American Journal of Computational Linguistics *Microfiche 56*

PROCESSING CASE

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ABSTRACT

This paper has three purposes: firstly, to describe how case information is distributed in the preference semantics system of language understanding, and to show what practical use is made of that information. Secondly, to argue that that way of doing things has advantages over two alternatives: (a) putting all case information in one place, and (b) not using any case information at all, but only the names of English prepositions. Thirdly, I wish to use the positions established earlier to counter some recent arguments by Charniak and others that the notion of case is not in fact functioning in any natural language understanding systems that fall within what could be called the Artificial Intelligence paradigm. A theme that recurs in the paper is that tendentious distinctions, such as "surface", "deep" and "conceptual" case, must be expounded in processing terms if they are to make sense.

ACKNOWLEDGEMENTS

The paper owes a great deal to discussions with Eugene Charniak, Graham Ritchie, Margaret King and Frederick Parker-Rhodes. The mistakes, as usual, are all my own.

TABLE OF CONTENTS

INTRODUCTION

This paper is intended to describe the case handling procedures of the preference semantics (Wilks 1972, 1975a) system of natural language understanding by giving a more complete account than in previous papers, and in particular I shall distinguish the application of case to the parsing of preposition structures in English from subsequent inferences using case. Case information in this system is stored in two different places: in what are called formulas and paraplates respectively. I shall argue a reasonable processing account of case requires this. I shall contrast this position briefly with those of Schank and Riesbeck, who seem to me to advocate a single type of case information, and a no case view respectively. More importantly, I shall argue against a recent position of Charniak that Artificial Intelligence (AI) natural language systems do not in fact make any use of case. I shall discuss his arguments and urge that, although there are systems to which his arguments do apply, they do not apply to the one described here, at least not if case is to have anything like its normal meaning.

The use of case information in AI comes from the work of Fillmore (1968), in which the underlying structure of a sentence is displayed, in essence, as an array of argument values for a predicate, where the predicate is the verb of the sentence. The corresponding values are the case parts of the sentence, each of a different case type, and, for any given verb, the general pattern of cases it takes is called the case frame of that verb.

Thus, if the horizontal lines denote the verb predicate, the case frame for "break" could be written as:

(------- OBJECT (AGENT) (INSTRUMENT))

which means that this verb must take an object, and can but need not take an agent and instrument case. These latter two cases are optional here and that optionality is indicated by the parentheses round the case names. So, on this view:

(1) John broke

would be ill-formed because it gives us only the (optional) agent of breaking, which is John, but omits the obligatory object that is broken.

This analysis can be contrasted with "hit", whose frame would be

(------- OBJECT (AGENT ⟩⟨ INSTRUMENT))

where the overlapping brackets mean that the two cases, agent and instrumental are semi-optional, in that at least one of the two must appear. Thus

(2) The window hit

would be ill-formed on that view because, although it contains the obligatory object, it contains neither the agent nor the instrument of the hitting. However,

(3) The window broke

would be perfectly well-formed with respect to the frame for 'break'. This sort of case analysis is normally called deep case to distinguish it from the surface case manifestation of word inflections in Greek, Latin and German etc. It should be noted, too, that here, as throughout the paper, no attempt is made to stick to the actual list of case names used by any author, since these vary so much from one to the next, and no point of principle hangs on any particular list of cases.

Fillmore's linguistic theory is, naturally enough, a generative one in that the procedures it suggests would be those for generating sentences from an underlying structure of a verb plus its case argument values. What the surface form would be, given any particular underlying structure, is determined by what Fillmore calls the "subject selection rule", which says that, if there is an agent, that will be the subject of any active sentence produced; if there is no agent but there is an instrument, then that will be the subject and so on.

In this paper, I shall concentrate, as is normal if not desirable in AI and computational linguistics, on questions of analysis rather than generation. The general problem in analysis (that is not emphasised in generation) is that of the selection restrictions on the cases, which can be illustrated by looking at the simplest of the systems using case analysis (Simmons 1973). Simmons wishes to map all of the sentences (4) - (7) onto the same semantic network because all four, in some sense, refer to the same event:

(4) John broke the window with a hammer

(5) John broke the window

(6) The hammer broke the window

(7) The window broke

All are perfectly well-formed with respect to the frame for "break" given earlier. Simmons parses such sentences using an augmented transition network (Woods,1970) and a notion of case paradigm due to Celce-Murcia (1972). This paradigm, for active forms of a verb like "break", has the form:

(8) AGENT * OBJECT INSTRUMENT

AGENT * OBJECT

INSTRUMENT * OBJECT

OBJECT *

The lines of (8) are patterns that must match input word strings in left right order so as to assign the cases they contain. The lines of (8) match each of (4) - (7) in turn, where marks the position of the verb (break) in each line of the paradigm. The lines of (8) are no more than the possible case combinations allowed by the case frame for "break" together with an analytic version of the "subject selection rule", which always makes the Agent the first (subject) item in any line of the paradigm (8) in which it occurs. There is no need for the lines of (8) to be ordered in their application to input sentences,

although there is one additional item of information required before they can be applied at all: the selection restrictions. These tell us what it is to be an agent of "break": in Simmons's scheme a noun marked ANIMATE. The selection restrictions attached to the cases in (8) are essential to the application of the paradigm, for only thus could we know that "John" in (4) was matched by AGENT in the first line of (8). It should be noted that the restriction of AGENT in (8) to nouns marked ANIMATE is not necessarily a restriction peculiar to 'break', but rather to the class of verbs for which (8) is the (active) paradigm. Conversely, the ANIMATE restriction on AGENTs in (8) is not necessarily on AGENTs as such although it might turn out to be so. These points will be important when we come to Charniak's arguments later.

Notice too, that there are not two different ways in which a sentence can be ill-formed with respect to the paradigm: one with respect to selection restrictions and one with respect to the case frame (as has been argued by Bruce 1975). The case frame expressed by the paradigm, and the corresponding selection restrictions are indivisible. So, for example,

(9) John broke

is ill-formed with respect to the case frame for "break" as explained earlier. However, if we look at that fact in procedural terms, such

as those provided by Simmons' paradigm, we cannot deem that failure as one of matching a line of (8) as distinct from (Bruce's view) not meeting the selection restrictions PHYSOB , say, on the case OBJECT on the fourth line of (8). For the selection restriction associated with a case defines what it is to match a corresponding line of (8). The only way in which a sentence could independently fail to match any line in the paradigm of (8) would be the trivial one of having some number of arguments (say, four or zero) not corresponding to any line of (8).

CASE IN PREFERENCE SEMANTICS

Case in formulas

This system builds meaning structures and inference rules from eighty primitive semantic elements. These are of eight types, one of which consists of the case elements as follows:

*DIRE the general DIRECTION case element. Like all the primitive elements whose names are preceded by an asterisk, it is equivalent to a class of other primitives, in this case the following four:

TO direction towards

FROM direction away from something

UP in an upwards direction

THRU direction through some other thing.

INST the INSTRUMENT case, indicating the instrument used in some action

FOR the RECIPIENT case, indicating the normal recipient of an action

IN the CONTAINMENT case, indicating what contains some other thing

LOCA the SPATIAL LOCATION case, indicating the place of an activity or thing

TLOCA the TIME LOCATION case, indicating the time location of an activity

GOAL the PURPOSE case, indicating the purpose of an activity

SOUR the SOURCE case, indicating the substance from which some object came

WAY the MANNER case, indicating the manner or method by which an activity was performed

OBJE the OBJECTIVE case, indicating the object of an action

SUBJ the AGENT case, indicating the instigator of an action, 'subject' here being taken to refer to a semantic, rather than a surface, subject

WITH the ACCOMPANIMENT case, indicating the accompanier of an entity

POSS the POSSESSIVE case, indicating who owns some thing

These case primitives are ultimately the names of relations in the system of semantic representation, just as in the familiar semantic net representations (Simmons 1973) that indicate the instrumentality of say, the action of striking by a labelled arc such as:

The representations described here are not of this superficial form for three reasons:

a) Semantic nets do not immediately suggest their associated processes, whereas the representations here are intended to be directed towards the processes that operate on them.

b) There is a clear distinction in the present system of represent-

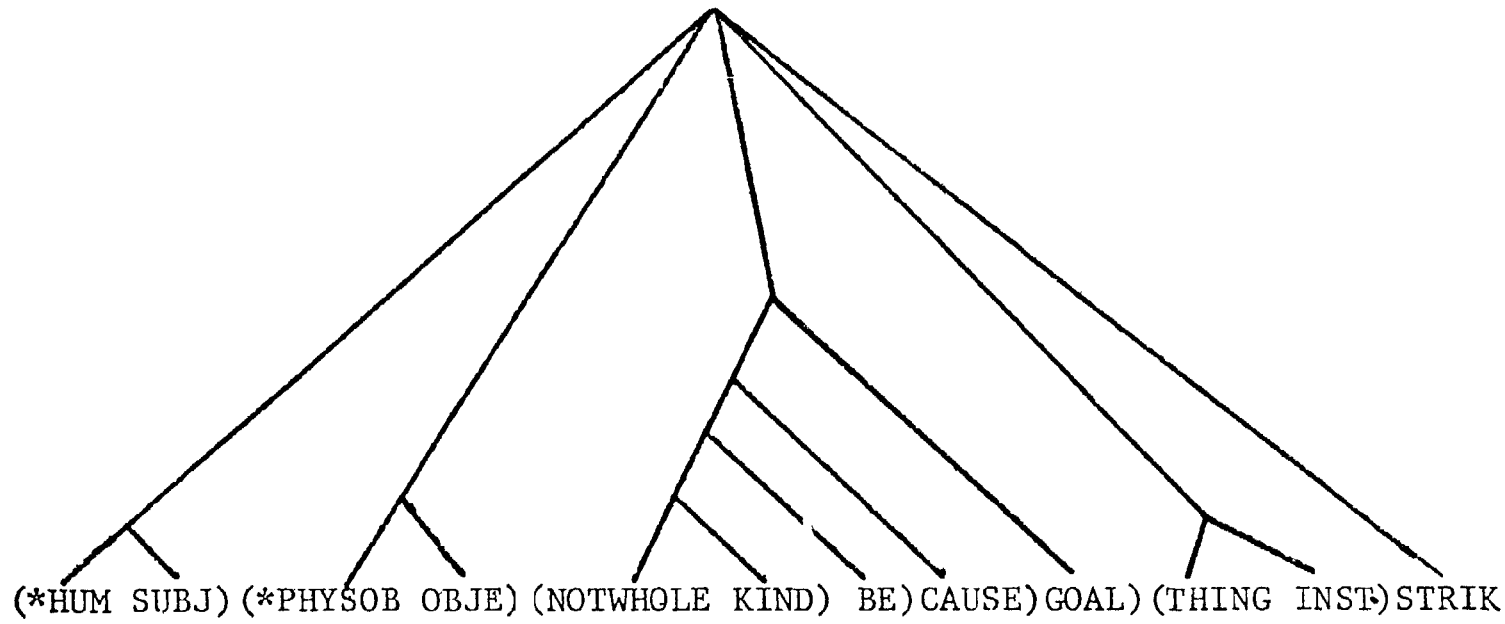
ation between the knowledge stored and the patterns sought in language, on the one hand, and the language text actually represented found, on the other; where the latter may not exactly match what was being looked for. This distinction is not always easy to work into a semantic net structure.

c) The present system of representation is intended to be more "habitable" in Watt's (1968) sense of providing a language of semantic representation that is appropriate to the way humans express themselves. That is a highly subjective notion, perhaps, but here it is taken to require at least a dynamic, or readable structure, which nets do not have. This requirement rests upon another assumption: that our representation must have the "one thing after another" feature that texts have, rather than being static and timeless like most semantic nets (though Norman and Rummelhart (1975) have constructed nets containing ordered assertions, though these are no longer semantic nets in the classic sense).

The case primitives function within a semantic dependency grammar (Hays 1964), intended to express the meaning of word senses and, by extension, of texts. Each of the case primitives above will have a dependent, which is a type of entity for all the case primitives except WAY and GOAL, which take an assertion as dependent. The case primitive and its dependent (entity or assertion) form a case group which is in turn dependent on a primitive action (except

for WITH and POSS which depended on an entity , and may therefore be only semi-cases). This is best seen by example of the first structure in the system, the formula which expresses word sense in the dictionary. The formula for the action sense of "break" is as follows:

(10)



The general structure of such formulas has been explained in Wilks (1968, 1972, 1975a, 1975b). They are intended to express the interlingual meaning of the sense of the word, and the primitives that comprise them are intended to be interlingual (as are Fillmore's cases) even though they happen to be mostly Anglo-Saxon monosyllables. Formulas are trees of left-right dependencies but the dependence is interpreted differently according to the type of the subformula.

We have already mentioned the dependence of an entity (or assertion) on a case primitive to form a case group, such as (*HUM SUBJ), which means that an agent is (preferably) human. These case groups (except WITH and POSS) all depend rightwards on some action, so that (*HUM SUBJ) in (10) depends on the main primitive action of the whole formula STRIK. The whole formula is to be interpreted as "breaking" being a STRIKing, done preferably to a *PHYSOBJect, and by a *HUMan SUBJect, using an INSTrument that is a THING and with the GOAL of CAUSing the *PHYSOBJect to BE NOTWHOLE.

This interpretation can be constructed from the following general rules for the building and interpretation of formulas:

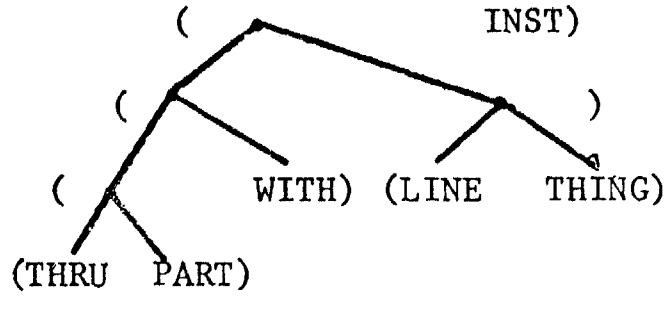
i) Each subgroup in the formulaconsists of a left member depending on a right member, and left or right may be either a single primitive element or another group. Thus, in (*HUM SUBJ) we have a case group, known to be such because the rightmost member of its pair is the governor and SUBJ is the primitive element naming the Agent case. One level higher (*HUM SUBJ) depends on STRIK, the main primitive of the whole formula, to form an assertion group. Similarly, each of the other main subparts of the formula (whose heads are respectively OBJE, INST and GOAL) depends on STRIK to form in each case an action group which always consists of an action and any case group that is not an Agent group (nor a POSS or WITH group).

ii) The dependency within a group is interpreted differently according to the type of the group. Within an action group ((*PHYSOB OBJE) STRIK) the dependence is that of an action's object on the action and OBJE does no more than name that relation. In the case group (*PHYSOB OBJE) the relation internally is no more than the preferred type of case filler (physical object) on the name of the case. With a substantive group like (LINE THING) the dependence is interpreted as specification, i.e. linear object. *PHYSOB is a name of a class of primitive elements which includes THING, but also other primitives like MAN. In case subformulas, except GOAL and WAY, the leftmost item is always the preferred entity type, to function in the corresponding rightwards-named case. This leftmost item is, if you will, the 'selection restriction' for that case role for whatever action is being coded: i.e. in the formula above, for 'break'. The reader should not confuse this with being a restriction for the associated primitive STRIK. This point will be discussed later, but for now the formula is to be taken as no more than a formal expression of the meaning of the action 'break' that can be used in subsequent inference and parsing routines. However, "selection restriction" here is to be read as 'preferring the agent of "break" to be human', say, I have described elsewhere (Wilks 197 c) how when text representations are assembled that will be only a preference on the agent of "break", and the system will not baulk at assembling a representation for "The dog broke his bowl" where the agent is not human, though the system

would prefer a human agent if it could find one. I write of "assembling representations" because the elements like *HUM in the formula above are not slots to be filled by, in this case, the agent of some breaking. The formulas are 'blueprints' for how representations are to be assembled elsewhere from whole formulas. When a representation for "The man broke the window" is assembled the whole formula above (together with a PAST element) will stand at some appropriate node of a higher-level representation.

It is this feature of the system that explains why the head, or principal, element of a formula is easily accessible at one end of it --rather than buried in the center as it would be if the formula were in SVO form, rather than SOV form, as above. Formulas exist for all parts of speech so, for example, a formula for an entity will have not a primitive action head like STRIK, but an entity head like THING or MAN or STUFF (for substance). Note too, that the preference restrictions for case need not be simple as above but can be as complex as required, including further case restrictions recursively. So, for example, if we had a formula for 'sew' it might well have a case sub-formula

(11)



to be interpreted as: done with an INSTrument that is preferably a LINEar THING WITH (accompaniment case) an aperture (THRU PART).

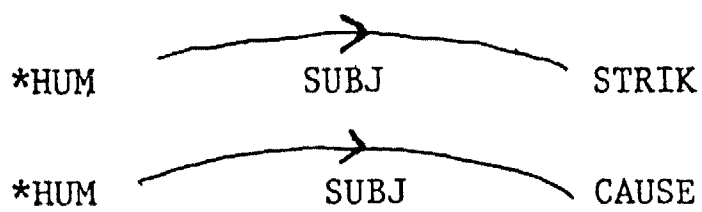
iii) In order to make the formula "habitable" the agents and objects are compressed, in that they can be agents and objects for more than one primitive action. Agents and objects of actions in a formula are normally sought to the left of the primitive action element. If the whole formula is for an action (as above for 'break') the two left-most subparts of the formula will always be the preferred agent and object of the head primitive, in that order. For any actions within the formula (such as CAUSE in the formula for 'break') its preferred agent and object are normally the next agent and object to its left -- which of course, as in the case of 'break' may turn out to yield the same entity as the preferred agent of the whole formula, though this need not be the case. Moreover, in the case of actions within a formula (i.e. not constituting the head) the agent need not be marked though the object must be if it is an entity type. This proviso does not apply in the formula above since the agent is the same for CAUSE and STRIK, and CAUSE takes an assertion as object, but within a formula a group (MAN STRIK) would always be interpreted as an assertion group, MAN being an unmarked agent of STRIK, and not as a man being struck which would require a marked object in the action group i.e. ((MAN OBJE)STRIK).

All this implies that some of the subgroups in the formula for

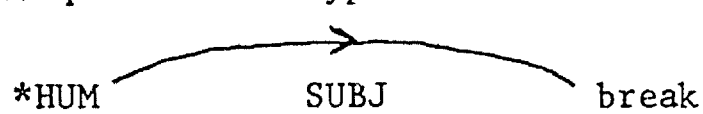
break' are not the apparent ones i.e. the dependent of GOAL, as mentioned earlier, must be an assertion, whereas it is bracketted to only (((NOTWHOLE KIND)BE)CAUSE) which can only (during inference procedures called 'extraction' to be described later) become an assertion group by the addition of an agent found to the left namely (*HUM SUBJ). CAUSE also requires a dependent object that is an assertion (hence (*PHYSOB OBJE) will not do as its object taken alone) and can take, as dependent of that group, an entity to its left marked either OBJE or SUBJ whichever is closest. Hence the dependent of ((NOTWHOLE KIND)BE) is *PHYSOB and the "real" dependent of CAUSE (found by inference) is(*PHYSOB ((NOTWHOLE KIND)BE)) and the real dependent of GOAL is ((*HUM SUBJ)(*PHYSOB((NOTWHOLE KIND)BE)))CAUSE).

This compression of expression can be argued to be "habitable" for a formula maker. It also avoids to a large extent the defect of some fuller conceptual representations of this general type, pointed out by Sandewall (1972), that if the entities like (*HUM SUBJ) are put into the representation many times but are intended to refer to THE SAME HUMAN, then this must be indicated as it frequently was not. Where such identity must be specific in formulas, but cannot be achieved by the above compressed expressions, it is obtained by means of the primitives SAME and NOTSAME: the same (or not), that is to say, as the first encountered token of the associated primitive when working in from the top level of the formula. One point that should emerge

from this is that those who want to use case names as the names of relations, as in semantic nets, and also deal with surface language, must be prepared to extract a number of such relations from a single occurrence of certain formula subparts. Thus, the formula for 'break' above would contain not only the net links:



but also the quite other type of link



which asserts that the preferred agent of breaking will be human. However the top link must not be interpreted as saying that the preferred agent of the primitive STRIK is human, because that is not an assertion in the system at all. All the top link can say is that the primitive action STRIK sometimes takes human agents. In some other formula, for another surface action whose underlying primitive was also STRIK, the preferred agent might be *ANI, a wider class. Hence, in this system there are not specific semantic restrictions on the dependents of the primitives, as in, say Schank (1973).

In the present system, such a restriction could emerge only inductively from a survey of a considerable body of formulas. It is worth clarifying this issue here: what do underlying representations constitute case frames for? The issue is related to two others:

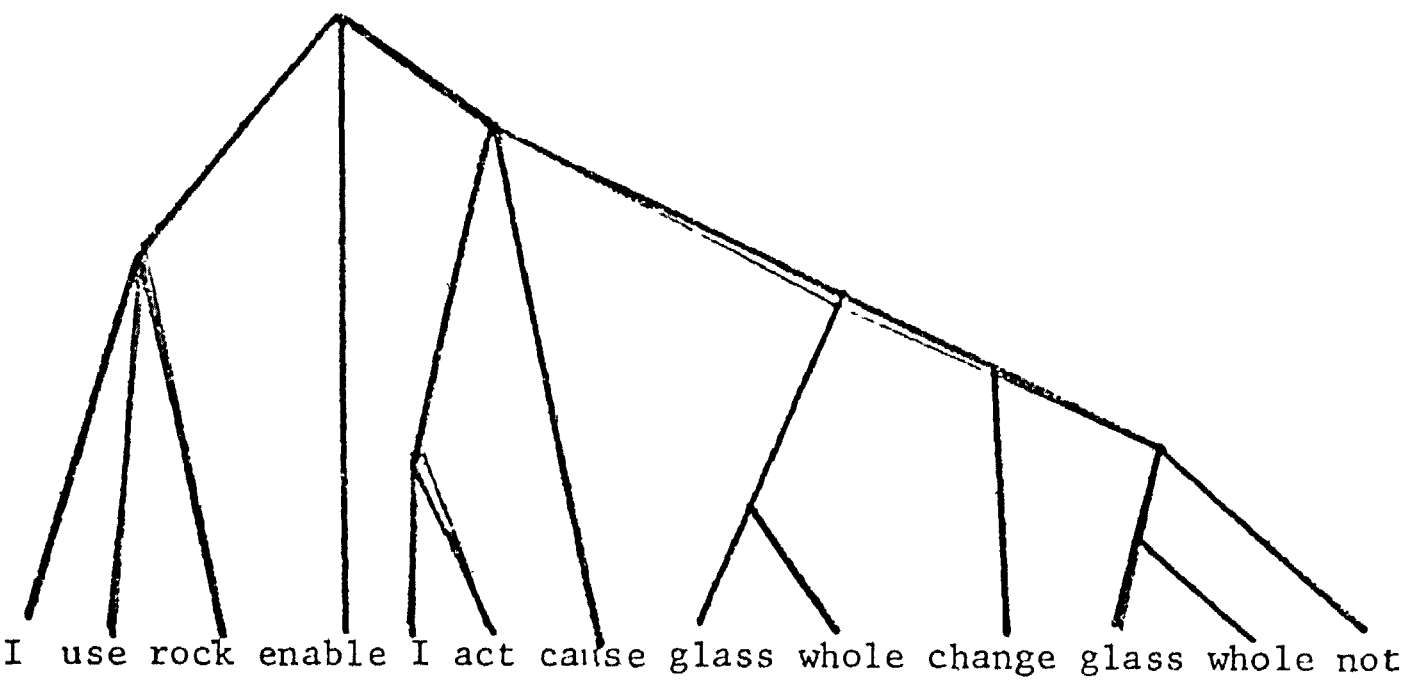
first , the different roles of case frames in analysis and generation, and secondly, the procedural opposition between case frame blueprints, like formulas, and the 'fuller' representations of generative semanticists' trees and Schankian 'conceptualizations'.

First , let us note that it has never been as clear as might be wished what case frames are for in Fillmore's work. The normal introductory account given earlier states that they are for surface verbs like 'break', but in Fillmore (1975) he argues that it is not so simple because he would want to admit sentences like:

(12) Noon found Harry sleeping

as perfectly well-formed, while not taking account of the usage in the agentive part of the case frame for 'find'. On the other hand, he wishes to avoid the position of saying that case frames are for underlying verbs like semantic primitives in formulas, or the underlying verbs of Generative Semanticsrepresentations which avoid cases altogether, as in the following for "I broke the glass with a rock".

(13)



I have followed Fillmore's (1975) device here of making (13) easier to read by putting it in SVO rather than the usual VSO (predicate first) form. It will be seen that it is pretty similar to the above formula for "break" except that, in order to avoid case notation, they have had to resort to such philosophically suspect devices as separating the act of using from the basic 'act' inside the tree, even though there was really only one action in the whole business.

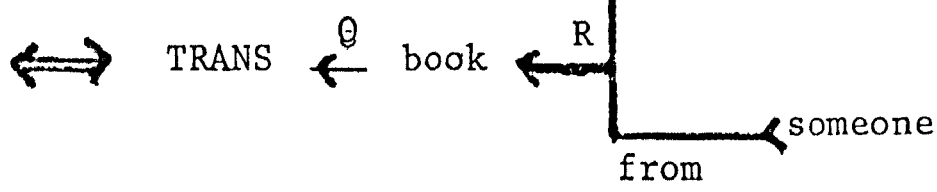
An extreme version of the view that case frames belong only to the underlying structure is Schank's (1973) view that case frames are for underlying primitive acts and that all cases that a primitive act takes, it takes obligatorily.

Thus, for example, Schank's primitive act TRANS expresses the

underlying content of such actions as "buy", "sell" and "take", and he would begin the representation of

(14) The man took a book

as (Schank 1973, p. 196)

(15) man 

where the arrows labelled "R" and "O" indicate Recipient and Objective case respectively, and the Agentive case is in fact indicated by the double arrow linking "man", the agent, to the act TRANS. The details here need not concern us, the point being that Schank is setting up case frames, not for surface verbs of English, like Fillmore (1968), but for these primitive acts, of which he has about twelve.

From the point of view on ease expressed in the system described here, both these strong positions have drawbacks, indeed they have complementary ones. In the first place, Fillmore's (1968) system, with the aid of which he wants to contrast verbs by means of their frames, only becomes significant if interpreted with the aid of some non-surface representation of actions. So, for example, Charniak has pointed out (personal communication) that the earlier contrast of the frames for "hit" and "break" is significant only if there is some common, underlying, action that the two verbs share, and which can be thought of as being substituted for the horizontal line in the frames.

For, if that is not so, then the contrast of the frames for "kill" and "murder" is of no more interest than the contrast between "kill" and "remember", or any other random verb. In other words, it is only because the two verbs already have something in common, over and above their case frames, that the comparison has point. Thus, the contrast of the case frames of only surface verbs is, if unsupplemented, unsatisfactory.

Conversely, there may be certain problems inherent in Schank's attempt to both (a) relate surface verbs to underlying primitive actions, and then discuss only the latter, and (b) at the same time make all participants in the case frames for primitives obligatory. So, for example, Fillmore would express the case frame for "see" as (OBJECT DATIVE) and for "learn" (OBJECT AGENT). While Schank (1973 pp. 220-1) expresses both verbs by an underlying primitive MTRANS together with a case frame, for the primitive, containing at least A, O and R (Fillmore would call R by D). The individual letters for cases assigned by different authors need not detain us, nor need their contrasting interpretation of the case names, for the present point is the perfectly general one that, whether or not Fillmore is right with this particular verb pair, it is highly likely that there are pairs of surface verbs like this one whose surface case frames are different and whose Schankian primitive act is the same.

It follows from (b) above that, for Schank, their "deep" case

frame must therefore be the same too. Since, for him, every surface verb has a main act expressing it, there is clearly going to be a problem with this consequence of (b) unless he is prepared to say that there is no necessary relation at all between a verb's case frame and the case frame of its corresponding primitive act. It may well be possible to defend such a position within his theory, but he will still be left with the difficulty that verbs with quite different semantic behaviour (for Fillmorian case differences are not superficial) have identical behaviour in his system. There is bound to be a lack of discrimination consequent upon Schank's all-cases-are-obligatory view unless some careful avoiding action is taken, that he has not yet, to my knowledge embarked upon.

However, Schank would probably not wish to take advantage of this last possibility because he does not himself hold the view that conceptual case "is entirely independent of surface structure considerations", as was wrongly attributed to him by Bruce (ibid.p.338), and for the simple reason that he intends that case structure in conceptualizations shall resolve the case ambiguities present in English preposition constructions. Schank (1973) makes this quite clear, and I shall return to it when discussing preposition constructions in the next section. Thus, since Schankian case frames for primitives are not independent of all surface structure considerations, he does have the problem above presented by the contrast of "see" and "learn".

The burden of the last arguments have been to show that three different positions on the question of "what are case frames for?" are unsatisfactory:

(i) that they are simply for surface verbs : Fillmore's 1968 position, argued against along the lines sketched above as early as Schank (1969),

(ii) that underlying structures containing primitive actions do not require case frames at all: the Generative Semantics position, for example, Postal (1971),

(iii) that underlying structures containing primitive actions are case frames for those primitives and, moreover, are all obligatory case frames: Schank's position just discussed.

Let me now restate the position of the present system, as it concerns formulas. Formulas are meaning structures for surface word senses. Formulas for surface verbs can be interpreted as case frames for the verbs, in that they contain case subparts at the top level (i.e. depending directly on the head action primitive) that the formula maker has considered necessary to express as part of the meaning of the verb. Thus, the formula for "break" given earlier (10) contains case subparts at the top level (i.e. depending directly on the head primitive STRIK) INSTrument, GOAL, OBJect and Agent(=underlying SUBJect). The formula maker is concerned only with specifying, as best as he can, the semantic preferences of the particular surface word in question.

If it were a verb he would semantically specify the preferred agent, say, of that action, with no implicit reference to agenthood as such. The same goes for the other cases: he would attempt to put those cases into a formula that he thought necessary to specify the meaning of the action. Consider

(16) He lives in Lugano

and

(17) He drank some Barbera in Lugano.

It is logically true that one must, if one drinks, do it somewhere, but no one would hold that the notion of location was involved in explaining the meaning of drinking. However, one might well hold that it was impossible to explain the notion of living, in the sense of inhabiting, without making clear that it was done in some location. Thus only in the formula for "live" would we expect a location case subpart (.....LOCA).

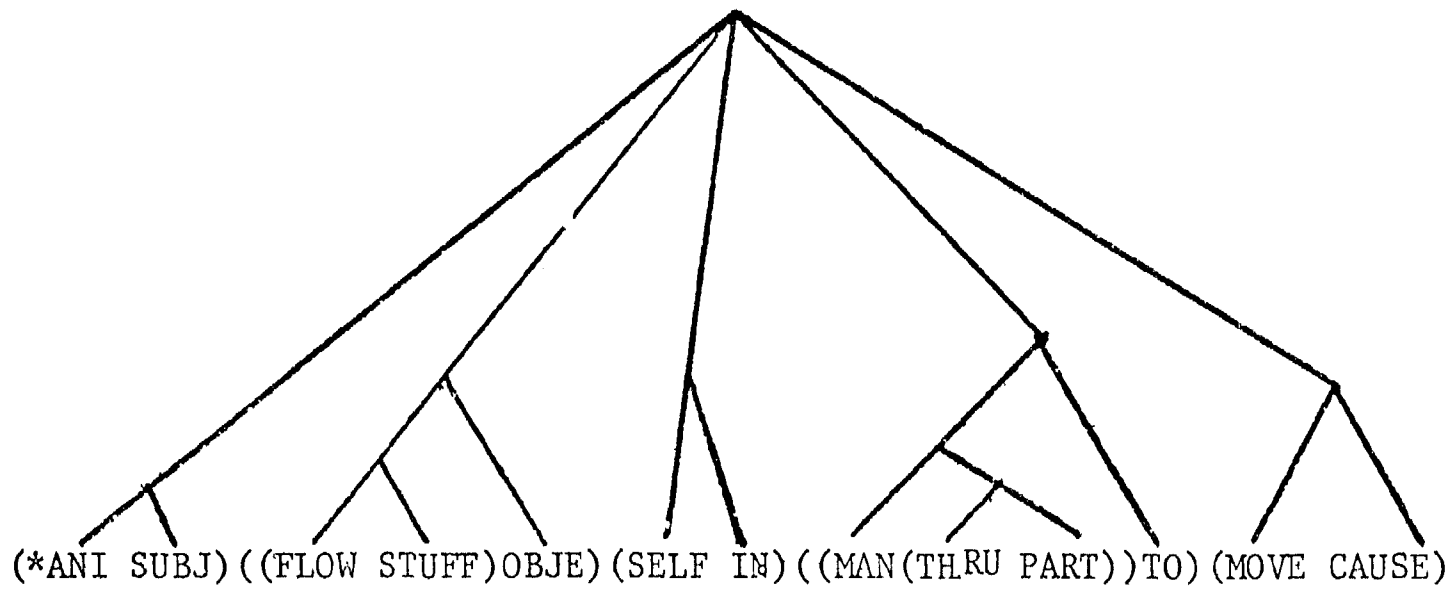
This description of the insertion of case specification into the formula for some given surface verb does not correspond in any clear way to Fillmore's obligatory or optional distinction, though it seems clear that any formula should contain <u>at least</u> Fillmore's obligatory cases for that surface verb and, as we saw , (10) above, for "break", does this, since the only obligatory case for "break" is <u>object</u>.

The main reason for this difference remains the essentially generative quality of a Fillmorean case frame. Much sophisticated

linguistic argument in the past decade has gone into attempting to prove that the term "generate" is neutral between "analyse" and "produce". One of the best efforts is to be found in Lyons' (1968, p.155). But, although it is easy to see the productive role of, say, Fillmore's subject selection rule (SSR), it is very hard to see what analytic significance it could have; the surface subject is, after all, usually revealed by simple methods not requiring the notion of case. The SSR tells one how to choose the subject given the case structure and in that sense is inherently generative, in its non-neutral sense meaning 'productive'. The system presented here however is inherently analytic (its productive aspects have been described in(Herskovits (1973)), and this accounts for a great deal of the difference of approach to the notion of meaning structure. Those with practical acquaintance with sentence analysis and production will need little persuasion that the two processes are not in any sense simple inverses of each other (nor does Fillmore himself believe they are, see(Fillmore 1972 p. 23).

Charniak has argued (1975) that the method of formula coding results in top level case subformulas that cannot appear in the surface form of the verb, and he cites (ibid. p.16) the formula for "drink":

(18)



where the containment group (SELF IN) indicates that the liquid object (FLOW STUFF) is moved into the animate agent (SELF), and the direction group ((MAN(THRU PART))TO) indicates that this movement is in the direction of a human aperture. These two groups appear at the top level of the formula, and thus dependent on the head primitive action CAUSE. However, later inferential procedures of extraction (see below) would show, as with "break" (10) earlier, that the real dependency of the two groups was on MOVE. However, the requirement is observed that the Fillmorean obligatory cases (only Agent presumably) for "drink" appear at the top level, and the other case groups - containment and direction - most certainly could appear at the surface with 'drink' as in:

(19) John drank the beer up through his nose with a straw and into his brain.

where both cases appear at the surface. Charniak is confusing what

can appear at the surface with what it would normally be redundant to say. The difference is made clear in (19) if we choose to say something remarkable, and false.

In this section on formulas I have tried to justify the intermediate role of case description in formulas: by claiming BOTH that they give a meaning structure that, under inferences processes, can provide a real underlying structure for text AND that they must include enough of the surface case behaviour (of the verb meaning being expressed) to give procedural power in analyzing the input surface sentences. It seems to me essential to preserve both these roles, and to avoid the path taken, in their different manners, by Schank, Fillmore and the Generative Semanticists, of displaying a full underlying structure directly without the processes that reach it. I argued earlier that each of those three gave only a filled-in or final structure which in itself gives no hints as to how you get there.

The generative linguist argues, of course, that he is not trying to reach such a structure at all, but to generate surface structures from it, and the "artificial intelligence critique" of this aspect of generative linguistics is familiar by now (my own version is in Wilks 1975c). The way in which Schank emphasises a filled-in structure is a quite different and more interesting matter. His conceptualizations are filled-in structures, with no procedural capacity. However, at the back of his early papers (i.e. the Appendix to Schank et al. 1970)

are dictionary entries or skeletons for conceptualizations, which contain selection restrictions on the slots in the conceptualizations (and in (Schank 1973, p. 229)). These objects are much more fundamental to his approach than is generally realized, for they do give it more procedural power than one could envisage from looking only at the final conceptualizations.

Their role is somewhat like that of the formulas for actions: they are blue-prints showing what the system would like to be the usage and context of a given action. But the difference from formulas is this: the Schank dictionary entry has slots, marked, say, HUMAN which, when they are all filled by surface words yield the filled-in conceptualization. The formula too has case specifications, like (*ANI SUBJ), but these are not slots to be filled in, but directions as to how to fill in an agent slot in a higher order entity called a template which consists of whole formulas: essentially, a network based on an agent formula, an action formula and an object formula (although any of these may be dummies). Schank has no equivalent to formulas for nouns or adjectives, or any part of speech other than verbs.

Thus, if the formula (10) for "break" is placed at the action node of a template, its agent preference tries to ensure that a formula for an animate entity will go at the corresponding agent node. There is a metric for this initial parsing and matching described in (Wilks 1972, 1975a, 1975b). The role of the formulas as data for parsing

here is as follows: templates, matched onto sentences and clauses expressed as strings of formulas, try to pick up surface subjects and use the formulas as blue prints for selecting the best template, by trying to ensure that the surface subject is also the agent. In the initial matching of the "The hammer broke the window" this will not be possible because the formula for "hammer", the surface subject, will be placed at the first (or agent) node of the template. However, since the formula for "break" will be at the corresponding action node the system will know at any point in later processing that the surface subject is not the underlying (animate) agent as preferred by the "break" formula at the action node of the same template. This clash will, as we shall see, lead to later extraction inferencing that deals with the ergative paradigm in a uniform manner. But this clash is only observable in a system which builds structures that retain their preferences built in: i.e. not in one like Schanks' that just fills in slots in dictionary entries. Fillmore's anomalous "Noon found Harry sleeping" causes no trouble here: the formula for "find" expresses a preference for an animate agent. In the template for this sentence, that is not satisfied by the surface subject (a formula for "noon", with a head (WHEN POINT)) but no case frame is violated.

Formulas are not used as parsing mechanisms to deal with preposition structures in English. This is done by other structures called paraplates, to which I will now turn, so as to give a fuller

account of them than in the past, in (Wilks 1975a). In what follows templates will be written in short form: not as triples of complex formula trees, but as square brackets round the surface phrase or clause that the template is for. The words are clustered within the brackets so as to represent the three nodes of the template.

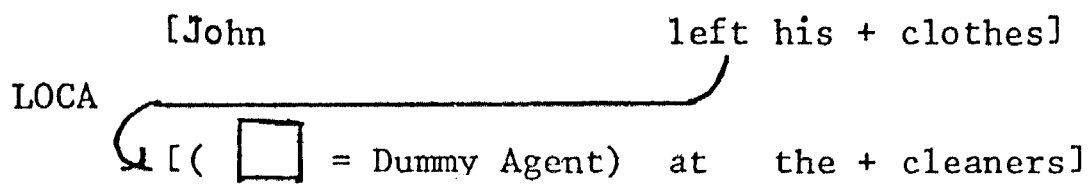
Case in paraplates

Paraplates are structures employed to assert a connectivity between two templates, typically between a template representing a main clause and one representing a prepositional phrase. Thus, if we were analysing

(20) John left his clothes at the cleaners

which would be represented initially in the system by two templates, the correct paraplate, when applied, would assert a spatial location case (LOCA) tie between the two templates as follows:

(21)



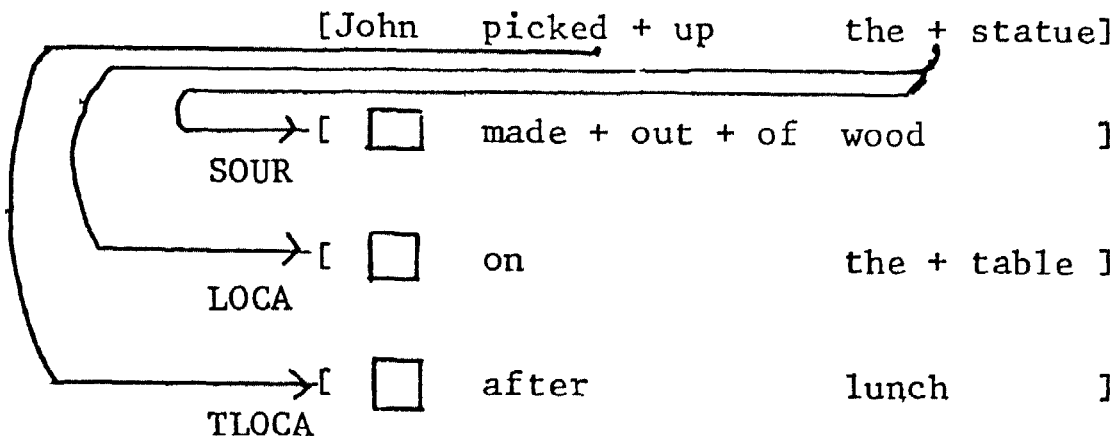
Each paraplate corresponds to one of the cases in the inventory, which is the same as the inventory used to construct formulas. Many paraplates, however, may correspond to a single case. A paraplate has the form of two template-skeletons connected by a label indicating the case expressed by the paraplate, where by template-skeleton I mean an

entity like a template except that, instead of a formula at each of its three nodes, it has a function ranging over formulas. Any template that matches either part of the paraplate must have formulas that satisfy the functions in the corresponding part of the paraplate. If the functions in both parts of a paraplate are satisfied by a pair of templates (and the template for the prepositional phrase is normally considered to be the right-hand part, though this need not correspond to actual order of occurrence in text) then the case label of the paraplate is asserted in the representation as holding between the two templates.

In earlier descriptions I have distinguished paraplates from inference rules, but in fact they can perfectly well be seen as a form of inference rules as Schank has argued. However, the essential role of paraplates is as <u>parsing structures</u> for prepositional phrases.

So, if we were representing "John picked up the statue made out of wood on the table after lunch" we would expect paraplates for the various case dependencies to create ties as follows:

(22)



where SOUR indicates source case, and TLOCA, time location.

The preference semantics system applies paraplates immediately after matching templates and choosing the "most preferred" ones (Wilks 1975a). In operation, the system inputs small English paragraphs on-line, produces a semantic structure for them, and from that generates a French translation (Wilks 1973b, 1975a; Herskovits 1973). Thus, as regards English, the system is an analytic one, and is faced with the standard problem that a single English preposition can introduce many cases (and can, of course, often be translated by a number of French prepositions depending on the case).

Let us consider "by", functioning in the following sentences, all of which may be considered to start, like (23), with "He left Lugano by ...", where I have indicated the apparent (though disputable) case of the last clause at the right of each line:

(23) He left Lugano	by courtesy of the police	SOUR
(24)	by Comano	TO
(25)	by car	INST
(26)	by stealth	WAY
(27)	by Monday night	TLOCA
(28)	by following the arrows	WAY
(29)	by stealing a boat	INST

Paraplates are six-place entities, not all of whose places need be filled, corresponding to Agent-of-first-template, Action-of-first-template, Object-of-first-template, and so on for the second template.

Here are four paraplates that should match onto the templates for the sentences above with corresponding numbers. Like the sentences, the paraplates will all have the same left-hand side, which is written only once.

(24)' (*ANI) (MOVE) (WHERE POINT) TO → □ □ (WHERE LINE)

(25)' INST → □ □ (*REAL)

(28)' WAY → □ (*DO) (WHERE SIGN)

(29)' INST → □ (*DO) (*REAL)

The parentheses containing the formula parts are all to be interpreted as matching onto corresponding part of a template if and only if the latter has the mentioned subparts as its head of formula. Thus paraplate (24)' matches (24) because the formula for

"he"	has head MAN included by	*ANI
"left"	has as head	MOVE
"Lugano"	has a head containing subpart	(WHERE POINT)
"autostrada"	"	(WHERE LINE)

and so on[$] for the other correspondences of sentences and paraplates, which will then assert the case label tie written at the right hand end of the sentence in each case (and on the corresponding arrow in the paraplate) as holding between the corresponding template pair.

$ □ is a dummy place holder, *DO covers a wide class of actions, as does *REAL of entities.

The paraplates above (24)' to (29)' are a sublist of those stacked under the name of the preposition "by" and under the primitive action MOVE that occurs in action position of the left side of each paraplate. There will also be other sublists of paraplates stored for "by" under other primitive actions. For example,

(30) This painting is by Titian

would, during its analysis, also access the paraplates under "by" but in this case the sublist under BE.

The sublists of paraplates, for a given preposition, that are names by different primitive actions are not ordered with respect to each other. However, within any sublist, such as the stack (24)' to (29)' above, the paraplates are ordered, in that the paraplate at the top of the stack is applied first, the next only if that fails and so on. Let us return to the example to see why.

First, INST case is largely a default case for MOVE as it is cued in by "by", in that almost any entity can be an instrument here if we have no reason to believe it is anything else. Thus the more specific (24)' must be applied before (25)' in order to match direction case for (24)' since, if the order were reversed, (25)' might match with what "ought" to match with (24)'. We could imagine something very specific in (25)' to match the formula for car (such as a formula expressing "thing for moving humans"), but that would risk missing

"by cattle truck" which is not normally used for transporting people. However, it should be noticed here that the paraplates as described do not have the power to detect an anomaly such as "John walked home by car". The templates matching that sentence would be quite properly tied (as INST) by (25)'. Any anomaly in it would have to be revealed by later inference. This is an example of what Lyons (op.cit.) means by the criteria of analytic systems being (initially) weaker than those of productive systems.

A stronger but similar argument applies to putting (28)' above (29)' in a preference stack, given the very weak criterion embodied in (29)', that almost any action upon any physical object would satisfy in default; and one could extend this to putting a (23)' above a less specific (26)'.

The main point here is as follows: it is clear that such paraplates must be applied in some order, but it is not clear that they should be simply ordered. For example there is no reason why (28)' should be ordered with respect to (24)'. There is no formal trouble expressing a partial ordering of this sort procedurally. I argued in (Wilks 1975a) that in many cases we might expect more than one template attached to a fragment at this stage and that we would "resolve the ambiguity" by preferring whichever template matched higher up such a preference stack of paraplates. Order, then, is important in such paraplates stacks, even if it turns out to be only partial order.

If such a stack is only partially ordered then we may, in the case of a prepositional phrase with two or more current templates competing to represent it, expect a draw at some stage: that is to say, two possible templates for the same phrase may match with paraplates that are not ordered with respect to each other. Such a situation might well correspond to an example such as:

(31) John jumped on the box

where the last phrase is genuinely ambiguous between TO and LOCA case (in the sense in which the substitution of "onto" for "on" could only be interpreted as TO). Thus under "on" we would properly expect MOVE (for "jump") paraplates for TO and LOCA to be mutually unordered.

But let us turn to:

(32) He beat the girl with a withered arm

where the case dependence of the prepositional phrase could be either instrumental or a specification of which girl it was. In such cases one might imagine some expectational force to be drawn from the case content of the formulas. Thus, if "beat" has an instrument group in its formula, we can conceive of using this fact to decide the draw on the grounds that "beat" really "expects" an instrument, so why not give it one here, and settle the question. And there might indeed be some psychological grounds for doing that.

But in general, it is clear that the paraplates do not function expectationally, except in the sense that by looking first at the paraplates most preferred in the stack (for a given preposition and basic action) one could be said to be expecting it. And that sense of "expectation" is perfectly consistent with trying more than one candidate template, for a given phrase or clause, at the same time against the paraplate stack, as we might have to in a sentence like

(33) He beat the dog with a branch

where we would not only be resolving the case of the prepositional phrase, but also, and at the same time, the word sense of "branch", where the senses of "branch" might give rise to a corresponding number of templates and we would always prefer the one that matched further up the paraplate stack, as in (Wilks 1975a).

The reader may have been struck by an overlap of case content between the paraplates and formulas. For example, in (10) the formula for "break", the head action CAUSE has a dependent (THING INST). Yet, if we were analyzing the standard sentence "He broke the window with a hammer", we would expect to use a stack of paraplates under "with", containing a substack whose left-hand action was CAUSE, and in it find the appropriate paraplate for tying together the two templates for that sentence with an INST tie. This latter information might seem to overlap heavily with that contained in the formula (10) and the question arises whether it need be stated twice.

However, although the two forms of information overlap there is no reason to believe they are the same: the paraplates reflect the case ambiguity of English prepositions while the formulas reflect only the sorts of case inferences one might subsequently want to make (in extraction, see below). There is no reason to suppose that one form for data can suffice for both these activities. However, Schank does make this assumption, and the point here may become clearer after some brief recall of his position on the point.

In (Schank 1973) an account is given of case inferences from a primitive action. In

(34) John shot the girl with a rifle

the underlying primitive is PROPEL which forms the center of any conceptualization for "shoot". An obligatory INST inference is always made for PROPEL or, as it was put earlier, INST is part of the (obligatory) case frame for PROPEL, and also (as it happens) an optional part of the Fillmorean surface frame for "shoot". In Schank's scheme Instrumental case involves the insertion of another primitive action into the conceptualization but that is not essential to the present point which is that, for Schank, PROPEL "expects" an instrument, and criteria can be postulated such that a rifle will fit those criteria, in a way that hair will not, as in

(35) John shot the girl with long hair.

Thus, for (34) an INST interpretation is achieved for "with", while in (35), by default, the hair is taken as a specification of the girl.

These solutions are, of course, correct but the different aspects of the phenomena do not seem to connect in procedural terms. So, for example, Schank is perfectly well aware of the case ambiguity of the preposition "with", and even lists four forms of it (ibid, p. 231) corresponding to different cases, along with four "conceptual realizations for the syntactic item 'with (noun)' ", and specifies that they should be checked in order "for conceptual validity", just as paraplates are. The correspondence to the notions described in this paper (and in Wilks 1973, in the same volume) is reasonably clear: the inference of an instrument from PROPEL corresponds to an instrument specification in a formula for "shoot" (and for Schank it also comes from ' shoot", rather than more generally from PROPEL, since otherwise it could not be so specific about the instrument being a gun, as PROPEL does not deal <u>generally</u> in guns); whereas the ordered list of case possibilities for "with" is not developed, but corresponds roughly to a paraplate stack for "with".

But here is the problem: in Schank (1973) the two forms of information do not actually meet in any general way. Schank writes as if the list of possible case functions of "with" is general (i.e. action independent), but we have shown that it may well be specific to different primitive actions, in that there may well be a separate

paraplate substack for each primitive action, and may be no short general list of funttions of "with".[$] Schank suggests that the example (34) is resolved because PROPEL and/or "shoot" "expects an instrument", but that piece of information does not, and cannot, take account of the pre-existent ambiguity of "with": it just happens to fit this example, because PROPEL "expects" an instrument and instrumental case is put at the top of the ambiguity list for "with" (ibid. p. 231).

But will this coincidence hold in general? If we had been dealing not with PROPEL but with some other primitive, it is not clear that the same order for "with" would help. I described earlier a MOVE primitive underlying "leave" (the primitive and its name are not important, only that it is not PROPEL), and considered sentences like

(36) I left Lugano with two pounds in my pocket

which shows that instrumentality is unlikely to be the "expectation" for "with" from whatever primitive underlies "leave". Hence Schank's list for "with" is perhaps specific to its use with PROPEL, and he must develop some structure analogous to paraplates and not assume

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$ i.e. a "dictionary entry" for a preposition (like a paraplate subtrack) will be a function of a primitive action.

that the instrumentality of PROPEL suffices:

My point is simply that any attempt to introduce generality here will show that another sort of information structure is required to deal with prepositions, one specific to particular prepositions, and that general case inferences (like instrumentality from PROPEL) could only help in special cases. Any development of "with" lists into paraplate substack structures would, I believe, show that the expectational inferences from the primitives play a far smaller role in analysis, because the criteria they contain will have been procedurally expressed somewhere else.

It is true, however, that there is a strong expectation of a gun-instrument from "shoot", and this phenomenon does not fit easily into the paraplate scheme. It might be necessary to ensure that if a specific instrument were mentioned in a verb formula then that could override subsequent paraplate matching when it arose. However, such specific instruments are not the norm for PROPEL, for this primitive presumably also underlies "break" for Schank, and there is no such presumption of specific instrument with that verb. Indeed, such an expectation would be bound to lead to error if any object found after "with" were taken as an instrument, rather than using a breadth-first approach like paraplates that considers the ranked possibilities for that preposition and that action. This is especially true for a system like Schanks that has no back-up and no

possibility of recovery if it goes wrong.

Formula and paraplate information do sometimes overlap, and I suspect Schank's system, that assumes that the same mechanism can serve both functions, draws much of its force by choosing an example from an area like (34) where they do overlap. But how, in the examples of (23)-(29), could we work in general with the ambiguity of "by" by assuming that MOVE had some strong single case expectation, over and above the fact that some case paraplate (like (24)' for TO) would have necessarily to appear at the top of any substack. How could Schank express the action-dependent ordering of the rest of the substack?

Another peculiar feature of Schank's treatment of these phenomena is his suggestion (ibid. p. 232) that any ordering of preposition functions must go "from the general to the specific". Such limited data as are afforded by substacks like (24)' - (29)' indicate that it may turn out to be the other way round, because the most general (right-hand) criteria tend to appear in the paraplate at the bottom of the substack.

Much though not all, of what has been said about Schank's approach applies to Riesbeck's (1974) implementation of it. It is again a strongly expectational system, in practice in Riesbeck's case, and that leads to the mentioned defects of a depth-first approach (if implemented without back-up, as it is), since the whole

notion of "preference", in case as elsewhere (Wilks 1973a), depends on following a number of possibilities breadth-first for a while before comparing them and committing the system to only one. Only in that way could one treat, in a general way, examples like (33) that require comparison of how high up a paraplate stack a given interpretation comes relative to others.

Riesbeck's system generates expectations (called "requests") from main sentence verbs and uses these to anticipate the case parts of the sentence. The main difference from Schank's approach, and which makes it a curious implementation of it, is that it deals with prepositions not, as one might expect, by primitive actions seeking certain cases, but by verbs seeking actual preposition names. So, for example, "prevent" he seeks "from" and "by", just as the computational linguistic systems of the fifties and sixties did. It also has less power than Schank's theory (and paraplates) in that Riesbeck specifically says (ibid. p. 95) that requests (including preposition requests presumably) are not ordered.

All this seems to require that all possible preposition sequents be stored for every surface verb in the system which leaves little scope for semantic generalization (the aim of the whole exercise, presumably).

The strong point of difference, between Riesbeck's system and

the one described here, concerns the role of uninhibited "expectations".[$] The examples presented here suggest that one cannot base a system simply on the observation that if someone uses "by" after "leave" then it will be expected to introduce an instrument. For "He left Lugano by day" does not fit that and yet cannot be said to be violating any expectation. It is simply that the structural ambiguity of prepositions must be accounted for in a structured and general manner like that offered by the paraplates. The usefulness of expectation, in any field, depends on (a) the high chances of it being right, and (b) knowing what to do when it is frustrated, and Riesbeck's system seems to lack both these desiderata.

$ For further discussion of the issue, see (Wilks 1975c, pp. 40-45)

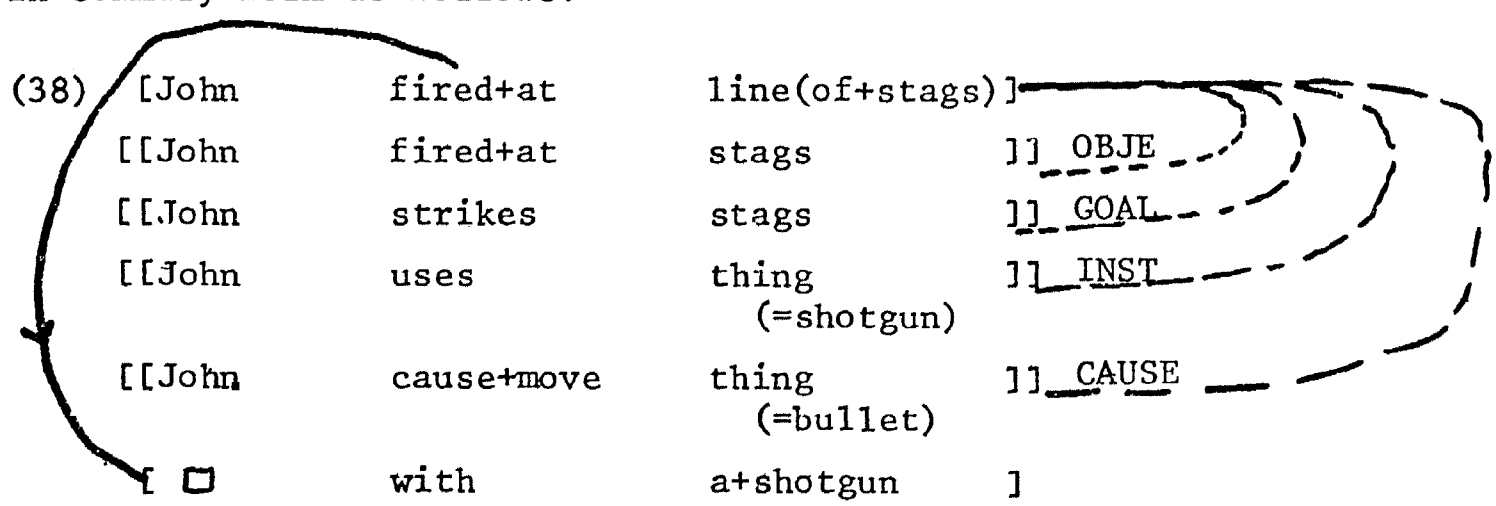
Case extraction inferences

Extraction inferences produce new template-like forms from the case content of formulas embedded in source templates: those that have been matched with text sentence fragments. They are styled "template-like" here only to indicate that they have not been matched with input text, and hence the inferred propositions they represent have not necessarily been stated explicitly in the input text. Let us first see the effect of doing this, and then the mechanism that does it. In what follows, we extend the "short form" of templates (obtained by writing square brackets round English words, clustered at three nodes to show the distribution of formulas in the full template) by writing extractions as English words inside double square brackets.

Let us consider

(37) John fired at a line of stags with a shotgun

The result of matching this with templates, applying paraplates as described above, and then performing case extractions can be written in summary form as follows:



The extracted templates are tied by dotted lines to the source template from which they have been extracted, and the case name on the dotted line shows the case type of the extraction. The inferences cover both those that must be true (like the OBJE extraction, since to fire at a line of stags is necessarily to fire at stags) and those, like the GOAL extraction, that are only likely.

These extracted templates are not printed out (in the way in which MARGIE (Rieger 1974) does) for they do not in themselves constitute testable output. Their role, as described in (Wilks 1973c, 1975a) is to be data for further inferences using common-sense inference rules, whose function is not essentially connected with case and will not be recapitulated here. In the implementation described in those references, the extractions were purely "problem driven", in that they were only done when some problem of reference resolution in the text demanded that the representation be deepened. However, that was a strategic consideration in no way a consequence of the nature of extractions: they could equally well be data driven, and be executed after every matching of a sentence with templates.

The difference between paraplates and extractions should be clear from (38) because it contains both an INST paraplate-imposed tie between main clause and preposition phrase templates, and an INST extraction from the main clause template yielding an extracted template equivalent to "John uses a thing(=a shotgun)".

In this way, we are able to retain as part of the overall semantic representation of text, and in a message form appropriate for subsequent inference, both the surface structure (paraplate INST tie) and the underlying structure (INST extraction inference). As we saw in the last section, Schank holds that these are one and the same thing. It is true, as we shall see, that in order to extract that John uses a shotgun, the extraction mechanism must consult the template tied by the INST paraplate but, as I argued in detail in the last section, this in no way establishes that the surface semantics and the underlying semantic structures are one and the same, requiring only a single representation.

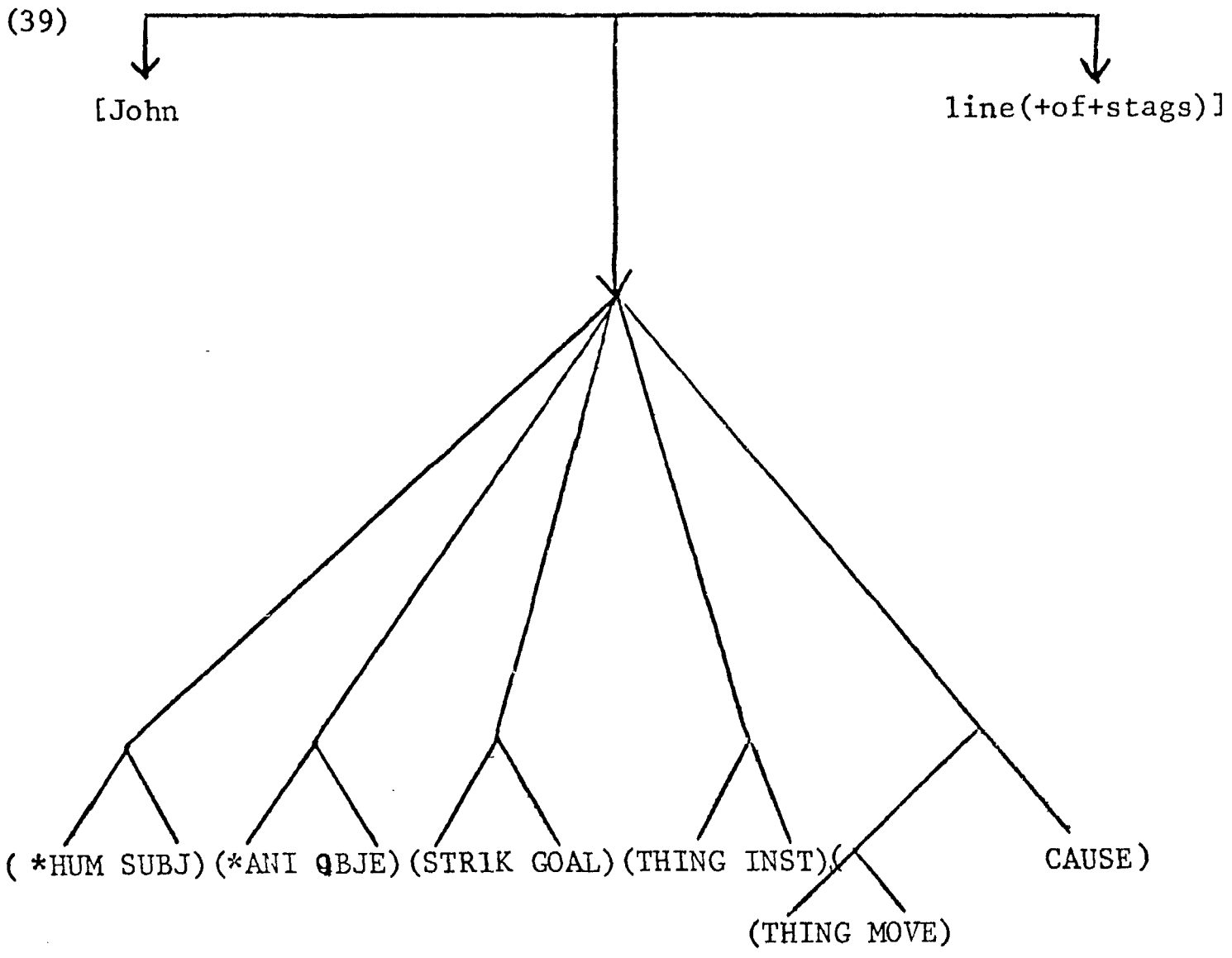
The extraction mechanism consists of a "specialist" (to use Winograd's term) for each case (and for CAUSE, which is treated as a semi-case during extraction). It is called after an initial semantic representation for a text has been built up as templates tied together by paraplates and anaphora ties (See Wilks 1973c, 1975b) An extraction, resulting in a new double-square-bracketted template, as in (38) above, is made for each case (or CAUSE) sub-formula at the top level of the formulas of each source template.

Let us see how the extractions in (38) are actually obtained. This will require that we give more of the content of the first source template in (38), and in particular the formula for "fire+at". (39) may be considered a semi-full-form of

[John fired+at line(of+stags)]

in that the centre node has been expanded to its formula but the other two nodes are left in "short form".

(39)



Each top-level case (or CAUSE) subformula is extracted by the appropriate "case specialist" which has access to the additional information provided by the whole template in which that formula is embedded (and, as we shall see, to other templates as well). By way of illustration, we will look at the OBJE and GOAL extractions from the action formula in (39).

The dependent of the OBJE case in (39) shows that "fire+at"

prefers an ANImate object, but the formula is in a template whose object is not animate (it is "line"), and so we have a failed preference. However, an animate object (stags) is available as a dependent of the surface object in the template. The extraction process takes the form of filling a new copy of the source template, and imposing the available preferred animate object,to yield:

[[John fired+at stags]]

Extracting the GOAL case is more complex. As we saw earlier, in the formula (10) for "break", the real dependent of a GOAL case is an assertion group. The appropriate full dependent to the left of GOAL in (39) is

(*HUM SUBJ)(*ANI OBJE)(STRIK $)

where $ is indicates the position of "GOAL" in (39). This is an assertion group as it appears in a formula. The extraction takes the form of rewriting this in template form (from SOV to SVO form) and attempting to fill in its nodes with full formulas matching the preferences: so, on rewriting the above we get:

(*HUM SUBJ) STRIK (*ANI OBJE)

in which an agent and object can be inserted from the whole template (39) so as to match the preferences expressed (if we incorporate the above OBJE extraction as well). Thus, we get an extracted "short form" template (converting STRIK to "strikes" for uniformity

of expression, though it really remains as the primitive):

[[John strikes stags]]

The extractions for INST and CAUSE require that we are able to look outside the source template for confirmation to other templates. Here, only INST receives any such confirmation because there is no mention of any "bullet" or other missile that would confirm ((THING MOVE) CAUSE)). Since the primitive dependent on INST is THING. the "INST specialist" produces a copy template whose primitive action is USE (if the dependent had been another type of entity, the rule could have been different). The INST-tied template matched to "with a shotgun" in (39) is accessed by the INST specialist to provide the full object formula for USE yielding the extracted template shown in (39) as:

(40) [[John uses thing]]
(=shotgun

Let us look briefly at how extractions cope in a novel way with the standard ergative paradigm rehearsed at the beginning of the paper, and in particular with the interesting forms "The window broke" and "The hammer broke the window". Initially these will receive a template match so as to yield a representation even more superficial than that given in Simmons' system. Under extraction however, appropriate representations are obtained and cued by the fact that the superficial subject formula in the templates does not, in either

case, satisfy the animate agency preference of the formula (10) for "break" which is the action node of both templates.

Thus "The window broke" yields initially:

(41) [the+window broke

Now, on extraction, the SUBJ (agent) specialist sees not only that (a) the surface subject (window) does not specify satisfy the (*ANI SUBJ) preference of (10), but (b) the same surface subject does satisfy the (*PHYSOB OBJE) preference of (10), which is filled by only a dummy in the source template (41). Thus the "SUBJ specialist" produces a copy template with the agency preference satisfied:

[[some+animate broke □]]

while "OBJE specialist" correspondingly produces:

[[□ broke window]]

and these are immediately conflated, on the general preference (Wilks 1973a) principle of producing the fullest representation possible, as the extraction:

[[some+animate broke window]]

where the agent formula (now, of course, a true agent, not a surface subject) is merely (THIS *ANI), an extraction from the "break" formula (10): it has not been confirmed by the text, and

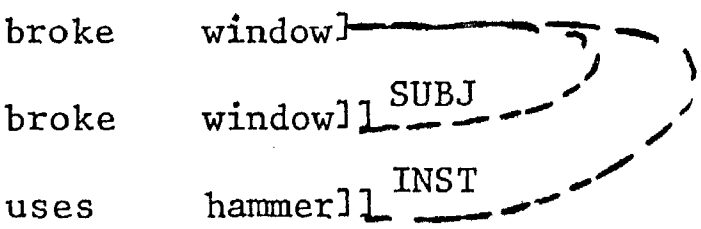
replaced by a full formula from a source template, as were the object and agent of (40).

Let us turn finally to the sentence matched initially as:

(42) [hammer broke window]

and again consider the extractions from (10) for "break" when at the action node of (42). We can produce the same SUBJ extraction as for (41) above, and we can again, using the "INST specialist", produce an extraction with USE as its main action primitive, as from (39), but in this example the dummies in the extracted template can not be filled in from an INST-tied template, as in (41), and as would be the case with "John broke the window with a hammer", but from the surface subject of the source template itself. Thus we obtain an extraction scheme for (42):

(43) [hammer broke window]
[[some+animate broke window]] SUBJ
[[some+animate uses hammer]] INST



It is, of course, essential here that the extractions are applied in a fixed order, so that the INST extraction can make use of the SUBJ extraction and know that "hammer" is not available to be the real agent of an extraction from (42).

Not all ergative verbs would receive identical treatment. Thus, the relation between:

(44) John moved the stone

and

(45) The stone moved

would not be the same as between the corresponding examples above for "break". The action formula for "move" in (44) would have CAUSE as head, but the action (again "move") in (45) would be a different sense and so a different formula, whose head would be MOVE, and which would not contain an instrument specification. So we would not expect any extraction:

[[some+animate moved stone]]

from (45), though we might well expect an extraction equivalent to (45) from the template for (44)

There can be legitimate dispute about the limits to which case extractions should go: so, for example, some writers (Parker-Rhodes 1975) would consider that "John wrote a letter" should be an inference from I received a letter from John , and he describes a lattice scheme in which an AGENT case is generally and legitimately inferred from a SOURCE case. That could only be achieved with the "SOURCE specialist" in the present system from a very full, specific, formula for 'letter' (and extractions can come from nouns and not only from verbs) in which a person) source was specified at the top level of the formula.

Two points should be noticed, in conclusion, about this method of producing a semantic structure appropriate to the ergative paradigm. First, the "case specialists" are not in general dependent upon the particular formula in which they operate (i.e. the word the formula is for), nor upon the primitive that is the formula head. Each specialist does, of course contain ranked side conditions but they are not, except in special cases, dependent on the head of the formula. It is not the case that every line of the specialist for case X, say, is of the form "if the head of the source formula is Y do Z, else ..." This point will be important in the next section when we consider Charniak's arguments concerning case.

Secondly, this way of describing the ergative paradigm is naturally different from Fillmore's because, as has been noted, he is primarily concerned with restrictions of the generation (=production !) of surface sentences by means of his ordered Subject Selection Rule: "If there is an agent it is the subject, else if there is an experiencer it is the subject, else if there is an instrument .... and so on". This way of looking at things assumes that John must in effect, already be marked as an agent, hammer as an Instrument or Object and so on. Simmons' analysis paradigms for the same example are, as we saw at the beginning, an analytic version of that rule. The difference between those two approaches and the present one is twofold. First, that the present system is preferential in that John does not

have to be marked as an agent: no confusion would be caused here, for example, if he was used as an instrument. Secondly, and more importantly, the construction here of the ergative representation follows not only from the application of the "case specialists", but from the general rule of preference (Wilks 1973a) that <u>as full (or maximally redundant) a representation should be produced as possible</u>. This is required, in addition to the case specialists, to produce the extraction

[[some+animate broke window]]

from, the less redundant ergative, (41). On this ground I would argue that the phenomenon is dealt with here using a more general rule, and moreover, a general rule that drives this whole preference semantics system of analysis.

CHARNIAK'S BRIEF ON CASE

In a recent paper, Charniak (1975) has argued that AI systems that use case notation in their analysis of natural language are not <u>really</u> making use of case, and the present system is one of those he criticises in this connection. Arguments along the same general lines are to be found in Welin (1975). I think Charniak's arguments are important and stimulating, though in some ways misguided. They have the paradoxical side-effect of showing that not even Fillmore is really making use of case. I shall briefly summarise seven aspects of Charniak's complex argument, and make some reply.

(i) The position argument. Charniak distinguishes between case notation and position notation (ibid. pp. 3-4). If we have an event of Jack opening the door with a key then, for Charniak, a case form of that would be:

(PREDICATE EV OPEN) (AGENT EV JACK) (OBJECT EV DOOR) (INSTRUMENT EV KEY)

whereas OPEN(JACK, DOOR, KEY)

would be pure <u>position notation</u>. He argues that many AI systems claim to be using case notation but in fact are using only position notation: using places arbitrarily to pass particular case arguments to a predicate.

(ii) The evacuation argument. Charniak argues that the standard benefit of case --- the production of, say, the ergative paradigm for

"open" from a case representation as in (i) above, together with a subject selection rule --- can be obtained equally well with the position notation, (ibid. p. 17). In other words, the whole business can be evacuated of case altogether, with the case names remaining perhaps as "mnemonic variable names" (ibid. p. 27).

(iii)The linearity argument. Charniak argues that the expression of meaning in terms of case is non-linear. Schematically, if it was linear it would look like:

MEANING(LOOK)=MEANING(OBSERVE)+MEANING(AGENT)

while the meaning of "see" would have EXPERIENCER where the above has AGENT. However, in AI systems it tends to be non-linear, like:

MEANING(LOOK)=MEANING(OBSERVE,AGENT)

or, in other words, the meaning of MEANING(AGENT) cannot be computed independently of knowing that the agent is the agent of OBSERVE.

(iv) The production argument. Charniak argues that the notion of case for Fillmore is essentially connected with its productive generative role in controlling surface grammaticality, and that since AI systems are preoccupied with analysis, they are not making use of case.

(v) The case-content argument. Charniak argues that we are never told what it is to be an agent as such. This is a subargument

of (iii) above that one cannot compute MEANING(AGENT) independently.

(vi) The surface analysis argument. Charniak demands that the "semantics-based systems" in AI also do surface case analysis, of the type found in Fillmore's papers. He argues that some such analyses, like the formula given earlier for "drink", actually exclude the surface forms, but I showed earlier that this is not so.

(vii) The case-inference argument. Charniak argues that a system using case for semantic representation should provide "case inferences". The meaning of case CASE would then be "the set of inferences one can make about X, knowing only that X is in case CASE" (ibid. p. 19).

In reply, I think Charniak misjudges where the heart of his argument lies by giving undue prominence to rather bizarre arguments like (i) and (ii), whereas the serious ones are those like (iv) and (vi) that draw attention, as this paper has tried to do from a quite different point of view, to the need to relate the use of case in "semantics-based understanding systems" to its original Fillmorean role as a classifier of superficial forms, like preposition and other case constructions in English. I would paraphrase Charniak's argument on this point, perhaps unfairly, as claiming that "case" takes its meaning from surface phenomena and therefore any attempt to locate it only in a deep semantics, wholly divorced from such phenomena, is to make "case" meaningless. My answer to that, and it is a serious charge, is the

presentation, here and elsewhere, of a system that both parses surface English by means of case and expresses its underlying semantics in the same notation.

The third aspect of Charniak's arguments, like (v) and (vii), is his concern with the precise content of the cases. This bothers everyone, including Fillmore, who had been unable to provide it, and so if the production of such definitions is made a necessary condition of using case then Fillmore, like everyone else, fails the test.

Let me, in conclusion, reply to the arguments above in a little more detail.

(i) is, I think, simply confused. The two (case and position) are simply equivalent forms of information, provided one knows that the "first argument is the agent" etc. etc. Charniak himself seems to see this when he admits (ibid. p. 4) that one could have case notation without case, and case without case notation.

(ii) shows only the triviality that any computational system could have all its top level notions replaced by gensyms, like G00567, and function in the same way. This would not however show that the notions being programmed were not essential to the meaningful function and interpretation of the system. In any system doing propositional logic, the notion AND can properly be replaced by a truth-table vector 1000, but that does not show that the notion AND represents is

vacuous, or a mere mnemonic convention.

(iii) does not establish that systems must be wholly linear, in Charniak's sense. However, it would clearly be a defect in a system if, every time an inference about AGENT was made, the system had to look and see what verb it was the agent of, or what the primitive action coding the verb was. Some examples of Schank's that Charniak discusses do show that this access to the head primitive is sometimes made, and Charniak then argues that the case is ipso facto dispensible, and the inferences are better seen as inferences from that head primitive action. But, as I pointed out when discussing extraction, the "case specialists" in the present system, at least, do not generally make such reference back to the action head. So, for example, the "GOAL-specialist" did not have to find out, before operating, what the action was that a given GOAL was a goal of.

(iv) and (vi) These arguments are partly true but their points are met by presenting a system, like the preference semantics one, that uses case both as a semantic representation and a parsing mechanism (the paraplates).

(v) It is true that no system, Fillmore's included, has given precise definition of the cases beyond the most general indications, such as that agency is concerned with initiating force etc. This criticism is true far beyond case: it applies equally to notions of thinghood, causation and movement etc. It is just a fact that basic

semantic notions are vague, and perhaps necessarily so. It is certainly no ground for lament, and does not prevent us speaking precisely in everyday life. Provided, therefore, that a programmed system can perform precisely using these vague notions, we can demand no more. The fallacy is to imagine that underneath the vague notions used in thought, speech and writing, there must lie precise criteria for their use. This is a persistent fallacy that has received much attention in Twentieth Century philosophy.

In the present system, as in many others, specifications (selectional or preferential) are given of the agents of particular actions (human for "think", animate for "see", and so on). One could argue that "agents as such" are, if anything, the union of all such agents, but that will not, and cannot, yield an intensional definition of the notion. Extraction operating on such specifications (the "SUBJ-specialist") yields inferences such as that "some animate does so and so", but these do not meet Charniak's demand in (vii) above.

It is worth noting at this point that Charniak puts his demand (or test for "using case") in such a way (in points (v) and (vii) above) that it is hard to see what could satisfy it: what result of computation could we conceivably expect as the value of MEANING(AGENT)?

I would maintain that extractions, as described above, are most certainly "case inferences", but are not "the set of inferences one

can make about X, knowing only that X is in case CASE" (ibid. p. 19) because that set is not the sort of thing one wants to know in a language understanding system. The "case specialists" in operation produced inferences by taking information from the appropriate points in the representation; but from knowing merely that John is an agent nothing interesting follows or could follow! (And from that fact nothing follows to the effect that agency is vacuous, as Charniak seems to think). The most that could follow would be that John does something or instigates some act.

We could hardly infer at that point that John was animate, because that is presumably information generally attached to "John", and, in any case, some verbs (like "calculate") may have a selection or preference restriction on their agent that is more general than animate, so that being animate could not follow from being an agent.

To infer anything useful, as in the extractions earlier in the paper, we have to look not just at what John is the agent of (which would make the whole thing circular for Charniak, by argument iii), but potentially at all the information available in the representation.

It is, perhaps, significant that agent is the case that makes Charniak's point best. The other extractions answer it better, for example in the way the " INST-specialist" creates an extracted template with action USE; or the way the "GOAL-specialist" extracted an

inference "John strikes stags" in a manner independent of the fact that the source action was "fire at", for the "GOAL-specialist" did not consult the source verb name or its head primitive action CAUSE. Or, again, the way in which common-sense inference rules (Wilks 1973c, 1975a, 1975b, but not discussed in this paper) would operate on any such extracted GOAL template and infer that the corresponding agent wanted the GOAL (whatever it was). And an inference rule like this latter can operate only if it can locate the corresponding agent. So, when we extracted the GOAL equivalent to "John strikes stags", we would have (in order to operate the new inference rule) to be able to find that John was the agent of the extracted template if we wanted to infer further that John wanted to strike the stags. The agent (John) will of course be the formula in the first position of the extracted template, and Charniak might then say that that does not require agency but only access to a first template position. This would be a reversion to the bad position argument (i), and the answer is simply that the mechanism goes to the first position because that is where the agent has been put; in just the way that dollars are written before the decimal point and cents afterwards yet that fact does not allow us to dispense with the notions of dollars and cents in financial calculations. However, the important point here is that the "seeker of the agent" would seek it generally: it would not matter what the action (striking) in the extracted template was.

The real point behind Charniak's "position" argument (i) is that no AI systems have such general routines, and hence an agent for one verb could be stored quite differently from that for another because there are no such routines that would ever find this out! And that I believe is not the case.

REFERENCES

Bruce, B. (1975) Case systems for natural language. Artificial Intelligence, 6, 327-360.

Celce-Murcia, M. (1972) Paradigms for sentence recognition. (Los Angeles: UCLA Department of Linguistics).

Charniak, E. (1975) A brief on case. Working papers No. 22 (Castagnola: Inst. for Semantic and Cognitive Studies).

Fillmore, C. (1968) The case for case, in (eds) Bach & Harms, Universals in Linguistic Theory. (New York: Holt, Rinehart & Winston) 1-90.

Fillmore, C. (1971) Some problems for case grammar, in (ed) O'Brien, Linguisticics: developments of the sixties (Washington DC: Georgetown UP), 35-56.

Fillmore, C. (1972) Subjects, speakers and roles, in (eds) Davidson & Harman, Semantics of Natural Language (Dordrecht: Reidel),1-24.

Fillmore, C. (1975) The case for case reopened. Lecture at Univ. of Bielefeld.

Hays, D. (1964) Dependency theory: a formalism and some observations Language, 40, 511-525.

Herskovits, A. (1973) The generation of French from a semantic representation. Memo No. AIM 212 (Stanford, Calif. Computer Science Dept.)

Lyons, J. (1968) An Introduction to Theoretical Linguistics. (Cambridge: Cambridge UP).

Mellema, P. (1974) A brief against case grammar. Foundations of Language, 11, 39-76.

Norman, D. & Rummelhart, D. (1975) Explorations in Cognition. (San Francisco: Freeman).

Parker-Rhodes, A. (1975) Inferential Semantics. Unpublished MSS.

Postal, P. (1971) On the surface verb 'remind', in (eds) Fillmore & Langedoen, Studies in Linguistic Semantics, (New York: Holt, Rinehart & Winston), 181-270.

Rieger, C. (1974) Understanding by conceptual inference. Amer. Jnl. Comput. Ling., 13.

Riesbeck, C. (1974) Computational understanding. Memo No. 4 (Castagnola: Inst. for Semantic and Cognitive Studies).

Sardewall, E. (1972) PCF-2, A first-order calculus for expressing conceptual information. (Uppsala Univ.: Computer Science Dept.).

Schank, R. (1969) Linguistics from a conceptual viewpoint. Memo No. AIM-88 (Stanford Calif.:Computer Science Dept.)

Schank, R. (1973) Identification of conceptualizations underlying natural language, in (eds) Schank & Colby, Computer Models of Thought and Language. (San Francisco:, Freeman) 187-248.

Schank et. al. (1970) Spinoza II. Memo No. AIM-109 (Stanford Calif. Computer Science Dept.)

Simmons, R. (1973) Semantic networks, in (eds) Schank & Colby, Computer Models of Thought and Language, (San Francisco: Freeman, 63-113.

Watt, W. (1968) Habitability. Jnl. Amer. Soc. Infor. Sci., 19, 388-394.

Welin, C. (1975) Semantic networks and case grammar. Memo No. 29 (Stockholm University: Inst. of Linguistics).

Wilks, Y. (1968) Computable semantic derivations. Memo No. SP-3017. (Santa Monica: Calif. Systems Devel. Corp.)

Wilks, Y. (1972) Grammar, Meaning and the Machine Analysis of Language, (London & Boston: Routledge.)

Wilks, Y. (1973a) Preference Semantics, in (ed) Keenan, The Formal Semantics of Natural Language, (Cambridge: Cambridge UP), 329-350.

Wilks, Y. (1973b) An artificial intelligence approach to machine translation, in (eds) Schank & Colby, Computer Models of Thought and Language, (San Francisco: Freeman), 114-151.

Wilks, Y. (1973c) Natural language inference. Memo No. AIM-211 (Stanford, Calif. Computer Science Dept.)

Wilks, Y. (1975a) An intelligent analyser and understander of English. Comm. A.C.M., 18, 264-274.

Wilks, Y. (1975b) Natural language systems within the AI paradigm. Memo No. AIM-337 (Stanford, Calif.: Computer Science Dept.), and Amer. Jnl. Comp. Ling., 40 (1976).

Wilks, Y. (1975c) Seven theses on artificial intelligence and natural language. Memo No. 16 (Castagnola: Inst. for Semantic and Cognitive Studies).

Woods, W. (1970) Transition network grammars for natural language analysis. Comm. A.C.M., 13, 591-606.

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WASHINGTON DEVELOPMENTS

FEDERAL RESERVE UNDERTAKES MAJOR EFTS PROJECT

The Federal Reserve System (the "Fed") is developing a pilot project in co-operation with the National Automated Clearing House Association (NACHA), to implement electronic fund transfers (EFT) between regional automated clearinghouses (ACH's) The project will involve Federal Reserve districts for Boston, New York, Cleveland, Atlanta, Dallas, and San Francisco. The system will utilize the Federal Reserve s existing communications network, "Fed Wire," and the FRCS Bulk Data capability for transmitting funds between ACH sites. While the project has received little public exposure or announcement outside of the trade press, its initial phases have been underway since July, and it is scheduled for completion (including transmission of live payments) by December, 1976

Federal and private reaction. The provision of EFT services by the Federal Reserve has been the subject of comment, from both the Federal and private sectors. Earlier this year, in commenting generally upon the provision of EFT services by the Federal Reserve, John Eger (then director of the White House Office of Telecommunications Policy) said, "[t]here do not appear to be any economic or technological reasons for the Federal Reserve to involve itself in the actual provision of [EFT] services. Accordingly, absent any compelling justification for government entry into this market, the private sector should be left to provide electronic funds transfer services in an environment that is free from government operational involvement." This viewpoint has been reinforced by comments from potential private vendors of EFT services which have been filed with the National Commission on EFT (NCLFT); such groups have called for public hearings on the exchange project prior to its full implementation.

In an interview appearing in *EFS-Industry Report*, OTP Assistant General Counsel Thomas McKnight said that the project suggested the "surreptitious development of an on-line capability," and called it a "move without regard to the wishes of the NCEFT, Congress, and the private sector is to how the ultimate complexion of the nation's EFT systems should appear."

The p[redacted] also raises privacy concerns, due to the potential access that the Fed, as a Federal government agency, would have to financial data of private citizens in a full scale EFT system.

Post-pilot activity. While the Fed's proposed project lists as its objectives a compilation of recommendations and possible problems involved in EFT systems, a planning document for the project clearly comtemplates an expanded Federal government role; in particular, the document states that the pilot "should be conducted in the most realistic environment possible. . . . [C]onsideration should be given to the desirability of selecting participants that have a broad base of interregional activity, *which would facilitate expansion of the program to other nonpilot ACH's in the future.*" (Emphasis supplied).

While the NCEFT has not taken a definitive stand on the project, it has been a topic of discussion at recent meetings of the Commission.

SENATE REVERSES DECISION ON SSN USAGE

The Senate recently approved an amendment to the Tax Reform Act of 1976, which would eliminate some of the restrictions on Social Security Number usage originally implemented by the Privacy Act of 1974. Specifically, the amendment would allow state governments to demand disclosure of an individual's SSN, and to provide information on an individual so identified to the Parent Locator Service operated by the Federal department of Health, Education and Welfare. The amendment was a compromise between Senate forces which on one side wish to remove all restrictions on SSN usage, and on the other wish to restrict its usage to legitimate needs of State taxing authorities.

NBS FORMS TASK FORCE ON LIBRARY AND INFORMATION NETWORK STANDARDS

The National Bureau of Standards has announced the establishment of a task force to "address the problem of developing high level computer-to-computer protocols for the nationwide interchange of information among existing and planned Library and information science networks." Task force members were chosen by the National Commission on Libraries and Information Science, based on their expertise in the area of computer-to-computer data interchange for such applications, and their competence in developing related standard protocols for computer networks.

The task force, which will receive technical support from the NBS Institute for Computer Sciences and Technology, is expected to complete its efforts in approximately one year, and provide results to the American Society for Information Science, the American National Standards Institute, and other related organizations.

Further information may be obtained through the ARIPS Washington Office or by contacting Mr. John L. Little in NBS, at (301) 921-3723.

CONGRESS TO UTILIZE NEW DATA BASE SERVICES

The Congress will take an initial step toward access to Executive Branch information systems (See *Washington Report, #76*) this month when the General Accounting Office inventory of over 1,000 systems in 53 different Executive agencies is made available on-line to members of Congress through the SCORPIO data base maintained by the Library of Congress.

In addition, SCORPIO is scheduled to be augmented with a new daily index to the *Congressional Record*. The file, which will be updated daily will be accessible by 170 subject terms, and will contain complete data back to the beginning of the second session of the 94th Congress (from 1/19/76). Available data will include summaries of floor actions, recorded votes, and the location of Member's statements made during debate.

NEW OTP DIRECTOR STATES INITIAL POSITIONS

In his first press conference, the new director of the White House Office of Telecommunications Policy (OTP), Thomas J. Houser, revealed both similarities and differences of opinion with his predecessor, John Eger. According to reports in the trade press, Houser intends to continue Eger's advocacy of deregulation in the telecommunications industry, and support for private sector initiatives. In contrast to Eger, however, Houser has taken a neutral stand on the legislation now before Congress which would reassert AT&T's monopoly status in communications (*Washington Report*, 7/76)

Houser said that OTP would continue to be interested in data communications, privacy and electronic funds transfer; he further announced that the Office would develop by the end of the year a document which would take a long range look at telecommunications, and would contain statements of principles by OTP and private industry, respectively. While Houser indicated that OTP was not presently taking position on the Federal Reserve Board's ACH exchange project (*Washington Report*, this issue), he said that the OTP staff was preparing a position paper.

NEWS BRIEFS

The National Bureau of Standards (NBS) has published Federal Information Processing Standards (FIPS) PUB 40, *Guideline for Optical Character Recognition Forms* (#, enclose $1.80).

The National Science Foundation (NSF) has released *Grants and Awards for Fiscal Year 1975* (#, enclose $3.10).

The NSF Science Resources Service has released *National Patterns of R&D Resources: Funds and Manpower in the United States, 1953 - 1976* (#, enclose $.95).

Joseph J. Ryan has been appointed as special assistant to the director of the White House Office of Telecommunications Policy.

NSF has reported that Federal obligations for research and development are $19.0 billion for fiscal year 1975, and are expected to be $21.6 billion in 1976 and $23.5 billion in 1977.

OSTP DEVELOPMENTS

Against the background of enabling legislation passed earlier this year (*Washington Report*, 5/76) the Senate has confirmed Dr. H. Guyford Stever as director of the new White House Office of Science and Technology Policy (OSTP). While President Ford's nomination had apparently been delayed until the outcome of the Republican delegate race was clear, confirmation was readily obtained in the Senate. Dr. Russell Drew, formerly on Dr. Stever's staff at the National

Science Foundation (NSF), is one of the first OSTP staff members and will serve as Deputy Director for Security & International Affairs.

The topics of telecommunications and information systems have been identified by the Federal groups planning for OSTP as areas of attention for the Office. More generally, these Advisory Groups identified eight major issue areas: organization of OSTP itself; oceans; energy; food; nutrition; industrial productivity; health and safety; and basic research. Several of the specific issues identified by the groups relate directly to computer technology; e.g How should OSTP identify and promote incentives for accelerated application of new information handling technology in both government and private sectors? Are there telecommunications initiatives that should be pursued by OSTP? What should be the relative roles of OSTP and the Office of Telecommunications Policy in these areas? (The full set of 65 OSTP issues is available through the AFIPS Washington Office.)

President Ford also has appointed Dr. Simon Ramo of TRW as chairman of the new President s Committee on Science and Technology (PCST), a long range planning group created by the OSTP legislation. The Committee is to survey the overall Federal science, engineering and technology effort, submit an interim report with recommendations one year after its inception and a final report with recommendations within two years. While Dr. Ramo has not yet outlined his program, he is known to place a high priority on computer technology and particularly on its application to improve productivity.

afips Washington Report 81

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Vol. II, No. 9 October, 1976

WASHINGTON DEVELOPMENTS

HOUSE HOLDS HEARINGS ON AT&T LEGISLATION

Just prior to adjournment of the 94th Congress, second session the House of Representatives held preliminary hearings on HR12323, (*Washington Report*, 7/76). The House Subcommittee on Communications had sought testimony on three primary topics: (1) the advantages and disadvantages of Federal Communications Commission (FCC) policy allowing competition in the telecommunications industry, (2) the identification of unresolved issues relating to competition, and (3) identification of further information necessary prior to a subcommittee decision

AT&T Testimony. AT&T chairman John D. deButts testified that the proposed legislation would not affect the profitability of his company, since AT&T would in any case petition the FCC for rates which would allow sufficient earnings to attract capital. DeButts reiterated AT&T s primary argument, however that such competition would likely *shift* cost burdens from business to residential users of the system. DeButts maintained under questioning that competition permitted by the FCC had required AT&T to adapt its design standards and operating methods to competitive equipment, had complicated network planning, and had divided markets which could more economically be handled (by virtue of economies of scale) by a single system.

Response from competitive vendors. Representatives of numerous companies competitive with AT&T in both voice and data communications testified during the second day of hearings. Philip Wittaker of Satellite Business Systems (SBS) argued that AT&T was but one of many companies in command of the technology and that further national economic development required the resources and expertise of these companies in a competitive environment, in order to meet the needs of specialized users. He maintained that SBS will make available services not now offered or proposed by other carriers and which will be significantly advantagous to users. Telenet Vice President Philip Walker submitted that if the AT&T legislation were effective in 1974, Telenet's applications to provide packet switching services (which are not provided by AT&T) would never have been approved. Walker proposed that AT&T be permitted to provide competitive services only through subsidiary companies Peter McCloskey of the Computer and Business Equipment Manufacturers Association (CBEMA) testified in favor of competition in the manufacture of terminal equipment, arguing that the market itself provides the mechanism necessary to allow users a choice of equipment at the lowest possible prices

FCC Chairman Wiley. Richard Wiley opened by describing existing exceptions to monopolistic network control, including independent telephone companies and independently produced equipment used by telephone companies. Wiley also

stated that the proposed legislation would jeopardize significant new developments such as data communications and EFT systems, and would allow concentrated control over this "increasingly vital and sensitive information system." The FCC had in May of this year submitted written comments oppos ing the proposed legislation, on the grounds that it would inhibit the development of consumer alternatives, and allow higher costs; the FCC also maintained that AT&T would be allowed to collect and dispense "substantial subsidies" without effective Federal oversight.

Speaking for the Justice Department, Assistant Attorney General Baker praised FCC regulation for allowing competition where possible in the common carrier field Baker stated that competition brought substantial benefits, and urged the Congress to pursue such competitive solutions. Baker maintained that existing data to substantiate AT&T's claims of economy of scale was inconclusive; he indicated that local message switching may involve economies of scale, but that the manufacture of terminal equipment probably did not.

SENATE SCIENCE AND TECHNOLOGY COMMITTEE REORGANIZATION

The Senate in recent hearings considered three alternative plans to restructure its complex system of 174 subcommittees which relate to science and technology. The Temporary Select Committee to Study the Senate Committee System is focusing on this area by considering primarily three alternative plans which, if adopted, would be subject to further modification. The first plan would retain the existing committee organization, but would significantly reduce the number of committee members and reorganize committee jurisdictions. This plan involves several different options, one of which would create a Committee on Science and Technology which would have jurisdiction over science, engineering and technology (including aeronautics and space) its oversight jurisdiction would encompass the new White house Office of Science and Technology Policy, the National Bureau of Standards, the National Science Foundation and the Congressional Office of Technology Assessment. The second plan would consolidate the existing thirty-one committees into twelve standing committees, with a possible option to again create a Committee on Science and Technology. The third plan would create five broad committees on government human, natural and financial resources, and on defense and foreign policy, each of which would have responsibilities for relevant agencies in the Executive Branch.

The Senate is expected to deal with these proposals when the 95th Congress convenes next year.

NSF DEADLINE FOR COMPUTER SCIENCE OR ENGINEERING PROPOSALS

National Science Foundation (NSF) Division of Mathematical and Computer Sciences has announced a November 1, 1976 deadline for computer science or computer engineering proposals for Fiscal Year 1977 Funding. Prospective grantees can request NSF document 76-20 (#) which describes current programs in the Computer Sciences Section (CSS): Theoretical Computer Science (Dr. W. Richard Adrion), Software Systems Science (Dr. Thomas Keenan), Software Engineering (Dr. Bruce Barnes), Intelligent Systems (Dr. Sally Sedelow), Computer Systems Design

(Dr. John Lehmann) and Special Projects (Dr. Fred Weingarten).

According to Dr. Kent Curtis, head of CSS, a new guide for preparation of proposals will be released shortly. Proposals are to contain (1) a statement of intended research, (2) a statement of related research in progress or completed, (3) a budget, (4) vitae on principal investigators and, optionally, (5) an appendix describing relevant unpublished literature.

CSS is receiving proposals in all programs mentioned above, and expects a six month turnaround in processing proposals. Applicants may contact NSF directly at (202) 632-7346 or obtain assistance through the AFIPS Washington Office

GAO REPORTS ON FEDERAL MODELING

The General Accounting Office (GAO) has released a report on "*Ways to Improve Management of Federally Funded Computerized Models*" (#-enclose $1.00). The report concludes that appropriate standards from the Department of Commerce, and guidance from the General Services Administration should be provided for improving management of such models. GAO developed and proposed a phased approach for planning, managing and controlling the development of computerized models which consists of five phases: problem definition, preliminary design, detailed design, evaluation, and maintenance. According to GAO, this approach will reduce costs overruns and result in models better suited to the needs for which they are designed.

OBM PROPOSED STANDARD COMPUTER SCIENCE CLASSIFICATIONS

The White House Office of Management and Budget (OMB) recently released a draft *Standard Occupational Classification [SOC] Manual* which categorizes the occupational structure of the U. S. work force. It is anticipated that the Manual would be used by the Department of Labor and other Federal agencies for categorizing manpower data collected or required by the Federal government.

The SOC is intended to provide a mechanism for cross referencing and aggregating occupation-related data collected for social, economic and statistical reporting programs.

According to OMB, a standard classification "has become an urgent need in order to maximize the utility of [Federal] statistics . . . The classification should . . . facilitate long-range analyses, should reflect the structure of the world of work as realistically as possible and should provide the mechanism by which data from disparate sources can be linked." The Standard Occupational Classification was developed under an interagency committee established by OMB. Although no direct contact was made with AFIPS, OMB stated that professional organizations and other interested parties were provided an opportunity to comment on the classification

The Manual is structured heirarchically and, for example, proposes the following categories for "computer scientists:"

NATURAL SCIENTISTS AND MATHEMATICIANS
181 Computer Scientists
1812 Computer Systems Analysts
Applications engineer
Engineering analyst
Programer engineering and scientific
Systems engineer
Computer analyst
Computing-systems analyst
Computer-systems planning
Systems analyst, data processing
Systems analyst, computer systems
Systems engineer-189,739
1819 Computer Scientists, Not Elsewhere Classified
Systems engineer electronic data proc
Systems analyst business electronic d
Computer application engineer
Digital-computer programmer
Electronic data programmer
Methods analyst, computer
Software specialist

Possible AFIPS comment is presently being explored by the Washington Office.

NEWS BRIEFS

The National Bureau of Standards (NBS) held a September 21 and 22 workshop on its proposed data encryption standard, to address the "strength" of the algorithm, formal proofs of security, effectiveness of the standard in different modes, and keying variable control and distribution.

The FCC has proposed a "network access charge" for connection of both common carrier and privately purchased terminal devices.

The U. S. Comptroller General has issued a booklet entitled *"Acquiring Financial Management & Other Information Systems"* which synthesizes GAO guidelines for the acquisition of such systems (#); the publication discusses systems planning, contracting, design, development, testing, implementation and operation.

The Commerce Department is considering a new procedure in export control of computer hardware which would allow manufacturers to certify the performance levels of their own equipment.

Robert Ross has been appointed general counsel of the White House Office of Telecommunications Policy.

According to the trade press, AT&T and CBEMA have held discussions on a possible interconnection standard for data communications equipment.

The U. S. Privacy Protection Study Commission held an October 13-15 workshop on state privacy and fair information practices acts in St. Paul, Minnesota.

The Privacy Protection Study Commission solicited private sector organizations to submit information on employment and personnel record-keeping practices by October 15.

AFIPS IN WASHINGTON

AFIPS ORGANIZES FCC PLANNING CONFERENCE

Plans have now been finalized for AFIPS to provide a planning conference on computer communications to the Federal Communications Commission. A copy of the press release for the Conference is appended to this issue of the AFIPS *Washington Report*.

AFIPS ATTENDS SCIENCE COURT COLLOQUIUM

In September the director of the AFIPS Washington Office attended a colloquium on the proposed "Science Court" sponsored by the Department of Commerce, National Science Foundation, and American Association for the Advancement of Science. The Science Court has been proposed by Dr. Arthur Kantrowitz, a member of the Presidential Advisory Group on Anticipated Advances in Science and Technology, as a means of adjudicating scientific disputes which are part of major public polity decisions. The proposed Court would deal only with scientific issues leaving policy matters for the normal decisionmaking groups within the Executive, Legislative and Judicial branches of the Federal government. While utilizing an adversary hearing, the Science Court would attempt to deliver definitive, credible rulings on scientific issues, or at least to identify the current state of scientific knowledge.

The Colloquium heard divergent views on the merits of proceeding with an experimental science court and while there was by no means a consensus, the prevailing opinion appeared to be supportive of going forward with such an experiment. In particular, the colloquium heard favorable views from both Presidential Science Adviser Guyford Stever and Secretary of Commerce Elliot Richardson.

CIVIL SERVICE COMPUTER SCIENTIST OCCUPATIONAL STANDARD

The Executive Committee of the Association for Computer Machinery (ACM) recently provided comments to the U.S. Civil Service Commission on the proposed Federal occupational standard for a "Computer Science Series" (*Washington Report*, 8/76) Both ACM president Herb Grosch and vice president Dan McCracken sent letters to the Commission; McCracken summarized the Executive Committee comment as follows:

> We believe that the standard is weak in requiring 18 hours of mathematics courses for all computer scientists, without differentiating between courses that are of relevence to computer science, and those of essentially no value except for those few who specialize in numerical analysis. It would be possible to meet the educational requirements of this standard with a selection of courses providing a background inappropriate for most work with computers, even work in computer science. Further, there is much professional work with computers that does not require even this much mathematics Finally, we believe that the field of computing is still so new and so much in flux that any standard in this area should be provisional and should be frequently revised.

PENDER McCARTER, LINDA MARTIN JOIN AFIPS WASHINGTON STAFF

Mr. Pender McCarter recently joined as research associate, and Ms Linda Martin as secretary, the staff of the AFIPS Washington Office.

Mr. McCarter comes to AFIPS from his position as editor of: *EFTS--Industry Report; Peripherals Weekly;* and *Software Digest;* all publications of EDP News Services of Washington. He had earlier undertaken significant research for AFIPS in connection with the *AFIPS Study on Professionalism,* and the AFIPS roundtable on "Professionalism in the Computer Field" held in 1970. McCarter's journalistic insight into Washington and related information processing issues is expected to be a strong asset to AFIPS in Washington; he will be responsible for the *AFIPS Washington Report* as well as research efforts undertaken through the AFIPS Washington Office.

Ms. Martin also brings with her in addition to the skills required for the numerous support functions within the Washington Office, both exposure and training in the information processing field by virtue of her previous position with Sperry Univac in Washington, D. C. A graduate of Cushing Jr. College, she has had significant Washington experience through positions in both the Federal Government and a nonprofit association. Ms. Martin replaces Marcie Terrones, who left AFIPS in September.

We offer Pender and Linda our best wishes in their work with AFIPS, and welcome them to the staff.

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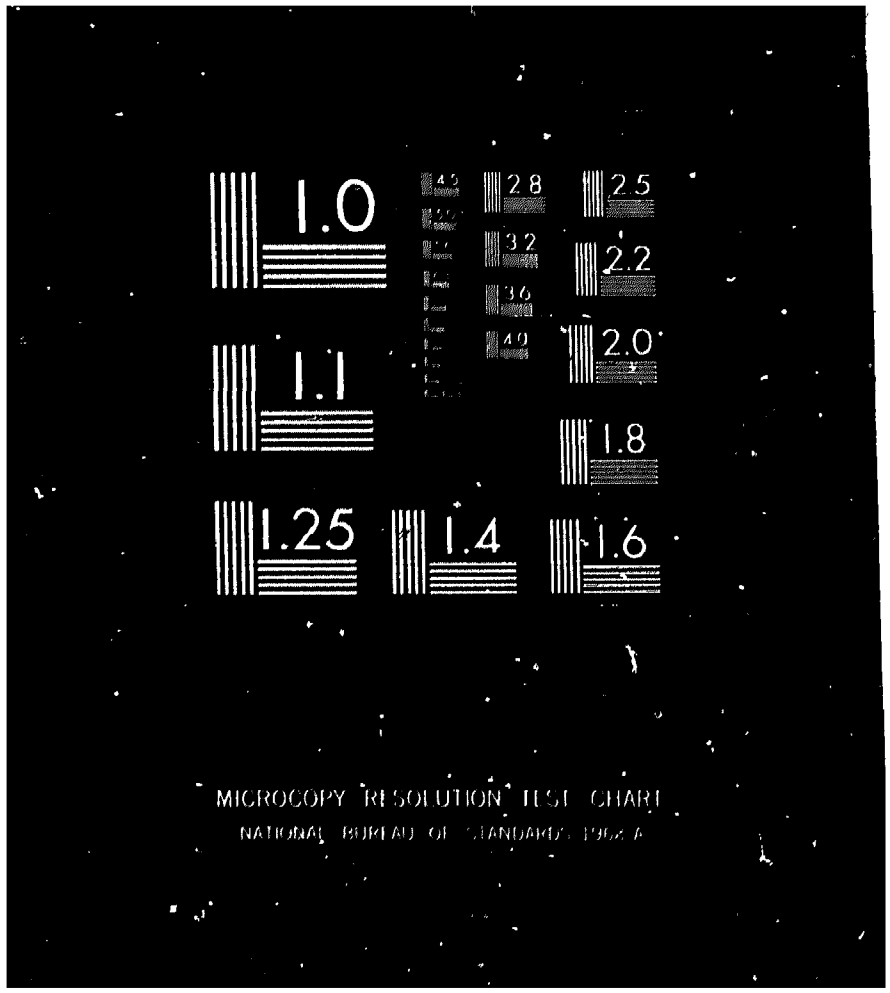
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