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ON TENSE, ASPECT, MODALITY, AND MEANING

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The *meaning* of a sentence of a natural language may be regarded as the logical form or linguistic structure of that sentence within a suitable interpreted underlying logic.[1] The phrase 'the meaning' suggests that there is only one logical form of a given sentence, and indeed this is often the case if the word order of the sentence, stress, rhythm, intonation, and the like, are taken into account. Ordinarily these are disregarded, but surely they should be considered in a full account. Also sentences are usually taken in isolation from one another, and their logical forms likewise. But this will never do. The wider linguistic context in which a sentence is usually embedded should also be taken into account, a point well emphasized by Henry Hiż. Sometimes this wider context may not be especially significant, but often it will be crucial in influencing the choice of the logical form. Ultimately, then, the meaning of a sentence cannot be given in isolation. Rather is the meaning of a sequence of sentences given by means of a sequence of logical forms, providing for as much of the environing context as is relevant.

In logico-linguistics due attention should be given to both the character of the underlying logic assumed and to the mass of empirical data painstakingly garnered by linguists. The logic to be used in the present paper is to be an event logic, as construed on a first-order basis.[2] And as our linguistic guide, we can surely do no better than to follow the lead of Randolph Quirk and associates in their monumental *A Grammar of Contemporary English*[3] Let us follow them for relevant data concerning tense, aspect, and modality in English (§§ 3.23 ff.), and attempt to provide an exact theory to accommodate suitable logical forms for the various kinds of examples they consider, within the event-logic framework. The result will be a kind of running logical commentary on some of what they have written.

English has only two tenses, syntactically speaking, present and past, and these may be accommodated by means of the earlier- or before-than relation $\text{Before}_{\text{Time}}$. Thus '$e_1$ $\text{Before}_{\text{Time}}$ e_2' expresses that e_1 occurs or takes place earlier than e_2. And let '*sp* Now *e*' express that the speaker takes *e* to be a present event, occuring within what he takes to be now. The full story about 'now' is complicated, and cannot be given here. The use of '*sp* Now *e*' will suffice for the present.[4]

Quirk and associates note that the simple present tense has four uses in English, to indicate (a) the present without reference to specific time, (b) the instantianeous simple present, (c) simple present with future time reference, and (d) simple present with past time reference. And under (a), *universal* time statements are distinguished from *habitual* time statements. Examples of the former are

(1) 'Two and two make four',
(2) 'The albatross is a big bird',
and
(3) 'Onions smell',
and of the latter
(4) 'We go to France every year'
and
(5) 'He loves going to the theater'.

In these examples there is supposed to be "no limitation on the extension of the state into the past and future times. This category includes 'eternal truths', which do not refer specifically to the present but are general timeless statements." (1), (2) and (3) are presumably eternal truths and thus may be handled in terms of the logician's tense of timelessness. In this sense they are not tensed at all. It is not just that there is no reference to a specific time in them, it is that no reference to time in general is made and that any temporal considerations are irrelevant to their truth or falsity. Thus suitable logical forms for them can be given without using '$\text{Before}_{\text{Time}}$' or 'Now'.

In (1) the 'and' is of course not the truth-functional conjunction 'and' but is the colloquial 'and' synonymous with 'plus'. The 'make' similarly is the popular 'make' of identity' Without too much difficulty, then, we should be able to arrive at '(2 + 2)= 4' as its logical form!

For (2) we must work a bit harder. The 'the' is the so-called "institutional" or generic 'the'. Also (1) may be construed either *per accidens* or *per necessitatem*, but to simplify, let us disregard this latter for the present. Let

'$\{F \ni \text{--}F\text{--}\}\ G$' be defined as '--$G$--',

where 'F' and 'G' are expressions for virtual classes and '--F--' and '--G--' are sentential forms differing appropriately[5]. The definiendum expresses that the virtual class G is a member of the virtual class of virtual classes F such that --F--. Note that although 'F' is a virtual-class *constant* here, it is used as a variable of abstraction.

Let (εG) be any selected object having G, so that the context

'$F(\varepsilon G)$' is short for '$(Ex)(Fx\ .\ Gx)$'.

The generic use of 'the G' *per accidens* is then symbolized as 'ΣG)'. In fact we let

'$(\Sigma\ G)$' be short for '$\{F \ni (x)\ (Gx \supset \{y \ni y = x\}(\varepsilon F))\}$'.

To say then that the albatros is a bird is to say, where 'Albatross' stands for the virtual class of albatrosses and 'Bird' for that of birds, merely that (Σ Albatross)Bird, that Bird is a member of the class of classes F such that every member of Albatross is identical with some member of F. The '(Σ Albatross)' here is best read as 'the albatross is a'.

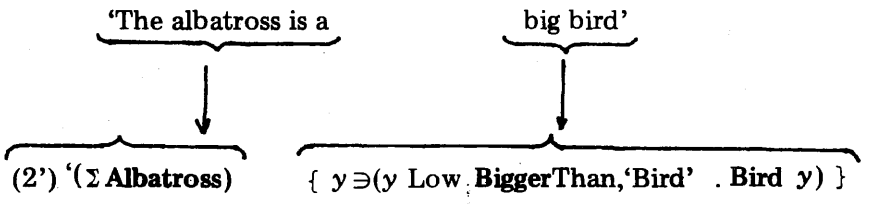
We must now bring in the modifier 'big' as relativised to birds. Let

'x Low **BiggerThan**,a'

express that x is low on the bigger-than scale relative to the one-place predicate a. And where a is an inscription or sign-event of the shape 'Bird', we may let

'x Low **BiggerThan**,'Bird'' abbreviate '$(Ea)(x$ Low Bigger Than,a . 'Bird' a).[6]

Then to say that x is a big bird is to say that it is a member of the virtual class $\{\ y \ni (\text{Bird}\ y\ .\ y\ \text{Low}\ \ \textbf{BiggerThan}\text{'Bird'})\ \}$. The "derivation" of the structure of (2) is then as follows.



By abstraction twice we gain then

'(x)(Albatross $x \supset$ $(Ey)(x = (\varepsilon\{y \in (y$ Low **BiggerThan**, 'Bird' . Bird $y)\}$))))'.

It might seem that this latter is a more perspicacious way of writing (2'). But note that in (2') the word order of (2) is preserved, so that the correspondence is more direct and easier to see.

(3) seems to pose no essential problems and no doubt may be handled as usual as '(x)(Onion $x \supset$ Smell X)'. Any subtleties in (3) should presumably depend either upon the context in which it occurs or upon some specific intentions of the speaker.

Sentences of the kind (1) — (3) are the main kinds of sentences that may be analyzed without bringing in the specific resources of event logic. These latter comprise not only the theory of 'Before$_{\text{Time}}$' and 'Now' but also that of the *gerundine* or so-called *event-descriptive predicates*. Let '⟨Go⟩e', for example, express that e is a going, or that e is a member of the class of all goings. This locution, in fact, will be useful for the analysis of (4). 'We go to France' thus becomes

(4')'(Ee)(**we** Agent e . ⟨**Go**⟩e **To**$_{\text{Place}}$ **France**)',

where 'Agent' stands for the relation of being agent of, 'To$_{\text{Place}}$' for the prepositional To-relation of place, and 'we' stands for a suitable logical sum of persons. If the 'every year' clause were initially placed we could handle 'Every year we go to France' as

'(**Every** e')((**Year** e' . e' Approp$_{sp}$ *us*) $\supset$ (Ee)(**we** Agent e . ⟨**Go**⟩ e . e **To**$_{\text{Place}}$ **France** . e During$_{\text{Time}}$ e'))'.

where 'e' Approp$_{sp}$ *us*' expresses that the e'is taken by the speaker *sp* to be *appropriate* for us, i.e., is a year during a certain span of our lives — the Approp relation is essentially that of Zellig Harris[7] — and

'(Every e)--e--' is defined as '((e)--e--'.

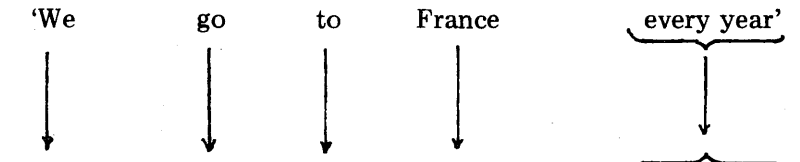
However, the 'every year' is terminally placed in (4) so that this analysis will not do if word order is to be preserved. However, we may define, somewhat loosely,

'(Ee)(---e During (every year appropriate to x) ---)' as '(e') ((Year e' . e' Approp$_{sp}$ x) $\supset$ (Ee)---e During$_{\text{Time}}$ e' ---)'.

Strictly some scope indicators are needed here as in *14 of *Principia Mathematica*, but are omitted here to simplify[8]. Then (4) may be given the form

'(Ee) (**we** Agent e . ⟨**Go**⟩e . e **To**$_{\text{Place}}$ **France** . e During ((**every year** appropriate for us))'.

The bold-face letters are used to show the obvious correspondence between the word or phrase as occurring in ordinary English and its representative in the logical form or deep structure. Every word in the original presumably will have its counterpart in the form, plus a good deal of logical embroidery bringing the various structural interrelations into the open. To see this more clearly we could use a diagram with arrows (as in (2') above), such as :



'(E*e*)(**we** Agent *e* .⟨**Go**⟩ *e* . *e* **To**$_{\text{Place}}$ **France** . *e* During (**every year** appropriate for us))'.

Our forms are then seen to be merely English sentences with suitable logical material inserted in the interstices between the component words. *Logic in fact is merely the theory concerning these insertions.* And note how important *conjunction* is here, the entire form being a conjunction, usually with many conjuncts. Many forms will turn out to exhibit essentially this same pattern.

The relation of *loving* is an intentional relation, such relations being handled here by bringing in the linguistic modes of description under which a thing or things are taken, essentially *Frege's Arten des Gegebenseins*. Thus '*p* love *e*,*a*' expresses that *p* loves *e* as described by the virtual-class predicate *a*. And if *a* is of a shape Sh, then

'*p* Love *e*,Sh' is short for '(E*a*)(*p* Love *e*,*a* . Sh *a*)'.

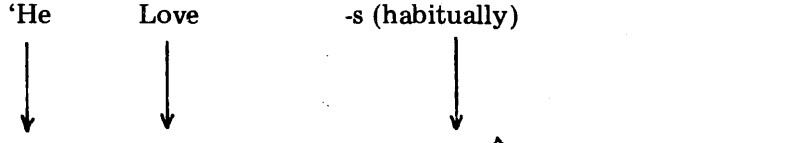
A first approximation to a form for (5) is then

'(E*e*)**he Love** *c*,' {*c* ∋ (⟨**Go**⟩ *e*' . *e*' **To**$_{\text{Attendance}}$ (**the theatre**). *e*' By$_{\text{Agent}}$ *him*)}'.

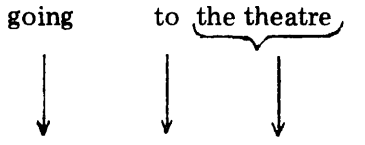
To simplify we leave '(the theatre)' here unanalyzed. It stands for theatrical performances, of course, not for the institution of the theatre. Note that this form contains no tense and does not bring out the *habitual* character of the loving. To accommodate this latter let

'*F* Habitual *p*'

express that doing things of the kind *F* is habitual for person *p*. An appropriate clause of this sort may then be added as a conjunct to the preceding, resulting in a better form for (5). The clause concerning habituality brings in the present tense, shown in the original by the final 's' on 'loves'. Our diagram for (5) then is :



'(E*e*)(E*a*)(**he** Do *e* . ⟨**Love**⟩*e* . {*e*'∋(⟨Go⟩*e*' . *e*' To$_{\text{Attendance}}$ (the theatre)



. e' By_{Agent} *him*) } Habitual *him*. '{e' ∋(⟨**Go**⟩ e' . e' $\text{To}_{\text{(the theatre)}}$.
e' By_{Agent} *him*) } '*a* . *e* $\text{Under}_{\text{Description}}$ *a*)'.

Some additional explanation is needed here. Note that the form '*p* love *e*,Sh' is regarded as equivalent to

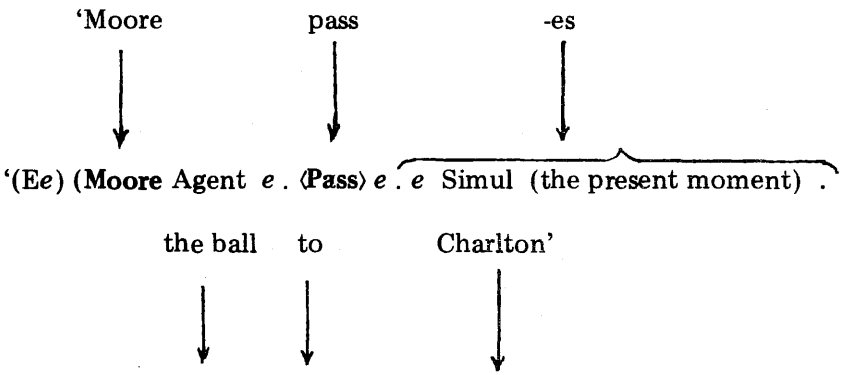
(E*e*)'(E*a*)(⟨Love⟩*e*' . *e*' By_{Agent} *p* . *e*' $\text{Of}_{\text{Object}}$ *e* . *e* $\text{Under}_{\text{Description}}$ *a* . Sh *a*)',

expressing that there is a loving *e* *by* person *p* as agent *of* event *e* as object and as taken *under* a predicate-description *a* of the shape Sh. The '$\text{To}_{\text{Attendance}}$' here stands for a special To-relation, that of *attendance*. It is used to express that one goes to *attend* a concert or theatrical performance. It would not be appropriate to use here the To-relation of *place* or of *destination* or of *intention* or the like. (The question as to how '$\text{To}_{\text{Attendance}}$' is to be defined, if at all, is left aside for the present.)

One might object to the use of the forms '*p* Love *e*,*a*' or '*p* Love *e*,Sh' on the grounds that one might love things of the kind described by a predicate *a* of the shape Sh without there being any such *e*, or perhaps even without *p*'s ever having experienced such an *e*. It is doubtful that such an objection would be cogent in the case of loving, although a similar objection might be lodged against a similar treatment of other intentional relations. But even if it were, there is always Lesniewski's null individual to fall back on if needed[9]. The *e* could simply be null.

If (4) above is construed as stating that we *habitually* go to France every year, an appropriate clause to this effect should be conjoined to the form given.

The instantaneous simple present is used "to signify an event simultaneous with the present moment." The word 'now' is often used to indicate the present moment but not always. It is thus best perhaps to take 'the present moment' as a special deictic description and to handle the instantaneous simple present in terms of it rather than in terms of 'now'. Thus we have :



Here obviously Simul is an appropriate relation of simultaneity, and To$_{\text{Passage}}$ is the preopositional relation To of passage. The presence of the clause concerning simultaneity assures the use of the instantaneous present.

An example of the use of the simple present with future time reference is

'The plane leaves for Chicago at eight o'clock'.

The temporal adverbial here establishes that the eight o'clock departure is in the future. The full logical form should no doubt embody this circumstance. Thus

'(E*e*)(*e* By$_{\text{Agent}}$ (**the plane**) . ⟨**Leave**⟩ *e* . *e* **After**$_{\text{Time}}$ (**the present moment**) .*e* **For**$_{\text{Destination}}$ **Chicago** . *e* At$_{\text{Time}}$ (**eight o'clock**))'

gives here essentially what is needed. Another example, embedded in a temporal clause, is

'He will do it when you pay him'.

Here the 'pay' has future time reference although actually occurs in the simple present. Let '*e* When *e*'' express that *e* takes place when (or very soon after) *e*' does. The desired form is then

'(E*e*)(E*e*')(**he** Agent *e* . *e* **After**$_{\text{Time}}$ (**the present moment**) . ⟨**Do**⟩ *e* . *e* Of$_{\text{Object}}$ **it** . *e* **When** *e*' . **you** Agent *e*' . ⟨**Pay**⟩ *e*' . *e*' To$_{\text{Patient}}$ **him**)'.

(The word 'will' will be discussed in a moment.)

Sometimes the simple present is used with past time reference, for example,

'John tells me that you are American'.

Here the telling is in the past of the now or present moment. To handle this, the form '*e* That *a*' is used to express that *e* bears the intentional relation That to the inscription *a*. We then gain the structure

'(E*e*)(E*a*)(E*e*')(*e* By_{Agent} **John** . ⟨**Tell**⟩ *e* . *sp* Now *e*' . *e* $\text{Before}_{\text{Time}}$ *e*' . *e* $\text{To}_{\text{Intended Object}}$ **me** . *e* **That** *a* . '**American you**' *a*)'.

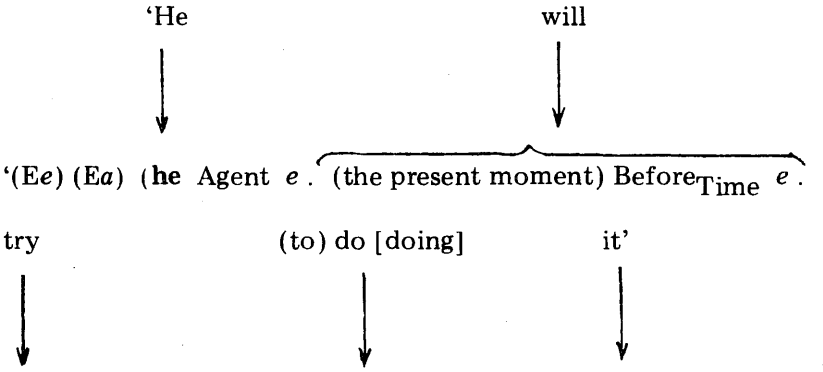
The relation That is of course a very special relation between speech acts and suitable inscriptions. Here '*e* That *a*' and its context expresses that *e* is an act of telling something to the effect that *a* holds, where *a* expresses that you are an American. Suitable meaning postulates concerning 'That' are needed, of course, as for all other primitive prepositional and other relations. (One of these might be to the effect that if *e* That *a* and *a* is a paraphrase of *b*, then *e* That *b* also.) The To-relation needed here is that of To relative to the *intended object* or hearer. Also to say that *e* occurs before some *e*' taken by the speaker as now is presumably merely to say that *e*' occurs before the present moment does.

The simple past is used ordinarily to indicate "**definite past time**, *i.e.* what took place at a given time or in a given period before the present moment. It is found with adverbs referring to past time." Such uses may easily be handled in terms of the devices above. Several examples will be given below.

Let us turn now to the future, which is closely related with modality and aspect, and may be expressed in English in a number of ways. First there is the use of 'shall' and 'will' as auxiliaries, as in

'He will try to do it'.

For this, diagrammatically we have here



Note that here '*he* Agent *e*' appears rather than '*e* By_{Agent} *him*', as also in (4') above. This is no difference in meaning, although there is of course the important syntactical difference of having the nominative 'he' occur in the one and the accusative 'him' in the other.

Is there a meaning difference between 'He will try to do it' and 'He will try doing it' in a suitable context? If there is, it is not captured in the foregoing, but would have to be supplied by some additional clause or clauses, or might come to light in the forms for the environing sentences.

Another way of handling reference to future time is by means of constructions involving 'be going to'. To be going to do so and so is usually ambiguous between present intention to do so and so and being, or already having been, caused to do so and so. Thus

'She is going to have a baby'

is ambiguous as between

'(E*e*)(E*e'*)(E*a*) (she Agent *e* . ⟨Intd⟩ *e* . *e* $\text{During}_{\text{Time}}$ now . *e* $\text{Of}_{\text{Object}}$ *e'* . *e'* $\text{Under}_{\text{Description}}$ *a* . '{*e"*∋(⟨Have⟩ *e"* . *e"* $\text{Of}_{\text{Object}}$ (∈ Baby) . shee Agent *e'*)} '*a*)'

that she now intends to have a baby, and

'(E*e*)(E*e'*)(E*a*)(⟨Cause⟩ *e* . (*e* Simul (the present moment) ∨*e* $\text{Before}_{\text{Time}}$ (the present moment)) . *e* $\text{Of}_{\text{Object}}$ *e'* . *e'* $\text{Under}_{\text{Description}}$ *a* . '{*e"*∋(⟨Have⟩ *e"* . *e"* $\text{Of}_{\text{Object}}$ (∈ Baby) . *she* Agent *e"*)} '*a*)',

that there is a present or past cause of her having a baby. The idiomatic 'is going to' here may be spelled out in either of these ways. Note that 'cause' is handled as a triadic relation by the use of which something is said to cause an event as taken under a given linguistic description. In the example there is no mention, however, of the causal agent. Also

'*e"* $\text{Of}_{\text{Object}}$ (∈ Baby)' here is short for '(E*x*)(*e"* $\text{Of}_{\text{Object}}$ *x* . Baby *x*)'.

The present progressive may refer "to a future happening anticipated in the present" as well of course as to a present happening. Its "basic meaning" is supposed to be "fixed arrangement, plan, or programme". It may occur in a sentence with or without an adverbial of time. Thus

'The orchestra is playing Mozart'

is ambiguous as among

'The orchestra plans (has arranged) to play Mozart',

'The orchestra will play Mozart tomorrow (next week, etc.)',

and

'The orchestra is playing Mozart now',

depending in part upon context. Forms for all of these may readily be given on the basis of the foregoing. 'The orchestra' is regarded as designating the logical sum of the musicians plus conductor. It is not the institution of the orchestra that does the playing, nor is it separately the members of the orchestra. It is a complex sum-individual that does the playing collectively. And, needless to say, it is not the person Mozart who is played, but works composed by him. And to play a work by him is to produce sounds having a suitable relation to a score or paradigmatic text.

The simple present tense is often used to indicate futurity, especially in subordinate clauses. For example,

'The guests will be drunk before they leave',

Although their leaving is in the future of the present moment, there is no need to indicate this in the structural form, for this will be a logical consequence of what must be contained therein.

Frequently future constructions "can be used in the past tense to express time which is in the future when seen from a viewpoint in the past." Thus the past progressive is used in

'I was meeting him in Bordeaux the next day'

to indicate past intending. This may be given a form such as

$(\mathrm{E}e)(\mathrm{E}e')(\mathrm{E}a)(\mathrm{I}\ \mathrm{Agent}\ e\ .\ e\ \mathbf{Before}_{\mathrm{Time}}\ \mathbf{(the\ present\ moment)}\ .\ \langle\mathbf{Intd}\rangle\ e\ .\ e\ \mathrm{Of}_{\mathrm{Object}}\ e'\ .\ e'\ \mathrm{Under}_{\mathrm{Description}}\ a\ .\ '\{e''\ \ni (\langle\mathbf{Meet}\rangle\ e''\ .\ \mathrm{I}\ \mathrm{Agent}\ e''\ .\ e\ \mathrm{Of}_{\mathrm{Object}}\ \mathbf{him}\ .\ e''\ \mathbf{In}_{\mathrm{Place}}\ \mathbf{Bordeaux}\ .\ e''\ \mathrm{During}_{\mathrm{Time}}\ \mathbf{(the\ next\ day)})\}\ 'a)'.$

Here of course '(the next day)' is a description of the day following the day during which the present moment occurs.

According to Quirk and associates, the aspect of a verb "refers to the manner in which the verb action is regarded or experienced. The choice of aspect is a comment on or a particular view of the action. English has two sets of aspectual contrasts: PERFECTIVE/NON–PERFECTIVE and PROGRESSIVE/NON–PROGRESSIVE." The *present perfect* aspect "indicates a period of time stretching backwards into some earlier time. It is past with 'current relevance'." Thus we may contrast the past imperfect (or simple past) of

'John lived in Paris for ten years'

with the present perfect of

'John has lived in Paris for ten years'.

The form for the former should contain a clause to the effect that John is no longer living in Paris, and for the latter that he still is. Thus, for the former we have something like

'(E*e*) (**John** *Agent e* . ~ (E*e'*) (John Agent *e'* . ⟨Live⟩ *e'* . *e'* During$_{\text{Time}}$ now . *e'* In$_{\text{Place}}$ Paris) . ⟨**Live**⟩ *e* . *e* Before$_{\text{Time}}$ (the present moment) . *e* **In**$_{\text{Place}}$**Paris** . *e* **For**$_{\text{Duration}}$ (**ten years**))',

and for the latter

'(E*e*)(**John** Agent *e* . (E*e'*)(John Agent *e'* . *e'* During$_{\text{Time}}$ now ⟨Live⟩ *e'* . *e'* In$_{\text{Place}}$ Paris) . ⟨**Live**⟩ *e* . *e* Before$_{\text{Time}}$ (the present moment) . *e* **In**$_{\text{Place}}$ **Paris** . *e* **For**$_{\text{Duration}}$ **(ten years**))'.

Here the '*e*' During$_{\text{time}}$ now' clauses are intended to be equivalent to 'e' During$_{\text{Time}}$ (the present moment)'. In the first of these examples, the 'lived' corresponds with the conjunction of the second, third, and fourth conjuncts, and similarly for the 'has lived' in the second.

The key difference between the past imperfect and the present perfect comes out clearly in the presence of temporal adverbials. Adverbials with the simple past "refer to a period now past" and adverbials with the present perfect "refer to a period stretching up to the present", for example.

'I saw him yesterday'

as contrasted with

'I haven't seen him since yesterday'.

The former becomes

'(E*e*) (I Agent *e* . ⟨**See**⟩ *e* . *e* **Before**$_{\text{Time}}$ (**the present moment**) . *e* Of$_{\text{Object}}$ **him** . *e* During$_{\text{Time}}$ **yesterday**)'.

Strictly the clause concerning the present moment can be dropped here, being a consequence of the last conjunct, yesterday being the day before the day containing the present moment. Its retention, however, is harmless and helps to account for the presence of the past tense in the original. The second sentence has the form, rather,

'~(E*e*) (I Agent *e* . ⟨**See**⟩ *e* . (*e* **Before**$_{\text{Time}}$ now ∨ *e* **During**$_{\text{Time}}$ **now**) . e Of$_{\text{Object}}$ **him** . *e* **Since**$_{\text{Time}}$ **yesterday**)'.

The circumstance that this is a negative sentence with the tilde occurring first in the logical form must be noted in recognizing the correspondence between this and the original.

Some temporal adverbials, however, can be used with either the past imperfect or present perfect, as

'I saw him today'

and

'I have seen him today'.

There is still a slight difference of meaning, however, the former suggesting that the seeing was "on some one occasion", the latter

that the seeing could have taken place on several occasions. Thus we would naturally say 'I have seen him today several times', but less naturally 'I sam him today several times'. However, this difference is perhaps not sufficiently important or striking to incorporate it into the respective forms.

The past perfect "has the meaning of past-in-the-past." Thus

'John had lived in Paris for ten years when I met him'

becomes something like

'(E*e*)(E*e'*)(**John** Agent *e* . *e* Before$_{\text{Time}}$ *e'* . ⟨**Live**⟩ *e* . *e* **In**$_{\text{Place}}$ **Paris** . *e* **For** Duration (**ten years**) . *e* **When** *e'* . I Agent *e'* . ⟨**Meet**⟩ *e'* . *e'* **Before**$_{\text{Time}}$ **now** . *e'* Of$_{\text{Object}}$ **him**)'.

The "past-in-the-past" is indicated here by the two conjuncts containing 'Before$_{\text{Time}}$'. Here the correspondence for 'had' is somewhat complex.

The progressive aspect of a verb, we are told, is used to indicate "temporariness — an action in progress instead of the occurrence of an action or the existence of a state". This distinction is perhaps not too clear, for the occurrence of an action takes place progressively and the existence of a state has some temporariness about it. Consider

'Joan sings well'

as contrasted with

'Joan is singing well'.

The former, we are told, "refers to Joan's competence as a singer, that she has a good voice". This is doubtful. What seems to be said, by use of the simple present, is rather that Joan habitually (or usually) sings well. She might do this without having a particularly good voice or even without having much competence as a singer. The use of a '*F* Habitual Joan' clause is needed here. The sentence with the verb in the progressive can be handled with a suitable clause indicating when Joan is singing well, either now or during some time span including now, such as these days, this year, and so on.

The progressive aspect is sometimes used to indicate limited duration, incompletion, even emotional coloring, and so on. Thus we may contrast

'John always comes late'

with

'John is always coming late'.

The latter seems to contain some indication of the speaker s disapproval of John's tardiness. If so, this may be built into the form.

The main difference between the past imperfect and the past progressive is, of course, the difference between the completion and

incompletion of the action. Thus

'I read the books that evening'

expresses (in part) that I completed reading the book that evening, whereas

'I was reading the book that evening'

does not. For the former we have

'(E*e*)(I Agent *e* . ⟨**Read**⟩ *e* . *e* **Before**$_{\text{Time}}$ **now** . (E*e'*)(I Agent *e'* . ⟨Finish⟩ *e'* . *e'* Before$_{\text{Time}}$ now . *e'* Of$_{\text{Object}}$ *e* . *e'* During$_{\text{Time}}$ (that evening)) . *e* Of$_{\text{Object}}$ (**the book**) . *e* During$_{\text{Time}}$ (**that evening**))'.

And for the latter we have the same form but without the clause concerning finishing the action. Clearly the first sentence has the second as a logical consequence but not conversely. This seems to be as it should be. (Note that because '(that evening)' is taken to refer to an evening in the past, the two clauses containing 'Before$_{\text{Time}}$' may, strictly, be dropped.)

An important division of verbs is that into *dynamic* and *stative*. The correlative in event logic is that between events, processes, and actions, on the one hand, and states, on the other. It is not easy to draw this distinction in a precise way. The following comments, however, may not be without interest. In a state, all the temporal parts of it are alike in being closely similar, sufficiently close to be describable as instances of the same kind of state. Stative verbs seem to be of two types, intentional "verbs of inert perception and cognition" ('abhore', 'believe', 'imagine', 'recognize', and so on) and various relational verbs ('contain', 'possess', 'own', 'remain', 'resemble', and so on). Now let 'e_1 TP e_2' express that e_1 is a *temporal part* of e_2, that is, that the time duration of e_1 is wholly contained in that of e_2. And let 'St *e*' express that *e* is a state. It would then seem to hold that

(e) ((St *e* . ⟨**T**⟩ *e*) ⊃ (*e'*)(*e'* TP *e* ⊃ (St *e'* . ⟨**T**⟩ *e'*))),

where ⌜⟨**T**⟩⌝ is an event-description predicate. Every temporal part of a state of believing is a believing, every temporal part of a possessing is a possessing, and so on. For dynamic verbs, however, this is not the case. In actions, there are pauses and caesuras that interrupt the total action. Not every temporal part of an eating is an eating, not every temporal part of a change is a change (it might be a stasis), not every temporal part of a kicking is a kick, and so on. Thus, we seem to have that

(*e*) ((~St *e* . ⟨**T**⟩ *e*) ⊃ ~ (*e'*)(*e'* TP *e* ⊃ ⟨**T**⟩ *e'*)).

In any case, some clear-cut way of demarcating between stative and dynamic events ought to be forthcoming.

This demarcation is of interest here because verbs expressing stative events do not usually occur in the progressive. Thus

'I am knowing that she will come',

'She is owning this book',

and the like, are at best peculiar. Verbs for dynamic events, on the other hand, do happily take on the progressive aspect, as we have already seen, usually to indicate "incomplete events in progress." The distinction here between the simple present or past and the present or past progressive for such verbs may be handled essentially as above.

The perfect progressive is used to indicate "a temporary situation leading up to the present moment." Let us contrast the present perfect of

'John has lived in New York since 1970'

with the perfect progressive of

'John has been living in New York since 1970'.

"The meaning difference is slight, but the use of the progressive indicates that the speaker considers John's residence in New York to be temporary". A clause to indicate this temporariness is needed in the structure for the latter. Thus we have something like

'(E*e*)(**John** Agent *e* . *e* $\text{Before}_{\text{Time}}$ now . ⟨**Live**⟩ *e* . (E*e*')(John Agent *e*' . *e*' $\text{During}_{\text{Time}}$ now . ⟨Live⟩ *e*' . *e*' In_{Place} New York) . *e* Mid Less-Temporary-Than, '{ *e*' ∋ (⟨Live⟩ *e*' . *e*' In_{Place} New York)} '. *e* $\textbf{In}_{\text{Place}}$ **New York** . *e* **Since 1970**)'.

The *e* here is placed midway in the scale of Less-Temporary-Than relative to the predicate for livings in New York. Note that this structure has the structure for the former sentences as a logical consequence. In general the perfect possesive seems logically to imply the past progressive, but not conversely, *ceteris paribus.* (Here likewise the correspondence is for 'has been living' complex.)

Let us turn now to the so-called modal auxiliaries, 'can'/'could', 'may'/'might', 'shall'/'should', 'will'/'would', 'must', 'ought to', and 'used to'. It is a pity that so-called modal logic has paid so little attention to the actual uses of these words within ordinary language — hence its sterility. Let us see how these words may be incorporated within the foregoing kind of framework.

Let '*p* $\text{Can}_{\text{Capable}}$ *F*'' express that *p* can, in the sense of being *capable of*, perform actions described by the predicate '*F*'. Similarly '*p* $\text{Can}_{\text{Permitted}}$ *F*'' is to express that *p* can in the sense of being *permitted*, do actions described by '*F*', and '*p* $\text{Can}_{\text{Possible}}$ *F*'' that *p* can, in the sense of its being (theoretically or factually) *possible*, do actions described by '*F*'. These three forms will enable us to handle

'can', 'could', 'may', and 'might'. Thus

'He can speak English'

becomes

'**he** $\text{Can}_{\text{Capable}}$ '$\{e \ni (Ea)(\langle\textbf{Speak}\rangle\ e\ .\ e\ \text{Of}_{\text{Object}}\ a\ .\ \textbf{Eng}\ a)\}$'

that he is capable of doing actions describable as his speakings of words or phrases belonging to English. ('Eng *a*' here expresses that *a* is a word or phrase of English). The 'can' here expresses capability or ability in the sense of 'knowing how to'. Similarly

'You can smoke here'

becomes

'**you** $\textbf{Can}_{\text{Permitted}}$ '$\{e \ni (\langle\textbf{Smoke}\rangle\ e\ .\ e\ \text{At}_{\text{Location}}\ \textbf{here})\}$',

and

'Everybody can swim there'

becomes in the first instance,

'(p) (Per $p \supset p\ \text{Can}_{\text{Possible}}$ '$\{e \ni (\langle\text{Swim}\rangle\ e\ .\ e\ \text{At}_{\text{Location}}$ there)}'.

But then we may let

'Everybody---' abbreviate '(p) (Per $p \supset$ ----)',

gaining then a form with the word order closer to the original, that is

'**Everybody Can** $_{\text{Possible}}$ '$\{e \ni (\langle\textbf{Swim}\rangle\ e\ .\ e\ \text{At}_{\text{Location}}$ **there**)}'.

Similarly '$p\ \text{Could}_{\text{Capable}}$ *F*'', '$p\ \text{Could}_{\text{Permitted}}$ *F*'', and '$p\ \text{Could}_{\text{Possible}}$ *F*'' may express that *p* could, in the respective senses, do actions to which '*F*' is applicable. Thus

'I could play the banjo'

is ambiguous as between capability and permission.

'The road could be blocked'

can be handled in terms of '$\text{could}_{\text{Possible}}$'.

To say that $p\ \text{May}_{\text{Permitted}}$ '*F*', that *p* may do something to which '*F*' is applicable, seems to be merely a more formal way of saying that $p\ \text{Can}_{\text{Permitted}}$ '*F*'. To say that $p\ \text{May}_{\text{Possible}}$ '*F*'. on the other hand, is to express that it is "factually possible" to do something to which '*F*' is applicable, whereas '$p\ \text{Can}_{\text{Possible}}$ *F*'' expresses that it is "theoretically" possible. Thus

'He may succeed'

is

'**he** $\textbf{May}_{\text{Possible}}$ $\langle\textbf{Succeed}\rangle$'',

whereas

'*He cannot succeed in that enterprise*'

is rather

'~ **he Can**$_{\text{Possible}}$ '{$e \ni$(⟨**Succeed**⟩ e . e **In**$_{\text{Regard}}$ (**that enterprise**))}',

'Might' likewise may express either permission or possibility, so that 'p Might$_{\text{Permitted}}$ F'' and 'p Might$_{\text{Possible}}$ F'' are both needed. Thus

'His contention might displease you'

is

'(**his contention**) **Might**$_{\text{Possible}}$ '{$a \ni$ (⟨**Displease**⟩ e . e **Of**$_{\text{Patient}}$ **you**)}'.

'Shall' in its volitional uses seems to be of three kinds, expressing weak volition in the second or third person, intermediate volition or intention on the past of the first person or speaker, or strong volition or insistence, with perhaps a legal or quasi-legal force. Accordingly we need 'p Shall$_{\text{W Volition}}$ F'', 'p Shall$_{\text{Intention}}$ F'', and 'p Shall$_{\text{S Volition}}$ F'', to handle, respectively

'He shall get his money',

'We shall let you know our decision',

and

'He shall be punished',

'Should' is used to express ***obligation***, as in

'You should obey the laws'.

For this we should need 'p Should$_{\text{Obliged}}$ F''. For its *hypothetical* use, as in

'We should love to go abroad if we had the chance',

we need 'p Should$_{\text{Hypothetical}}$ F'', and for its ***putative*** use, as in

'It is odd that this should happen now',

we need 'p Should$_{\text{Putative}}$ F''.

'Will', like 'shall', has weak volitional uses, intermediate-volitional or intentional uses, and strong volitional uses. Thus 'p Will$_{\text{W Volition}}$ 'F'', 'p Will$_{\text{Intention}}$ F'', and 'p Will$_{\text{S Volition}}$ F'' are all needed. In addition, there is the predictive use, as in

'Oil will float in water' or

'He will be finished by now',

to that 'p Will$_{\text{Prediction}}$ F'' is also needed.

In these various forms, the 'p' is a parameter for human persons, but some of the forms may be needed also with an object-variable, or even an event variable or a mass-term, in place of 'p'. Thus 'x Will$_{\text{Prediction}}$ F'' is needed to handle 'Oil will float on water'.

'Would' seems to have only a weak and a strong volitional use, but no intentional use. It does, however, have other uses in addition : a use expressing characteristics or habitual activity, as in

'Every morning he would go for a walk',

a use in main clauses expressing a hypothetical meaning, as in

'He would smoke too much unless I stop him',

and a use expressing probability, as in

'That would be his mother'.

For handling 'would', then, we need not only 'p $\text{Would}_{\text{W Volition}}$ F'' and 'p $\text{Would}_{\text{S Volition}}$ F'', but '$p\text{Would}_{\text{Characteristic Activity}}$ F'', 'p $\text{Would}_{\text{Hypothetical}}$ F'', and 'p $\text{Would}_{\text{Probable}}$ F'' as well.

'Must' is used to express obligation or compulsion in the present tense, and is roughly equivalent to 'be obliged to' or 'have to', as in

'You must be back by ten o'clock.

or

'You must obey the law'.

'Must' is also used in the sense of necessity, logical or otherwise, as in

'There must be some mistake'

or

'The velocity must be faster than you indicate'.

There are thus various relations needed for handling 'must'. In particular we need the forms 'p $\text{Must}_{\text{Obligation}}$ F'', 'p $\text{Must}_{\text{Compulsion}}$ F'', and various forms for necessity, logical, physical, technical, and so on.

Let us consider now these various modal auxiliaries in connection with tense and aspect.

The modal auxiliaries do not combine with other modal auxiliaries, so that they can never be used with 'will' or 'shall' to indicate future time, However, some auxiliaries do, when combined with suitable adverbials, have "inherent future reference," as in

'He may [or might] leave tomorrow'.

But strictly, it seems, there is no future tense for the modal auxiliaries.

Some auxiliaries do have a past tense, however. Thus 'could' is past for 'can', 'could' or 'might' for 'may', 'should' or 'shall', and 'would' for 'will'. To handle these we may define here '$\text{Could}^{\text{Past}}_{\text{Capable}}$', '$\text{Could}^{\text{Past}}_{\text{Permitted}}$' and '$\text{Could}^{\text{Past}}_{\text{Possible}}$'. These of course are given a very different meaning from the corresponding forms for 'could' introduced above. And similarly for the others. Examples of sentences requiring these notions in their logical forms may readily be given, expecially where the sentence contains some adverbial referring to the past.

The perfective and progressive aspects of certain modals do not

occur, apparently, those for ability or permission, but those expressing possibility, necessity, or prediction do freely occur.

The problem of the interdefinability of the modal auxiliaries will not be discussed here. Some must presumably be taken as primitive, others then being definable in terms of these[10]. And concerning the primitive ones suitable meaning postulates must be laid down. The full theory of modality emerges then only when both definitions and postulates are given. Once this is done, the subject will be seen to be vastly more complex and interesting than anything accomplished to date by modal logicians.

A few final comments. Although a few words and phrases of traditional grammar have been used above, note that no use whatsoever has been made of any of its doctrine. In particular, no essential use has been made of the theory of parts of speech. A few well-known facts concerning English have been cited here or there, and some convenient classifications concerning the occurrences of certain kinds of words (e.g. 'will' or 'should') have been invoked. But such facts and classifications serve merely as heuristics for formulating the theory of deep structure or logical form.

Whatever the defects of the foregoing, it serves at the very least to open up the subjects of tense, aspect, and modality in English to exact semantical study within the confines of event logic. It is hoped that it will be useful as a basis for extension and improvement.

NOTES

[1] Cf. the author's "On the Very Idea of a Logical Form", *Theoretical Linguistics*, to appear.

[2] See the author's *Events, Reference, and Logical Form* (The Catholic University of America Press, Washington : to appear).

[3] R. Quirk, S. Greenbaum, G. Leach, and J. Svartvik, *A Grammar of Contemporary English* (Seminar Press, New York and London : 1972).

[4] Cf. "On the Logic of 'Now'," in the author's *Semiotics and Linguistics Structure*, in preparation.

[5] On virtual classes, see the author's *Belief, Existence, and Meaning* (New York University Press, New York : 1969), *Chapter VI* and *passim*.

[6] For additional comments on, and explanation of the notation here see again *Events, Reference, and Logical Form* and *Semiotics and Linguistic Structure*.

[7] See "The Two Systems of Grammar : Report and Paraphrase," in his *Papers in Structural and Transformational Linguistics* (Reidel, Dordrecht : 1972). The 'During$_{Time}$' here stands for the prepositional relation of during. Several further prepositional relations will be symbolized in obvious fashion and used below without comment. For further explanation see the author's "On Some Prepositional Relations", in *The Logical Enterprise*, the Fitch *Festschrift* (Yale University Press, New Haven : 1975). Also note that the use of 'Approp' here is somewhat oversimplified, for it should be handled intentionally.

[8] Or, alternatively, a notation for *virtual propositions* (sic !) could be introduced and used here.

[9] See the author's "Of Time and the Null Individual", *The Journal of Philosophy*, 62 (1965) : 723-736.

[10] The 'presumably' is inserted here in view of the possibility that all predicates for prepositional relations except 'To' and 'From' may be definable, e.g., 'By$_{Agent}$' in terms of 'Agent', 'Can$_{Permitted}$' in terms of 'Permitted' and so on. See again "On Some Prepositional Relations."