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ASSOCIATION FOR COMPUTATIONAL LINGUISTICS

14 TH ANNUAL MEETING

SAN FRANCISCO - OCTOBER 8 - 9, 1976

ACCOMMODATIONS: HILTON HOTEL

SESSIONS: ST. FRANCIS HOTEL

REGISTRATION: \$15 FOR MEMBERS
\$20 FOR NONMEMBERS
\$10 FOR STUDENTS

PROGRAM: FRIDAY OCTOBER 8

8.30 Registration

TECHNIQUES IN LANGUAGE PROCESSING

9:00 AN EASILY COMPUTED METRIC FOR RANKING ALTERNATIVE PARSES
George E. Heidorn, IBM Research ... *Abstract, Frame 5*

9:30 MEDIAN SPLIT TREES: A FAST LOOKUP TECHNIQUE FOR
FREQUENTLY OCCURRING KEYS
B. A. Sheil, Harvard University ... *Abstract, Frame 7*

10.00 TRANSLATING 'WELL-WRITTEN' ALGORITHM DESCRIPTIONS INTO
CODE
Jerry R. Hobbs, City College of CUNY . . . *Abstract, Frame 9*

10:30 GENERATING NATURAL LANGUAGE EXPLANATIONS OF COMPUTER
PROGRAMS
George E. Heidorn, IBM Research ... *Abstract, Frame 13*

11:00 THE SEMANTIC INTERPRETATION OF MASS NOUN EXPRESSIONS IN
THE PHLIQA 1 SYSTEM
Harry C. Bunt, Philips Research Laboratories ... *Frame 15*

11.30 · EMPIRICAL STUDIES OF NOUN MEANING
John Bennett, University of Wisconsin - Madison ... *Frame 18*

1:30 PANEL: EVALUATION OF NATURAL LANGUAGE SYSTEMS ... *Frame 21*

Chair: Joyce B. Friedman, University of Michigan

Participants: William A. Martin, M.I.T.

William H. Paxton, Stanford Research Inst

Stanley Petrick, IBM Research

Naomi Sager New York University

Eric van Utteren, Philips Research Labs

Terry Winograd, Xerox Research

FRIDAY, OCTOBER 9

MACRO MODELING OF NATURAL DISCOURSE

8 30 METHODS FOR MODELING DIALOGUE (SPECIAL GROUP PRESENTATION)

William C. Mann, James A. Levin, and James A. Moore
Information Sciences Institute, University of Southern
California ... *Abstract, Frame 22*

10.00 A PROCESS MODEL FOR SPEECH ACT UNDERSTANDING

Allen Munro, University of California, San Diego ... *Frame 3*

10.30 NATURAL LANGUAGE UNDERSTANDING BY COGNITIVE NETWORKS

Richard Fritzson, SUNY at Buffalo ... *Abstract, Frame 32*

11.00 HOW TO REPRESENT AND USE KNOWLEDGE ABOUT CAUSALITY

Charles J. Rieger, University of Maryland ... *Abstract, Frame 33*

11.30 A HEURISTIC SEARCH APPROACH TO DISCOURSE ANALYSIS

Jerry R. Hobbs, City College of CUNY ... *Abstract, Frame 35*

AN EASILY COMPUTED METRIC FOR RANKING ALTERNATIVE PARSES

GEORGE E. HEIDORN

IBM RESEARCH

The idea of attaching a modifier to its nearest potential modificand is often stated as a reasonable heuristic in natural language parsing. (This is essentially Kimball's Principle Number Two*, "Terminal symbols optimally associate to the lowest nonterminal node." Although Kimball calls this principle "right association" and illustrates it with right-branching examples, it can apply equally well to left-branching structures.)

In the sentence, "Are those invoices produced from the orders processed by the system in New York?", the prepositional phrase "in New York" could potentially modify "system", "processed", "orders", "produced" and "invoices", both syntactically and semantically. Similarly, "by the system" has four possibilities and "processed" has two. According to the heuristic stated above, the preferred analysis is: "in New York" modifies "system", "by the system..." modifies "processed", and "processed..." modifies "orders".

A "potential modificand" must be acceptable pragmatically as well as syntactically and semantically. This means that if the system referred to in the above example were spread

*Kimball, John. Seven principles of surface structure parsing in natural language. Cognition 2 (1), 15-47.

out over the entire country and just had one of its processing stations in New York, the preferred analysis would have had "in New York" modifying "processed" instead of "system". Similarly, dialogue context can have an influence on what qualifies as a potential modificand.

This paper describes an easily computed metric that involves attaching a number to each syntactic unit as it is formed, to rank the possible analyses for any portion of an utterance according to the above-stated heuristic. The technique is illustrated by its use in a system which supports a natural language dialogue for automatic business programming. This system utilizes syntax, semantics, pragmatics, and context to understand user utterances.

MEDIAN SPLIT TREES:

A FAST LOOKUP TECHNIQUE FOR FREQUENTLY OCCURRING KEYS

B. A. SHEIL

HARVARD UNIVERSITY

Median split (MS) trees are a new technique for searching sets of keys with highly skewed frequency distributions (such as the lexemes of a natural language). The basic idea is to modify frequency ordered binary search (FOBS) trees to contain two key values--a node value which identifies the key which resides at that node (as in a conventional binary search tree), and a split value which gives the largest key value to be found in the left subtree. (If the keys are expensive to store in the tree nodes, or costly to compare, they may be hashed into integers without affecting the algorithm.) Searching an MS tree proceeds as in a binary tree except that the decision to go left or right from a node whose node value does not match the current key is made by comparing the current key to the split, rather than to the node, value. The use of two different values allows one to prevent the search tree from being unbalanced as FOBS trees become when a high frequency key has an extreme key value. In fact, by selecting the median of the key values of a node's descendants as its split value, one can force the search tree to be perfectly balanced--which both allows a highly space efficient representation of the tree, and achieves high speed search.

The average cost per search in an MS tree, like a FOBS tree, depends on both the frequency distribution of the keys, and the ordering relation on them. Performance analyses for specific frequency distributions and key orderings of interest are presented, and it is shown that, unlike FOBS trees, MS tree search time is $\log n$ bounded and is very stable around a value that can be shown to be optimal for any binary tree search procedure. Furthermore, in addition to being substantially faster than "optimum" binary tree search, an MS tree can be build for a given ordering relation and set of frequencies in time $n \log n$, as opposed to n^2

A discussion of the application of MS trees to dictionary lookup for English is presented, and the performance obtained. is contrasted with hash and trie solutions.

TRANSLATING 'WELL-WRITTEN' ALGORITHM DESCRIPTIONS INTO CODE

JERRY R. HOBBS
CITY COLLEGE OF CUNY

In this paper we describe a system for the semantic analysis of "well-written" algorithm descriptions in English, such as one finds in Knuth (3), and the translation of the resulting structures into a program in a higher-level programming language, such as PL/I. There are two approaches one might take toward the sublanguage of algorithm descriptions. One may treat the English as a deviant programming language and try to smooth out the deviations. Or one may view the English as a well-behaved, highly regular form of natural language, and apply to the text the sophisticated techniques of analysis that have been developed for less tractable sorts of texts. We have taken the latter approach,

Semantic analysis is done by a system that has been developed for and is being tested on a variety of natural language texts (1). It takes as input the text in a predicate calculus-like notation produced by a syntactic front end (4, 2). It applies semantic operations which access a data base of "world knowledge" inferences that are drawn selectively, depending on context and in response to the operations. The operations are described below with examples that show their importance in analyzing algorithm descriptions:

1. Predicate interpretation: Inferences are sought to satisfy the demands predicates make on the nature of their

arguments.. Among other things, this operation recovers omitted material, for example when the whole is used to refer to the part. In

"T points to a binary tree"

the predicate "point" requires its second argument to be a node. The knowledge stored in the data base about binary trees is searched for a dominant node, the root node is found, and the sentence becomes

"T points to the root node of a binary tree."

2. Intersentence relations are determined by matching successive sentences against a small number of patterns. These patterns are stated in terms of inferences to be drawn from the current sentence and a previous sentence. An ordered heuristic search of the data base is used to locate the desired inferences. Intersentence relations are especially important in algorithm descriptions, for they determine the flow of control in the program. The most common and easily handled patterns in these texts are Temporal Succession, Cause, and Enablement. They are translated into successive lines of code.

But also important is the Contrast pattern: "The predicates of sentences S_1 and S_2 are the same. One pair of corresponding arguments are contradictory. The other pair are different but similar." Consider

"If $VAL(M) > VAL(N)$, set N equal to $LINK(N)$."

If $VAL(M) < VAL(N)$, set M equal to $LINK(M)$."

It is intended that these translate not into successive instructions, but into a case statement. This is keyed by the Contrast pattern. (The top-level predicate is "imply".)

Similarly, consider the sentences

(1) "Decrease N by 1, and if it is zero, reset it to MAX."

(2) "Decrease N by 1, but if it is zero, reset it to MAX."

In (1) the test for zero comes after decreasing N, in (2) before. This is because in (2), "but" invokes the Contrast pattern, forcing us to recover the implicit "If N is not zero" before "Decrease". (2) is translated into a case statement.

3. Knitting: Redundancies are recognized and merged. This frequently resolves anaphora as a byproduct.

4. Resolving anaphora: Antecedents not found by knitting are searched for by trying to maximize the redundancy of the text. In

"Decrease N by J, and if it is zero, reset it to MAX." "N" is chosen over "J" as the antecedent of "it" since it is N whose value is subject to change.

5. Search for Primitives: Certain predicates are "primitive" to this application, i.e. the task component has substitution rules for them. Where possible, a decomposition of the text in terms of these primitives is looked for. For instance, a tree is, in part, a set of nodes, a node is a set of fields, and a field may be a number. "Set" and "number" are primitives. To decrease N by 1 is to cause N to be equal to one less than before, and "cause to be equal to" is a primitive.

Semantic Analysis augments and interrelates the text. What is produced is then given to the task component which performs two functions:

1. The temporal succession relations discovered by operation 2 may form only a partial ordering on actions. A linear ordering is imposed.

2. Substitution rules are applied to primitives to translate the semantic representation into code. A set translates into an array declaration, a set of sets into a two-dimensional array. "Cause to be equal to" translates into an assignment statement.

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- 3 Knuth, Donald. The art of computer programming, 1. Addison-Wesley, Reading, Mass., 1968.
- 4 Sager, Naomi, and Grishman, Ralph. The restriction language for computer grammars of natural language. CACM 18 (7), July 1975, p. 30.

GENERATING NATURAL LANGUAGE EXPLANATIONS OF COMPUTER PROGRAMS

GEORGE E. HEIDORN

IBM RESEARCH .

An automatic programming system that converses with a user in a natural language must be able to generate explanations of portions of the program being produced. In the system that we are developing for producing customized business application programs, these explanations must be given in application terms rather than program terms. For example, the system might say, "The quantity shipped is the lesser of the quantity ordered and the quantity available," rather than "QS=MIN(QO,QA)".

One could certainly imagine generating such sentences by having an inventory of sentence patterns and name phrases and using a fill-in-the-blanks approach. However, in addition to not being very interesting, such an approach would certainly not provide the same flexibility of expression that a more linguistically motivated approach would. Also, it seems reasonable to do this generation by utilizing information that the system already has for understanding the user's English utterances.

In our system, information is stored in the form of a semantic network with three parts. The program part contains information about the programming language and about a specific program; the application part contains information about business concepts; and the language part contains information about English words. Each of these parts has its own internal structure, and there are links between the parts where appropriate. For example,

within the application part the node for the concept QUANSHIPD has a SUPerset arc to QUANT and a KIND arc to SHP. Between parts of the network, QUANSHIPD is linked as the RAO (Related Application Object) arc of the program node QS, the language node QUANTIT (the stem of "quantity") is linked as the RLO (Related Language Object) of QUANT, and the language node SHIP is the RLO of SHP. In general, the links between adjacent parts are many-to-many.

The linguistic processing in our system is specified by augmented phrase structure rules, uniformly for the three levels of processing: semantic, syntactic, and morphological. Given a pointer to a node in the program part, along with some information about what aspect of that node is to be explained, these rules can generate an appropriate English statement by utilizing the structure of the network. Because these statements are constructed from very small pieces (i.e. word stems), considerable flexibility of expression is possible, including taking into account dialogue context.

This paper will describe in some detail the overall method of generation, with special emphasis on complex definite noun phrases.

THE SEMANTIC INTERPRETATION OF MASS NOUN EXPRESSIONS
IN THE PHLIQA 1 SYSTEM

HARRY C. BUNT
PHILIPS RESEARCH LABORATORIES

A large number of the most commonly used, English nouns belongs to the category of mass nouns. In recent years it has become increasingly clear that the semantic analysis of expressions containing mass nouns encounters great difficulties because of the uncertain logical status of mass noun referents. This uncertainty is reflected in the appearance of a variety of vague terms, such as "substance", "quantity", "matter", "bits", "pieces", "stuff", etc. in recent literature on the subject (see Pelletier 1975). It is indeed fair to say that "the logic of mass expressions ... at present is grossly underdeveloped" (McCawley 1975)

Work in computational linguistics so far has not contributed to a solution or even a better understanding of the problems that mass nouns pose. In language understanding systems that have been developed in the past few years these problems have been evaded, either by restricting the admitted use of mass nouns trivially, as in the SHRDLU dialogue system (Winograd 1972), or by explicitly excluding their use altogether, as in the LSNLIS question answering system (Woods 1972).

The recently implemented question answering system PHLIQA 1 (Landsbergen 1976, Medema et al. 1975, Scha 1976) may be considered as a substantial step forward in this

respect. This system performs the semantic analysis of complex mass noun expressions, including quantifying phrases, adjectives, amount expressions, etc. The analysis is based on a theory, in which a central role is played by a logical formalism, developed for the semantic representation of mass expressions. These representations were required to meet the following conditions:

1. They should be in agreement with the ontological commitments of mass noun uses. In our view, the typical use of a mass noun indicates that the noun referent is viewed as a continuum; i.e. no articulation of the referent into individual elements is taken into consideration--which is of course not to say that the referent actually is a continuum.
2. They should bring the logical properties of mass expression to the light, e.g. rendering analytic sentences tautologically true.

The paper develops this semantic theory of mass noun expressions, and describes its incorporation in the semantic analysis performed by the PHLIQA 1 system.

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EMPIRICAL STUDIES OF NOUN MEANING

JOHN BENNETT

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A central problem for computational models of understanding is to formalize the meanings of words which are manipulated by the model. This paper reports on research directed towards the formalization of the meanings of nouns. The goal of the research is to describe nouns sufficiently to enable the performance of a particular task of understanding: the appropriate selection of verb senses for multiply-sensed verbs.

The hypothesis being tested is that noun meaning can be described by primitive "units of meaning," here called features. The concepts of semantic features and componential analysis are familiar; the contributions of this work are the development of empirical methods of analysis and the generation of a general set of features.

The effect of noun meaning on the sense of a verb can be clearly seen by examining simple sentences with identical syntactic structure and no extra-sentential context. To study noun meaning in a regular, non-subjective fashion, a large number of simple sentences of the form noun-verb-noun have been generated. In groups of the sentences, the subject noun and verb have been fixed, while the object noun is varied. The variance in the object noun causes the verb to have different readings, or different mappings of the lexical verb onto one of its senses.

From that group of nouns, in the object position; which cause the selection of the same sense for the verb in question, the common thread of meaning is extracted and posited as a semantic feature descriptive of that group of nouns. Repetition of this process for various verbs and nouns yields a set of semantic features. These features are considered as formalizing noun meaning at least for purposes of verb sense selection.

The major problems in the above approach are 1) the inevitable intrusion of subjectivity into the feature extraction task and 2) the lack of generality of the feature set beyond the particular group of nouns and verbs studied. Several methods have been used to control subjectivity: repetition of the process using the same verbs with different nouns and vice-versa, and the generation of features from the regular study of other tasks of understanding which involve nouns--noun-adjunct:noun pairs (e.g. school house) and noun analogies. To ensure as much generality as possible, the words considered in the study have been chosen from the set of (statistically) most common English words and do not comprise any unified semantic field.

Results have been interesting and encouraging. In addition to the commonly used features ("human," "animate," "object"), features like "emotion," "authority," "concept," and "avocation" have been generated. Further work will look into the use of features in other tasks of understanding,

the use of empirical methods to study verbs, and the implications of features for semantic fields, meaning extension, and case structures.

PANEL: EVALUATION OF NATURAL LANGUAGE SYSTEMS

JOYCE B. FRIEDMAN, CHAIR
UNIVERSITY OF MICHIGAN

WILLIAM A. MARTIN, M.I.T.; WILLIAM H. PAXTON, STANFORD RESEARCH
INSTITUTE; STANLEY PETRICK, IBM RESEARCH; NAQMI SAGER, NEW
YORK UNIVERSITY; ERIC VAN UTTEREN, PHILIPS RESEARCH LABORATORIES;
TERRY WINOGRAD, XEROX RESEARCH

Diverse natural language systems share a common problem of evaluation. This panel will address the topic of evaluation, emphasizing the evaluation of performance. The panelists will consider such questions as: What measures are used to evaluate a system? How sensitive is performance to vocabulary size and scope of syntax? What alternatives can be studied analytically or experimentally?

Performance can be considered absolutely (how effective is a system, with respect to resources and goals?), relative to problem variation (how would it respond to changes in, e.g., vocabulary size), relative to system variation, and relative to other systems. In each case both the results of evaluation of particular systems and procedures of evaluation are of interest.

The panel will consist of experts, all of whom have written large systems. These systems include speech systems and text systems, business-oriented question-answering systems and artificial intelligence systems, and systems with contrasting linguistic theories.

METHODS FOR MODELING DIALOGUE

(SPECIAL GROUP PRESENTATION)

WILLIAM C. MANN, JAMES A. LEVIN, AND JAMES A. MOORE

INFORMATION SCIENCES INSTITUTE
UNIVERSITY OF SOUTHERN CALIFORNIA

RESEARCH METHODS FOR MODELING DIALOGUE

When people communicate with machines, they do so by specializing and extending their existing ability to communicate. To design systems which interact effectively with humans, we need to better understand how people communicate with each other.

In particular, we need to view human communication as a problem-solving activity, in which the people so engaged are using language as a method to achieve certain of their goals. The existing research into natural language has not focused on this aspect, so from our point of view the work so far has been fragmentary and hard to use, particularly in terms of helping to enhance man-machine communication.

Constructing a useful model of human communication is an extremely complex task. We view the controlling of this complexity (without sacrificing utility) as the central problem in designing our research approach. In response to this challenge, our research methodology contains some innovations, specifically intended to maintain control on the complexity, while retaining the usefulness of our results for designers of man/machine communication systems.

Specifically, these innovations include

- Case analysis, rather than functional design.
- Independent judgment of the adequacy of the model.
- Results in the form of individual algorithms, not full systems.
- Algorithms which are transferable into nonresearch systems.

We describe a research methodology, and the resulting Dialogue Modeling System which incorporates these innovations. The methodology analyzes naturally-occurring dialogues rather than prepared examples. For each dialogue we choose to analyze, a separate model is constructed. Each model is judged against annotations of the dialogue prepared by a trained observer who uses a predefined set of categories of phenomena.

Although the processes employed in each model are to be as general as we find practical, they may also be as ad-hoc as necessary to make the model work. After several models have been produced in this fashion, we expect to find that, although many processes have been too idiosyncratic to be used in more than one model, many others have seen repeated application and thus have demonstrated their more general utility. These processes are regarded as the principal results, since they have been verified against a diversity of observers' annotations.

Subsequent speakers will provide details on the memory organization of the model, the processors which operate on these memories, and the issues raised by the inclusion of the observer in the model development cycle.

KNOWLEDGE STRUCTURES FOR MODELING DIALOGUE

This paper describes the knowledge structures developed for our Dialogue Modeling System. Permanent knowledge is stored as Concepts in a semantic network Long Term Memory (LTM), using a predicate/parameter representational format. Concepts that are currently salient to the Processors of the System are represented by tokens of those concepts, called Activations, in the Workspace (WS). Activations are transient entities, with new ones frequently appearing and existing ones changing or disappearing. The WS at any moment forms the current context, which drives current processing. All Processors intercommunicate through the WS, modifying the set of Activations and being influenced by them. The WS simplifies the integration of multiple sources of information about any given entity.

Two kinds of higher level knowledge structures are used to model dialogues. There are Execution Scenes, representing organized clusters of actions and/or objects being discussed in the dialogue. These are similar to the other currently proposed higher level units, like "scripts" or "frames". There are also higher level units called Dialogue-games, specifications concerning the topic of discussion, the participants, the goals they are trying to achieve with a given type of dialogue, and a set of conventional subgoals for mutually achieving their goals.

In our analysis of naturally occurring dialogues, we have found many different kinds of Dialogue-games, including Helping, Smalltalk, Gripe, Polite-conversation, Order, Information-seeking, and Information-probing. An analysis of fourteen helping dialogues uncovered a surprising amount of consistency in the structure of these interactions, which is captured in the representation of the Helping Dialogue-game.

PROCESSORS FOR MODELING DIALOGUE

This paper provides details of the major Processors incorporated into our Dialogue Modeling System. These Processors are independent and asynchronous, monitoring the activity in the Workspace, and modifying it as appropriate.

PROTEUS PROCESSOR -- Every activation in the Workspace has a "level of activation" (a number) which corresponds to its degree of salience to the model's current activity. Each of these activations imparts some of its salience to its immediate neighbors (including those in Long Term Memory). Similarly, the activation level of each node is augmented by that imparted to it by all of its neighbors. Whenever a concept in LTM accumulates activation above a certain threshold, an activation of that concept is created in the Workspace. Thus, if enough concepts, closely related to X are active, X will also become active. Proteus is the Processor which attends to all of this, thus providing a mechanism for bringing a concept into attention, based on the attention directed toward related concepts.

MATCH PROCESSOR -- This identifies concepts in LTM that are congruent to existing activations in the WS. The Dialogue Modelling System contains a number of equivalence-like relations, which Match uses to identify a concept in LTM as representing the same thing as an activation of some seemingly-different concept. Once such an equivalent concept is found, it is activated. Match thus provides the same sort of attention direction that Proteus does, except that Proteus is driven by the explicit connectivity of the memory, while Match responds to more indirectly-represented similarities.

DEDUCE PROCESSOR -- This attempts to apply a rule, whenever that rule has become active. Rules are concepts of the form "(Condition)->(Action)". They become active by virtue of the activity of the concept which is their condition half. Deduce senses the activity of a rule and attempts to apply it by activating the concept for the action. Whatever correspondences were evolved in the course of creating the activation of the condition (left) half of the rule are carried over into the activation of the action (right) half. The combination of Match and Deduce gives us all the capability of a production system, where the system is represented by all the Rules in LTM.

DIALOGUE-GAMES PROCESSOR -- Dialogue-games are a theoretical construct we have developed to represent certain communicative forms used by people to interact in achieving goals each person has. Each Dialogue-game has a set of parameters, including two roles and a topic. Each parameter has a set of

specifications on what can serve as a value for itself. We have found that these dialogue forms are identified in conversation by utterances that attempt to establish these parameters. Once a Dialogue-game has been activated as possibly the communication form being proposed for a dialogue, the Dialogue-game Processor operates on it to verify that the parameters are properly specified, and then to establish the subgoals that are specified in LTM as the components of the particular Dialogue-game.

PRONOUN PROCESSORS -- The Dialogue Model System contains a set of Pronoun Processors, including an I-Processor, a You-Processor, and an It-Processor. Each of these is invoked whenever the associated surface word appears in an input utterance, and operates to identify some preexisting activation that can be seen as referring to the same object.

OBSERVATION METHODS FOR MODELING DIALOGUE

Most models of natural language are constructed using only the designer's own linguistic intuitions, and evaluated by others using their own intuitions. This paper describes observation methods which have been used as a guide for the generation of process models of dialogue phenomena and as a basis for empirical evaluation of these models.

The methods have concentrated on a number of specific dialogue phenomena. Observers were given the annotation instructions, and after some training, produced highly reliable

annotations of:

Requests - Annotations of requests and the various kinds of responses to these requests by the other participant in a dialogue were useful for evaluating various control issues.

Repeated reference - Annotations of repeated reference were used to evaluate models of anaphoric reference (cases in which two sets of words in a dialogue describe the same thing).

Topic - Observers' annotations of the topic units in naturally-occurring dialogues provide a basis for specifying high level multi-utterance knowledge structures.

Expressions of comprehension - Observers annotated the expressions of comprehension (or lack thereof) by each participant of the other's previous utterances. These annotations are being used to evaluate our model of the stopping rule for comprehension, which determines when the model has successfully comprehended an utterance.

Similar expressions - Observers judged possible paraphrases of the utterances of dialogues for similarity in meaning in isolation and also in the context of the dialogue. This is serving as useful data for determining the effect of context on comprehension.

Correction actions - Observers' annotations of utterances that corrected some information conveyed previously in the dialogue allow us to evaluate our representation of the comprehension of the previous utterances.

While these phenomena don't span all possible issues of interest in natural language comprehension, this same general methodology can be extended to other language phenomena. It can provide a valuable guide for building natural language models, and an empirical basis for evaluating models.

A PROCESS MODEL FOR SPEECH ACT UNDERSTANDING

ALLEN MUNRO

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In a conversation, hearers must make judgments about the intention of a speaker's utterance. A restaurant waiter realizes that when a patron says, "Waiter, this soup is cold," he is not merely thereby making an assertion, but is also making a complaint, and perhaps requesting rectification.

Utterances can be understood to have more than one intention. Two types of intentions are described in this paper, both of which depend largely on contextual factors for their recognition or understanding in a dialogue situation. Those of the first type (type A) are broadly applicable to many discourse situations and are understood primarily on the basis of the syntactic structure of utterances and certain facts about the status relationships that hold between the speaker and the hearer. Type A intentions are very similar to the Speech Acts of Searle or of Gordon and Lakoff. Speech acts of the second type (type B) are much more dependent on the nature of the particular contextual situation. They are recognized or understood on the basis of shared cultural norms concerning the particular kind of conversation the participants are engaged in. Type B speech acts are much less general in nature than type A. If a salesman says, "This little two-tone model has been priced to sell," then the customer should recognize that the type A intention is to make an assertion or a claim, and that the type B intention is to offer an item for sale.

A processing model for speech act recognition or understanding is presented, in which procedures called speech act schemata are activated. In the example with the salesman, the customer should have experienced the activation of both an assertion schema and a sales-offer schema. The schemata are formulated in SOL, the high level language of the LNR memory model (Norman, Rumelhart, and LNR), which permits the modeling of conceptual entities which have both structural and procedural properties. In addition, the type B speech act schemata are subprocedures of larger information organizers which are sensitive to the particular context. These larger devices are called scripts and are related to the computational entities of that name developed by Schank and Abelson. In the example with the salesman, the sales-offer speech act is part of the "Commercial Transaction" script.

A detailed model for one such script, an "Airline Reservation Phone Call" script is presented, together with an account of the interactions between scripts, the two types of speech act schemata, and the syntactic structure of utterances.

NATURAL LANGUAGE UNDERSTANDING BY COGNITIVE NETWORKS

RICHARD FRITZSON
SUNY AT BUFFALO

A model of human cognition which stores and utilizes linguistic knowledge in the same structures as 'general' or 'world' knowledge supports an efficient and intuitively satisfying technique for the understanding of natural language. Cognitive comprehension and syntactic parsing can proceed in parallel, cooperatively, using the same procedures, without the loss of the syntax/semantics distinction.

In this paper, a system which uses such a representation is described. The representation is a cognitive network, a directed graph model of human cognition. The grammatical knowledge it contains is shown to be similar in structure to an augmented recursive transition network, but the understanding process is not built around an ATN parser. Instead a "syntactically aided comprehension" procedure is used; cognitive processes, taking advantage of the uniform representation of knowledge, utilize linguistic knowledge as is required for tasks such as the disambiguation of conceptual relationships, and the location, in the network, of referents designated by phrases instead of names. Although the system has the syntactic knowledge needed to produce a correct parse for an utterance, it does not always have to apply it.

A few brief comparisons with other natural language understanding techniques will be included.

HOW TO REPRESENT AND USE KNOWLEDGE ABOUT CAUSALITY

CHARLES J. RIEGER
UNIVERSITY OF MARYLAND

A system for representing and using knowledge of cause and effect, called Commonsense Algorithms (CSA), will be described. The CSA project, ongoing for about a year now, has as its goal the unification of current ideas about problem solving with current ideas about contextual language comprehension. To this end, the CSA project currently consists of three parts, all built on top of the declarative CSA representation formalism: (1) a plan synthesizer, (2) a sentence-in-context interpreter (designed as the 2-sentence case of an eventual n-sentence story comprehender), and (3) a mechanism description "laboratory", whose purpose is to provide a framework for describing the "causal topology" of man-made devices and mechanisms. The LISP system which implements the CSA theory incorporates processes which are demon-like and processes which are more planful, and the CSA theory identifies how and why the planner and the population of demons interact. The presentation will cover the organization and access techniques for large numbers of CSA causal patterns in these two modes (planful and demonic), drawing on scenarios which illustrate the level of sophistication of the current implementation. One scenario will be taken from the children's story, The Magic Grinder (a Walt Disney book-of-the-month book), which the CSA group is employing to focus the language

comprehension part of the project. It is believed that any language comprehender must possess CSA-like knowledge, and that any theory of language comprehension must deal with issues quite similar to those encountered by plan synthesizers.

A HEURISTIC SEARCH APPROACH TO DISCOURSE ANALYSIS

JERRY R. HOBBS
CITY COLLEGE OF CUNY

This paper describes a computational approach to the problems of discourse structure of real-world English paragraphs, using the techniques of heuristic search. Procedures for detecting intersentence relations are being developed within the framework of a system for semantic analysis of English texts (1). This system takes as input the text in a predicate calculus-like notation produced by a syntactic front end (3, 2). Various semantic operations are applied:

1) Inferences are sought to satisfy the demands made by predicates on the nature of their arguments (predicate interpretation).

2) Redundancies are recognized and merged (knitting).

3) Anaphora are resolved.

The operations work by accessing a data base of world knowledge inferences, which are drawn selectively in response to the operations, and which carry a measure of their salience that varies with the context.

Intersentence relations are determined by matching the current sentence and the previous text against a small number of patterns. These patterns are stated in terms of inferences to be drawn from the current sentence and an "eligible" previous sentence, and the modification to be performed on the text if the pattern is matched. The patterns are of two

kinds--coordinating and subordinating. One coordinating relation is Temporal Succession: "The current sentence asserts a change whose initial state is implied by an eligible previous sentence." Other coordinating relations are Cause, Contrast, Parallel, and Paraphrase. Two subordinating relations are

1) Example: "The predicate and arguments of the assertion of the current sentence stand in a subset or element-of relation to those of the assertion of an eligible previous sentence." (See below.)

2) "Relative clause in disguise": "The current sentence provides further information about an entity fairly deeply embedded in an eligible previous sentence." (E.g. the second and third sentences of this abstract.) When this pattern is matched, the modification made to the text is equivalent to turning the current sentence into a relative clause.

As analysis proceeds, a tree-like structure is constructed for the paragraph, with subordinating relations building the tree downward and coordinating links building it to the right. A previous sentence is "eligible" if it is on the right frontier of this tree. For example, in a text $S_1 S_2 S_3$, if S_2 is a disguised relative clause on S_1 , then S_3 may be coordinated with either S_1 or S_2 , but if S_2 succeeds S_1 temporally, then S_3 may be coordinated only with S_2 .

The heart of the operation is an ordered heuristic search of the data base for desired inferences. These

desired inferences are kept on a goal list, and have strengths associated with them. The strength of a goal depends on the type of text and the patterns found previously in the text. Also, the presence of conjunctions and some other elements advance certain patterns--"and" promotes Temporal Succession and a repetition of the previously recognized pattern, a dash and "i.e." promote Paraphrase, and the article "this" frequently signals a disguised relative clause. The evaluation function which orders the heuristic search is based on the strength of the goal, the length of the chain of inference, and the current salience of inferences in the chain.

When a partial match is found, the difference, or the remainder of the goal, is placed high on a goal list for subsequent processing. Consider the text

"Republicans are discouraged about their prospects

The party chairman is convinced that many GOP congressmen will lose their bid for reelection."

Suppose for simplicity "be discouraged" decomposes into "believe something bad will happen" We have a partial match with the Example pattern since the second sentence asserts that a particular Republican believes something. Hence a principal goal for our processing of the "that" clause is to show that what is believed is that an event bad for a Republican will occur. This is shown by accessing the fact about a political party that one of its purposes is to win elections.

Goals generated by a partial match are also passed on to subsequent sentences. In a Newsweek paragraph analyzed, the first sentence S_1 asserts a change. The next three sentences S_2 S_3 S_4 assert stages along the course of this change. S_2 is matched with the initial state of the change in S_1 , thus generating as a goal the matching of S_3 and S_4 with succeeding states. Finally, the structure " S_2 then S_3 then S_4 " is taken as an Example of S_1 .

This work has significance for future attempts to summarize paragraphs automatically. For instance, in a text tied together by the Example pattern, the sentence "exampled" must be a major part of the summary.

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The Panel is expected to meet three times annually, in fall, winter, and spring. All proposals are to be reviewed at Panel meetings; proposals received too late for the spring meeting will be held until fall, possibly extending the customary six-month interval between submission and decision.

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Conference on Very Large Data Bases, Framingham, Massachusetts,
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L A T S E C :

CONGRESSMAN QUESTIONS PAYMENT

A supplementary payment of \$400,000 on an indexing contract was criticized on the floor of the House by Congressman Aspin of Wisconsin. According to the Congressional Record (May 4, H3909), Aspin said that the payment was made "under the provisions of a special bailout law (Public Law 85-804)" when Peter Toma "said that he would be 'impelled to leave the United States' without the aid."

The bailout law, according to Aspin, "should only be used when the Pentagon really needs equipment that is vital to the national security." The Latsec contract was one of several that Aspin characterized as not qualifying for the supplementary payments. He called for a new study of the whole concept.

Toma was quoted in newspaper reports as saying that "If Congressman Aspin were to look at our system and what it is doing for this country, he would withdraw his criticism." The newspaper story describes the basic contract as one with the Foreign Technology Division at Wright-Patterson Air Force Base, originally worth \$460,000 for a three-year period.

THE FUTURE OF M T

RUDOLPH C. TROIKE, DIRECTOR
CENTER FOR APPLIED LINGUISTICS

There is a widespread myth among linguists that machine translation--or, properly, machine-aided translation--which was the object of intense effort and research a decade and a half ago, was found to be a failure and has since been abandoned. Nothing, in fact, could be further from the truth.

Although a number of institutions and agencies in the U. S. and elsewhere undertook extensive efforts in the late 1950s and early 1960s to develop computer programs for translation, only one, the Georgetown University program, succeeded in becoming fully operational (without requiring extensive pre- or post-editing). The Georgetown program was the ultimate basis for two of the major functioning MT programs in the U.S. today, that at Oak Ridge and at Wright-Patterson Air Force Base.. These and other programs every year produce thousands of usable scientific and technical translations. However, they are all built on a research base which is now nearly twenty years old.

The 1966 report of the Automatic Language Processing Advisory Committee (ALPAC), which concluded that MT results had not been fully satisfactory, led to the virtual elimination of government

support for MT research. While the conclusion was not strictly justified (for example, scientists at Oak Ridge and Euratom, given choice between human and machine translation, both opted for the latter), the reduction in funding was timely, since the extant programs had largely exhausted the then-available possibilities in computer technology and linguistics.

Unfortunately, much of the money spent on machine translation projects was applied to theoretical research rather than being used for translation--which was often disparaged as being merely practical and lacking in theoretical interest. It is therefore ironic that had more research been done directly on translation, the development of linguistic theory itself might have been accelerated by five to ten years. (Interestingly, transformational linguists, so often linked with computers in the public mind, had little involvement with MT.)

In the ten years since the ALPAC report, there has been considerable development in computer technology and in linguistics. The state of the art has advanced in both fields to the point where a new synthesis is now possible, which could produce greatly improved translations on a more cost-effective basis. (Unfortunately, one of the few projects in recent years to try this, at Berkeley, was curtailed last year for lack of funds.)

The time has now come for a new effort in MT to be undertaken. Properly conducted, such an effort would not only improve the quality and efficiency of translation, but would add to our knowledge of substantive universals and semantics, as well as

deepen our understanding of particular languages. MT can make an important contribution to the building of the information base on which the growth of linguistic theory must depend, at the same time that it produces a result of great practical value.

M A C H I N E T R A N S L A T I O N :

M O S C O W I N T E R N A T I O N A L S E M I N A R

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An International Seminar on Machine Translation took place in Moscow from 25 to 27 November, 1975. About 200 scientists from People's Republic of Bulgaria, the German Democratic Republic, Czechoslovak Socialist Republic, People's Republic of Poland, and the Soviet Union participated in the Seminar which was organized by the All-Union Center for Translation of Scientific and Technical Literature and Documentation.

In his opening speech the head of the All-Union Center for Translation (ACT), Dr. V. N. Gerasimov, said that the expansion of interational contacts and internationalization of science had promoted the growth of the translation activities in the USSR. In the country at present translation is being done by various specialized and departmental organizations. In 1975, for example, the ACT translated more than 30,000 author's sheets of scientific and technical literature and documentation. In the

nearest future ACT alone will reach the volume of 50-80,000 printer's sheets a year. Dr. Gerasimov sees the way out of this situation in the speediest possible development and installation of industrial systems of machine translation. This was also the conclusion of the Temporary Scientific and Technical Commission on Machine Translation of the State Commission on Machine Translation of the State Committee on Science and Technology of the Council of Ministers of the USSR which worked in 1972-1973

At the plenary session, four reports dealing with general principles of construction of machine translation systems and ways of improvement of MT quality were delivered. Yu. N. Marchuk (ACT, Moscow) draws our attention to the increased role of computer dictionaries in automatic data processing systems and namely in MT systems. Since the quality of MT largely depends on the word-list and volume of the dictionary and the information contained in the dictionary entries, these dictionaries must, according to Marchuk, be compiled with due regard to distributional and statistical methods. It is important to make wide use of contextual information. Inter- and post-editing are absolutely indispensable in running the first industrial MT systems.

This idea is developed in a joint report by B. D. Tikhomirov, Yu. N. Marchuk, and I. I. Oubine (ACT, Moscow), who put forward a new approach to inter- and post-editing for correction of input and translation errors. Interediting follows a search in the

dictionary, automatic analysis of new words and formation of the information required for future processing. The intereditor either confirms or corrects the grammatical information of new words and can also correct input errors, supply translations for new words, etc. At the intereditor's command the system accumulates new words for the posteditor.

The posteditor exercises phrase-by-phrase control of the translation. If the translation of a phrase does not satisfy him he edits it with the help of a display unit and, if necessary, sends the original phrase and its machine translation to a special storage device for further analysis aimed at the improvement of the MT algorithm:

In his summarizing report, Dr. A. Ljudskanov (PRB) singled out the main stages of MT development, and showed what an unfavorable effect the ALPAC report and the pessimistic statements of Dr. Y. Bar-Hillel had produced on MT. MT systems aimed to operate on an industrial scale in the nearest future are to be developed on the basis of the "selective" strategy, i.e. they are to use only that information "which is necessary and sufficient for the given aim for the given pair of languages." Dwelling upon this thought, Dr. Ljudskanov said in his second report, "Lexeme dictionary for MT systems", that in the MT system which is under development in Bulgaria "deep" difficulties are shifted to "surface" levels (lexical and morphological) and solved with the help of context analysis.

The fourth report at the plenary session was read by Dr. R. G. Piotrovsky, who thinks that for the time being those who develop MT systems must not strive to achieve 100% efficiency of text processing and these MT systems must be based not on deductive generative grammar but on deductive-inductive linguistics of text. According to the linguistics of text, MT systems should be developed consecutively from simple algorithms operating with units of the surface levels of the text system to more complicated algorithms oriented to the deep levels of the text systems. Dr. Piotrovsky considers that vocabulary contains the lion's share of syntactic and semantic information of the text and consequently the basis of any MT system must be a bilingual automatic dictionary with the output word list of the thesaurus type: Such MT systems can be developed within reasonably short periods of time and will, according to Dr. Piotrovsky, enable the consumer to derive all semantic information from the input text.

Thus the main speakers put forward as the cardinal task of the present day the creation of MT systems not yet oriented to high-quality translation but working industrially

More than 60 reports were made at the seminar which were distributed into four sections: (a) computer dictionaries; (b) automatic analysis and synthesis of texts; (c) semantic analysis of texts; (d) mathematical and program maintenance.

Various trends in the theory and practice of machine translation were represented at the section on computer dictionaries. A number of reports were read by members of the Speech Statistics

group (the work is under the scientific guidance of Dr. R. G. Piotrovsky). Scientists of this group compile dictionaries for MT within the framework of one scheme in accordance with the postulates of the linguistics of text; their MT dictionaries consist of two parts: a dictionary of commonly used words and changeable terminological dictionaries for various fields of science and technology. The input entries of these dictionaries are either single word forms or combinations of several word forms. Morphological and syntactic information is written straight in the dictionary entries. The volume of syntactic information is relatively small. This information includes indices of grammatical word-class, transitivity-intransitivity for verbs, type of government and some other syntactic characteristics. Dictionaries of input and output languages have charts for coding information and correspondence charts which in this MT system are the principal linguistic algorithm. All programs of automatic processing of linguistic information are based on these charts. The authors of these reports pay great attention to methods of coding information and compressing codes in the computer. The computer realization of such dictionaries makes it possible to get an interlinear version which is not actually a translation but gives the consumer the main contents of the original text. During the discussion, many participants of the seminar, criticizing this approach to MT, pointed out that automatic dictionaries should not be compiled separately but as component parts of MT systems. The coding of lexical information

in an MT system should be preceded by the elaboration of blocks of grammatical analysis and synthesis which use lexical information and in their turn may affect its composition and coding.

A different approach to principles for development of MT systems was presented by Z. M. Shal'japina in "The ARAT system: dictionary, grammar, and their use in automatic analysis" (Moscow, State Institute of Foreign Languages). The central component of this Anglo-Russian Automatic Translation system (ARAT) is a dictionary of a special type (Anglo-Russian Multiaspect Automatic Dictionary--ARMAD) in which every entry gets complete and diverse characteristic properties of its linguistic behavior on all levels of description: morphological, lexical, syntactic, and semantic. For formal recording of all required information, ARMAD employs syntactic patterns, lexical functions, demands imposed by the word on the linear and structural context, rules of standard and individual modifications of lexical and syntactic structures with this word, formal semantic representation, semantic selection of syntactic valencies of the key word, etc.

The abundance and variety of information contained in the dictionary entry of practically every word is the principal advantage of ARMAD as compared with other types of automatic dictionaries. Wide use of syntactic and especially semantic information makes it possible with the help of this dictionary in the framework of the ARAT system to solve such a cardinal problem of MT as grammatical and lexical ambiguities. Data on lexical co-occurrence of the original English word and its Russian equivalent

as well as on required syntactic transformations, it is hoped, will ensure an exact and idiomatic translation of the original text. But at the same time the abundance and variety of the information in ARMAD naturally leads to a more complicated entry structure and multiplies the difficulties which linguists have to overcome when writing entries. At present the difficulties and possibilities of algorithmic realization of full-scale dictionaries of this type have not been investigated.

A number of reports were devoted to compiling various types of auxiliary dictionaries and creation of whole systems for automatic lexicographic work. In their reports, Yu. N. Marchuk, N. G. Tikhonova, and I. I. Oubine (all of ACT, Moscow) informed the participants of the seminar of the work now being done to develop a bilingual automatic lexicographic system to compile frequency and semantic frequency dictionaries and bilingual concordances as auxiliary material for MT dictionaries.

E. V. Vertel and V. A. Vertel (State Institute of Foreign Languages, Minsk) submitted a joint report on the elaboration of an algorithm and a set of programs to compile a frequency-alphabetic dictionary and concordance on a medium-size computer. The set of programs is designed to process an original text of up to 300,000 words.

An interesting report on the compilation of a reverse French dictionary was submitted by E. L. Kozmina (Applied Mathematics Institute, Moscow), who worked out a method of getting a wordform by its ultima or by one wordform representing a whole class of

words inflecting uniformly. This method makes it possible to reduce a reverse dictionary of word-forms to the size of an ordinary dictionary.

In this session the participants in the Seminar discussed the principles of compilation of MT dictionaries and came to the conclusion that it is necessary:

- to consider an MT system as a whole in which all parts are interlocked, while the dictionary is its principal component;

- to design MT systems for sublanguages and consequently compile automatic dictionaries for well-defined topics;

- to pay special attention to strict selection of entries for automatic dictionaries, and for this purpose compile various auxiliary dictionaries and concordances;

- to increase the volume of diverse syntactic, semantic, and lexical information in automatic dictionaries;

- to attach great importance to the structure of automatic dictionaries. According to a number of the participants of the seminar, the optimum structure is a combination of a dictionary of stems and a dictionary of wordforms. The dictionary of wordforms contains more frequent words and the dictionary of stems contains the less frequent words.

The section on automatic analysis and synthesis of texts attracted the largest number of reports, reflecting the intense interest of linguists in these important parts of MT systems. A series of interconnected reports was read by scientific workers of the Computational Center of Leningrad State University Dr.

G. S. Tseitlin proposes to use for automatic syntactic analysis models which do not simply contain a set of rules for construction (or "filtering") of admissible syntactic structures but also mark out among these rules more or less "preferable" ("normal", "nuclear", "productive"). B. M. Leikina (Leningrad State University) is working on a model of an English grammar which permits under certain limitations nonprojectivity while fulfilling the projectivity demands for the majority of cases. At present this group is working on a more complicated model which takes into account among other things the order of establishment of syntactic links in a particular structure'. A number of experiments have been carried out with the first variant of this grammar. These experiments were aimed at checking the presence of the correct analysis and absence of a fixed incorrect analysis and were carried out under the conditions of man-machine interaction during which a part of the intermediate results were rejected by the man. Complete analysis has been tested only on several sentences.

The principles of analysis in the ARAT system were expounded in this section. Besides the report of Z. M. Shaljanina already mentioned, three reports on less general problems were read: L. A. Afonasjeva, "Disambiguation of homonymy in the ARAT system", T. N. Nikanorova, "Prepositions in the ARAT system", and O. A. Sternova, "On a model of Russian inflexion in the ARAT system" (all State Institute of Foreign Languages, Moscow). In this MT system the disambiguation of homonymy is not singled out into a

separate block but is carried out during the analysis simultaneously with the fulfillment of other tasks. Prepositions in the ARAT system are treated like any other lexical unit of the text. Meaningless prepositions, i.e. prepositions serving as surface-syntactic indications of strong government and having no influence on the meaning of the text are eliminated during the transition from combined syntactic structure (CSC) to semantic representation. Meaningful prepositions, i.e. prepositions having their own meaning, are elements of the semantic structure and are preserved during the transition from CSC to semantic representation.

E. E. Lovtsky (ACT, Moscow) proposed formal means for the description of the syntax of natural languages. The description is an oriented graph, in the nodes of which are symbols of syntactic classes and of subgraph. The information on the dependency structure of strings is recorded on the edges of the graph. The description of a natural language syntax, made with the help of the suggested formal means, can be used in a system of automatic syntactic analysis. For the analysis of a phrase, it is necessary to find in the graph all occurrences of a string of syntactic classes corresponding to this phrase and to read from the edges of the graph the information about the structure of the string. This procedure is done automatically by a special algorithm. As a result of the analysis we get immediate constituent trees and dependency trees of the analyzed phrase. In case several trees correspond to the analyzed phrase then the

choice of the tree corresponding to the lexical units of the phrase is made on the basis of the information contained in the automatic dictionary. The said description is being done for the analysis of English scientific and technical texts.

The joint report of E. Benesova, A. Bemova, S. Machova, and J. Panevova (Czechoslovakia) contains characteristics of cardinal components and principles of functional generative description designed to get semantic representations which in their turn are the basis for synthesis of sentences of a natural language.

Other reports at the section on automatic analysis and synthesis of texts were of a less general character. Dr. Klimonov (GDR) presented a set of criteria for automatic identification of antecedents of personal and possessive pronouns in Russian and German. Dr. Starke (GDR) read a report on a method of transformation of Russian structures with German equivalents having different dependency representations. Each transformation is performed by means of elementary operations: insertion, deletion, alteration of a node, etc.

The reports submitted to the section on semantic analysis touched on some narrow problems. A number of reports show their author's efforts to solve their problems within the framework of automatic text processing. These reports are the definition of the concept of answer in question-answer structures of texts (Dr. Konrad, GDR); semantics of prepositions (Leontjeva, ACT, Moscow) and Nikitina (Institute of Linguistics, Academy of

Sciences, Moscow); semantic and syntactic analysis of Russian words with the meaning "quantity" (Iljin and Smirnova, Leningrad State University); communicative structure of the English sentence (Korolev, ACT, Moscow); semantic analysis of headings of Japanese patents (Zeinařová, Samariņa, and Shevenko, Institute of Oriental Studies, Academy of Sciences, Moscow).

An interesting report was submitted by N. A. Kuzemskaya and Dr. E. F. Skorokhodko (Institute of Cybernetics, Kiev), who reported work on quantitative criteria for estimation of translation quality. They propose to solve this problem with the help of a semantic language which would meet the following conditions: (a) ability to express the required information; (b) possibility of getting the necessary quantitative estimates; (c) possibility of translating into this semantic language from the original language and from the language of translation.

Semantic networks can be used as such a semantic language. Comparison of two speech semantic networks--the primary corresponding to the original text and the secondary to the text of the translation--makes it possible to define a number of parameters characterizing various aspects of the quality of the translation. The main aspects of translation quality are completeness and accuracy. Completeness is calculated from the proportion of the primary network contained in the second, and accuracy from the proportion of the secondary that coincides with the primary.

The problem of automatic recognition of key words in text was the main concern of the reports of R. A. Kovalevitch, V. A. Sorkina (State Institute of Foreign Languages, Minsk), and G. S. Osipov, A. I. Chaplja (Mahachkala State University). Kovalevitch and Sorkina singled out more than 50 elementary semantic units and, relying on formal characteristics of the text and using distributional statistical methods, they singled out and formalized rules of combination of elementary semantic units in free word-groups. The result of the analysis is a matrix of relations of components in English word groups and their Russian translations with all necessary grammatical information. The set of formal characteristics of all components of a free English word group determines the corresponding Russian equivalent. In their report, Osipov and Chaplja spoke about an attempt to construct (by the thesaurus method) formal means useful for elaboration of an algorithm of recognition of key words in a text. These authors build this formal apparatus on the basis of estimating the degree of synonymy of words in the structures of the input text.

To our regret it should be admitted that in spite of the universally recognized importance of the semantic component for MT, the seminar lacked reports in which authors put forward methods and instruments of formal representation of word meanings for the solution of problems of analysis and synthesis of texts during MT. The participants of the seminar did not pay sufficient attention to the search for optimum ways of elaborating formal semantic languages for MT.

In the software section, ten reports were made, three of which are characterized by a broad approach to this important part of MT systems. These are the reports of N. A. Krupko and G. S. Tseitin (Leningrad State University), V. S. Krisevitch and I. V. Sovpel (Institute of Foreign Languages, Minsk), and D. M. Skitnevsky (Institute of Foreign Languages, Irkutsk). The joint report by Krupko and Tseitin sums up the research work carried out during the last 13 years, involving development of software to be used in computer experiments on MT. At present the software of the MT model at the MT laboratory of Leningrad State University comprises the following components: (a) the system of symbolic representation of the linguistic content of the model; (b) the machine representation of the linguistic content; (c) the compiler for translating the symbolic representation into the machine representation; (d) the interpreter which employs the machine representation to process a given text in accordance with the aim of the experiment. Such a structure of the software is motivated mostly by the necessity of changing the linguistic content in the course of experiments and by the impossibility of keeping in core memory more complicated linguistic information in the form of a compiled program. The same approach with an appropriate shift in the structural role of each of the component parts seems, in the opinion of the authors of the report, to be quite reasonable in developing practical MT systems.

The report by Skitnevsky considers some basic principles of software development for linguistic investigations. The main idea of Skitnevsky's model is to consider as interdependent the following three levels of software: (a) the conceptual level--a model of linguistic process; (b) the compositional level--an input language; (c) the programming level--the implementation system. The development of software includes the following five stages: the first stage is an analysis of a set of algorithms which are given in their verbal description (i.e. as flow charts). The analysis results in an informal definition of the class of algorithms. The second stage consists in specifying this formal definition. As a result we have a logical and mathematical framework, which is a sufficiently precise and dynamic description of basic concepts occurring in the informal definition (MODEL). At the third stage a data bank and a service program package using the standard software are formed on the basis of the set of objects and operations of the model. The fourth stage consists of working out an input language which permits the user to state his tasks in terms of the MODEL. The fifth stage designs an operational system which uses the standard software and remains intact in respect to relatively extended MODEL, its data bank and service program package. The MODEL built along these lines and an input language form a convenient metalanguage for the description of the computer semantics of natural languages.

The report by Krisevitch and Sovpel emphasizes that an MT system operates with large information files including input and

output, automatic dictionaries containing grammatical and semantic information; therefore the efficiency of an MT system depends to a great extent on the degree of optimization of information processing. The authors believe that the efficiency of use of storage and the minimization of average access time are determined by such factors as the nature of information, the request frequency, and the properties of storage devices. In keeping with these principles, the authors constructed their model of the information base for an MT system. The other reports discuss less general problems of software relating to automatic text processing. The report by N. G. Arsentjeva (ACT, Moscow) describes the results of the machine experiment which was aimed at forming surface syntactical characteristics of a word on the basis of its semantic description. The input information is a semantic description of some word, represented as a formula containing semantic elements and operation signs. The author has devised an algorithm which supplies the linguist with a list of possible realizations in the text of the syntactic pattern of the processed word on the basis of the semantic description of the word, its syntactic pattern and some other linguistic information. The program is written in the algorithmic language of recursive functions. The experiment shows that the said language is quite applicable for linguistic purposes.

S. A. Ananjevsky and P. I. Serdukov (Institute of Cybernetics, Kiev) informed the seminar of their work on the development of a system of automatic syntactic analysis of text for purposes of

automatic abstracting, information retrieval, and MT. The system permits one to obtain the following characteristics of the English verb: search area (zone of syntactic dependents of a verb in a sentence), position of a verb (predicate), which is the initial point of the search; the immediate distribution of the verb; syntactical compatibility of the verb; syntactic compatibility of the dependents (string of verb dependents). This system is implemented on the Minsk-32 and permits one to obtain a complete formal description of syntactical dependencies of the English verb.

The report by L. N. Beljaeva and E. M. Lukjanova (Gertsen Pedagogical Institute, Leningrad) formulates principles of compiling an automatic polytechnical dictionary for MT. The dictionary is a system of sets of linguistic data as well as algorithmic, linguistic, and programming units of a Russian text, different for different linguistic algorithms. The structure of such a polytechnical dictionary gives the possibility of organizing this system as a linguistic data bank. E. V. Krukova and T. I. Gushchina reported the results of the application of the PL/I language for an automatic analysis of texts. The authors have written a number of programs in PL/I, designed to compile frequency and reverse dictionaries, for morphological analysis of Russian words, and for resolution of ambiguity of French nouns. In their opinion, PL/I is well suited to the purposes of automatic text processing.

Summing it up, it should be noted that the reports submitted to this section varied considerably from the point of view of the problems discussed and the methods employed due to lack of uniformity in using programming languages and types of computers

The main characteristic feature of the seminar, in our opinion, is an emphasis on developing practical systems of MT for well-defined sublanguages of natural languages rather than devising global language models of which MT is only a component. The most essential thing now is not to carry out experiments but to develop practical systems of MT operating on a large scale.

At the concluding session the participants of the seminar adopted a memorandum which admitted the importance of the seminar for the development of practical MT systems and appealed to ACT and the International Centre of Scientific and Technical Information to hold another seminar in Moscow in 1977. The participants of the seminar think it necessary to promote further coordination and integration of research in MT in the USSR as well as in the framework of the International System of Scientific and Technical Information. They find it reasonable to determine the main body responsible for problems and to entrust ACT with this important task.

BOOK REVIEW

ESSAYS ON LEXICAL SEMANTICS, VOL. I

EDITED BY V. JU. ROZENCVEJG

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The sixteen papers in this volume of some four hundred pages were written from the perspective of the Laboratory of Machine Translation at the Moscow Institute of Foreign Languages. Many of the papers are the work of members of the laboratory, and some originally appeared in its journal Machine Translation and Applied Linguistics in the period 1957 to 1969. Written by eight linguists showing similar views, these papers present a consistent but evolving theory of language. The papers are concerned for the most part with semantics, but there are papers dealing with such syntactical matters as order and conjunction. Moreover, many of the papers primarily concerned with semantics explore issues at the boundary of the theory of semantics that they are about -- to use J. A. M. 11's words -- "morphological meaning". A meaning may be expressed, for example, by a grammatical category in one language and by a word in another.

Though directed towards mechanical translation, this volume is not concerned solely with practical aspects of linguistics. There is an expressed desire to develop formal theories at all language strata; as the authors realize that a solid, theoretical basis is required for significant progress at the 'practical' or applied level. The way to build a translating machine, it is argued, is to model it on human speech behavior. A person's semantic competence is manifested in his ability to express and understand similarities and differences of meaning. A semantic theory must account for how a person can understand an utterance in one language and produce an utterance that 'means the same thing' in a second language. The capacity of the human speaker to analyze and synthesize spoken and written natural language discourses must be incorporated into the translating machine. The Moscow linguists' emphasis on analysis and synthesis perhaps gives their theories, as viewed from Chomsky's framework, the character of 'performance' models as opposed to 'competence' models.

The meaning-text model developed by the Moscow linguists incorporates a meta-language for expressing entries in a dictionary and rules for establishing a correspondence between semantic structures and their phonetic or graphic realizations. The dictionary is to contain all semantic information needed for the analysis and synthesis of utterances. The emphasis on dictionary construction, as indicated by the term "lexical semantics" in the volume title, reflects the traditional Soviet

interest in lexicology. The volume provides a wealth of information on dictionary entries for lexical items of various kinds.

The translations of the papers in the volume are good for the most part. However, there are many typographical errors. Also, the natural language analyzed in most of these papers is Russian, so appreciating all of the subtler points made by an author is not always easy for one who is not a speaker of Russian.

Before indicating a bit about the content of each paper, four topics not covered in this volume should be mentioned. First, none of the papers deal explicitly with the rather speculative question of the syntactical capacity of the human mind--- that is, with where natural languages are situated in the Chomsky hierarchy of formal languages. Since, presumably, natural languages must be recursive if fully automated high quality mechanical translation is to be feasible and since, e.g., I. A. Mel'cuk employs rules for Spanish conjugation which appear to be at least as strong as context sensitive rules, the volume indicates lines of delimitation on this question. The formal properties of the interlingua, some of which are mentioned below, is of relevance here, too. Second, there are no algorithms for parsing (though one compiled by Ju. S. Martem'janov is mentioned), as might be expected from the above comments, since this would presuppose something about the generative power of natural languages. Third, though there is reference to the similarities between logic and natural

languages and the need for Carnapian meaning postulates, there is no discussion of exactly what kind of logic underlies natural languages. Is first-order logic sufficient or is there need for such systems as type theory of modal or tense logics? Also not fully addressed is the question as to how semantic information utilized by a person in the analysis and synthesis of utterances is to be expressed in a logical language, captured in the speaker's 'theory'. Fourth, the alleged dictionary-encyclopedia distinction and related concepts as treated by, for example, Carnap or Fodor and Katz is mentioned but not analyzed in detail:

V. V. Ivanov's two short papers written in 1957 introduce the volume, presenting analogies between phonological and semantic systems. Neutralization of phonological contrasts can be seen as having a parallel on the semantic level. Ivanov also points out that, just as distinctive features have been used to characterize phonemes, so semantic features can be used to characterize semantic units. Semantic features should be incorporated in the machine interlingua, a general form of representation or language into which a source language is analyzed and from which a target language is synthesized. Without universals such as the semantic features represented in the interlingua, translation from one natural language to another would not be possible.

In the third paper of the volume, I. A. Mel'čuk provides an ordered system of rules for determining the gender of French

nouns from their endings. A compact and consistent system of rules is needed for such applications as language learning and computational linguistics as well as for theoretical reasons. Many systems of rules to be found in the literature are either far too complex to be applied by one learning a second language or are not sufficiently explicit and rigorous to be followed by one who is not a native speaker, much less be mechanically translatable into a programming language. Mel'ouk employs statistical techniques using a frequency dictionary to arrive at an economical system of rules accounting for most of the linguistic data.

In "A Model of Spanish Conjugation", Mel'ouk outlines a universal conjugation model and applies it to Spanish. The model does not provide a generative grammar in the usual sense but rather a translator which maps the meanings of word-forms into their phonetic or graphic realizations in much the same way as latter papers in the volume describe the synthesis of a target language text from its representation in the inter-³lingua.

The central terms "syntactical meaning", "lexical meaning", and "grammatical meaning" are defined by Mel'ouk in the fifth paper, and he describes an aspect of the construction of the interlingua in these terms. The interlingua can be viewed as a formal language embodying all and only the semantic universals of natural languages. Since grammatical meanings are not universal by definition, there are no grammatical meanings in the interlingua.

A. K. Zolkovskij, N. N. Leont'eva, and Ju. S. Martem'janov's "On the Basic Use of Meaning in Machine Translation" and the following two papers by Leont'eva and Zolkovskij sketch algorithms for the analysis and synthesis of sentences. They take as given a source language sentence together with its syntactic structure and, employing dictionaries, stop through its reduction into its representation in the interlingua and then through the generation of a target language sentence from the interlingua representation. Having the same underlying representation in the interlingua, the source language sentence and the target language sentence have the same meaning. The (analysis) dictionary entry for a word, which is taken to be either the name of an individual or a one- or two-place predicate (three-place predicates being defined, by appealing to what amounts to the notion of 'causativity', in terms of two-place predicates), consists of a list of semantic factors. (However, the philosophical problem of defining 'hyponyms' of a certain class, specifically predicates applying to the determinates of a determinable, which leads Fodor and Katz to introduce the vacuous notion of 'semantic distinguishers', is intractable using a list or conjunction of semantic factors.) Information about cases and prepositions encoded in the dictionary determines the place for an argument of a predicate. On analogy with dependency grammars in syntax, the meaning of a source language expression is initially built up as a tree of semantic factors and eventually becomes, through an algorithm which combines

the structure as the tree is traversed, an expression in the interlingua. The convenient notation of the interlingua allows for indicating which part of an expression, the predicate or one of its arguments, is principal (roughly, the topic) and for readily identifying the converse of a two-place predicate. Variables, quantifiers, and formal aspects of definability are not treated.

The next six papers, including an introductory piece by Zolkovskij, appeared during 1964 in Machine Translation and Applied Linguistics and concentrate on the construction of a dictionary for such automatic semantic operations as paraphrasing. In compiling word meanings for particular domains of discourse, these papers use no formal notation and present no algorithms, since machine implementation is considered premature. In a review of Sapir's writings on structural semantics, Zolkovskij discusses the problems of defining words with quantitative meanings and analyzing transitive verbs in 'notional' terms and indicates the need for providing information about "the nature of things, physical and social" to explicate implicit meaning. Zolkovskij's "The Vocabulary of Purposeful Activity", beginning with twenty-three semantic factors as primitive, defines in terms of these words such as "cause" and "means". In "Definitions of Words Denoting Time and Temporal Relations", Leont'eva defines a number of temporal words, arguing that one of their semantic functions in a discourse is to arrange the events described into a partial order and that a theory

of temporal events is needed so that conclusions about the characteristics of events and their causes can be derived from a text. Ju. K. Ščerbov describes two groups of words applying to actions, one clustered around the notion of "force" (movement) and the other around "will" (intention). He takes the idea of an action to be a program, which can be communicated to someone else by means of the semantic structure of a discourse, and he talks of the execution of a program realizing the idea of an action being brought about by a "compulsion device" (reason). Ščerbov's "On Logical Subjects and Predicates" delimits distinctions related to topic-comment and to grammatical and logical subject-predicate by appealing to an interrogation transformation which reveals what is 'given' in a situation as opposed to what is 'added' by an utterance. He describes rules concerning order, intonation, and transposition.

In a paper published in 1967, F. A. Drejzin considers semantic means of discourse analysis. By establishing semantic dependencies, nominal reference can be determined and disambiguation achieved. If a text is sufficiently redundant to be understood by a human reader, expressions in the same text can be mechanically related by means of one or more transformations and ambiguities thereby eliminated. Conditions on transformations involve semantic factors and labeled tree structures, and the passive transformation and synonymous transformations relating, e.g., a two-place predicate and its converse are provided as illustrations. The appendix contains a detailed analysis of a sample text.

The final and most recent paper in the volume is N. N. Leont'eva and S. E. Nikitina's "Semantic Relations Expressed by Russian Prepositions". In the appendix is the basis of the paper a fifty-five page table which gives the meanings of prepositions by their contexts. A number of relational concepts are universal, and certain prepositions in a particular language may be employed for their expression. Although rules for combining meanings are not provided, the table is intended for use in, e.g., the synthesis of discourses, as it specifies which prepositions may be selected in a given context. A preposition is thus seen to have syntagmatic meaning, and, because, it stands in paradigmatic relations with other prepositions, it also has lexical meaning.

Possible further inquiry. In discussing the consent decree itself, the Commission said that "we believe the appropriate manner to deal with this problem is through a petition seeking a revision of the Commission's rules, as well as a possible re-opening of the 1956 consent judgement." This statement appears to substantiate informal comments that the FCC is considering a new Computer Inquiry.

SECRETARY OF COMMERCE ANNOUNCES REVIEW OF LONG-TERM TECHNOLOGY POLICY

Recently-appointed Secretary of Commerce Elliot Richardson has announced a new program with the objective, in part, of developing long-term technology policy which would contribute to protecting "America's vital interests in evolving frontiers." Richardson noted that U.S. economic development and our quality of life have depended on fundamental research and development of advanced technology. Based on his concern that the U.S. may be underinvesting in research and technology development, Richardson has directed his Assistant Secretary for Science and Technology (Betsy Ancker-Johnson) to perform a comprehensive review and analysis of U.S. technology policy. He also announced the creation of a departmental "Regulatory Policy Committee" to develop positions on regulatory issues. Seen in the context of President Ford's program to reduce Federal regulation, it would appear that the new Commerce committee is likely to have a deregulatory orientation.

INTERAGENCY COMMITTEE ON ADP HOLDS PLANNING CONFERENCE

The Interagency Committee on ADP (automated data processing), a group comprised of ADP policy officials and managers from the various Federal agencies, recently held a major conference on Federal ADP planning. The conference, which was closed to the public, was devoted to presentations by Congressional and Executive Branch spokesmen, and to discussion of prominent Federal ADP issues: centralization of ADP management, executive-legislative relationships, management information systems, personnel management, public/private sector responsibilities, and sharing of computer resources.

Congressman Charles Rose, Chairman of the House Ad Hoc Subcommittee on Computers, warned the Federal agencies that they would have difficulty in obtaining funds for ADP services and equipment if they did not improve their ability to explain Executive Branch ADP requirements to the Congress. Speaking for the National Bureau of Standards, Dr. Ruth Davis described her agency's activities to implement the Brooks Act; she noted that despite NBS proposals, "there [remains] no means for insuring compliance with Federal information processing standards." In the area of personnel management, the conference participants offered several recommendations for further development by the Civil Service Commission and the Interagency Committee, including the fostering of professionalism through a formalized certification and testing program, and the strengthening of Civil Service qualifications standards.

VICE PRESIDENT ROCKEFELLER ANNOUNCES INFORMATION POLICY STUDY

Vice President Nelson Rockefeller recently announced that President Ford had directed the Domestic Council Committee on the Right of Privacy (chaired by Rockefeller) to undertake a comprehensive study of issues related to "information policy." The Vice President stated that "[t]he Committee will examine a number of critical issues facing this country, including the political, social, economic and international consequences of our economy's growing information sector. Specific issues, such as

the impact of computer and related technologies, the relationship between privacy and freedom of information, and access to information and information delivery systems will also be considered." The study will produce a report, due September 1, 1976, with recommendations on how the Federal government should organize to deal with matters of information policy; the Domestic Council Privacy Committee itself is not funded beyond October 1, 1976, and is expected to cease operation at that time.

EFTS COMMISSION HOLDS SECOND MEETING IN WASHINGTON

The National Commission on Electronic Fund Transfers held in March its second meeting. The Commissioners decided that they would not comment on the Federal Reserve System's proposed Regulation J, or other regulations proposed by any Federal or state agencies, until they are prepared to take a position on the basis of thorough investigation. The Commissioners also voted against a proposal to urge the States to abstain from acting upon state EFTS legislation until the National Commission produces its report, on the grounds that such action would be inconsistent with Congress' earlier refusal to impose a moratorium on state EFTS legislation.

ABZUG HEARINGS ON COMMUNICATIONS INTERCEPTION

Rep. Bella Abzug (N.Y.), Chairman of the House Subcommittee on Government Information and Individual Rights, recently held hearings on interception of non-voice communications (i.e., cable traffic) by U.S. intelligence agencies. The Subcommittee heard testimony from Western Union International, RCA Global Communications, and ITT World Communications. The hearings further pursued an earlier Senate investigation which had revealed that the National Security Agency intercepted cables from U.S. carriers by either picking up messages directly at their offices, or electronically intercepting them using its own electronic intelligence facilities outside the continental United States.

CONGRESS HOLDS HEARINGS ON EXPORT OF TECHNOLOGY

Both the Senate and the House recently held hearings on the export of U.S. technology, and related regulatory mechanisms. In the Senate, Charles Phipps of Texas Instruments (Manager, Strategic Planning) presented the highlights of the so-called Bucy Report prepared by the Department of Defense Task Force on Export of U.S. Technology. Among its many findings the Bucy Report concluded that non-communist nations, including those of Third World and particularly those of the Middle East, are "potential pipelines" for the transfer of high technology to communist nations. The Report also found that government-to-government scientific exchanges had the potential of transferring technology very actively, and as such "should be monitored to ensure consistency with restrictions on export of strategic U.S. design and manufacturing know-how."

Testifying in both the House and Senate, Peter McCloskey, President of the Computer and Business Equipment Manufacturers Association (CBEMA) objected to the lack of clear policy guidance in Federal statutes which regulate East-West trade; he specifically objected to the "national interest" criteria used in assessing specific license applications under the Export Administration Act. McCloskey urged that Department of Commerce Technical Advisory Committees (which include industry representatives) be given a greater voice in formulation of policy related to technology export. He also argued that criticism of East-West trade policy relating to computer technology is unfounded, stating that "no significant military contribution has accrued to the U.S.S.R." as a result of U.S. computer exports.

NEWS BRIEFS

The National Science Foundation (NSF) has published *An Analysis of Federal R&D Funding by Function, Fiscal Years 1969-1976* (#, enclose \$1.80).

AT&T has filed with the Federal Communications Commission (FCC) for permission to install and operate a switched Dataphone Digital Service (DDS).

The House Committee on Science and Technology plans to hold late April hearings on the impact of Federal research and development on the economy.

Mr. Thomas W. Taylor will replace Russell C. Browne as Payments Systems Advisor to the Comptroller of the Currency, and as the Comptroller's representative to the EFTS Commission.

The Department of Defense has cleared an AFIPS request for copies of the ARPA Information Processing Techniques Office budget submission to Congress for fiscal year 1977 (#); this document describes in detail the ARPA program outlined at the recent AFIPS White House Briefing (*Washington Report*, 3/76).

The Privacy Protection Study Commission will hold public hearings in New York on April 21 and 22, on the record keeping practices of banks, savings and loan associations, credit unions and consumer finance companies.

The National Bureau of Standards has published FIPS-PUB 38, *Guidelines for Documentation of Computer Programs and Automated Data Systems*, (#, enclose \$1.35).

The Federal Home Loan Bank Board has published (1) a proposal (open for public comment through April 12) to extend the experimental use of remote service units by savings and loan associations (S&L's) to December 31, 1977, and (2) a proposed rule which would permit savings and loan account holders to authorize fluctuating payments (*e.g.*, utility bills) to a third party, and would allow S&L's to accept an order from such a third party (*e.g.*, a utility company) through an automated clearinghouse.

Compilation of State and Federal Privacy Laws is available for \$10.00 from *Privacy Journal*, Box 8844, Washington, D. C. 20003.

The National Science Board of the National Science Foundation has released a report entitled *Science Indicators, 1974* (#, enclose \$4.60) which shows a weakening in U.S. science and technology.

AFIPS IN WASHINGTONAFIPS EFTS COMMITTEE MEETS WITH NATIONAL COMMISSION; COMMENTS ON REGULATION J

Paul Armer, Chairman of the AFIPS Special Committee on Electronic Fund Transfer Systems (EFTS), accompanied by the Director of the AFIPS Washington Office, recently met with William Widnall and John Benton, Chairman and Executive Director respectively of the National Commission on Electronic Fund Transfers, to discuss prospective AFIPS interaction with the Commission. Both Widnall and Benton indicated a generally favorable reaction to the concept of providing AFIPS technological expertise to the Commission, and discussions are expected to continue on developing specific mechanisms.

In a separate development, Armer provided comment through AFIPS on the proposed amendments to the Federal Reserve's Regulation J, which deals with wire transfers between Federal Reserve Banks, and other aspects of the Federal Reserve's automated payments system. The letter comment submitted by Armer was initially drafted by Dan McCracken, Vice Chairman of the AFIPS committee, and was reviewed by committee members prior to submission.

The comments focused on two specific areas. First, Armer pointed out that while privacy and confidentiality of account information was addressed in the amended regulation, the area was treated in a very cursory manner. In the absence of a specific definition of "adequate safeguards," prescribed appeal procedures for consumers, and related penalties on financial institutions and their employees for unauthorized disclosure, he argued, the proposed treatment was nearly meaningless. Second, Armer pointed out that while the press release describing the proposed amendment made reference to "payments on magnetic tape" (and implied the transfer of funds by physical delivery of tapes), the proposed regulation defined acceptable "media" much more broadly than magnetic tape, in a way that would make the Regulation applicable to a full scale Electronic Fund Transfer System. Armer urged the Board to restrict the definition of media to only transfers on magnetic tape, and to gain relevant experience in this area before publishing broad regulations which would reach EFT systems more generally.

AFIPS PRESIDENT RALSTON URGES CONTU TO EXPLORE COMPUTER-RELATED COPYRIGHT

The Director of the AFIPS Washington Office met in March with staff members of the National Commission on New Technological Uses of Copyrighted Works and was told that the Commission would, at its April 1 meeting in New York, determine whether it would investigate and make recommendations on copyright matters related to computer technology (*Washington Report*, 3/76)

As a result, AFIPS President Anthony Ralston has written the Commission, urging the Commissioners to go forward with investigation of these "important" issues, and to make recommendations which would lead to clarification of the relevant law. Ralston emphasized that AFIPS' interest in this area is not commercial, but rather, that the Federation wished to see the legal treatment of the area developed in a manner which is technically sound. "Both the Congress and the Federal Judiciary, by the nature of these institutions, are in a difficult position to consider all aspects (*i.e.*, legal, economic and technical) of [these issues]." Ralston said in his letter. He concluded, "[i]t is our hope that your Commission will apply its unique resources to give these issues the considered study which they demand."

STATUS OF H.R. 214 PRIVACY LEGISLATION

Rep. Charles A. Mosher has predicted that H.R. 214, a bill which would require court orders for government surveillance of many kinds of communications, will be approved within the month by the House Subcommittee on Courts, Civil Liberties and the Administration of Justice. The bill, as revised by the Subcommittee, is expected to include coverage of non-aural interception of electronic communications (*i.e.*, data communications) sent over wire; AFIPS had earlier been asked to provide technical comment upon this aspect of the bill (*Washington Report*, 2/76). While the proposed statute would not reach non-wire data communications, it would for the first time provide Federal statutory privacy protection for computer data transmissions, telegrams, and other non-verbal transmissions over wire.

AFIPS COORDINATES INFORMAL COMMENT TO STATE DEPARTMENT ON IBI

In response to a recent Federal government meeting (*Washington Report*, 3/76) discussing U.S. relations with the Intergovernmental Bureau for Informatics, the AFIPS Washington Office coordinated informal comment to the State Department. The comments submitted consisted of correspondence from Dr. Richard I. Tanaka, Chairman of the AFIPS International Relations Committee, and Mr. Isaac Auerbach, former Chairman of the same committee.

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FCC CHAIRMAN ANNOUNCES PROPOSAL FOR NEW COMPUTER INQUIRY

Speaking at the recent Fourth Annual Conference on Telecommunications Policy Research (cosponsored by the Federal Communications Commission (FCC) and the White House Office of Telecommunications Policy (OTP)), FCC Chairman Richard Wiley announced his proposal for a new FCC "Computer Inquiry" which would re-examine the interrelationship between computer and communications technologies. Wiley is specifically proposing to the Commissioners that the FCC initiate a notice of inquiry and proposed rule making, and that it undertake a series of public sessions which would reach both the commercial and research communities regarding new technologies (both current and planned) and their applications. Particularly significant, Wiley indicated an innovative approach in which these public sessions would become part of the record in the formal Computer Inquiry proceedings.

The public sessions will be in two formats. First, Wiley indicated that he would propose a "Future Planning Conference" which would be oriented toward new developments in computer communications and their impact on FCC regulatory responsibilities; while the Future Planning Conferences are not themselves new to the FCC, Wiley's proposal to incorporate the transcript of the Conference into the Computer Inquiry record represents a novel approach to obtaining technical information from the research community, which is not normally a party to FCC proceedings. Second, Wiley described a proposed "Commission Demonstration Program" which would supplement written comments submitted in the course of the Computer Inquiry with live demonstrations and debate regarding communications equipment (including terminal devices). This program would attempt to elicit information pertaining to vendors, users and uses of such equipment; vendors would be allowed to comment on their own as well as competitors equipment.

OTP COMMENTS ON FEDERAL RESERVE'S PROPOSED REGULATION J

The White House Office of Telecommunications Policy recently submitted comments on the Federal Reserve Board's proposed Regulation J. (See *Washington Report*, 4/76). OTP's comments indicated concern that the proposed changes would permit the actual provision of EFT services by the Federal Reserve, an activity which would be "inappropriate and unwise." In a letter to the Director of the AFIPS Washington Office, OTP Acting Director John Eger described OTP's specific concerns:

"First, we have been witnessing for some time the steady development by the private sector of the generic type of services now proposed by the Federal Reserve Board. There do not appear to be any economic or technological reasons for the Federal Reserve to involve itself in the actual provision of these 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.

Our second concern relates to the control of and access to the comprehensive body of sensitive and confidential financial information that will eventually be carried by electronic funds transfer systems. Operation of such systems by the Federal Reserve would give it direct and automatic access to this information. We seriously question the wisdom of creating an environment wherein a government agency would have such ready and unprecedented access to this vast amount of information concerning the day-to-day financial affairs of the public."

PRESIDENT SIGNS WHITE HOUSE SCIENCE ADVISER BILL

President Ford has signed a compromise version of legislation to establish a White House Science Adviser. passed by the House and Senate on April 26. It was anticipated that the President would sign the bill, since the compromise version was without most aspects of the Senate bill which he had found objectionable (*Washington Report*, 1/76). President Ford is expected to name the new science adviser very shortly; amid various rumors, Dr. Simon Ramo of TRW is considered to be a leading candidate for the new position.

The compromise bill (#) will give the new White House Office of Science and Technology Policy relatively limited budgetary authority, to "advise the President on scientific and technological considerations with regard to Federal budgets, and assist the Office of Management and Budget with an annual review and analysis of funding proposed for research and development in budgets of all Federal agencies" (emphasis supplied). The bill creates a President's Committee on Science and Technology (similar to a predecessor committee, the President's Science Advisory Committee) to bring together leading scientists for a two-year study of the Federal science and technology program. While the bill will make the new science adviser a member of the White House Domestic Council, one of the legislative compromises will preclude the adviser's membership on the National Security Council. Finally, the measure eliminates a proposed grant to each state, which would have been applied to development of state science and technology programs.

COMMUNICATIONS REFORM BILLS GENERATE GROWING CONTROVERSEY

The Consumer Communications Reform Act of 1976, a bill which would radically modify to the benefit of AT&T recent Federal Communications Commission (FCC) policy on specialized carriers and interconnection, has recently been introduced in various versions in both the House and Senate (primarily H.R. 12323 (#) and S. 3192(#)). The Act, which closely follows AT&T's original proposal, carries four key provisions. First, it would restrict approval of specialized carrier (*e.g.*, providers of data communications services) applications by requiring the *applicant* to show that the proposed service will not result in increased charges for telephone exchange service or "wasteful or unnecessary" duplication of common carrier facilities, and will not significantly impair the technical integrity of, or capacity for unified planning in the nationwide telephone network. Second, it would preclude the FCC from requiring charges for new common carrier services which exceed the incremental cost of providing such service; opponents argue this provision would allow AT&T to subsidize its new offerings through existing services, thereby forcing specialized carriers out of the market. Third the bill would allow acquisition of a common carrier by another common carrier. Finally, it would put jurisdiction over interconnection policy (regarding the connection of non-bell instruments to the network) exclusively under state jurisdiction, which would have a nullifying effect on the recent FCC interconnection decision (*Washington Report*, 12/75).

Rep. Torbert Macdonald (Mass.), chairman of the House Subcommittee on Communications has responded to the Act by arguing that competition against common carriers would not necessarily increase local rates (contrary to AT&T's position), nor would it cause other undesirable redistributions of rates; he stated it to be in the national interest to allow competitive costs to determine rate structure. Specialized carriers (*e.g.*; MCI and Datran) have also denounced the bill as an AT&T effort to legislatively eliminate competition, despite contrary policies implemented by the FCC and the courts.

AT&T Chairman John deButts replied in recent comments at the AT&T shareholder meeting that FCC decisions allowing interconnection and selective competition in high-profit markets (*i.e.*, high-volume urban markets) threatened the technical integrity of the network as well as AT&T's ability to plan its facilities and operations.

NEWS BRIEFS

H.R. 214 has been reported out of the House Subcommittee on Courts, Civil Liberties and the Administration of Justice, with the provision protecting computer data transmissions remaining in the bill (*Washington Report*, 4/76).

The National Bureau of Standards Experimental Technology Incentives Program has published *Federal Funding of Civilian Research & Development* (#).

A Federal Circuit Court of Appeals has stayed the FCC interconnection decision (*Washington Report*, 12/75) pending the determination of a suit filed by AT&T and other telephone companies.

The National Science Foundation (NSF) has awarded a grant to Dr. John Hamblen of the University of Missouri to survey computer-related activities and programs in U.S. college and universities.

The NSF Advisory Panel for Computer Science and Engineering will meet in Washington on May 11 and 12.

NSF has published its Annual Report for 1975 (#) as well as its *Guide to Programs for Fiscal Year 1976* (#).

The Commerce Department has reported favorable trade balances in 1975 in electronics and business machines, with an 11% increase over the previous year in the approximately \$2 billion positive balance in computers and related equipment.

The National Bureau of Standards (NBS) has published a proposed *Guidelines for the Evaluation of Interactive Computer Services Delivered Through Networks* (#).

NSF has published *Technological Innovation and Federal Government Policy: Research and Analysis of the Office of National R&D Assessment* (#).

NSF has published *Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1974, 1975, and 1976* (# - enclose \$1.80).

The U.S. Interagency Committee on Automatic Data Processing (ADP) will meet in Washington on June 15 to discuss Federal ADP management; persons interested in attending may contact the AFIPS Washington Office.

AFIPS IN WASHINGTON

AFIPS PROVIDES COMMENTS ON SOFTWARE COPYRIGHT TO CONTU

In response to a request submitted to the AFIPS Washington Office by the National Commission on New Technological Uses of Copyrighted Works (CONTU), AFIPS societies recently commented on the issue of copyright protection for computer software. The request from CONTU executive director Arthur Levine enumerated nine specific questions on which the Commission sought comment. The AFIPS Washington Office, working through the liaisons from the respective AFIPS societies, arranged comment from those societies electing to participate ACM, DPMA, and the IEEE Computer Society.

It should not go without recognition that the individuals invited to prepare comment by the participating AFIPS societies did excellent work in the extraordinarily short time period (ten working days) which CONTU allowed for preparation of comment. The individual participants were: for ACM, Herbert S. Bright; for DPMA, William J. Moser; and for the IEEE Computer Society, Herbert R. Koller and Nathaniel Macon. In

addition to preparing written comment, each of these participants (with the exception of Dr. Macon) participated in the hearings which GONTU held in Washington on May 6. In all cases, the participants spoke either as individual experts, or presented a summary of comments from various experts within their society.

The comments reflected a fairly widely perceived need for some form of software protection. While there was little support for the proposition that copyright provided the best legal vehicle for such protection (in contrast to approaches such as patent or trade secret), there appeared to be greater agreement within the societies on the desirable *characteristics* of software protection, and on the principle that protection should encourage software development by allowing a reasonable commercial return.

While existing copyright law precludes only copying of protected materials, the participants' comments supported the suggestion that software protection should be extended to include use (*i.e.*, execution) as well. Further, the comments indicated that "copying" should be defined to include the reading (or copying) of a program into core memory for execution, a necessary prerequisite to "use." The commentators all indicated that approaches other than copyright may constitute the best solution; there was some indication that an entirely new legal system of protection (*i.e.*, outside of patent and trade secret as well) should be considered. While there were divergent statements on whether software protection should extend beyond program code itself, the participants indicated that programs other than literal copies in the same computer language should, in some cases, constitute an infringing copy. The witnesses generally concurred that software protection, properly implemented, would increase the useful dissemination of software and not unduly restrict users.

AFIPS WASHINGTON ACTIVITIES COMMITTEE MEETS IN WASHINGTON

The AFIPS Washington Activities Committee (Keith Uncapher, chairman; Ralph Leatherman; and Frank Ryan), along with AFIPS executive director Robert Rector, met on April 20 at the AFIPS Washington Office. The Committee reviewed and discussed AFIPS' activities in Washington over the past year (the period for which the Washington Office has been in operation), as well as future activities and priorities for the Washington Office. The Committee also met briefly at the Federal Communications Commission, to discuss the planning for a prospective AFIPS computer communications conference with Mr. Dale Hatfield, chief of the FCC's Office of Plans and Policy. The Committee approved the development of AFIPS-provided testimony for the National Commission on New Technological Uses of Copyrighted Works (*Washington Report*, this issue), and directed investigation of several new activities and projects for AFIPS in Washington.

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that the most important aspect of Congressional computer capabilities has yet to be implemented; Rose described the system which he envisions as follows:

"The greatest challenge that we are faced with in the Congress is making the legislative branch of government an effective overseer of the Executive Branch. That's our constitutional mandate. . . .

"We need to have the legislative branch of government tied into the executive branch. When the executive branch writes a check or transfers a fund or encumbers or rescinds money or does anything to a dollar, including spending it, their computer needs to notify our computer in the House of Representatives. Our computer can be programmed to notify the subcommittees of the House that have jurisdiction over that particular area so that a judgment and decision can be made as to whether that particular transaction is within the Congressional intent or was outside the scope of what we originally intended."

FEDERAL EFTS DEVELOPMENTS

The Federal Home Bank Board (FHLBB) has amended its regulations (as earlier proposed -- *Washington Report*, 4/76), to extend the experimental use of remote service units to December 31, 1977, and to reopen the application period for operation of such units from August 1, 1976 to March 31, 1977. The Board has taken the position that operation of electronic fund transfer systems will furnish information which will be useful to both itself (in developing permanent regulations) and the National Commission on EFTS.

The Comptroller of the Currency, a different Federal agency which regulates national banks, has issued guidelines for the evaluation of EFT systems. According to an article appearing in *EFTS-Industry Report*, these guidelines indicate a need to deal with consumer and security issues prior to the interim or final reports of the National Commission on EFTS. The guidelines recommend that a bank should assure its customers that the personal and financial information which it accumulates will be used only for banking purposes, and that it should not be sold or divulged without written customer consent, unless required by law or within "generally accepted banking practices;" further, information processed by outside services must be treated with the same degree of confidentiality as transactions handled entirely within the bank. In the area of security, the Comptroller suggested that the National Bureau of Standards encryption algorithm be considered as a means of protecting transmissions between banking terminals and central processors, and recommended a number of other specific technical security procedures.

BELL BILL: PLAYERS AND ISSUES

The recently introduced "Bell Bill" (Consumer Communications Reform Act of 1976 -- see *Washington Report*, 5/76) promises to make Federal communications regulation a major political issue in the next year. Approximately 35 substantially similar bills have been introduced in the Congress to date, by approximately 75 members.

The primary policy issue in the controversy is whether AT&T should be allowed to reassert its monopoly status in communications, in contravention of recent FCC policies allowing limited competition by specialized carriers and value-added carriers, particularly in data communications. However, a major *factual* issue has recently emerged which will play a key role in the controversy: whether revenues in those AT&T services subject to competition subsidize residential rates. AT&T staunchly maintains that competition will raise residential rates, while its competitors maintain that this is not the case; the FCC has stated that careful studies must be undertaken to determine who (*i.e.*, which user groups) subsidizes whom. Congress is expected to hold extensive hearings on these and related issues.

Groups opposing the AT&T legislation have organized the Ad Hoc Committee for Competitive Telecommunications (ACCT), which will establish a Washington office and expects to expend on the order of \$500,000 in its first year of operations. Present Committee members are Datran, ITT's U.S. Transmission Systems, MCI, and others; Satellite Business Systems, the North American Telephone Association, and Telenet are reported to support the Committee, while not becoming members. Both the Computer and Business Equipment Manufacturers Association and the Computer Industry Association oppose the legislation, and are expected to issue position statements soon. AT&T has been alleged by several of the opposition organizations to have undertaken extensive lobbying activities, including making personal contact with most members of the Congress and sending letters to its 3 million shareholders.

GAO REPORTS ON COMPUTER PROBLEMS RECEIVE CONGRESSIONAL ATTENTION

A recent series of reports released by the General Accounting Office (GAO) on the subject of computer-related problems in the Federal government have received considerable attention by Sen. Ribicoff, chairman of the Senate Committee on Government Operations. The series of three GAO reports deal with (1) computer-related crimes, (2) unreviewed automated decision making by computers, and (3) protection of Federal computer facilities against sabotage, fire and flood, fraud and human error. Regarding computer crime, GAO reported 69 instances of computer abuse resulting in losses of over \$2 million; most of the fraud involved "uncomplicated acts" made possible by inadequate management controls. GAO also reported that computers programmed for automatic decisions can cost the government a large but undetermined amount of money by issuing unreviewed payments and instigating unreviewed (and incorrect) actions in Federal agencies.

Sen. Ribicoff described these reports in considerable detail in remarks in the *Congressional Record*, and indicated that his committee staff is conducting a preliminary investigation into the problems identified by the GAO reports; he is expected to hold Senate hearings on the subject by the end of the year.

CURRENT FCC MATTERS

Tymshare has filed an application with the Federal Communications Commission (FCC) requesting authorization for a new subsidiary, Tymnet, to operate as a value-added carrier. Tymshare's non-regulated status has been an issue at the FCC for some time, in an informal proceeding brought by Telenet, a regu-

lated competitor of Tymshare (*Washington Report*, 11/75). The proposed new service would include such capabilities as speed and code conversion, and store-and-forward message services.

Meanwhile, Telenet has filed with the FCC for the provision of a public packet-switched data communications service between the United States and the United Kingdom. The proposed system would interconnect the Telenet network with packet-switching facilities operated by the British Post Office, using the X.25 packet mode interface approved by the CCITT (an international telecommunications standards organization). The network will charge for service at a proposed rate of 1 cent per packet (128 characters of customer data), according to Telenet.

NEWS BRIEFS

NSF has announced a reorganization of the Computer Science Section effective July 1, into the following programs, in which *research proposals are now "welcome" and due by November 1, 1976*: Theoretical Computer Science, Software Systems Science, Software Engineering, Intelligent Systems, Computer Systems Design, and Special Projects. Contact the Computer Science Section, Division of Mathematical & Computer Sciences, NSF, Washington, D.C. 20550; or call (202) 632-7346. Assistance may be obtained through the AFIPS Washington Office.

Thomas J. Houser has been nominated as the new director of the White House Office of Telecommunications Policy.

Dr. H. Guyford Stever, who presently serves as National Science Foundation (NSF) director and (within NSF) as Presidential science adviser, has reportedly been offered the position of Presidential Science Adviser within the newly created White House Office of Science and Technology Policy; four Republican senators have written President Ford opposing the possible nomination (which must be confirmed by the Senate), alleging abuse of the NSF grant award process.

The Commerce Department has relaxed export controls on computer systems sold to Communist Bloc Countries, by allowing somewhat higher processing speeds and larger memory capacities.

NSF's proposed Fiscal Year 1977 budget (*Washington Report*, 2/76) has been cut \$60 million by the House Appropriations Committee, but was later restored to the Administration's proposed level by the Senate Appropriations Committee; the likely result will be a compromise on half the cut proposed by the House.

The House Committee on International Relations has produced a committee print on *Science, Technology, and Diplomacy in the Age of Interdependence* (#).

The Federal Privacy Protection Study Commission has produced its first Annual Report (#), as well as its first report on a major area of investigation, *Federal Tax Return Confidentiality* (# - enclose \$1.45).

The Institute for Computer Sciences & Technology of the National Bureau of Standards now provides disk calibration services for low, medium and high (12-disk pack) data surfaces; requests for information or submissions for calibration should be addressed to: Data Acquisition and Storage Section (magnetic disk), Computer Systems Engineering Division, Room B-212, Bldg. 225, National Bureau of Standards, Washington, D. C. 20234.

NSF has released *Federal Support to Universities, Colleges and Selected Non-profit Institutions*, Fiscal Year 1974.

AFIPS IN WASHINGTON

WASHINGTON OFFICE MAKES FIRST YEAR REPORT TO AFIPS BOARD

The first annual report of the AFIPS Washington Office was submitted to the AFIPS Board of Directors for its June, 1976 meeting at the National Computer Conference. The report, summarized below, described the activities of the Office in pursuing its objectives of informing the AFIPS societies of significant Washington developments and providing technological information to the Federal government.

Summary of the report. The Office has become integrated into the Washington community, and is becoming a focal point for dialogue on an increasing number of Federal issues related to information processing.

In terms of disseminating information, the *AFIPS Washington Report* has been established as a regular monthly publication. This publication (to which complimentary subscriptions are available upon request) describes recent Federal developments as well as our current AFIPS activities in Washington.

In February of this year the Office arranged, in cooperation with AFIPS Headquarters, a White House briefing to senior officials of the AFIPS societies. At this briefing, Federal officials from the White House, and various agencies discussed the current Government outlook regarding computers and telecommunications, Federal research and development in information processing, and international transfer of computer technology (*Washington Report*, 3/76).

With regard to providing technological information to the Federal government, the following comments and briefings (in approximate chronology) were arranged through the Washington Office:

- An address to the U.S. Interagency Committee on ADP, by the chairman of the AFIPS Washington Activities Committee.
- Briefing to the executive director of the White House Domestic Council Committee on the Right of Privacy, on the subject of Federal government "information policy."
- Testimony before the U.S. House of Representatives Committee on Science and Technology, Subcommittee on Domestic and International Scientific Planning and Analysis; hearings on Computer Technology Transfer to the Organization of Petroleum Exporting Countries.
- Computer communications briefings to the Federal Communications Commission (informal discussions by AFIPS experts, as well as plans for a major presentation to the FCC).
- Written comment, at the request of Rep. Charles Mosher, on the technological aspects of H.R. 214, a bill which would legally protect data communications over wire against surveillance.

Formulation of a panel of experts, at the request of the Federal Privacy Protection Study Commission, on private sector usage of the Social Security Number.

Comments on the establishment of a White House science adviser, to Dr. Lewis Branscomb, a member of the Advisory Group planning for the (now established) Office of Science and Technology Policy.

Briefings on the technology underlying EFTS, to the National Commission on EFTS, and the White House Office of Telecommunications Policy, by members of the AFIPS EFTS Committee.

Informal written comment to the State Department on the (International) Intergovernmental Bureau for Informatics.

Written comment (by the AFIPS EFTS Committee) on proposed amendments to Federal Reserve Board Regulation J, which pertains to Electronic Fund Transfer Systems (EFTS) which may be operated by Federal Reserve banks and automated clearinghouses.

Written comment and testimony on the subject of software copyright, before the National Commission on New Technological Uses of Copyrighted Works.

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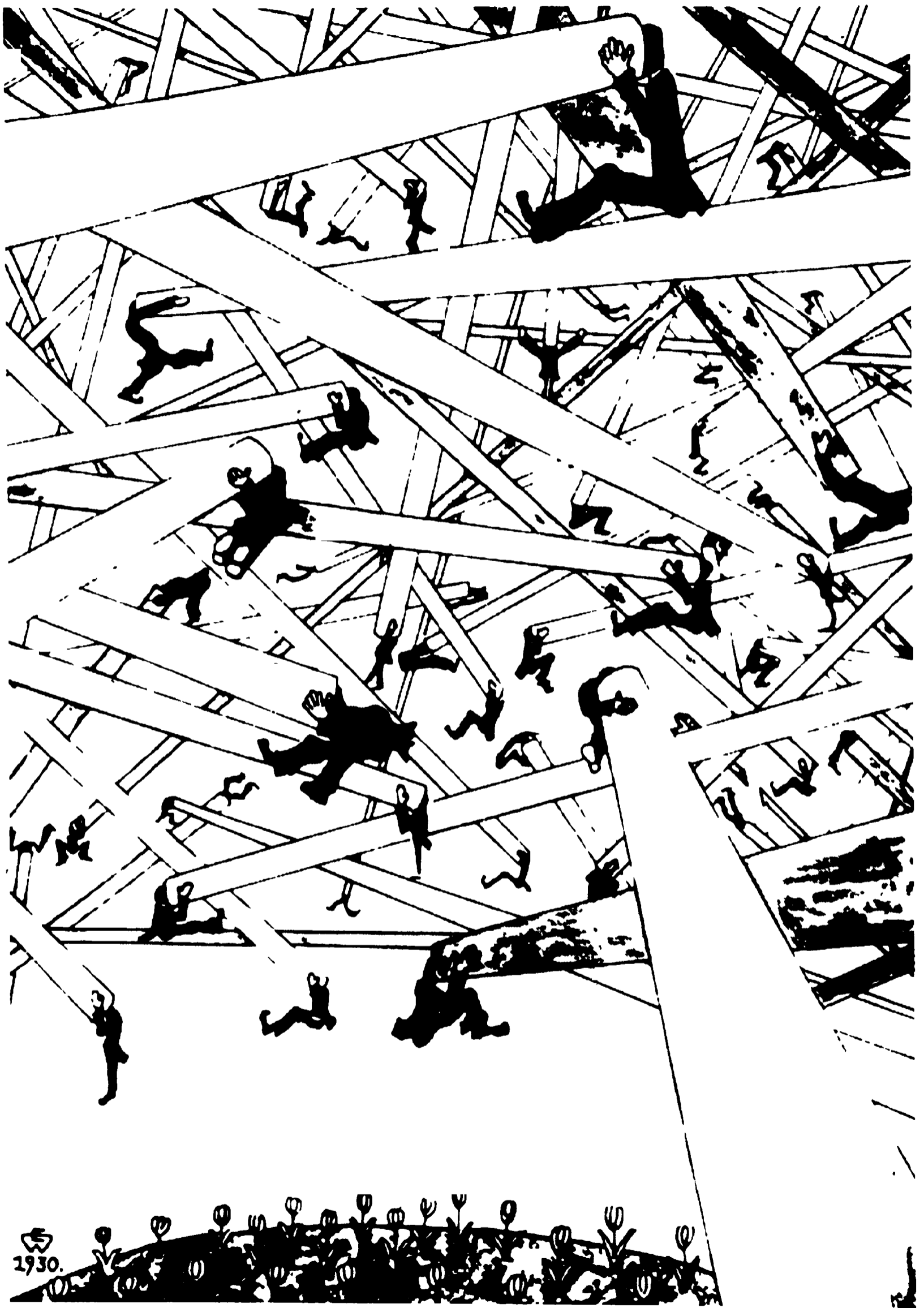
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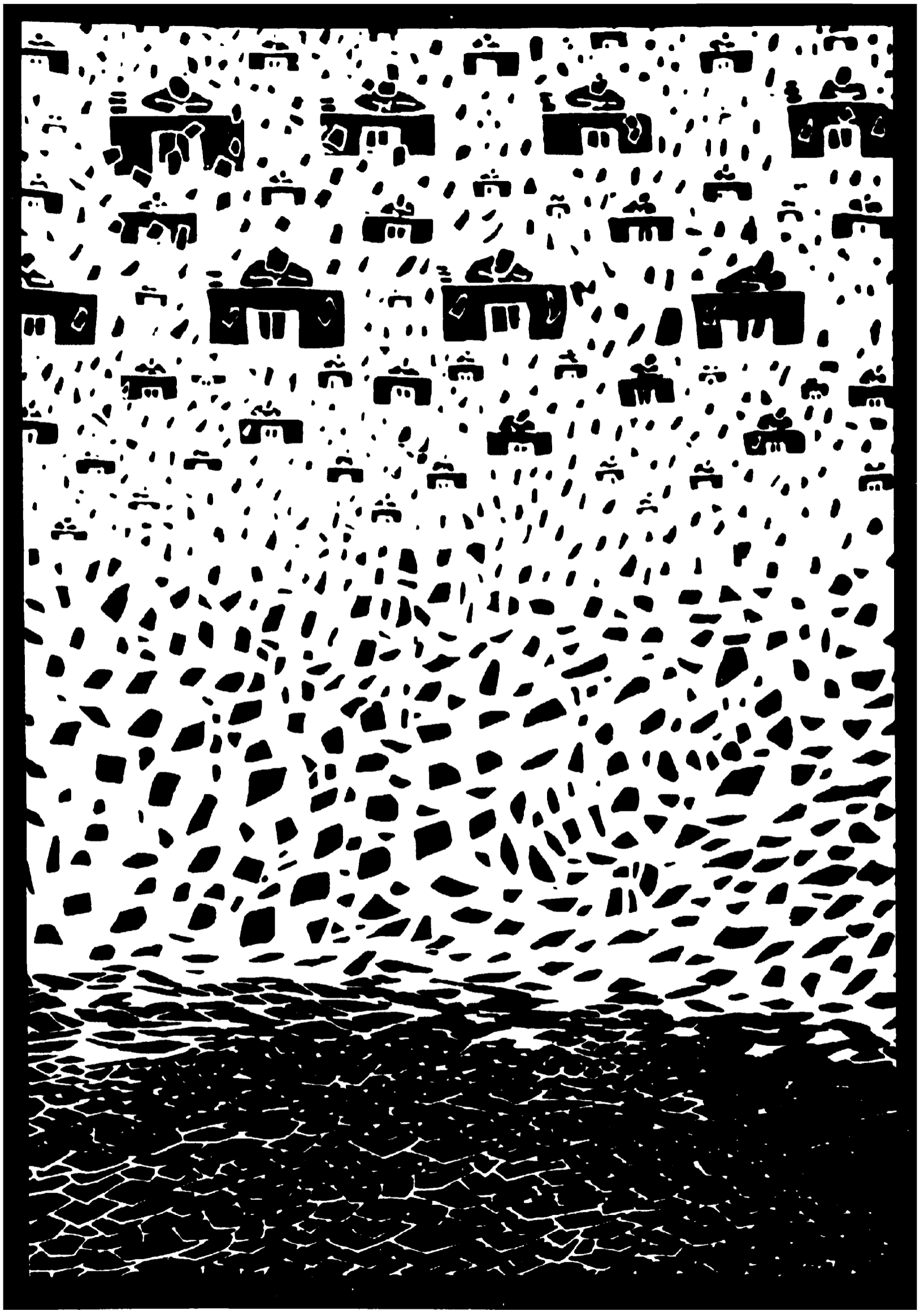
C. EUGEN WEGMANN

The drawings on the following two frames first appeared in Geologische Rundschau, b. 30, 1939.

The are are reproduced with the kind permis ion of Prof. Dr. W. Zeil, Hauptschriftleiter.

The first illustrates the scientific viewpoint; the second, the flow of scientific information.





END

