LOGIC, LANGUAGE AND FORMALIZATION

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§ 1. *The theoretical significance of formalization*

How it is possible to use an "artificial" logical system for the purpose of "conceptual analysis" of ordinary-language locutions ? This "transcendental" question (1) presupposes that it is possible to use an artificial logical system for the purpose of conceptual analysis. The presupposition in question can be counted on, though, since the current practice of *formalization*, in which arguments and formulations represented in a natural language are "paraphrased" (2) by strings of formulae and formulae (respectively) in a "constructed language", is, precisely, a utilization of a formal system for the purpose of "conceptual analysis". That is, conceptual analysis can be construed as "finding the logical form" of given formulations (for whatever ulterior purposes).

Hence, our initial question can be paraphrased as follows:
How is formalization possible ?
As a first step towards answering this question, two familiar facts should be attended to:

i. Philosophical logicians, and good students of a course of elementary logic for philosophers, can formalize arguments, and formulations, which are "new in their experience". That is, confronted with a given formulation, most of them can provide a formula of an appropriate logical system which they consider to represent adequately the "logical form" of this formulation. This is not to say that this can be done with any (indicative) formulation whatsoever. But it seems obvious that the number of formulations which can thus be treated by philosophical logicians having a standard logical education is not limited.

ii. There is a considerable consensus among the various members of the community of "formalizers" that a given formula, *p*, is, or is not, an adequate formalization of a given formulation in an ordinary language F (which they master). (3)

Hence, it cannot be assumed that formalization of a given formulation, or a given argument, depends on the specific sample of examples which a given formalizer was confronted with in the logical courses he has taken. The "learning histories" of different formalizers in the field of philosophical logic are not very similar. Despite that, both i. and ii. obtain. The situation here is quite analogous to that of a linguistic community. (4) All members of such a community can produce, and understand, utterances of sentences which they have never heard or used before. Moreover, there is a considerable consensus among speakers about the "grammaticality" of suggested sequences of words. (5) Since the learning histories of speakers with respect to their language are quite unsimilar, Chomsky (6) had to postulate a "linguistic competence" to account both for the capacity to produce and understand utterances of new sentences, and to account for the considerable consensus among speakers with respect to such matters as grammaticalness.

Thus, it seems to us that the analogy between the capacity to formalize and the capacity to use language compels us to postulate a "formalizing competence", in complete analogy with "linguistic competence".

That is, more explicitly, the answer to our initial question will be provided by an appropriate system of rules, which will take as input formulations in an ordinary language, and provide as output formulae in a specific constructed language.

Hence, one of the main purposes of this paper is to initiate the study of the formalizing capacity. This will be done by a somewhat detailed analysis of certain examples in which formalization is, to a considerable degree, straightforward.

Though, any discussion of the relationship between logic and language from the point of view of formalization cannot neglect certain programmatic conceptions which deal with logical systems as providing theories of a "universal semantic base" for natural languages (7), or even as being a possible

component of a theories of linguistic competence ([8]), or again, in quite different circles, those of philosophical logicians, as "explanatory models" for the logical behavior" of ordinary language locutions ([9]).

Hence, another objective of this paper is to discuss the interrelationships between these views and some general suggestions which seems to facilitate a systematic and comprehensive study of formalization. Thus, the analysis of our examples, and the discussion which will follows them, will attempt also answer to the question:
What are the relationships between the competence to formalize and linguistic competence ?
In addition to the initial question:
What is the nature of formalizing competence ?

§ 2. *Rules of Substitution*

Consider the following argument:

1. *Either John killed the old lady, or George killed the old lady.*
2. *It is not the case that John killed the old lady.*
3. *Hence, George killed the old lady.*

This argument seems to be valid. It exemplifies the (valid) pattern:

4. $p \vee q$
5. $\underline{\quad -p \quad}$ (Disjunctive Syllogism) ([10])
6. $\quad q$

Though, the rule of inference 4 - 6 (henceforth referred to as DS) cannot be directly applied to 1 - 3. These utterances have first to be formalized. Now, it is true that 4 - 6 can be considered to be a formalization of 1 - 3 "on the level of propositional logic". This formalization can be described as the result of applying the following *rules of formalization*:

F1: Replace "Either.....or ___" by ".....v ___"

F2: Replace "It is not the case that ....." by "-....."

F3: Replace "Hence....." by "$\overline{\ldots\ldots}$"
F4: Replace "John killed the old lady" by *p*
F5: Replace "George killed the old lady" by *q*.

The application of F1 - F5 to 1 - 3 yields 4 - 6.
Though, 4 - 6 is not "the full logical analysis" which elementary logic can prove to 1 - 3. A fuller analysis (which is maximal, as far as elementary logic is concerned) ([11]) will be given by the following sequence of formulae, which conforms to DS — hence constitutes a valid argument:

7. Rac $\vee$ Rbc
8. — Rac

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9. Rbc.

In order to transform 1 - 3 into 7 - 9, the following rules need to be applied, in addition to F1 - F3:

F6: Replace "John" by *a*.
F7: Replace "George" by *b*.
F8: Replace "The old lady" by *c*.
F9: Replace "killed" by *R*.
F10: Move a predicate to the left of all of its arguments. ([12])

Now F6 - F8 all conform to the pattern:

F11: Replace a *singular NP* by a *free singular term.*
F9, on the other hand illustrates the pattern
F12: Replace a VP by a n-adic predicate. Choose *n* as the number of NP's which occur to the right and left of the VP up to the end of "its scope". ([13])

The importance of F11 and F12 derives from the generality of their application, which is parallel to that of F1 - F3. Thus, F6, F7 and F8 all derive from F11, from the knowledge that "John",

"George" and "the old lady" are singular NPs (respectively) and from some (unspecified up to now) convention concerning the choice of free singular terms. Such a convention can take the form of a well ordering of all free singular terms available and a rule which requires that the first free singular term in the well ordering which has not been used up to now in the process of formalization is to be chosen, whenever a new singular NP has to be replaced. F1 - F3, F10, F11, and F12 (with the convention just mentioned) can be used for the formalization of an infinity of arguments. This, though, can be done only if one is capable of assigning phrases to their grammatical categories.

Now, all of these rules can be *inverted* (with the exception of F10 which will be dealt with immediately). That is, to each of them one can match a rule in which what recedes the "by" in the F-rule will succeed it, and what succeeds the "by" in the F-rule will precede it. These rules, which we will call T rules, and number in the same number which indexes the matched F-rule, can be applied to 7-9 so as to yield 1 - 3. The only explicit remark concerning their formulation has to be made with respect to F10 which does not have a unique inverse. Suppose then that we will formulate its inverse as follows:

T10: Remove a predicate from the left of its argument to a position following the first of its arguments.

Now, the system of rules T1 - T3, T10 - T12, conjoined with a system of formation rules for a language for elementary logic, and some sets of phrases classified as singular NPs and VPs, is a partial grammar of English. It can generate a large amount of sentences which have the same structure as either 1, 2 or 3. Moreover, it has a definite advantage over an ordinary English grammar of the Chomskyan type, since its component T1 - T3, T10 - T12, (and the categorization of phrases above), has as input "representations of logical forms" of sentences and as its output sentences. It is quite tempting to revert to Frege's labelling of formulae of a constructed language as representing directly "judgements". ([14]) Then, we can say that this component transforms judgements into their linguistic representations. Since it is part and parcel of common sense to distinguish

judgements from their "linguistic dress" and to conceive of linguistic "faculty" not merely as the capacity to produce utterances of sentences, but also to produce utterances of sentences which express a "thought" or "judgement", such a grammar, as distinguished from the classical Chomskyan one, reconstructs more closely classical conceptions concerning the organization of grammars. ([15]) Thus, our analysis of the first example suggests the two following answers for our initial questions, which are, though, obviously incomplete and tentative:
First, the formalizing competence contains rules which replace words directly by symbols of a logical language. Second, the formalizing capacity can be conceived of as consisting of rules which are "inverse" to rules of grammar — relative to a certain conception of the organization of grammars.

§ 3. *Pragmatically oriented rules*

Consider now the following argument:

10. *Either John or George killed the old lady.*

11. *John did not kill the old lady.*

12. *Therefore, George killed her.*

10 - 12 is valid by DS, as 1 - 3 is. It seems to be the same argument. Though, if one applies 10 - 12 F1 - F3, F6 - F10, the result is not 7 - 9, as it should be, but, rather, the following string of non-well-formed formulae:

13. R(avb,c) ([16])

14. did not R(a,her)

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15. R(b,her)

In order to get the desired 6 - 9, one has first to "standarize" 10 - 12. That is, transfer the disjunction in 10 from its position between "John" and "George" to a position between two sentences, transfer the negative particle to the front of 11, and replace the pronoun "her" by its coreferrent "the old lady". These operations possess, though, a precisely formulable structure which can be coded by the following rules, which have also to be assigned to the competence of formalization.

F13: Replace (Either NP_1 or NP_2)$\overset{\cap}{}$VP by Either ($NP_1\overset{\cap}{}VP$) or

F14: Replace NP$\overset{\cap}{}$(did not VP) by It is not the case that NP$\overset{\cap}{}$VP.

F15: Replace $NP_1\overset{\cap}{}V\overset{\cap}{}$Pronoun by $NP_1\overset{\cap}{}V\overset{\cap}{}NP_2$ (where NP_2 has the same reference as Pronoun).

The application of F13 - F15 to 10 - 12 yields 1 - 3, and then F1 - F3, F6 - F10 apply as before to yield 7 - 9.

Now, the new Fs are invertible in the same way as the old ones. Their inversions can be identified with known grammatical transformations. Thus, T13 (the inverse of F13) can be conceived of as the transformation which maps the "underlying structure" of 1 on the surface structure of 10. This is the transformation which forms disjunctive NPs. ([17]) A similar description applies to T14 - T 15. Hence, the representation of the competence to formalize as "inverse" of the linguistic competence, i.e. as consisting of rules which are the inverse transformational rules, can be extended. Its extension carries with it the suggestion to organize grammars as consisting of a "logical component" which "generates judgements" by a system of formation rules of the usual type, and a "transformation component" which maps them onto surface structures of sentences.

There is another course which can be taken here, though. Applying F1 - F3, F6 - F10 to 9 - 12 yields 13 - 15. Hence, if one applies T1 - T3, T6 - T10 to 13 - 15, one gets 9 - 12. Therefore, if we could formulate a system of rules which would map 7 - 9 to 13 - 15, this system of rules could take the place of T13 - T15

in the transformation of 7 - 9 to 10 - 12.

The rules needed would be the following:

T16: Replace $p \vee p(b \overset{n}{//} a)$ by $p(avb \overset{n}{//} a)$. ([18])
T17: Replace $p(a_1 \ldots a_n)$ by NEG $p(a_1 \ldots a_n)$ ([19])
T18: Replace *p* by p(x/a) if *a* has occurred in some preceding formula (in the same context).
M19: Map NEG on an appropriate negative form (which depends on the context e.g.: *did not, do not,* before a verb, *not* or *un* before an adjective, etc.) ([19])
M20: Map individual variables on pronouns which are appropriate (again in a manner which depends on the context: the gender of *a* of T18 has to be taken into account, as well as the environment of x in p. Thus, if this environment is mapped onto V..., x has to be replaced by a reflexive pronoun, while if it is .....VP, an ordinary pronoun has to be used).

T16 - T18 seem to be quite bizarre: they map wffs on non wffs. M19 - M20, being both context dependent (in their precise formulation, which was not even attempted here) and dependent on the history of the derivation are very complicated. It seems that the prior course, that of taking T13 - T15 to supplement our "grammar" is much simpler, saying nothing about its greater conformity to Chomskyan (and even neo-Chomskyan) ([20]) tradition.

Though, there is a cause fo T16. It can be used to derive

16. *The old lady killed either John or George*

from the wff

17. $Ccb \vee Rca$.

This cannot be done by T13. A separate rule is needed. Moreover, even the derivation of

18. *Either John or George believe that life is hard today*

from the formula which formalizes in a "direct" fashion, that is, relative to formalization rules of the type discussed in the preceding section, the sentence

19. *Either John believes that life is hard today or George believes that life is hard today.*

can be mediated by T16, but not by T13.
Thus, T16 plays the role of at least three separate rules of the type of T13. Hence, it is to be preferred. ([21])
A similar case can be made for T17, when applied before M19. The ordered pair (T17, M19) can be used to derive

20. *John and Mary are not married.*

from the formula which formalizes, in a "direct fashion"

21. *It is not the case that John and Mary are married.*

But T14 cannot be applied here at all. ([22])
Again, the ordered pair (F18, M20) can help us to derive (in the appropriate context)

22. *He has killed the old lady.*

from the formula which directly formalizes

23. *John has killed the old lady.*

where T15 is irrelevant and an additional rule has to be postulated. It is needless to say that these arguments depend on the a-symmetry of Subject and Direct Object in the Chomskyan schemes. This a-symmetry rules out certain possibilities of formulating transformations which apply to NPs irrespective of their place. There is no parallel a-symmetry between different arguments of a predicate in a logical formula.

However, both the system T13 - T15, and the system T16 - M20 can be described as having pragmatic purposes, or as representing pragmatic pressures.

Thus, T16 deletes one repetition of the neighborhood of *a* in *p*. The structure which one gets is, simply, shorter. The input to T16 represents the information conveyed by uttering the sentence derived from its output quite explicitly. But mapping it directly, by rules of the type described in the preceding section, on sentences, would result in a repetitive sentence. Now, repetitiveness conflicts with a very basic demand of communication situations:

Be as short as possible. This demand (which can be explained, in its turn, by limitations of Short Term Memory of speakers, or by a principle of "economy in mental functioning" which demands that processes of linguistic analysis will not be repeated unnecessarily) is universal. Hence, it can be expected that a rule which replaces disjunctions by sentences with disjunctive NPs will be universal. This claim has to be tested — I can only say that it is corroborated both by Hebrew and by French. ([23])

In the same manner, T18 - M20 makes it possible to avoid repeating NPs. Now, since NPs can be of any internal complexity ("the boy who killed the girl who ate her father's liver", e.g.) such a possibility serves the same demand of communication situations mentioned above. It also shows (what is not shown by the preceding example) what price we are ready to pay for shortness, we are ready to use indexical expressions (such as pronouns), whose intended reference has to be gathered by the hearer from the context of communication (which is not necessarily exhausted by the list of utterances made in it, as is well known). Thus, information which was explicitly represented in the formula which "underlies" a given sentence in the model of organization of grammar suggested by our examples and discussion, gets lost due to appropriate transformations. The loss is calculated to shorten communication, and is made good by implicit knowledge concerning the context. Thus, we have an example of a rule of grammar which serves the purpose of deleting information for the sake of effective communication.

This is the point to note what would happen had we used a version of elementary logic called "free logic" ([24]) in which free singular terms do not automatically refer, but one has to conjoin a formula of the form:

24. Ex(x = a) (which means: *a* exists).

to sets of formulae in which *a* occurs, if one wants to legitimize such inferences as universal instantiation with respect to *a*.

Then, the formalization of "*John killed the old lady*" would have been

25. Rac & Ex(x = a) & Ex(x = c).

That is, since part of the information conveyed by uttering this sentence is that both John and the old lady exist (the second only in the past, if the sentence is reliable). This is not to say that this information is part of what the sentence is intended to convey. That is, it is quite safe to conjecture that both hearer and listener assume that both "John" and "the old lady" do refer to some specifiable, unique, individuals. But then this shared assumption of them would be a good guarantee for a transformation which simply deletes existence claims for referring phrases. They can be, anyway, "gathered from the context".

Now, there seems to be a good case for preferring free logic to standard logic, in order to formalize adequately arguments in ordinary language, since it is not always the case that we use singular NPs with a referring force (this applies equally to definite descriptions and "proper names"!): Hence, one can assume that deletion transformations applying to existence claims should be embedded in our transformational component

Now, there is a tradition which classifies existential claims of this type as "presuppositions" ([25]) This conception is quite harmonious with ours, though. We can define presuppositions of a given utterance as those formulae which underlie the derivation of the sentences which occur in it, but which were deleted by appropriate transformations, e.g. for the purpose of

shortening communication, thus avoiding the explicit utterance of sentences which express information which is know to both speaker and hearer. The formalization of the utterance necessitates, though, recovering these presuppositions, in conformity with our suggestion above. Namely, that rules of formalization should be inverse to rules of grammatical transformation. Not all transformations serve the purpose of shortening discourse, though. Some of them can be argued to serve other pragmatic purposes. Thus, take (T17,M19). This pair inserts negations into sentences, thus making the NP which is their "topic" to come earlier. Hence, it serves the purpose of helping the listener to locate the "topic" as quickly as possible. ([26]) It should be stressed that the same purpose is served by such rules which have not occurred, as far as now, in our framework, but have been extensively dealt with by linguists. Thus, *Passive* which makes a "grammatical subject" out of a "logical direct object" ([27]) is traditionally said to serve this purpose, and to convey the information that the "topic" of the discussion is the "logical direct object".

Thus it can be said that under the assumptions of our suggested model for the organization of grammars, the two components of linguistic competence serve two distinct purposes. The first, which generates formulae of some logical system, is calculated to produce as explicit representations of information as possible. The second, which consists of transformational rules, is calculated to serve certain constraints imposed by the situation of communication: shortening discourse as far as possible, even at the price of transferring some information from the status of explicitly represented information to the status of "presuppositions", introducing the topic as early as possible, and, of course, many others not mentioned as yet.

Any transformation which can be assumed to represent a universal type of pragmatic pressure (such as all those above) can be assumed to be a universal of language. ([28])

A transformation which reflects a pragmatic pressure which is specific to some culture, say e.g. a sociological norm which dictates a form of address of a man of one class to a man who belongs to another ([29]) can be assumed, on the other hand, to be language specific.

The rules of formalization, being inverse to linguistic transformations, on this view, serve, among other things, to reintroduce presuppositions. Again, this accords well with the accepted conception of formalization as making explicit that which was implicit. ([30])

Obviously, as far as now our few examples cannot carry the weight of the theoretical superstructure which we have sketched. Hence, before we turn to an elaboration of the conception of the relations between logic and language we have suggested, it seems mandatory to apply it to some more examples.

§ 4. *Some more examples*

Consider the following argument:

26: *The man who killed John, is Mary's father.*

27: *The man who is Mary's father, killed George.*

28: *Hence, the man who killed John, killed George.*

This argument is intuitively valid. Its validity seems to be established by the transitivity of identity:

29: $x = y$

30: $y = z$

31: $x = z$

Though, in order to validate 26 - 28 by 29 - 31, 26 - 28 need to be formalized. A first step in its formalization will be its standardization to:

32: The man who killed John is the same man who is Mary's Father.

33: The man who is Mary's father is the same man who killed George.

34: Hence, The man who killed John is the same man who killed George.

The standardization can be effected by applying the following rule, which can be assigned to the competence of formalization:

F21: Replace $(Np^{\frown} wh\ VP_1)^{\frown} VP_2$ by $(NP_1 wh^{\frown} VP_1)$ is the same $(NP_1 wh^{\frown} VP_2.)$

It should be stressed, though, that F21 can be applied only when there is a unique thing (person) which "satisfies" $NP^{\frown} VP_1$ and $NP^{\frown} VP_2$. This condition cannot be formulated at all by the standard grammatical machinery, though it can be easily formalized within a logical framework. This will provide us later with a good justification to abandon F21, in the same way as we have abandoned (or rejected) F13 - F15, in favour of rules inverse to T16 - T18, M19 - M20.

After F21 has been applied, we have to apply the following rules:

F6: Replace "John" by *a*.
F22: Replace "Mary" by *d*.
F7: Replace "George" by *b*.
F29: Replace "killed" by $R^{(2)}$.
F23: Replace "man" by $M^{(1)}$.
F24: Replace "father" by $F^{(2)}$.
F10: (See ibid)
F25: Replace "the P^i who P^j" by $\imath x(P^i(\ldots x\ldots) \,\&\, P^j(\ldots x\ldots))$.
F26: Replace "is the same as" by $\equiv$.

There is no novelty in F6, F2, F7 (which conform to F11), or in F9, F23, F24 (which conform to F12). F26. like F1 - F2, replaces a linguistic locution by a logical constant. F25, though has some additional interest since it can be applied only when some other rules of formalization have already been applied.

That is, since it can apply to a sequence in which some linguistic phrases have already been replaced by predicates. Moreover, it introduces the definite-description operator, ιx. This operator is not included in all systems of logic. Though, it seems necessary to include it somehow in order to account for formalizations of wh-constructions.

The result of applying all these rules to 32 - 34 is

35: $\iota x(Mx \,\&\, Rxa) = \iota x(Mx \,\&\, Fxd)$

36: $\iota x(Mx \,\&\, Fxd) = \iota x(Mx \,\&\, Rxb)$

37: $\iota x(Mx \,\&\, Rxa) = \iota x(Mx \,\&\, Rxb)$

35 - 37 seems to conform to 29 - 31, hence to provide the necessary endpoint for our formalization. Things are not that simple, though. The application of 29 - 31 to 25 - 37 can be done only if we assume that definite descriptions can be substituted for free variables, i.e. that they refer, and uniquely so.

Now, it seems to be a presupposition of 26 - 38 that there is a killer of John, and that there is a killer of George. Hence, it is also presupposed that John, George (and Mary) exist.

Moreover, it is presupposed that "John" and "George" refer to such entities as can be "killed", while "Mary" refers to some entity which may have a father. These presuppositions bring us squarely into the problem of "semantic categories" ([31]) and of "category mistakes". We will leave, though, these problems to a subsequent paper, and only hint that our approach demands that such presuppositions be also representable within the constructed logical system which provides the symbolic framework for the products of formalization.

Lastly, the uniqueness presuppositions concerning "the killer of..." and "the father of" seem to follow from "meaning postulates" ([32]) which govern these locutions: there can be at most one killer, and at most one father, for anyone. ([33])

Hence, we have to assume that, in addition to 35 - 37, our formalization brings us to the following formulae, which have

also to be counted among the premisses of our argument:

38: Ex(Rxa) & (y) (Rya$\supset$y = x).

39: Ex(Fxd) & (y) (Fyd$\supset$y = x).

40: Ex(Rxb) & (y) (Fyb$\supset$ y = x).

41: Ex(x = a)

42: Ex(x = b)

43: Ex(x = d).

On Russell's theory of descriptions, 38 - 40 follow from 35 - 37, while 41 - 43 are redundant since any "proper name" refers. ([39]) On Hintikka's theory of descriptions ([35]), 38 - 40 are needed so as to make the rule of transitivity of identity apply to 35 - 37, while 41 - 43 are not redundant (since he utilizes a free logic). In any case, we have to concede to 38 - 43 some legitimate standing with respect to the product of formalization of 26 - 28, either as independent carriers of information or as immediately derivable. If the later course is adopted, one has to assume that in addition to the rules of formalization which were included up to now, also the following rules have to be applied !

F27: Add to ...e... (where *e* is a free singular term) the wff

Ex (x = e).

F28: Add to ...ιxp... the formula Exp & (y)(p(y/x)$\supset$y = x).

F27, F28 should be, though, context-sensitive: they cannot be applied when, e.g. a free singular term occurs in the environment "*e* does not exist". That is, since such environments are subject to the rule (in addition to F17, of course)
F29: Replace "*e* exists" by Ex(x = a) (following Hintikka ([35])).
The application of F17, F29, and F27 will provide us with the contradictory wffs:

44: Ex(x = e) & — Ex(x = e).

But since, e.g.

45: Hamlet does not exist

is not contradictory, its formalization by means of 44 (where *e* replaces "Hamlet" with conformity to F11) is inadequate.

Similar considerations apply to the possible contexts of F28. We can now repeat the procedure of the preceding sections and invert our F-rules. Instead of inverting F21, we will, though, repelace T21 by T30: Replace ιxp = ιxq by q(ιxp/x) & Ex q & (y)q(y/x) ⊃ y = x. The output of T30 is subject, of course, to T28 which deletes the last conjunct, transforming it into an "existential presupposition". Then the other rules can be applied to derive 26 - 28 directly from 35 - 43, without the mediation of 32 - 34. In this process, all existential and uniqueness formulae are deleted and thus made presuppositions. Our new T rules shorten discourse (the elimination of existential and uniqueness presuppositions). Moreover, they bring 35 - 37 to a "subject predicate" form. This form is a-symmetrical between *p* and *q* (Cf. T30 above). *p* is included in the subject, while *q* is made predicate (under the appropriate transformations, obviously, which are, as already claimed, the inverse of our F-rules). Thus, *p* serves the pragmatic purpose of helping the hearer to identify the topic of discourse, while *q* provides the "new information" concerning this topic. New, that is, relative to the speaker's beliefs concerning the hearer's beliefs.

Thus, the choice between q(ιxp/x) & Exq & (y)q(y/x) ⊃ y = x) and p(ιxq/x) & Exp & (y)p(y/x) ⊃ y = x) which are two possible outputs of T30 (or, alternatively, which depend on the logically irrelevant order of ιxp and ιxq in the equation ιxp = ιxq), depends on pragmatic factors. That is, it depends on the distinction the speaker makes between information that is common to him and his partner of discussion, and information which he possesses while his partner does not, and which is, hence, worth communicating. This distinction has to be assumed to be represented as part of the relevant input for the rules which transform 35 - 43 into 26 - 28, though, obviously. it is not explicitly represented in their output. Hence, it is

also deleted (and in the status of "presuppositions"). The representation of this information within the framework of a logical language is not, though, some far-off hope, which cannot be realized as yet. It only requires that we will possess, in addition to the formulae which can be generated by the formation rules for a language of elementary logic, the following formation rule:

R1: If p is a wff, then $B_a p$ is a wff. ([36])

B_a should be read: a believes that.

Now, if s refers to the speaker, and h to the hearer, T30 will be reformulated as follows:

T31: Replace $B_sEx(p \,\&\, (y)p(y/x) \supset y = x) \,\&\, B_sB_hEx(p \,\&\, (y)p(y/x) \supset y = x) \,\&\, \iota xp = \iota xq$ by $q(\iota xp/x) \,\&\, Ex(q \,\&\, (y)\, q\,(y/x) \supset x = y) \,\&\, B_sEx(p \,\&\, (y)p(y/x) \supset y = x) \,\&\, B_sB_hEx(p \,\&\, (y)p(y/x) \supset y = x)$.

Obviously, the output of T31 is subject to T28. It is also subject to the following rule:

T32: Delete $B_sp \,\&\, B_sB_hp$ whenever it occurs.

T32 is necessary in order to safeguard the application of T31 without bringing about the utterance of its "presuppositions" — i.e. the speaker's beliefs concerning the common beliefs which he shares with the hearer and which can be relied on in the communication process (e.g. to facilitate the hearer's identification of the topic of discussion. ([37]) Thus, in a sense, it is a rule which can be included in the system of rules constituting "linguistic competence" in our approach to it. On the other hand, T32 is a rule which Chomsky would have surely assigned to "the theory of performance". ([38]) It is a rule whose deletion from a process of derivation would not bring about the generation of "nongrammatical" sentences: Consider

46: I believe that there is a unique person who killed John, and I believe that you believe that there is a unique person who killed John, and the person who killed John is Mary's father.

46 is grammatical, though odd to utter. It is generated by a process in which T32 does not occur.

Hence, we are here faced with a methodological dilemma: are we only interested in a theory of "grammaticality" — as Chomsky is, or are we interested in the theory of the mechanism which generates sentences which have to be used in a specific speech situation ?

We recommend the later interest. First and foremost, though, because if one restricts oneself to the study of "grammaticality" (and not of "oddness" for instance) one is bound to lose significant generalizations. Thus, one cannot explain why the speaker said, in a specific context:
"The man who killed John, is Mary's father" and did not prefer to it *"The man who is Mary's father, killed John"*.

Moreover, pronominalizations which introduce a pronoun to refer to something which was referred to by a NP which preceded it, but *not within the same sentence,* or which was never uttered in the discussion but the statement it could express was presupposed (Cf section 3, (F18, M20), cannot be made sense of within a theory of "grammaticality". Not that one cannot allow, ad-hoc, the introduction of pronouns into NP positions. But one cannot then explain how it is that they co-refer with some NP which has occurred in a sentence uttered just before now, or, more simply, how to determine their reference at all. I believe that even orthodox Chomskyans find that a semantic theory for some language should bother with the determination of the references of referring phrases.

Hence, we suggest to accept T32 as a rule which belongs to the "capacity to use language". It has considerable explanatory power: it explains, for example, what statements can be expected not to be made in a given context. It also explains the cryptic way of talking between specialists belonging to the same profession, which relies on a considerable amount of shared beliefs which are also believed to be shared, and never mentioned explicitly (though frequently occurring as premises in arguments, for example). T32 is another illustration for the idea that rules involved with using language are designed to shorten discourse as far as possible. Now, T32 could never be formulated had we preferred the inverse of F21, i.e. T21, to T31. This is another reason to adopt T31, (to say nothing about

its greater explanatory capacity, illustrated by e.g. 47: *John killed the man who is Mary's father*, derivable by T31, but not by T21, from the formula underlying 48 *John killed the man who is the same as Mary's father*.)

Thus, our analysis of this example can be represented within the same framework developed in the preceding section. The significant contribution it makes is that it illustrates the rule of language use which forbids uttering statements which represent, in any case, commonly shared information of both hearer and speaker, as far as the speaker's beliefs go. Moreover, it shows that a theory of definite descriptions should, somehow, be included in a logical system which we want to use in order to formalize arguments of a natural language. The methodological significance of these examples, lies, on the other hand, in showing the futility of attempting to demarcate a theory of "linguistic competence" from a theory of language use. A theory of language use can be represented by a system of rigorous rules which are also of linguistic relevance. "The abstraction from pragmatics" ([39]) involved in restricting one's interest to a theory of competence is not to be recommended. This methodological conclusion seems to be at odds with our starting point. We seemed to have committed ourselves to a notion of "competence" and now we seem to throw it away. This is not the case, but we have to leave the clarification of this point to another paper.

§ 5. *Formalization and theoretical linguistics*

We have discussed instances of formalization of arguments (and of formulations in general) in terms of the operation of a system of rules, which effect the transformation of a formulation in a natural language into wffs in a formal logic system. The rules which we have suggested either replaced linguistic material by logical material, or standardized linguistic formulations by cancelling the effect of grammatical devices for abbreviation (e.g. the formation of disjunctive NPs) and reintroducing deleted presuppositions. We have also considered

the possibility of inverting the process and "generating" utterances from wffs by formulating rules which invert the effect of the rules of formalization. This suggestion, though, has certain far-reaching implications concerning the organization of grammars, the goals of linguistic inquiry, the goals of philosophical logic, the nature of presuppositions, and the types of evidence available for linguists. Hence, it deserves a more systematic discussion.

Thus, this suggestion implies that the primary goal of linguistic inquiry is not to define "grammaticalness" — that is, to provide a grammar for a given language, but to specify which sentences can be uttered in a given context in order to express a given "thought". The thought in question is assumed to be represented by some wffs, which expresses explicitly all the information contained in the thouhgt. Thus, Chomsky's conception of "linguistic competence" has to be given up in favour of some conception of a "speech generating mechanism. ([40])

Moreover, this suggestion implies that the full-description of such a mechanism would involve two components:

a. A logical system (defined, as usual by a system of formation rules) which is general enough so as to provide a target language for all possible formalizations. Obviously, such a constructed language includes quantification theory, doxastic and epistemic-logic, deontic logic ([41]) and many other systems of that kind, as proper subsystems. Let us call this "logical" language the Representation System (RS). This label is suitable since this system has to be capable to represent anything expressible by language. (Otherwise, it could not be the target language for the purpose of formalizing at least some formulations). Moreover, the logic of this constructed language need to be general enough so as to account for all argumentation in natural languages. ([42]) Otherwise, formalization of arguments as a first step in testing them would be pointless.

b. A system of transformations, which map formulae of the RS onto sentences to be used in specific contexts of utter-

ance (!). These transformations are calculated to facilitate communication, at the price of dammaging the explicit representation of information provided by formulae of the RS. This facilitation is brought about by

a. shortening discourse.

b. focussing the attention of the hearer on those parts of the information imparted which are important for the speaker.

a. is effected either by abbreviating constructions (deleting recurring phrases (T16, e.g.) or by deleting the representation of information which is assumed by the speaker to be common-knowledge between him and his listener (T32). Thus, the notion of presupposition gets defined as that part of the information contained in the "thought" to be communicated which is not explicitly represented by any linguistic material included in the sentences occurring in the utterance made.

b. is effected by such rules as T17 - M20, Passive, and T30. These rules provide negations, relations and conjunctions with a subject-predicate surface form, so that the speaker can be immediately informed "who is being talked about". This form is brought about by the generation of "infinite" sentences ([43]), the interchange of subject and object, and the generation of relative clause sentences. Other types of "pragmatic pressures" can be imagined, and any conjecture about the existence of any type of "pragmatic pressure" has to be tested, within our framework, by looking for rules of grammar which "represent" it. Now, when the goals of linguistic theory, and the organization of a grammar, are conceived in the way sketched above, philosophical logic is furnished with a new task.

Thus, philosophical logicians have always been interested in constructing new symbolic frames in order to provide formal devices for testing "new" argument patterns. Russell's theory of descriptions ([44]), which is an attempt to provide a logical analysis for the constructing "the...who ___ " is a very "old" step in this direction. On the other hand, Hintikka's epistemic, doxastic, deontic, "perceptual" etc logics are quite recent attempts in this direction. ([45])

In the spirit of our previous remarks, the task or philosophical logic is to attempt a reconstruction of the RS. That is,

to suggest a formal framework which is extensive enough so as to cover all argument patterns and to provide means of formalization for all formulations in any natural language. This task makes the unification of all suggested systems of modal logics which can at all be integrated a necessary first step. This is so since e.g. the formalization of

49: *I am surprised that you come to visit me*

will lead us to the formulae which underlie

50: *I believe you come to visit me but I did not believe you would come to visit me.*

The next steps of this formalization necessitate both the doxastic operator "*a* believes that..." and the tense-operators: "It was the case that..." and "it will be the case that..."

Though, these first steps are not sufficient, of course. We need more powerful logical systems for the formalization of additional locutions in ordinary language which behave as sentential operators apart from "*a* believes that..." etc). Other types of locutions (formalizable by predicates, e.g.) have to be provided a semantic analysis by means of a system of "meaning postulates" ([46]) (Cf. the analysis of those presuppositions of 26 - 28, which involve the meaning postulates of "father" and "killed".)

On the other hand, theoretical linguists can take, on our view, the process of formalization as an important source of linguistic insights, since it illustrates many important grammatical processes, on the one hand, and brings to clear light their pragmatic function, on the other. Moreover, if they are, themselves, competent enough in formalization, and familiar with a large variety of formal systems which provide target-languages for formalization, they can facilitate the search for a structural description or a given formulation, by taking the following steps:

a. Formalize the formulation, thus providing an explicit representation for the "thought" it communicates.

b. Trace the formal processes which have been utilized in the production of the formalization. This is much easier to do than to attempt a structural description of a "sentence" directly, since the last process has only one given "endpoint" — the sentence itself, while our suggestion provides the linguists with two endpoints: the sentence and the thought which it attempts to communicate (when uttered in the relevant context). The thought is represented by a logical formula.

Moreover, our suggested conception of the theory of language makes the cooperation between linguists and philosophical logicians, recommended by Bar-Hillel ([47]), much more tangible.

Thus, if a linguist shows that the process of formalization which leads from some types of ordinary-language formulations to the wffs of some constructed language, S, is carried by rules which have no obvious pragmatic purpose, while the formalization of these same utterances within S_1 can be shown to depend on pragmatically motivated rules, this is a good case for preferring S_1 to S, for whatever purposes of "conceptual clarification" a philosophical logician is interested in realizing. Hence, any logical system which is intended to reconstruct pragmatical features of ordinary language is ruled out by this consideration. This includes, I am afraid, all those works which attempt to provide a logical reconstruction of the notion of presupposition. ([48])

This is, simply, since relative to our assumptions, presuppositions arise only when one makes the transition from the "logical level" to the "linguistic level" and have no distinct location on the logical level.

In a more general fashion, one can even say that our approach rejects all conceptions of philosophical logic as attempting a simulation of ordinary language. This is precisely because on our suggestion the RS is calculated only to serve the purpose of representing information in as explicit fashion as possible. On the other hand, ordinary language is intended to serve many additional purposes which all arise from its primary function of serving a medium of communication, and which were discussed above. Hence, the approach taken by such philosophers of ordinary language as Strawson, ([49]) and

Ryle ([50]) towards philosophical logic, as a (necessary unsuccessful) simulation of ordinary language, has to be rejected — if our grounds are accepted. Philosophical logic is not intended to simulate natural language, hence it cannot be criticized as not providing an accurate simulation.

The last remarks point out some of the possible wider implications of our approach. Thus, it opens the way for a serious discussion of the relationship between thought and language, it opens the way for the representation of cognitive processes in general in terms of processing of representations in the RS, etc. All these further developments have to be left, though, for some further papers.

It is high time, though, to attempt now a discussion of the relationships between our approach and certain others, which have already, been published.

There is a good case to claim that a variety of philosophers were interested in the RS, including Leibnitz (the "Characteristica Universalia") Kant ("transcendental logic"), Frege (his "Begriffschrift") Carnap ("the Logical Syntax of Language") Quine ("canonical notation") etc. Quine's "syntactical insights" ([51]) can even be claimed to fall squarely into the common field of the theory of formalization and the theory of language. ([52]) All these philosophers, though, deserve a separate study in the light of our last hints. Here we will limit our discussion to three thinkers: Bar-Hillel, Hintikka, and Lakoff, Lakoff will be taken as a representative of a whole school in Theoretical Linguistics (Generative Semantics) which has quite similar views of language as those developed here.

§ 6. *Bar-Hillel: Universal Semantics and Logic*

Within our program, the RS is a component of the theory of language, or, at least, presupposed by such a theory. (I.e. In the case that the theory of language is only assumed to provide the system of rules which transform "thoughts" — i.e., wffs of the RS onto sentences occurring in some specific utterance). Bar Hillel, who in all his published papers did not explicitly

reject the Chomskyian conception of linguistic theory (in which logic is irrelevant for the theory of syntax, at least), has over and over stressed the immediate relevance of logic for the theory of the semantic component. Thus, he says: ([53])

"I claim that nobody has fully mastered the semantics of English who does not know that from *John is older than Paul and Paul is older than Dick* (with the occurrences of *Paul* referring to the same person) one can deduce (*John is older than Dick.* A complete semantics of English must contain a rule to this effect, either as a primitive, explicit one, or at least as a derivative, implicit one. Such a rule, might, for example, have the form: From X *is older than* Y and Y *is older than* Z, deduce X *is older than* Z. We also need rules to the effect: From X *is older than* Z deduce Y *is not older than* X and X *is not as old as* Y and Y *is younger than* X, and so on. None of these meaning rules can be derived from traditional dictionaries. Any stretching of the notion of dictionary (or lexicon, for that matter) in order to incorporate them would be at best merely pointless and, at worst, a misleading adherence to outmoded terminology,...

"Notice that logicians have a way of compressing this multiplicity of rules into very compact formulations. One such formulation would be *is older than* denotes an irreflexive, asymmetrical and transitive relation. A more compact formulation is: *Is older than* denotes a strict partial order...

"Notice that these meaning rules can be separated into two parts: one that is specific for a given language such as English, and one that is universal, holding for all languages, or rather is language independent. That *is as old as* and *is older than* form a quasi order is, of course, peculiar to the English language, is a rule of specific English semantics; but the fact that, if they do, *is as old as* is symmetrical, *is older than* is transitive, and so on, has no longer anything to do with English specifically. This implication belongs to "universal semantics" or "logic", depending on the department you belong to...".

Thus, our suggestion to embed the system of logic in which the above formal properties of adjectives such as "is older than" are represented within the theory of language, is quite

in line with Bar-Hillel. Our divergence from him is in that we do not think that one utilizes the semantic component in order to interprete "deep structures". Rather, we think that the semantic component defines "deep structures" — hence, (as it follows from Bar-Hillel's assumptions about the identity of universal semantic theory and logic: logical formulae constitute the underlying structures for ordinary language formulations. Language-differences follow from the difference in rules which transform "semantic representations" into sentences to be uttered in a specific context.

§ 7 *Bar-Hillel: sentences and statements.*

There is also another part in the preachings of Bar-Hillel which can immediately be incorporated within our program. This is his frequent appeal to the distinction between a *sentence*, and *utterance*, and a *statement*, his claim that only statements can be the objects for which the property of *Truth* is defined, and his persistent stress on the relevance of contextual dependencies of the sentence, occurring in a given utterance, for the identification of the statement being made by that utterance. Thus, he claims ([54]):

"Though a (declarative) sentence must be either true or false in such language systems, it is simply false, ridiculously false, I am tempted to say — to assume that this should hold also for natural languages. Leaving aside all those innumerably many sentences which might be too vague, obscure, indefinite, etc. to have the epithets 'true' and 'false' applied to them *simpliciter*, there are many other classes of declarative sentences to whose members truth values are not applicable ...the last class of indexical sentences whose very reference is context-dependent — think of "I am hungry" or "It will be raining here tomorrow" — so that, depending on the context, some tokens of these sentence types are true and others false (all this according to a mode of speech which I shall shortly urge to abandon altogether), making it again pointless to ask for the truth values of the sentences (-types) as such... The alternative

conception consists in drawing a sharp line between

declarative sentences and statements...

and, when necessary, between

uttering a declarative sentence and making a statement...

Truth and falsity should be regarded as primarily properties of statements and only derivatively as properties of certain sentences, namely of those (declarative) sentences of some formalized languages... To illustrate...: If John Doe, utters, on February 16, 1966, at 1:30 pm (in a certain situation which shall not be further specified here) a token of the English sentence "In am hungry" he will be taken by those who hear him utter this sentence, to have made a certain statement (and to have claimed that this statement is true)... When asked to specify the statement made, this request can be fulfilled in many different ways... Notice the transition from statements to sentences is absolutely necessary for certain purposes such as the application of formal logic, say for the talking about the validity of certain arguments. Statements have, of course, no form..."

Now, since Bar-Hillel consents that statements can be specified by the (context independent) sentences of formalized language, and since from his claim that only statements possess truth values it follows that arguments are sequences of statements, it seems to us quite in his line to reject his claim that statements have no form. Rather, we suggest to identify statements with formal entities which have an explicit and well defined form. Namely, the formulae of the RS. These formulae are context independent, non-ambiguous, and represented in such a fashion which makes it possible to define the notion of truth for them (in the fashion of Tarski ([55]) and Kripke ([56])). Thus, the distinction between sentences, statements, and utterances can be reduced to the distinction between the wff of the RS which serves as (partial) input for the linguistic mechanism in a given context, the sentence which is produced by the mechanism as the result of application of the transformation rules to the wff, taking into account also information about the context and the other beliefs of the listener, and the (physical) act of phonetically realizing this sentence in order to communicate

the information contained in the wff to one's listener. When this reduction is performed, all of Bar-Hillel's desiderata concerning statements are satisfied — except the claim that statements have no form, which, anyway is very odd. (It seems to clash with Leibnitz's law: statements are abstract entities, hence they can be distinguished only by reference to their structure. But if they have no form, even this possibility is lost. Hence there is only one statement, which is absurd.)

Though, the convergence of 'Bar-Hillel's ideas with those expounded here is less direct than the convergence of Lakoff's views. He discusses the *RS*, and identifies it with a logically constructed language. Hintikka's views, on the other hand, seem directly translatable into our program, and make a substantial contribution to its 'pragmatic' aspect. Hence, they will be dealt with first.

§ 8 *Hintikka's Depth Logic*

Hintikka's initial problem is similar to ours, though more limited in its scope. He had elaborated a formal system, called *Epistemic Logic,* in order to systematize the formal properties of argumentation which essentially involve the concepts of *knowledge* and *belief.* ([57]). His work was attacked on the grounds in which Brittish Analytic philosophy is rooted: a formal system, being, at most, a "regimentation" of natural language, is, at best, superfluous for the purposes of "conceptual analysis" which has be performed, rather, "within natural language" itself. ([58]) The attack compelled Hintikka to make explicit his conception concerning the possible relationship between natural language and a formal system such as Epistemic Logic: ([59])

"A branch of logic, say epistemic logic, is best viewed as an explanatory model in terms of which certain aspects of the workings of our ordinary language can be understood. In some cases, this explanatory model may be thought of as bringing

out the 'depth logic' which underlies the complex realities of our ordinary use of epistemic words ('knows', 'believes' etc.) and in terms of which these complexities can be accounted for. It therefore does not represent a proposal to modify ordinary language but rather an attempt to understand it more fully. But this explanatory model does not simply reproduce what there is to be found in ordinary discourse. As the case is with theoretical models in general, it does not seem to be derivable from any number of observations concerning ordinary language. (I have not quoted note 9 or any other notes to Hintikka's text. M.K.) It has to be invented rather than discovered. This conception of the relation of epistemic logic to ordinary language has many important consequences for the evaluation of what has been done in this branch of studies. At this point I shall mention only one example.

Elsewhere, I have shown how one can make a general distinction between what is said of the individual who in fact is, say, *a* and what is said of *a*, whoever he is or may be, whenever one is speaking of propositional attitudes or using other modal concepts (in the broad sense of the term). Now, in ordinary discourse statements of the former type are usually more important and frequent than those of the latter type. Hence, if mere congruity with ordinary usage is what we want, it may seem advisable to restrict the substitution values of our free individual symbols so as to allow statements of the former kind only. Suggestions in this direction have in fact been made for different reasons (e.g. by B. Rundle and Dagfinn Föllesdal, in his unpublished dissertation), and there is something to be said for them. They can even be butressed by applications of the Russellian theory of descriptions. This theory might seem (fallaciously) to enable us to eliminate constructions of the latter type altogether. However, it seems to me that in this way we gain little insight into precisely why it is that we have to restrict the substitution values of our free singular terms in the way we were asked to do. We also deprive ourselves of the possibility of characterizing the logical behavior of certain kinds of terms (pronouns, proper names) as distinguished from others. Hence, in the interest of genuine

theoretical insight into the logical situation we have to keep apart from ordinary language and carry out a deeper analysis of the situation.

"Other more general aspects of the idea of logic as an explanatory model can also be registered. This idea is related to Wittgenstein's idea of a language game. In fact, the explanations he offers in the *Blue Book* of the concept of language-game appear to be in agreement with what I want to say of an explanatory model. In many cases, an explanatory model may be thought of as giving us a way of suing language in so far as this use is determined only by one main purpose which the part of language in question is calculated to serve. This shows why such an explanatory model does not accurately reflect what happens in ordinary discourse, for what happens there is also influenced by many other factors of the following nature:

(i) Other, competing purposes. Often, these are the vague general purposes which virtually all discourse is expected to serve or at least expected not to hinder. Thus, many forms of discourse serve to keep others informed of whatever the situation happens to be. This purpose is not served very effectively if the speaker does not make as full (explicit) statements as he is in the position to make.

(ii) Various pragmatic pressures, such as the pressure not to use circumlocutions without some specific purpose.

(iii) Various built in limitations of the human mind, e.g. the limitations of one's short term memory.

(iv) The pressures due to the particular context in which a sentence is uttered or written.

The way in which one's explanatory model is supposed to throw light on what happens in ordinary discourse could be explained as follows: We shall call the meaning which an expression would have in the explanatory model its basic meaning. Now, we may start from this basic meaning and see

how it will be modified by the different factors (i) - (iv) (plus others, as the case may be). The resulting meanings, as far as they differ from the basic meaning, might be called *residual meanings*. If our explanatory model is an appropriate one, and if we have correctly diagnosed the pragmatic and the other factors involved in different cases, we shall in this way be able to explain what actually happens on the different occasions of ordinary usage...

Why are we justified in incorporating the law of double negation into our ordinary propositional logic ? Surely in ordinary language a double negated expression very seldom, if ever, has the same logical power as the original unnegated statement. Does not our propositional logic therefore distort grossly the logic of ordinary language ? The answer is (very briefly) that if the basic meaning is assumed to be tantamount to that of the original unnegated expression we can explain the residual meanings which a doubly negated expression has on different occasions. Hence, the basic meaning of a doubly negated expression can perfectly be assumed to be the same as that of the original unnegated expression."

In order to see the relevance of Hintikka's views to the ideas discussed in preceding sections, let us analyse in a less cryptic manner his last example.

Consider the formulation:

51: *John is not unwise*

In order to discover the "basic meaning" of 51, we need a recourse to an "explanatory model", which, in this case, can be taken to be first order predicate logic. This basic meaning can be represented by the formula

52: - - Wj

The transition from 51 to 52, can be done, though, only by recourse to appropriate rules of formalization, such as F11 (which justifies the replacement of "John" by *j*), some variant

of F12, say F'12, which justifies the replacement of "is wise" by *W*:

F'12: Replace is *Adj* by a monadic predicate.

and some variant of F14, say F'14, which will justify the prefixing of the negation operators:

F'14a: Replace "NP is not Adj" by It is not the case that *NP is Adj*

F'14b: Replace X — *Adj* where X is a syntactic variable ([60]) and Adj_1 is $unAdj_2$ by *It is not the case that* X — Adj_2.

Obviously, F'14 applies first, transforming 51 into

53: *It is not the case that it is not the case that John is wise.*

53 is then mapped by F2 (applied twice), F11 and F'12 onto 52. Thus, the discovery of the basic meaning depends on the process of formalization. At this point, though, the law of double negation applies. 52 is logically equivalent (and trivially so ([61])) to:

54: Wj.

Now, 54 can be mapped by T11, T'12 onto

55: *John is wise.*

Hence, 55, 53 and 51 have the same basic meaning. 51 is prefered in usage to 53 being shorter. But 55 is even shorter than 51. Since one of the basic pragmatic constraints discussed in preceding sections is that of shortening discourse, the usage of 51 instead of 55 signals that 51 does not serve all the purposes in common with 55. Hence, its choice by a speaker is calculated to serve additional purposes added to that of communicating the "basic meaning".

The argument sketched just now can be generalized: whenever one's purpose is to communicate some "basic meaning", the sentence he will use can be expected to be derived from the shortest formula which represents this "basic meaning" in the explanatory model. (Thus, a "basic meaning" can be identified with an equivalence class of formulae, under the relation

of trivial logical equivalence) ([62]) Therefore, when the formalization of a formulation brings us to a formula which is not the shortest to express this "basic meaning", one can expect that the utterance of this formulation serves certain additional purposes to those of communicating the "basic meaning".

Thus, Hintikka's argument can be translated into our approach. His "basic meaning" for an ordinary language expression comes to be identified with an "equivalence class of formulae of the RS" — when the RS is taken as containing all "explanatory models" for all ordinary language locutions, while his "derived meaning" depends both on the basic meaning, and the actual choice of an underlying formula for the representation of this basic meaning. This choice itself has "pragmatical function" — in addition to the pragmatical functions of the rules which map wffs of the RS onto utterances which we have already stressed.

Moreover, in the light of our program, much of Hintikka's actual work (concerned with the reconstruction, within epistemic logic, of subtle grammatical differences between English formulations) can be studied as illustrating "rules of formalization" ([63])

This study, again, has to be postponed to some other paper.

§ 9. *Lakoff's Natural Logic*

In contradiction to Bar-Hillel and Hintikka, Lakoff's intellectual tradition is that of theoretical linguistics, i.e. the analysis of language by transformational grammars. Though, he also came to see the relevance of formal logical systems to the representation of underlying linguistic structures through a concern with argumentation — which is quite close to ours: ([64])

"For better or for worse, most of the reasoning that is done in the world is done in natural language. And correspondingly, most uses of natural language involve reasoning of some sort. Thus it should not be too surprising to find that the logical structure that is necessary for natural language to be used as a tool for reasoning should correspond in some deep way to the

the grammatical structure of natural language... is there some necessary connection between grammatical structures... and the corresponding logical structures ? Intuitively, one would guess that the connection was not accidental. If this is true, one would like such a fact to be represented in a theory of linguistic structure... It follows that the rules determining which sentences are grammatical and which ungrammatical are not distinct from the rules relating logical forms and surface forms...

So far we have been speaking about "logical forms" of English sentences as though the term meant something. However, it makes sense to speak of the logical forms of sentences only with respect to some system of logic. And systems of logic are constructed with certain aims in mind — there are certain concepts one wants to be able to express, certain inferences one wants to be able to account for, certain mysteries one wants to explain or to explain away, certain fallacies one wants to avoid, certain philosophical problems one wants to elucidate. Most of the attempts made in recent years to provide logics for certain fragments of English have been motivated by a desire to shed light on certain philosophical problems that require certain concepts (e.g. logical necessity, change in time, obligation, etc.) be expressed and certain inferences (e.g. what is logically necessary is true) be accounted for. In this study, we have set an additional goal. In Section I, we saw that there was some connection between grammar and reasoning, and we inquired as to whether it was accidental, and if not, just what the connection was... To recapitulate, we have made the following assumptions:

(i) We want to understand the relationships between grammar and reasoning.

(ii) We require that significant generalizations, especially linguistic ones, be stated.

(iii) on the basis of (i) and (ii), we have been led tentatively to the generative semantics hypothesis. We assume that hypothesis to see where it leads.

Given these aims, empirical linguistic considerations play a role in determining what the logical forms of sentences can be. Let us now consider certain other aims.

(iv) We want a logic in which all the concepts expressible in natural language can be expressed unambiguously, that is, in which all nonsynonymous sentences (at least, sentences with different truth conditions) have different logical forms.

(v) We want a logic which is capable of accounting for all correct inferences made in natural language and which rules out incorrect ones. We will call any logic meeting the goals of (i) - (v) a "natural logic".

Thus, it seems that Lakoff's program, though it does not commit itself explicitly to the pragmatic function of grammatical rules, is quite similar to ours. The difference just mentioned hinges on the question:
Why do we not use a logical-language (i.e. a constructed language) for the purposes of everyday communication ?
That is: Why are rules of grammar needed ?

Our answer was, as claimed above, that rules of grammar were needed in order to facilitate communication: shortening discourse by various devices and helping in focussing the hearer's attention are relevant examples. Lakoff does not formulate this question explicitly. Though, Lakoff's program seems almost to coincide with ours with respect to the importance of "logical form" for linguistic purposes. Despite that, his actual practice of utilizing "logical forms" for the purpose of grammatical analysis is quite disappointing. Instead of attempting, as recommended above, the formalization of each formulation which should be grammatically analyzed, he simply replaces the well known Chomskyan rewrite rules

$S \rightarrow NP \overset{\cap}{} VP$

$VP \rightarrow V \overset{\cap}{} NP$

by the rewrite rule

$S \rightarrow \text{Predicate} \overset{\cap}{} \text{Argument} \overset{\cap}{} \text{Argument}\ldots$

Obviously, this rewrite rule is more economical than the Chomskyan pair, and it also avoids the asymmetry between *subject* and *direct object* which Chomsky acknowledges.

Despite that, it seems that the conformity to the Chomskyan tradition which starts each derivation within the grammar by an S has the following drawbacks:

1. It misses the (syntactically relevant) distinctions between unary connectives, unary operators, and predicates (!) on the one hand, while the distinctions between formulae, free singular terms, free variables etc, are lost on the other. This is so since by imposing artificially a form of an atomic formula on all "logical forms" (starting with the above rule), Lakoff has to treat all of the distinct logical particles of the first group as falling under "Predicate", while all the latter fall under "argument".

2. It misses the possibility of representing grammars as formal devices which transform semantic representations (logical forms, cognitive representations, thoughts, judgements, or what have you) into their linguistic formulation. Thus, the possibility of integrating linguistic theory within a wider mentalistic theory of the mind is missed, since in any such theory one should expect that the "speech faculty" should transform "thoughts" into their linguistic representation.

3. Therefore, the two formal process of applying formation rules of "natural logic" so as to construct "logical forms" and the process of applying to these logical forms grammatical rules which generate sentences (rather, sentences for certain utterances) out of them are not distinguished.

Despite these shortcomings, the considerable convergence between our program and Lakoff's makes it possible to utilize his considerable amount of insights into linguistic structure and the variety of sophisticated formal devices which can be classified among "grammatical rules" (apart from classical transformations ([65])) within our program.

§ 10. *Certain concluding remarks*:

We have suggested the formal study of the process of formalization, having also pointed out its relevance to both theoretical linguistics (Generative Semantics) and philosophical logic. Though, our program is, as yet, in infantry. It has to meet many problems which were not even touched in our discussion. Thus, to mention one example: how can sentences in which a nominalized sentence occur be formalized ? For example:

56: *John believes that the coming of George into town makes it urgent for him to leave.*

56, if formalized in a straightforward manner, will have the form 57.$B_aR(c,d)$.
Where *c* stands for "the coming of George into town"
and *d* stands for "it is urgent for John to leave:
(R will then stand for "makes it" or something of the sort).
57, is, though, formally unhappy since it necessitates inclusion of propositions (or some entities of that sort) in the domain of interpretation for our free singular terms.

Worse: the logical relation between 56 and

58: *John believes that George came into town and that since George comes into town it is urgent for John to leave*

is lost.

58 can, though, be formalized without any direct reference to propositions. I wonder whether it cannot be taken as manifesting the same logical form as 56. Hence, nominalization will be treated as another grammatical device which represents a pragmatic purpose. What pragmatic purpose, though ?

NOTES AND REFERENCES

(1) The question is "transcendental" since it manifests the pattern: How is it posible to... ?

which characterizes the well-known Kantian question: (roughly speaking). "How are *a-priori* synthetic judgments possible ?"
(KEMP-SMITH N. (tr): *Immanuel Kant's Critique of Pure Reason*, Macmillan and co, 1929, p. 55).
Moreover it can be argued — but this a matter for another paper and not for a footnote, that all such questions can be reformulated as questions concerning the specific nature of some "*competence*" or other.

(2) This is Quine's term for the process of formalization, since he conceives of logically-constructed languages as closely akin to ordinary languages. He has also envisaged part of our program: a study of the process of formalization — in the reverse: "The artificial notation of logic is itself, explained, of course, in ordinary language. The explanations amount to implicit specifications of simple mechanical operations whereby any sentence in logical notation can be directly expanded, if not into quite ordinary language, at least into semi ordinary language. Parentheses and variables may survive such expansion, for they do not always go over into ordinary language by easy routine. Commonly also the result of such mechanical expansion will display an extraordinary cumbersomeness of phrasing and an extraordinary monotony of reiterated elements; but all the vocabulary and constituent grammatical constructions will be ordinary. Hence, to paraphrase a sentence of ordinary language into logical symbols is virtually to paraphrase it into a special part still of ordinary or semi-ordinary language; for the shapes of individual characters are unimportant. So we see that paraphrasing into logical symbols is after al not unlike what we all do every day in paraphrasing sentences to avoid ambiguity." (QUINE, W.V.O. *Word and Object*, M.I.T. Press, 1960, p. 159).

(3) The qualification "which they master" is intended to account for disagreements between competent philosophical logicans concerning the correct formalization of certain formulation whenever the target language is a newly suggested constructed language. What is more significant, from the point of view of the main argument of § 1, is that debates of this type can be terminated: one side can (in many cases) convince the other that the formalization he suggested is the correct one. The other can, of course, claim that the correctness of the formalization suggested by his partner only testifies to the inadequacy of the target language, but this is another matter. Thus, while Castañeda claims that the formulation:
"(9) The war hero wounded 100 times knows that Smith knows that he (= (the war hero wounded 100 times)$_2$) is tall" (CASTAÑEDA H. N. "On the Logic of Self Knowledge", Noûs, v. 1, No 1 (1967) p. 16) is to be formalized by

"$K_a(Ey)(y = a \,\&\, K_b(Ty)$"

(*ibid.*, p. 18).
Hintikka claims that: "The translation of this into my symbolic language is not what Castañeda suggests but rather the following:

"$(Ex)(x = h) \& K_h K_{Smith}(x \text{ is tall})$"

(HINTIKKA J. "Individuals, Possible worlds, and Epistemic Logic", ibid, p. 50). I believe that Castañeda also agrees now that Hintikka was right about this formalization (though, of course, he might reject Hintikka's Epistemic Logic in toto).

Thus, such disagreements only corroborate my point.

(4) Moreover, differences of familiarity with novel logical systems (such as Epistemic Logic) can be conceived of as analogous to differences of dialect within a linguistic community. The "language" which seems to define the "community of formalizers", or, rather, the "community of philosophical logicians" is, essentially, quantification theory. Its various "dialects" are its various estensions (such as modal extensions, etc.) and modifications (intuitionistic logic, etc.).

(5) Moreover, it can be expected that the consensus in question will become more and more problematic as the study of formalization will proceed: especially, when the "secure field" of formalization within quantification theory will be left for such "obscure fields" as intensional logics of all sorts. A similar development has taken place in the study of linguistic competence. In 1965 Chomsky could claim: "The problem for the grammarian is to construct a description and, where possible, an explanation for the enormous mass of unquestionable data concerning the linguistic intuition of the native speaker (often, himself)." (CHOMSKY, N. *Aspects of the Theory of Syntax*, M.I.T. Press 1965, p. 20). Though, in 1970 Fillmore had to claim: "what does concern him is the nontechnical problem of knowing whether the sentences that get in are the good ones and whether the sentences that get left are the bad ones — whether, in other words, the grammar and the speaker make the same choices. He sees this as a problem because he knows that judgments about grammaticality are subject to all sorts of confusions between grammaticality and significance, acceptability and intelligibility; he knows that even when speakers say they understand they are to make judgments about grammaticallity rather than these other things, they still disagree; he knows that sometimes people change their minds about whether a sentence is grammatical; and he finds appeal to unending idiolectal variation somewhat unsatisfying."
(FILLMORE C. J. "On Generativity", *Working Papers in Linguistics*, No. 6, September 1970, p. 7).

(6) A restricted formulation of the problem involved in consensus about the "right formalization", or, for that matter, concerning "grammaticality" among persons with divergent learning histories can be gathered from Chomsky: "The child must acquire a generative grammar of his language on the basis of fairly restricted amount of evidence". (CHOMSKY N. "The formal nature of language", in Lenneberg E. H. *Biological foundations of language*, Wiley 1967, p. 437). The problem is better understood if it is taken into account that different persons have to construct their grammar, or their system of rules of formalization, on the basis of different restricted

evidence. Despite that, they come to possess the same grammar, or system of rules of formalization — as consensus testifies.

([7]) The notion is CHOMSKY's. Cf. "The formal nature of language", *ibid*, pps 404-405, pps 416-419. The suggestion to provide a universal semantics within a "logical" frame is Bar-Hillel's — Cf. BAR-HILLEL Y. *Aspects of Language*, pps 187-191.

([8]) The component which defines the level of "semantic representations" (Cf, MCCAWLEY J. D. "Semantic Representation", in GARVIN P. L. (ed) *Cognition: A Multiple view*, Spartan Books 1970, pps 227-247.)

([9]) Cf. HINTIKKA J. "Epistemic Logic and the Methods of Philosophical Analysis", *Models for Modalities*, Reidel 1969.

([10]) The DS can be found in many elementary textbooks which provide an exposition of quantification theory in terms of Natural Deduction, such as, e.g. COPI, I. M. *Introduction to Logic*, Macmillan 1961, 2nd edition, p. 277.

([11]) Obviously, the formalization of a given formulation, F, depends on the target language, L. If L is a language for propositional logic alone, its representational capacity is much more restricted than, say, a language which contains L and in which the whole quantification theory is expressible, L_1. Therefore, the "maximal analysis" which F is provided in L is less articulate thant that it is provided in L_1. Despite that, it is obvious that the formalization of F in L_1 should be closely related to its formalization in L. In this specific case the L_1 formalization should result by substitution in the L-formalization, for the schematic letters for propositions which occur in it, appropriate formulae.

([12]) F10 depends on our conventions. Its "converse" though, which should be, as argued later, part of the English grammar relative to the conception of grammar here developed, should be empirically adequate. Thus, we suggest that the predicate should be removed after the first of its arguments.

T10: Replace $F^{(n)}(a_1,...a_i,...a_n)$ by $a_1F^{(n)}a_2,...a_i,...a_n$.

T10 accounts for all cases in which Chomskyan Linguists apply the rewrite rule

$S \rightarrow NP_1VP$

That is, since the NP_1 is a_1, while the VP is $Fa^{(n)}_2,...a_i,...a_n$,

since VP is rewritten by the following rule

$VP \rightarrow V\ NP_2$

while NP can be rewritten, in the Chomskyan tradition, as, e.g.

$NP \rightarrow N$

Thus, T10, T11, T12 acount for the "deep structures" generated by the above Chomskyan rules, without introducing the irrelevant a symmetries between "subject" and "object". Cf. CHOMSKY, *Aspects* (ibid) pps 68, 69, for

the rewrite rules and the discussion concerning their role in generating "deep structures".

([13]) The concept of the "scope" of a predicate is of central importance for our program. Its meaning can be gathered, in an informal manner, from the following rules:

i. Adjectives had to be mapped on monadic predicates by F12; (hence, their scope includes a single NP).

ii. Transitive verbs, with "subjects" and a "direct object" have to be mapped on dyadic predicates (by F12, of course).

i. and ii. cannot, though, be taken as defining the notion of scope. It could be defined more precisely by a notion such as Ross' "bounds of an embeeded sentence". (Cf. Ross, J. R. "*Constraints on Variables in Syntax*, M.I.T. dissertation, 1967). Ross discusses a variety of rules which are "upward bounded". Thus, he says: (p. 298) "Sentences like (5.21), which the argument above shows not to be excludable by any presently available theoretical mechanism, can be blocked if rules can make reference to the boundaries of the first sentence above the elements being operated on. I will refer to a rule as being upward bounded if elements moved by that rule cannot be moved over this boundary". Alternatively, the notion of "bounding" could be defined by reference to our T12 (the inverse of F12).

([14]) According to Frege's usage, *judgments* are units of inference, and their representation should only reflect those features they possess which are relevant to their "logical role". His conception of the relationships between a constructed language in which "judgments" are directly represented and ordinary language, in which features of representation occur which are logically irrelevant but pragmatically important, falls squarely in line with our approach.

Thus, he says: "A distinction of *subject* and *predicate* finds no place in my way of representing a judgment. In order to justify this, let me observe that there are two ways in which the content of two judgments may differ; it may, or it may not, be the case that all inferences that can be drawn from the first judgment when combined with certain other ones can always be also drawn from the second when combined with the same other judgments. The two propositions 'the Greks defeated the Persians at Platæa' and 'the Persians were defeated by the Greeks at Platæa' differ in the former way; even if slight difference of sense is discernible, the agreement in sense is preponderant. Now I call the part of the content that is the same in both the *conceptual content*. Only this has significance for our symbolic language; we need therefore make no distinction between two propositions that have the same conceptual content. When people say 'the subject is the concept with which the judgment is concerned', this applies equally well to the object. Thus all that can be said is: 'the subject is the concept with which the judgment is chiefly concerned.'

In language the place occupied by the subject in the word order has the significance of a *specially important* place; it is where we put what we want the hearer to attend to specially... All such aspects of language are

merely results of the reciprocal action of speaker and hearer; e.g. the speaker takes account of what the hearer expects, and tries to set him on the right track before actually uttering the judgment. In my formalized language there is nothing that corresponds; only that part of judgments which affects the *possible inferences* is taken into consideration.
Whatever is needed for a valid inference is fully expressed; what is not needed is for the most part not indicated either." (GEACH P. & BLACK M. (eds) *Translations from the Philosophical Writings of Gottlob Frege*, Blackwell, 1966, pps 2-3.)
Thus, Frege clearly distinguishes between "logical" and "pragmatical" factors involved in an utterance made in a natural language, stressing that he intends to capture, by a formalized language, only the first, so that the process of formalization with his language (in order to represent arguments in a "pure manner") involves the abstraction from pragmatical "pressures". Cf. our subsequent discussion of Hintikka's depth logic. Moreover, Frege was also fully aware of the influence of pragmatical pressures on the form of presentation of a judgment by means of grammatical transformations (!), thus anticipating our program of organizing grammars in the format described in the sequel. Thus, he says: "Much of language serves the purpose of adding the hearer's understanding, for instance the stressing of a part of a sentence by accentuation or word order. One should remember words like 'still' and 'already' too. With the sentence 'Alfred has still not come' one really says 'Alfred has not come' and, at the same time hints that his arrival is expected, but it is only hinted. It cannot be said that, since Alfred's arrival is not expected, the sense of the sentence is therefore false. The word 'but' differs from 'and' in that with it one intimates that what follows is in contrast with what would be expected from what preceded it. Such suggestions in speech make no difference to the thought. A sentence can be transformed by changing the verb from active to passive and making the object the subject at the same time. In the same way the dative may be changed into the nominative while 'give' is replaced by 'receive'. Naturally, such transformations are not indifferent in every respect, but they do not touch the thought. They do not touch what is true or false. If the inadmissibility of such transformations were generally admitted then all deeper logical investigations would be hindered. It is just as important to neglect distinctions that do not touch the heart of the matter as to make distinctions which concern what is essential. But what is essential depends on one's purpose. To a mind concerned with what is beautiful in language what is indifferent to the logicians can appear as just what is important.
Thus, the contents of a sentence often go beyond the thought expressed by it. But the opposite happens too, that the mere wording, which can be grasped by writing or the gramaphone, does not suffice for the expression of the thought.
The present tense is used in two ways: first, in order to give a date, second, in order to eliminate any temporal restriction where timelessness or

eternity is part of the thought. Think, for instance of the laws of mathematics. Which of the two cases occurs is not expressed but must be guessed. If a time indication is needed by the present tense one must know when the sentence was uttered to apprehend the thought correctly. Therefore the time of the utterance is part of the expression of the thought." (FREGE G.; "The Thought: A Logical Inquiry", Strawson P.F. (ed) *Philosophical Logic*, Oxford 1967, pps 23 - 24.)

Frege also points out the relevance of contextual dependencies, encoded by indexical expressions, and decoded from the context, for the "recovery" of "the thought". Since "thought" in his usage is that object for which truth values are defined, and since "the recognition of the truth of a thought — judgment" (*ibid*, p. 22) shows that thought are "directly" represented in his constructed language, it seems that the formulae in which use for the purpose of formalization of utterances can be termed "judgments" or even "thoughts" — in full accord with Frege's usage, and as reminders of the deep similarity between the program sketched here and Frege's opinions concerning the relationships between "language", "logic" and "thought".

([15]) As is well known, CHOMSKY (*Aspects*, ibid) suggested to conceive of a grammar as a formal device which serves to define merely the notions "a grammatical sentence" and "a structural description of a sentence". He even claimed that this alone is relevant for the characterization of an "ideal speaker hearer":

"Linguistic theory is concerned primarily with an ideal speaker listener in a complete homogeneous speech community, who knows its language perfectly and is unaffected by such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention and interest and errors (random or characteristic) in applying his knowledge of the language in actual performance... To study actual linguistic performance, we must consider the interaction of a variety of factors, of which the underlying competence of the speaker hearer is only one... We thus make a significant distinction between *competence* ... and performance ... Only in the idealization set forth in the preceding paragraph is performance a direct reflection of competence ...» (pp. 2 4-5) On the other hand, when describing the "base" of the grammar, he conceives of it as a system of rewriting rules which "begin with the string S". (p. 64-68). But then, an ideal speaker hearer can talk complete (though perfectly grammatical) nonsense: He lacks a device which associates *thoughts* (in Frege's sense, see the preceding note) with sentences uttered on a specified occasion. Alternatively, such a device is not part of his competence.

On the other hand, if formulae of a constructed language system, which serves as the target language for formalization, are taken as representations of *thoughts*, then under our suggested inversion of the rules of formalization, the system of linguistic rules (the T-rules) maps *thoughts* onto their linguistic formulation. Hence, the organization of grammars in terms of a component in which "thoughts" are represented by means of logical

formulae, and a component which transforms these thoughts into sentences, corresponds to a more traditional view of the nature of "the faculty of language".

([16]) It is significant that

13. R(avb,c)
can be taken as the underlying structure of a "reduced disjunction"

10. *Either John or George killed the old lady.*

That is, since LAKOFF and Ross ("The transformational component", unpublished) have suggested to conceive of 10 as derived from the abstract structure underlying 1.

1. *Either John killed the old lady or George killed the old lady.*

where the derivation depends on the (optional) transformation of *disjunction reduction.* Hence, T16 does duty for disjunction reduction. Since, as is subsequently claimed in the text, T16 is pragmatically motivated, disjunction reduction is also pragmatically motivated. This is example to the light which can be shed by our program on results of transformational grammarians.

([17]) Thus, Kant's "infinite" judgments (Cf note 43) do not get an independent representation within our program. Formulations which seem to convey infinite judgments are transformed, in the process of formalization (in which judgments are recovered) into simple "negative" judgments. As for the Kantian terminology, Cf. *Critique* (ibid) p. 108 (B 97-8).

([18]) $p(b\overset{n}{//}a)$ is a result of substituting b for a in p in n of its occurrences. $p(b/a)$ is $p(b\overset{n}{//}a)$ when n is the number of occurrences of a in p.

([19]) NEG is a "nonterminal" symbol which is linguistically realized by forming "negated" VPs. Its precise linguistic realization depends on the neighborhood in which it is realized (did not..., un-..., do not..., does not..., are illustrative realizations it has.) M19 was formulated separately from F17 only in order to focus attention on this variety of realizations of NEG, without describing it systematically and exhaustively.

([20]) The Neo-Chomskyan tradition includes, mainly, generative seman ticists like LAKOFF (Cf. § 9). Though the program of generative semantics conceives of the theory of language as requiring two components for a grammar, and these two components correspond to ours, the actual work of generative semanticists contains chiefly rules like T13 - T15. That is, they refrain from using rules which transform formulae of a logicaly constructed language into sequences of symbols of that constructed language (which are not necessarily formulae) in the manner illustrated by T16.

([21]) The "Hence" in the last sentence rests on a very general pattern of

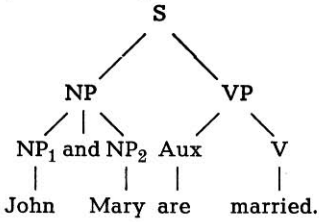
argumentation and theoretical decision current in the Chomskyan literature. This pattern can be schematized as follows:

Suppose that both R_1 and R_2 can account for the derivation of a sentence S. But R_1 can also be used to account for the derivation of the sentence S_1, thus making another rule R_3 dispensable. (That is, R_3 is either eliminated altogether or reduced to R_1). R_2 cannot do anything of the kind. Hence R_1 has to be preferred, and included in the grammar (or even in the Theory of Language which dictates a universal form for all grammars of particular languages. (Cf CHOMSKY, *Aspects* ibid, 1 § 7). Only one example will be given for the application of this pattern in linguistic research, which is drawn from CHOMSKY: (*Aspects*, p. 80)"... In this system, although we can easily state a rule that applies only to Proper Nouns or to Common Nouns, a rule that applies to Human Nouns must be stated in terms of the unrelated categories Pr-Human and C-Human. This, obviously indicates that a generalization is being missed, since this rule would now be no simpler or better motivated than, for example, a rule applying to the unrelated categories Pr-Human and Abstract Nouns."

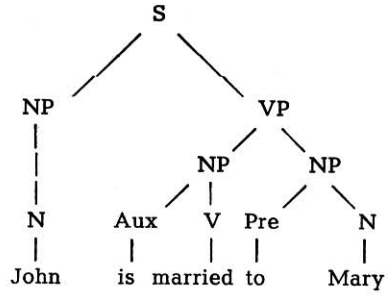
([22]) This is so since T14 applies to sequences of the form "It is not the case that $\overset{\frown}{\text{NP VP}}$" and not to sequences of the form "It is not the case that $\overset{\frown}{(\text{NP}_1 \text{ and } \text{NP}_2)}$ VP". It could be made to apply, had we adopted the further rewrite rule

$\text{NP} \rightarrow \text{NP}_1 \text{ and } \text{NP}_2$.

That is, since then the syntactic analysis of 20 would be given by



But then the deep logical relationships between 20 and 20': *John is married to Mary* are missed:



Moreover, T14 does not help us with 22, where (F18,M20) do.
Hence, the formalization of both 20 and 20' by $\neg M(j,m)$ both gives a clear indication of their logical interrelationships and gives place to the application of (T18,M20).
This example (as many others in this paper) only testifies to the mass of un-needed complications which one has to take heed of if he insists that the most profound structural analysis is given by $S \rightarrow NPVP$ instead of countenancing, among other things, basic structures of the pattern $F^n(a_1 \ldots a_n)$.

(23) A good French example is
Jean ou Claude a tué la belle fille
which can be analysed by reference to the formula underlying
Jean a tué la belle fille ou Claude a tué la belle fille
While a good Hebrew example is
Yaacov o Yitzhack Harag et Hagveret Hazkena
(Jacob or Yitzhack killed the lady old)
which derives from the structure underlying
Yaacov Harag et Hagveret Hazkena o Yitzhack harag et hagveret hazkena
(Jacob killed the lady old or Yitzhack killed the lady old)
It should be pointed out, though, that Lakoff and Ross's disjunction reduction is even more general than ours, since it derives
Johny killed the boy or helped the girl
from the structure underlying
Johny killed the boy or Johny helped the girl.
Hence, the treatment in the text misses a generalization. This generalization can, though, be captured in our program with somewhat richer notational conventions.

(24) A free logic separates the syntactic role of free singular terms — which is to associate with predicates so as to form formulae, from their semantical role, which is to refer. That is, free logic countenances non-referring free singular terms. In such a logic,
Hamlet exists
could be formalized directly by $Ex(x = h)$
without this last formula being a trivial logical truism,
hence incapable of formalizing any formulation which is usually taken as informative. Cf.
HINTIKKA J. "Existential Presuppositions and Their Elimination",
Models for Modalities, Reidel 1969, for a system of free logic.

(25) This tradition is connected, among others, with Strawson's famous attack on the Russellian analysis of definite descriptions. To quote Strawson (P. F. STRAWSON, *Introduction to Logical Theory* UP 72, 1963, p. 186): "We tend generally to speak of the _____ when we can safely rely upon some features of the situation in which we write or speak to single out some

one ___ for our hearers' or readers' attention... (187) The use of 'the' helps the identification by indicating (though not stating) that we *are* placing this reliance upon what may, in a broad sense, be called contextual features... (190-1) An immediate consequence given the sense I propose to 'subject predicate statement' is that the existential statements presupposed by subject predicate statements will not themselves count as subject predicate statements..."

Thus, Strawson conceives of existential claims concerning the "subject" of a sentence as presupposed by making a statement by the utterance of this sentence. These presuppositions are not explicitly included in the sentence, but gathered by the hearer from some additional information sources (context).

Our approach accommodates these ideas in a systematic fashion, by suggesting to conceptualize the presuppositions as those parts of the information of a statement which is explicitly included in its representation by a formula, but is deleted by the formal processes which transform this formula into a sentence intended to "carry" that statement in a specified context.

([26]) The identification of the topic is also facilitated by the grammatical transformation of "topicalization" (Cf Ross, *Constraints*, *ibid.*, 209-210) which generates

To John I gave my compliments from *I gave my compliments to John*

This transformation is another illustration for the capacity of our program to shed some systematic light on linguistic results. The importance of the identification of the topic deserves explanation in terms of the structure of distribution of attention in speech preception. The importance of this identification in communication-situations is the starting point of STRAWSON's (P.F.) *Individuals* (UP 81, 1964): "I shall speak, to begin with, of the identification of particulars... Very often, when two people are talking, one of them, the speaker, refers to or mentions some particular or other. Very often, the other, the hearer, knows what, or which, particular the speaker is talking about; but sometimes he does not. I shall express this alternative by saying that the hearer either is, or is not, able to identify the particular referred to by the speaker". (pps. 15-16).

Moreover, I guess that the pragmatic importance of making the topic prominent is a chief motivation for being especially interested in subject predicate sentences. Many attempts have been made, from Aristotle to Chomsky, to claim that this structure (or the closely associated $\overset{\frown}{NP}$ VP structure) is basic, logically speaking. I suggest, aletrnatively, that this structure is not basic but derived. However, its prominence is due to a universal factor which is to be located not in logic, or in the structure of the information which has to be communicated, but pragmatics, that is, in the structure of the situation of communication.

([27]) The terminology here follows CHOMSKY's *Aspects* (*ibid*), p. 70 e.g. "In both (7a) and (7b), *Bill* is the ("logical") subject-of the Sentence, rather

that *John*, which is the so called "grammatical" Subject of the Sentence, that is, the ubject with respect to the surface structure..."

([28]) Thus, we follow Chomsky's new arguments for claiming that the transformal component is universal (since it contains some universal transformations): "Apart from this, we would naturally be inclined to seek an explanation for the use of grammatical transformations in the empirical constraints that linguistic communication must meet. Even the simple fact that sound is irrecoverable imposes conditions on speech that need not, for example, be imposed on a linguistic system designed only for writing... A written system provides an "external memory" that changes the perceptual problem in quite a significant way. We would expect a system designed for the conditions of speech communication to be somehow adapted to the load on memory. In fact, grammatical transformations characteristically reduce the amount of grammatical structure in phrase markers in a well defined way, and it may be that one consequence of this is to facilitate the problem of speech perception by a short term memory of a rather limited sort." (CHOMSKY N. "The formal nature of language", LENNEBERG E. *Biological Foundations of Language*, Wiley 1967, p. 435). CHOMSKY's old argument relied on the assumption that transformations provided grammar with its recursive character. This is the underlying assumption of *Syntactic Structures*, (Mouton 1952). Though, it should be remembered that Chomsky's conception of the type of pressures exerted by situations of communications which affect the "design" of grammars is quite different from ours. Our "pragmatic pressures" relate essentially to the process of *interpretation* of uttered sentences and not to the preliminary processes of decoding the sentence uttered and of its storage.

([29]) Cf. BROWN R. *Social Psychology*, ch. 2, p. 52: "All societies have rules of address. To introduce the basic dimensions of interpersonal relationships we will make a study of these rules in a variety of European languages and in several historical periods. We shall find that address forms are always governed by the same two underlying dimensions: solidarity and status. However, we shall not always find these dimensions used in the same way..."

([30]) This idea, was, though, expressed in methodological contexts mainly. Thus CHOMSKY (*Aspects*, ibid) has stressed the importance of formalization for the purpose of construction of a "fully explicit" grammar: (p. 4): "A grammar of a language purports to be a description of the ideal speaker-hearer's competence. If the grammar is, furthermore, fully explicit — in other words, if it does not rely on the intelligence of the understanding reader but rather provides an explicit analysis of his contribution — we may (somewhat redundantly) call it a generative grammar... (p. 5) This is the traditional problem of descriptive linguistics, and traditional grammars give a wealth of information concerning structural descriptions of sentences. However, valuable as they obviously are, traditional grammars are deficient in that they leave unexpressed many of the basic regularities of the language with which they are concerned... (p. 8) But the fundamental

reason for this inadequatacy of traditional grammars is a more technical one. Although it was well understood that linguistic processes are, in some sense, "creative", the technical devices for expressing a system of recursive processes were simply not available until much more recently..." We suggest, on the other hand, to consider the theoretical implications of this idea. That is, to utilize it systematically within a theory of the competence to formalize, or, more daringly, in a theory of language.

([31]) This problem is quite central for any theory which tackles the problem of the relationship between linguistic structure and "conceptual structure". Ryle's notion of "category mistake" is relevant here (RYLE G. *The Concept of Mind*, Penguin 1963, pps 17-20) as well as BAR-HILLEL's "On syntactical Categories" (*Language and Information*, Addison Wesley 1964, chl.) We will not attempt, in this context, to probe more deeply into this problem.

([32]) The relevance of this Carnapian concept to the study of the conceptual structure underlying natural languages was stressed by Lakoff. (Cf. CARNAP R. "Meaning Postulates", *Meaning and Necessity*, Phoenix 1958, and LAKOFF G. *Linguistics and Natural Logic*, STIGS no. 1, 1970, e.g. p. 88: "Conclusion 1: There is more to meaning than logical form. Meaning postulates, as well as other logical apparatus, are needed." A case for its relevance to the semantical study of natural languages was made by Bar-Hillel (Dictionary and Meaning Rules", *Aspects of Language*, ibid, ch. 31).

([33]) This claim, should, though, be qualified. It is conceivable to talk about someone's two fathers, e.g. the sociological in contradistinction to the biological father. Moreover, one may be shot simultaneously by two bullets, each of them fatal in itself.

([34]) A clear analysis of the implications of this assumption is provided by HINTIKKA J. "Existential Presuppositions and Existential Commitments", *Journal of Philosophy*, v. LVI, 1959, pps 125-6: "Philosophers of logic have often been unhappy about singular terms that fail to refer... Much of the discussion have been provoked by Russell's theory of definite descriptions, which was calculated to explain why an empty description like 'the present King of France' can be used to form meaningful statements. Prima facie, Russell's theory serves its purpose well; it enables us to paraphrase all the apparent references to a missing individual by a *description* like 'the King of France' in terms of quantifiers like 'somebody', i.e., in terms of words which are formulated in logic by means of *bound variables* and which certainly refer only to actual objects or persons.

Descriptions, however, are not the only singular terms that logically minded philosophers have been worrying about. There are *names, like* Pegasus which do not refer to anything; there are names like 'Homer' and 'Atlantis' of which we do not know for sure whether they refer to anything; and recently Professor Prior has called our attention to the logical peculiarities of names like 'Bucephalus' which once had a bearer but which do not have one any longer. For an adherent of Russell's theory, the natural way of treating them is to extend the same strategy further. When a name has no

bearer one is tempted to say that it is not a genuine name at all but rather a hidden description; for this seems to explain why it can be used in significant sentences in spite of being empty. And once this step is taken, there is scarcely any way of refusing to take the next one and to declare that all the names that are not known with absolute certainty to have a bearer are also not genuine names."

([35]) HINTIKKA, J. "Towards a theory of Definite Descriptions", *Analysis*, v. 19, 1958-9, pps 79-85, claims (p. 82): "In the new system, we can reconstruct inferences that depend on the success of names in naming by introducing suitable contingent premises which insure that the terms in question are not empty. For instance, (A) is conceived as an enthymeme which depends on the tacit additional premise 'there is such a person as Schopenhauer' (with a non-temporal 'is' of course). It turns out that such formula as $(Ex)(x = a)$ may serve as the formal counterpart of these premises."

([36])Cf. Hintikka, J. *Knowledge and Belief*, Cornell University Press 1962, p. 12, (iv).

([37]) STRAWSON illustrates the importance of sharing a background of information in communication processes with respect to the identification of the topic, as follows (*Individuals*, UP 81, 1964, p. 21): «Now, for a speaker to use the words of a description with a certain reference and for a hearer to understand them as making a certain reference, — whether or not the intended reference and the understood reference are in fact the same — it is at least required that each should know of a particular which the description fits. (Or the hearer may at that instant learn, from the speaker's words, of such a particular.) But each may know of only one such particular; and each may have conclusive reason to suppose that the other knows of only one such particular; and each may have conclusive reason to suppose that the other knows of only one such particular, and that the particular the other knows of is the same as the particular he himself knows of. Or, even if this condition is not satisfied in full, each may still have conclusive reasons for thinking that the particular which one is referring to is the same as the particular which the other takes him to be referring to."

Let me repeat; abstraction is always a legitimate procedure..."

([38]) CHOMSKY's distinction between a theory of competence and theory of performance referred to here is the one made on the first pages of the *Aspects*. Thus, he says (p. 4): "To study actual linguistic performance, we must consider the interaction of a variety of factors, of which the underlying competence of the speaker hearer is only one... The problem for the linguist, as well as for the child learning the language, is to determine from the data of performance the underlying system of rules that has been mastered by the speaker-hearer and that he puts to use in actual performance." T32, being irrelevant to grammaticality and being relevant to the "use of language" falls squarely within the theory of performance. On the other hand, Chomsky continues: "Hence, in the technical sense,

linguistic theory is mentalistic, since it is concerned with discovering a mental reality underlying actual behavior." T32 belongs to competence in this sense. Horeover, if we accept Lakoff's argument for the claim that Linguistics should be concerned with the relationship of sentences with their "underlying logical forms" — T32 is obviously of some interest for linguists. (Cf. LAKOFF, *Linguistics and Natural Logic*, *ibid* p. 11 (Conclusion II)).

([39]) Both the term "abstraction from pragmatics" and the caution against the type of theoretical step it refers to, are due to BAR-HILLEL, Y. "Argumentation in pragmatic languages", *Aspects of Language*, ibid, p. 208: "Nevertheless, it seems that all these authors failed to do full justice to the fact that natural languages are essentially pragmatic languages, since they have not paid sufficient attention to the problematic character, in our special case, of a certain methodological step, which is, in general, in full accord with the best scientific traditions. They have all proceeded, with the greatest possible speed, to move away from the complex, complicated and multidimensional pragmatic aspects of human communication in order to move into the greener pastures of semantics, i.e. the theory that deals with the relations between language and the world, between signs and their designata, in deliberate disregard of the users of languages and their conditions of communication.
(*ibid*, p. 55).

([40]) There might be some interest in an explicit recapitulation of the argument leading to this conclusion: The classical definition of the task of Linguistics, as interested in defining "grammaticality" blocks the formulation of generalization which relate aspects of linguistics structure with aspects of logical structure. Since generalizations should not be missed, the task of Linguistics has to be re-defined so as to capture them. The suggested re-definition suggests that grammars — the products of linguistic research, should be conceived of as formal devices which match a formula, and certain information concerning the context of communication, with a sentence to be uttered in that context, in order to express the "thought" the formula represents. But if this re-definition is accepted, the theory of grammar includes certain generalizations which relate to pragmatical aspects of the situation of communication, hence do not belong to Chomsky's "competence" theory, but to his performance-theory. Thus, we can see how the image of a discipline can interact with specific discoveries made within its boundaries — or, rather "on its boundaries".

([41]) Deontic logic deals with the operators "It is obligatory to..." and "It is permissible to...", on the assumption that they, like the epistemic operators ("a knows that...", "It is possible, as far as a's knowledge goes that...") and the doxastic operators ("*a* believes that...", "It is compatible with all of *a*'s beliefs that...") are modal operators. That is, that their logic requires a possible world semantics. Denotic logic is presented, e.g. in HINTIKKA J. "Deontic logic and its philosophical Morals", *Models for modalities*, Reidel 1969, pps 184-214. Epistemic and doxastic logic are dealt with in

his *Knowledge and Belief, ibid.*

(42) This is the requirement imposed by LAKOFF (*Linguistics and Natural Logic*, ibid, p. 54):" (v) We want a logic which is capable of accounting for all correct inferences made in natural languages and which rules out in correct ones. We will call any logic meeting the goals of (i) - (v) a "natural logic". Lakoff rightly stresses that: "As should be obvious, the construction of a full, nonfragmental natural logic is not an immediate practical goal."

(43) The terms is used in Kant's way. That is, the sentence "The soul is non-mortal" is an "infinite" sentence Cf. Kemp. SMITH N. (tr) *Immanuel Kant's Critique of Pure Reason* Macmillan 1964, p. 108.

(44) Cf. RUSSELL, B. "On Denoting", *Mind*, 1905.

(45) Cf. his *Models for Modalities, ibid.*

(46) Cf. note *32, ibid.*

(47) Cf. his "A neglected recent trend in logic", *Aspects of Language, ibid,* ch. 32, pps 354-355: "I would have thought that the development of methods of evaluating arguments in natural languages should have been the prime topic of logic, of which all the others should have been regarded at most as secondary... Rescher could, of course, counter by claiming that argumentation in natural languages is a topic for whose treatment linguists rather than logicians should be responsible and be held responsible. I don't want to be very dogmatic about this claim which turns on a problem of a division of labour."

(48) Thus, despite its inherent formal interest, a system such as the one developed by WOODRUFF, P. W. ("Logic and Truth-Value gaps", LAMBERT K. (ed.): *Philosophical Problems in Logic*, Reidel 1970) has to be located outside the boundaries of philosophical logic, as presently defined. That is, since it attempts to reconstruct the partition of sentences, used in some utterance to make a statement into those used to make a true statement, those used to make a false statement, and those which fail to make any statement at all, on the logical level. That is, by attempting a semantics in which formulae may be either true or false, or valueless. Hence, one cannot even formulate any generalization which explains the failure of a given sentence to express a given statement on some specified context of utterance, by reference to the violation of the presuppositions for the utilization of that sentence, in that context, for that purpose.
It should, though, be stressed that the system referred to might be highly interesting for other theoretical purposes.

(49) STRAWSON, P. F. *Introduction to Logical Theory*, UP 72, 1963, p. 57: "The formal logician now aims at an exact and highly systematic logic, comparable in those respects with mathematics. But he cannot give the exact and systematic logic of expressions of everyday speech; for these expressions have no exact and systematic logic. What he can, and does, do is to devise a set of rules which satisfies his requirements, and, at the same time, while not doing full justice to the complexities of ordinary use, and diverging from it in many ways, does touch ordinary usage at some vital point. The formal logician, in relation to ordinary language, might be

compared with a man ostensibly mapping a piece of country of which the main countours are highly irregular and shifting. But the man is passionately addicted to geometry, and insists on using in his drawings only geometrical figures for which rules of construction can be given, and on using as few of such rules as he can. Naturally, his maps will never quite fit..."

([50]) E.g. RYLE G. *Dilemmas*, Cambridge University Press 1954, p. 124: "How then, it remains to be asked, is the philosopher a client of the Formal Logician ? Part of the answer I have already suggested. To know how to go through completely stereotyped movements in artificial parade ground conditions with perfect correctness is to have learned not indeed how to conduct oneself in battle but how rigorously to apply standards of soldierly efficiency even to unrehearsed actions and decisions in novel and nasty situations and in irregular and unfamiliar country.

Or, which is not quite the same thing, it is rather like what geometry is to the cartographer. He finds no Euclidean straight hedgerows or Euclidean plane meadows. Yet he could not map the sinuous hedgerows that he finds or the undulating meadows save against the ideally regular boundaries and levels in terms of which alone he can calculate out the relative positions and heights of the natural objects which he is to record from the visual observation that he makes...

But patently, fighting cannot be reduced to drill, cartography cannot be reduced to geometry... Nor can the handling of philosophical problems be reduced to either the derivation or the application of theorems about logical constants.

([51]) The terms is borrowed from GEACH, P. T., who has entitled thus his contribution to *Words and Objections* (The *Quine* volume in *Synthese* library, edited by Hintikka & Davidson, 1970).

([52]) Cf. QUINE W. V. O. *Word and Object*, M.I.T. Press 1960, chs v, vi, in which he discusses the moves needed in order to formalize formulations of ordinary language within his "canonical notation". A good illustration for the simultaneous relevance of his contributions both to the theory of formalization and to Linguistics is provided by his suggestion to formalize pronouns by means of individual variables. The suggestion is motivated by the need to prevent syntactic ambiguities. Quine has rather be quoted more fully, though: (pps 135-6): "Notable among such syntactical ambiguities is that of pronominal reference. An example is quoted by Jourdain:

> And Satan trembles when he sees
> the weakest saint on his knees

Such ambiguity is partially prevented in familiar languages by the devices of gender, number, and person, but only hit and miss; thus, for the prevention of the above case it would have sufficed that the weakest saint is female. But we can clear up this case by supplanting the trouble some pronoun by its grammatical antecedent, saying 'the weakest saint's knees'. What makes ambiguity of pronominal reference serious is that grammatical antecedents cannot always be thus repeated. We saw in § 23 that they

cannot be repeated, unless with the wrong effect, when they are indefinite singular terms. The pronoun whose antecedent is indefinite is not dispensable as a mere abbreviation of the antecedent would be. An example of ambiguous cross reference to idefinite antecedents is:

(1) Everything has a part smaller than it.

... One possible device for such cases is that of manifolding the pronominal 'it', or 'he' into 'former' and 'latter' or 'first', 'second' and 'third', etc... The mathematicians, happily, have a more readable method. They use arbitrary letters instead of 'first', 'second' etc, introducing each letter in apposition with its intended grammatical antecedent... For unobvious but traceable reasons, arbitrary letters used for cross reference... are called variables."

Quine's analysis van be directly translated into our program: it can be suggested that the sentences in which pronouns occur are derived from underlying formulae in which variables occur, that this process might incur ambiguities (that is, different, and logically unequivalent, formulae, are transformed onto the same sentence) but that since the transforming mechanism is sensitive to contextual information, in addition to the formula, the ambiguities have, in general, very limited pragmatical effects. Thus, since it is part of our knowledge of the world that persons can be on their own knees, but only in very extraordinary situations on the knees of somebody else, the Quinean example is, usually, not interpreted as ambiguous. Since, though, any theory of the understading of utterances which assumes that both speaker and hearer utilize their information about the context is "mentalistic", since it assumes that persons utilize certain formal devices in order to manipulate symbolic representations, Quine would have rejected our program. This should not distrub us, though, in adapting his contributions to it.

([53]) "Universal Semantics and Philosophy of Language", *Aspects of Language*, p. 187.

([54]) "Do Natural Languages contain Paradoxes ?" *Aspects of Language*, *ibid*, p. 279.

([55]) TARSKI A, "The Concept of Truth in Formalized Languages", *Logic, Semantics, Meta-mathematics*, Oxford 1956.

([56]) KRIPKE S. A. "A completeness theorem in modal logic", *Journal of Symbolic Logic*, v. 24 (1959) pps 1-14.

([57]) HINTIKKA, J. *Knowledge and Belief*, *ibid.*

([58]) For references, Cf. HINTIKKA J. "Epistemic Logic and the Methods of Philosophical Analysis", *Models for Modalities*, ibid, note 7 (p. 16).

([59]) HINTIKKA, "Epistemic Logic and the Methods of Philosophical Analysis", *ibid*, p. 5 ff.

([60]) A syntactic variable ranges over strings of formatives (Cf. CHOMSKY, *Aspects*, *ibid*, p. 5 for the notion of "formative".)

([61]) A trivial logical relation between formulae is a logical relation which can be established by a decision procedure designed for that purpose. Thus, any entailment relation within propositional logic is trivial, since there is a decision procedure for theoremhood in that part of logic,

and the Deduction Theorem also holds, there. Hence, the logical equivalence between p and - - h is trivial.

([62]) Thus, the notion of a trivial logical relationship (such as trivial equivalence between formulae), explicated in the preceding note, solves McCawley's problem. His problem is the following: suppose that sentence S_1 has as "meaning" formula p_1 while sentence S_2 has a "meaning" formula p_2. p_1 is logically equivalent to p_2.
are S_1 and S_2 synonymous ?
Our answer is: they are — if p_1 and p_2 are trivially equivalent. (The answer is given, of course, relative to McCawley's assumption that formulae can be taken as the "meanings" of sentences.)
Cf. McCawley, J. D. "Semantic Representation", Garvin P. L. (ed) *Cognition: A Multiple View*, Spartan Books 1970, ch. 10, pps 236-): "I will now turn for the moment to the question of sameness of semantic representations: under what conditions must one say that two sentences (or words or what have you) have the same meaning ? One obvious proposal that might be made is that two sentences should be said to have the same meaning if they are true under the same conditions... The proposal fails for at least three reasons. First, many sentences have no truth value... Second, all self contradictory sentences have the same truth conditions... but may differ in meaning... Third... there are cases in which there are reasons to consider two meanings as distinct even though they are true under exactly the same conditions..." We will leave, though, the detailed argument for the claim that our proposal solves all the difficulties raised by McCawley to some other paper.

([63]) One simple example will suffice to illustrate this claim. Hintikka ("Individuals, Possible Worlds, and Epistemic Logic", *Nous* 1, 1967, p. 51) says: "According to the letter of my earlier explanations in this paper, the translation of:

(24) the war hero wounded 100 times knows that he himself is the war hero wounded 100 times
will not be (23) but rather
(24') $(Ex)(h = v \,\&\, K_h(h = x))$"
The rules of formalization needed here will be those rules which distinguish between formulations in which knowledge about oneself is being talked about, in contradistinction with formulation in which, say, knowledge about someone who is, in fact, identical with oneself. This accords well to show that the hero knows that he himself is the hero..."
(23) $(Ex)K_h(h = x)$
in other words, the war hero knows who the war hero was — he has read his history books and war reports and knows enough of the hero to be justified in saying tat he knows who the hero was. Yet this does not go with Hintikka's claim:

([64]) Lakoff, G. *Linguistics and Natural Logic, ibid*, p. 1 ff.

([65]) Such as "transderivational constraints" Cf. Lakoff, G. "Some thoughts on transderivational constraints" preprint. (1970. It may be the case that this paper was already published somewhere).