however, some parts are not relevant to the event and are different in the degree of relevance. Therefore, the part-whole relation can not resolve the problem. In order to solve this problem, we suggest formal semantics be comprehensive enough to incorporate psychological aspects of meaning into its framework. We think this will lead to another violence to the other myth of formal semantics, objectivism.

We, however, think speakers judge subjectively whether or not any part

of an event is relevant to the whole event. Let us see the following sentence:

(33) John was building a house.

John decided to build a house, asked someone to draw a blue print and started to build. From what moment can (33) be valid? From the moment to decide or to ask? Speakers' subjective judgement decides which parts of it are relevant.

Meulen claims that an incomplete event in the progressive form is a part of the complete event denoted by its corresponding simple tense form. Then how can a speaker identify the part with a part of the whole event? When one comes up to a situation, how can one identify it with a part of an event that a person is drawing a house instead of a donkey?

In the following subsection, we give another substantial evidence which argues for the necessity of incorporating psychological aspects into the formal semantics.

## 3.2 Progressiveness of Stative Verb

In general, it is considered that verbs can be classified into two disjoint classes depending upon whether or not they can have progressive forms; namely, non-stative verbs vs. stative verbs. In particular, Quirk (1973) asserts that verbs must be classified in such a way as to reflecting the contrast between 'progressiveness' and 'non-progressiveness'. He called verbs allowing the progressive form dynamic verbs, while verbs not allowing it stative one. Accordingly, (34) and (35) are the examples of dynamic verbs, while (36) and (37) are those of stative verbs:

(34) a. John carefully searched the room.
b. John was carefully searching the room.

(35) a. It rained steadily all day.
b. It was raining steadily all day.

(36) a. The girl is now a student at a large university.
b. *The girl is now being a student at a large university.

(37) a. John knew the answer.
b. *John was knowing the answer.

Some stative verbs, however, can be used as dynamic ones and have progressive forms, as Quirk et al. (1973) observes:

(38) He is being a { nuisance / naughty } again

For example, in (38), taking the dynamic complement 'a nuisance' and 'naughty', the verb 'be' is used dynamically, and it has the progressive form.

Furthermore, according to Quirk et al. (1973), some progressive forms of stative verbs which do not take the recipient subject belong to the dynamic class, and the progressive form is allowed as in (39).

(39) a. I think of you.
b. I'm thinking of you.

Though the progressiveness of stative verb as in (38) and (39) can be treated exceptionally, the previous argument that progressiveness is defined in terms of stativeness and vice versa is clearly circular. Moreover, it does not seem that the possibility of using progressive forms depends upon verb classes of the sort observed in Section 2.

Comrie (1976) has provided a clue to the solution of this problem. According to him, the contrast between progressiveness and non-progressiveness is related to the internal structure of situation.[7] In this paper, extending Comrie's suggestion, we assume that the possibility of using progressive forms depends not upon the distinction between the stativeness and activity of verbs but upon the speaker's internal/external viewpoint of the situation.

Consider example (40):

(40) You aren't hearing.

Comrie thinks that (40) is ungrammatical. Let us assume that the speaker takes situation denoted by (40) as an unanalyzable whole with the external viewpoint. Then, (40) is an impossible sentence, as Comrie predicts. On the other hand, if the speaker has the internal viewpoint so that he takes the situation (40) as an analyzable whole from the situation-internal point of view, (40) is a possible sentence. It has an internal temporal structure. In Section 3.1., we assumed that only the relevant element must be taken into consideration in order to analyze the meaning of utterance in our framework. The relevant element which make (40) grammatical is the speaker's perception of the internal temporal constituency of the situation at hand.

In this context, (36b) and (37b), which Quirk et. al. think are ungrammatical, can be regarded to be grammatical depending upon the situation, i.e. upon what the relevant element is. In (36b), we can imagine that 'the

girl' is a student who studies at 'a large university' during the day and a waitress who makes money to prepare her school expenses in the evening. In this case, she becomes a student in the daytime. In order to interpret (36b) as a correct one she needs to become a student, and the speaker must be in the situation-internal position. That is, when the speaker utters (36b) implying that she becomes a student iteratively at a particular time everyday, he perceives the particular time as a relevant element, namely, the 'daytime', and (36b) can be interpreted as a correct sentence. The meaning of the whole consists of each of the relevant parts that she is a student only in the daytime, and the speaker perceives the internal temporal constituency of that situation. Therefore, as in the case of 'knock', the progressive form (36b) has the iterative meaning by which the homogeneous event is characterized.

In (36a), on the other hand, the speaker utters the only external fact that the girl goes to a large university. The uttered external fact is an unanalyzable whole and does not have any internal structure.

(37a, b) can also be explained in a similar way. Furthermore, Quirk et. al. asserts that the progressive sentence (38) may be acceptable because of the dynamic quality of its complement. In our framework, however, (38) is allowed because the speaker utters it perceiving the internal temporal structure in the utterance situation. In other words, we can imagine that the subject 'He' is performing some activity the quality of which is 'a nuisance' or 'naughty' before the speaker. Thus, the speaker can perceive the internal termporal structure of that activity.

Next, look at the sentences in (41).

(41) a. I live at 6 Railway Cuttings.
b. I'm living at 6 Railway Cuttings.

In (41), the same kind of explanation is possible. (41a) simply refers to the external fact as a whole that the subject "I" lives at 6 Railway Cuttings expressed in the perfective aspect. (41b) is uttered by the speaker perceiving the internal temporal constituency of utterance situation. Thus (41b) may mean that the speaker has been living at 6 Railway Cuttings for some time before the reference point and that he will live at 6 Railway Cuttings by some time after the reference point. This interpretation arises from the speaker's perception of the internal structure of utterance situation.

In Section 2, we noted that (27) gave rise to a problem. The problem now can be accounted for in our framework.

(27a) is a heterogeneous event which consists of processes going toward a goal, and the speaker utters (27a) perceiving the internal structure of the situation which consists of processes going toward a goal of 'winning'. In

our analysis, only the relevant element in the situation is taken into consideration, and in (27a) the relevant element is the internal temporal constituency of the situation denoted by (27a).

(27b) is also a heterogeneous event in which each process is going toward a goal of 'complete understanding' and the collection of each process gives the meaning of the whole. In this case, again, the relevant element is the internal temporal constituency of the situation.

Now let us consider (42):

(42) The car was stopping.

In (42), (though 'stop' is not a stative verb) as 'stopping' can not have an internal structure in any case by a constraint, the progressive form is not possible.

After all, whether verbs can have progressive forms or not depends upon whether they can have an internal temporal structure or not irrespective of the traditional classification of verbs.

So whatever the verb class may be, the meaning of the sentence in the perfective aspect is regarded as an indivisible whole, not referring to the internal temporal constituency. On the other hand, the meaning of the utterance in the imperfective aspect is the collective meaning of its parts including the beginning, the middle, and the end in relation with the speaker's perception of the internal temporal constituency of the uttered situation. In this case, the whole is divisible into many parts. Moreover, as the relevant viewpoint of the situation is in the situation itself, the internal temporal structure is patently transparent. That is, the imperfective aspect can not be used in the situation without the internal structure. Therefore, though the verb is stative, if the progressive sentence is related to the situation with the internal structure and the speaker has the situation-internal viewpoint, then the progressive form is possible.

Then, how can this kind of analysis be combined with the framework of situation semantics? On the basis of Hinrichs' interpretation, we can extend the conception of 'INTEND'. He used 'INTEND' in analyzing the meaning of progressiveness as in (15), because in the progressive form an agent has intent. This conception can be used more widely to include the meaning of the situation-internal viewpoint of an agent or a speaker in our framework. So, we introduce 'IND' as an extended notion of 'INTEND', which was rejected by Dowty at the outset. We will elaborate the formalization of some examples incorporating the primitive 'IND' in Section 4.[8]

Furthermore, this analysis seems applicable to Vendler's achievement verbs and state verbs as well. If this line of our observation is correct, the classification of verbs on the basis of stativeness or progressiveness seems

to be meaningless.

## 4. Sample Representation.

In Section 3, we provided a couple of arguments to the effect that semantic entities in a domain exist subjectively rather than objectively. These arguments led us to incorporate psychological aspects into the framework of formal semantics. Until Barwise and Perry introduced situation semantics, however, there had been no serious attempts to accomodate some pragmatic or psychological aspect with the framework of formal semantics. In a sense, situation semantics is an attempt to introduce the psychological aspect as a part of the mechanisms of formal semantics. B & P do not demonstrate any concrete device to incorporate a psychological aspect into the framework of the formal semantics, but provide a theoretic basis, on the basis of which Hinrichs tries to provide an analysis of the progressive form. In his analysis, he used the notion 'INTEND' which Dowty rejects. He does not make clear where it comes from and what status it stands on in his framework. We think this notion can be employed as a door through which psychological apects come into the framework of formal semantics. For this purpose, Hinrichs' notion of 'INTEND' is too narrow and we think it is necessary to widen its scope.

We assume 'IND' is not a lexical item, but a semantic primitive with which we can properly interpret various situations. Let us see what kind of functions it may have.

In Hinrichs' analysis, the notion 'IND' is understood as a mean, by which a speaker recognizes whether or not an agent has intention to perform the activity being done by him. In this paper we adopt Hinrichs' version of 'IND'.

Another work imposed on the primitive 'IND' is to fix the speaker's perspective of the situation: namely, whether it is dynamic or stative. In order to achieve this purpose, 'IND' can make use of pragmatic elements.

One more function we hope 'IND' to bear is to impose some relevance to the parts of an event. This function is licensed by a speaker's subjective judgements and other pragmatic elements as we pointed out in the previous section. To summarize, through 'IND' we think many things can be expressed: e.g., how to view a situation, how semantic entities are structured and whether or not the internal temporal structure of an event is relevant to the specific communication.[10]

As pointed out above, Hinrichs does not include 'INTEND' in his truth-conditions. We revise Hinrichs' formulation and represent it as follows:

(43) $\delta_1$ (PROG ($R_n$), $a_1$, ..... $a_n$) = 1 iff there exists an extension $\delta' \subseteq \delta^*$

(the complete actual world) such that

(i) IND, a, E, where *a* may be included in E as an agent or another agent *b* and where the indeterminate location *l* in E can be any location of the locations of e.

(ii) there is a constraint C;<at *l*: *involve*, E, E':l> and $\delta'$ realizes E and $\delta''$ realizes E' and $\delta_1''$ ($R_n$, $a_1$, ..... $a_n$) = 1 for $l \subset l''$.

Comparing with the original version, one may notice that we leave out Hinrichs' condition (i) for the reason we explained in Section 2. In its place we insert the new 'IND' condition. (We use the contracted form 'IND' for the notion 'intent' as a primitive.) We claim the primitive 'IND' can cooperate with the pragmatic component. This point is not expressed explicitly in the present formulation. Our analysis is based on situation semantics. Within its framework such a function is performed by constraint.

We are now in a position to provide our analyses of a few sentences with the postulated truth-conditions of the progressive form. Let us see the example in (44), repeated here for convenience:

(44) John was pushing a cart. (=(1))

(45) e: =at *l*, IND, John, E
E: at *l*, push-a-cart, a; yes
John, a; yes
at *l'*, of -cart, b; yes
at *l''*, push, a, b; yes
where *l*<*l'*<*l''*

We assume *l* indicates an indeterminate location and can be any location in e. In this case a speaker judges that the agent of 'IND' and that of 'push' are the same. Let us see another sentence in (46):

(46) John was drawing a circle. (=(3))

(47) e: =at *l*,IND, John, E
E: at *l*, draw-a-circle, a; yes
John, a; yes
at *l'*, of-pencil, b; yes
piece-of paper, c; yes,
at *l''*, draw, a, b, c; yes
where *l*<*l'*< *l''*

Dowty argues that 'push a cart' and 'draw a circle' are analyzed different-

ly. To this problem Hinrichs answers. We don't feel it necessary to repeat his argument here.

Next, let us take an ambiguous case which neither Hinrichs nor Meulen mentions in their respective analyses. Look at the sentence in (48) and its first possible interpretation in (49):

(48) John was building a house. (=(26))

(49)e; at *l*,IND, John, E.
E; at *l*, building-a-house, a; yes
John, a; yes
at *l'*, materials-of-house, b; yes
John, a; yes
of-house, c; yes
at *l''*, build, a, b, c; yes
where *l*<*l'*<*l''*

In the case of (49), the agent of 'IND' and the agent of 'build' are the same.

Another possible interpretation of sentence (48) is given in (50):

(50) e: at l, IND, John, E.
E: at *l*, build-a-house, a; yes
working, a; yes
at *l'*, materials-of-house, b; yes
workers, a; yes
of-house, c; yes
at *l''*, build a, b, c; yes
where *l*<*l'*<*l''*

In (50), the agent of 'IND' is different from that of 'build'. Unspecified workers realize John's 'intent', which is captured by the primitive 'IND'. In this process the pragmatic factors provide helps to the primitive. B & P imposes this job to the constraints.

(51) is another interesting case, which other previous investigators do not deal with intentionally or unintentionally. Let us consider (51):

(51) I'm living at 6 Railway Cuttings. (=(41b))

(52) e: at *l*, live-at-6-Railways-Cuttings, a; yes

speaker, a; yes
at $l'$, live a; yes
where $l<l'$

In this case 'speaker' is concerned with the internal temporal structure of an event. In the form of an incomplete event he intends to express his temporary living at the place. The notion 'IND' implies the internal perspective of the speaker.

In the case of homogeneous event (44), there's no difference from Hinrichs' analysis except $l$. In (47), (49), and (50), the activitis of 'draw a circle' and 'build a house' may include'empty intervals'. Even when some location $l$ is posited at some empty interval, as the agent 'John' collects the only relevant parts as the meaning of the sentence making use of 'IND', irrelevant parts are not taken into considertion. In particular, by formalizing as in (49) and (50), an activity of building a house can be performed not only by the subject John, but also by some workers John may hire. In (52), the state verb 'live' implies the internal perspective of the speaker and the definite short period of 'living at 6 Railway Cuttings'.

## 5. Summary and Conclusion

The purpose of this paper was to achieve the general semantic interpretation of perfect and imperfect aspects in English with a particular reference to the 'imperfective paradox' within the framework of situaition semantics.

In Section 2, we surveyed the previous studies by Dowty(1979), Hinrichs(1983), Meulen(1984,1985) and Cooper(1985), and discussed some problems of their assertions. Investigating various arguments, the introduction of a psychological aspect was considered to be necessary. In Section 3, we provided a couple of substantial evidences for the necessity of introducing psychological elements into formal semantics. For formalization, we made men's mind projected in the notion of 'INTEND' which was originally suggested by Hinrichs. The extended notion of 'INTEND' which we represent as 'IND' is a device to pick up the relevant elements in human mind, and it is utilized in the effective interpretation of progressive sentences. In Section 4, we provided sample analyses of progressive sentences with the notion of 'IND'.

To conclude, we hope to have shown the effectiveness of B & P's situation semantics with the suggested revision and extension, in providing a proper treatment of the progressive aspect in English.

## Notes

* This is a revised and expanded version of the paper we presented at the 5th Korean-Japanese Joint Workshop on Formal Grammar (August 19-21; Yonsei U, Wonju Campus). In preparing this version, we have benefited from kind comments and criticisms by Akira Ikeya, Akira Ishikawa, Ki-yong Lee, Byung-soo Park, and Susun Yoo. We deeply appreciate their insightful suggestions. Any defects in what follows, however, are all our own.

1. Cf. Hinrichs(1983;173). Dowty thinks inertia worlds indentical to the actual world up to the point of evaluation. And he assumes that the action in progress will be completed in the inertia world. Therefore hitting and crossing must be completed there, which is impossible.

2. Cf. Barwise & Perry(1983;56). A course of events is a set of triples(l,y,i), where l is a spatio-temporal location, y is a constituent sequence $(r, X_{\cdot}, \ldots\ldots, X_{n})$ and i is O or l. They think of coe as a partial function from loctions to situation-types.

3. Dowty(1977;46) thinks the progressive form of an accomplishement verb can not be defined in terms of the intention of an agent. He explains this by two examples: one case where a ninety-year-old composer can say his activity as writing a symphony without intending to complete it and the other where there are progressive forms of accomplishments that have no sentient agent who can have such an intention.

4. Cf. Meulen(1985;415).

5. Cf. Meulen(1985;416). According to Montague any semantic entity is atomic i. e. indivisible. On the contrary Meulen claims any entity is divisible and wants to relate any entity to its constituent parts.

6. Four closure conditions stipulated by Meulen(1984) are as follows:
   i) $\forall x \in X \quad \forall y \in P$ ($x \subseteq y$—$y \in x$)
   ii) $\forall x, y \in X \mid z \in X$ (if $x, y \in [[R]]$ then $z \in [[R]]$ and $z \subseteq x$ and $z \subseteq y$)
   iii) $\forall x\ x_1 \in X$ (if x—dec $(x_1, x_1, x_3)$ and $x_1, x_1, x_2 \in [[R]]$ then either $x_1$,.X or $x_2 \in X$)

vi) $\exists x \in X\ \forall y \in P\ y \in P\ (y \subseteq x \rightarrow y \in X)$

7. We assume that the internal phases of the situation are referred to by the imperfective aspect. Particularly in situation semantics, this internal structure can be easily formulated with locations.

8. As observed by Ishikawa Akira, one may question about the semantic content of the notion 'IND'. In our framework, however, 'IND' is an extended notion of Hinrichs 'INTEND' and used in a more abstract sense.

9. By this, we mean that the mental aspect suggested by Barwise and Perry (1983) may be understood in a broader sense, including a psychological aspect. On this point, we thank Akira Ishikawa and Byung-soo Park for their helpful comments.

10. As observed by Ki-yong Lee and Susun Yoo (when this paper was presented), one may suggest that the jobs we required to be performed by the semantic primitive 'IND' be carried out by the function originally deviced by Barwise and Perry(1983) in their book, *Situation and Attitudes.* But, the notion of 'IND' has a scope wider than the function in the sense that while a function works in a sentence level to pick up a meaningful option, the IND may work in a sublexical level as well, So, we may say that the delta function is a part of 'IND'.

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