American Journal of Computational Linguistics *Microfiche 17*

NEWSLETTER OF THE ASSOCIATION FOR COMPUTATIONAL LINGUISTICS

VOLUME 12 - NUMBER 2 JULY 1975

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This number of The Finite String contains news items, four short technical contributions, and a description of the constituent societies of the American Federation of Information Processing Societies.

Volume 12, Number 3 of The Finite String is distributed in the same packet of A J C L . It contains a short survey paper and current bibliography.

AMERICAN JOURNAL OF COMPUTATIONAL LINGUISTICS is published by the Center for Applied Linguistics for the Association for Computational Linguistics

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PERSONAL NOTES

Specialties and changed or improved addresses received since publication of the 1974 Membership Directory are given in asterisked entries.

BUSA, REV. ROBERTO, SI * Department of Philosophy, ALOISIANUM (College), 21013 Gallarate, Italy. *Index Thomisticus - Inventory and census of large quantity of natural text, lemmatized and codified as to text typology.*

DOUVILLE, MRS. JUDITH A. *Metals Information Center, Olin Corporation, 91 Shelton Avenue, New Haven, Connecticut 06504. *Indexing, abstracting, chemical literature searching; organization and maintenance of scientific information centers.*

ENGELS, LEOPOLD-KAREL * Applied Linguistics, Katholieke Universiteit Leuven, 61/3 Tiense Vest, 3200 Kessel-Lo, Belgium. *Automatic syntactic analysis of English; discourse analysis.*

JOSHI, ARAVIND K. *Department of Computer and Information Science, University of Pennsylvania, R. 268 Moore School, Philadelphia 19174. *Syntactic and semantic representations; mathematical linguistics and logic; artificial intelligence.*

KAPLAN, RONALD PhD 1975, Psychology, Harvard University.

LONGYEAR, CHRISTOPHER R. **Formal pragmatic representations; natural language models; data base structures.*

MATHIAS, GERALD B. To Department of East Asian Languages, Moore Hall 370, University of Hawaii at Manoa, 1890 East West Road, Honolulu 96822, from Indiana University.

NEEDHAM, DR. KAREN SPARCK JONES **Semantics, information retrieval, classification.*

NEEDHAM, ROGER **Computing, operating systems.*

PHILLIPS, BRIAN PhD 1975, State University of New York, Buffalo, Linguistics (Topic analysis).

SAGVALL, FIL. DR. ANNA-LENA *Department of Slavonic Languages and Data Center, Uppsala University. *Automatic text analysis, applied mainly to Russian text. Automatic text understanding, applied to Swedish medical text.*

SALKOFF, MORRIS *Laboratoire d'Automatique Documentaire et Linguistique, Universite de Paris 7. 2, Place Jussieu, Paris 5, France. *Automatic syntactic analysis of French; compilation of a dictionary of French verbal constructions.*

SCHUEGRAF DR. ERNST **Information retrieval; statistical linguistics.*

SHAPIRO, STUART C. **Semantic networks, representing and carrying out inferences computer assisted instruction.*

SILVA, GEORGETTE *System Development Corporation, 2500 Colorado Avenue, Santa Monica, California 90406. *Natural language processing; linguistics.*

SPITZBARDT, PROF. DR. HARRY **Automatic morpheme analysis; English, Indonesian.*

SUPPLE, JAMES P. *Product Support, Computel Systems Ltd *Scientific computer languages (Fortran, Algol, APL, Snobol); AI (visual); Biophysics (radial distribution function).*

WEBB, FREDERICK N. *Computer Systems Division, Bolt Beranek and Newman Inc. *Programming languages, syntax description languages, data structures.*

SIXTH

INTERNATIONAL CONFERENCE ON COMPUTATIONAL LINGUISTICS

COLING 76

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IN COLLABORATION WITH

DEPARTMENT OF COMPUTER SCIENCE

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JUNE 28 - JULY 2, 1976

CONFERENCE ORGANIZER: GUY RONDEAU

PROGRAM CHAIRMAN: MARTIN KAY

THEMES:

- PROBLEMS AND METHODS
- SEMANTICS: LOGIC AND A I
- SEMANTICS: LINGUISTIC
- PARSING AND SYNTHESIS
- LEXICOGRAPHY AND STYLISTICS
- SPEECH RECOGNITION AND SYNTHESIS

PAPERS ON MT AND MAT ARE WELCOME IN ALL THEME AREAS

Additional information on following frames

ADDRESSES

REGISTRATION

C O L I N G 7 6
Department of Linguistics
University of Ottawa
Ottawa, Ontario, Canada K1N 6N5
Telephone: 613-231-5778, 4207

SUBMISSION

Martin, Kay
Xerox Palo Alto Research Center
3333 Coyote Hill Road
Palo Alto, California 94304

SUBMISSION DATES

December 1, 1975	1000-word abstract
March 1, 1976	Selection announced
May 15, 1976	Full text

Preprints available at the conference

LANGUAGES

FRENCH, ENGLISH

The organizers will attempt to provide simultaneous interpretation in Russian if circumstances warrant

FEES

	BEFORE MAY 1, 1976	AFTER	
Participant	$40	$50	Includes excursion and preprints
Accompanying	$20	$25	Includes program of visits
Student	$15	$15	

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ACCOMMODATION	Student residences on campus Lord Elgin Hotel, 5 minutes from campus Cafeterias on campus Restaurants in Ottawa and Hull Banking and exchange facilities on campus
ARRIVAL	Mirabel Airport, serving Montreal and Ottawa, is one hour from the campus by a road to be opened in 1976.
DEMONSTRATION	IBM 360/65 on campus IBM 2741 and cer ain other peripherals at the conference Advance notice requested, not later than May 1., 1976

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LETTERS

The Finite String publishes letters of reasonable length on topics relevant to computational linguistics. On occasion letters are reviewed by referees prior to publication.

Fondazione Dalle Molle
6976 Castagnola, Switzerland

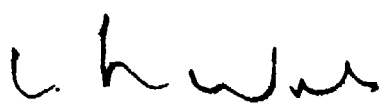
May I clarify a little the two sentences of mine about the LOGOS Machine Translation system that you were kind enough to publish and which provoked Mr. Scott s more extended reply? I feel sure that the differences betwen him and me are only matters of definition of what is unrestricted natural language and it may be worth making that clear. Let me also add that nothing I said was meant to deny that the commercial MT companies like his own have done excellent work, and that I wish them well in the future. But whether they have solved the MT problem for natural language in the sense in which that problem was understood the last time round this cycle in the Fifties and Sixties, is another matter, and I remain to be convinced.

For those who have just joined in, let me remind them that the intractable problems of MT in its first phase were word sense ambiguity, case ambiguity (of prepositions, if you like) and referential ambiguity (roughly, of pronouns). Anyone who claims to have solved those problems without making any general theoretical claims about natural language in the process is either dealing with restricted language, or is in much the same position as one who arrives to demonstrate a perpetual motion machine. In the latter case, he is entitled to a respectful hearing, but there is nonetheless a certain scepticism in the audience. No amount of talk about millions of dollars spent, or important contracts obtained makes that hard fact any softer.

Mr. Scott says that UN treatises should be a test case of what is natural, rather than restricted, language. I quite agree, and if his system can translate an unseen UN treatise chosen by a neutral party to the satisfaction of a neutral audience then I will back down. He is careful not to say he has done it, and I personally believe that

he cannot do it, armed with a phrase structure grammar. a semantic categorisation system and nothing more. The reasons why are set out in any standard paper on Artificial Intelligence and Natural Language. They involve the essential role of semantic structures, inference and knowledge of the world in understanding and so in translation. I will be happy to send him a bibliography.

Sincerely,



Yorick Wilks

HARRY GOODE MEMORIAL AWARD

KENNETH E. IVERSON

APL won its inventor the eleventh award presented by AFIPS for outstanding contributions to computing.

Dr. Iverson, IBM Fellow and Manager of the APL Design Group at IBM's System Development Division in Philadelphia, was formerly on the faculty of applied mathematics at Harvard.

AFIPS DISTINGUISHED SERVICE AWARD

MORTON M. ASTRAHAN

His key role in the formation of AFIPS and his influence on the growth, programs, and service of the organization earned Dr. Astrahan the third AFIPS award for service to the computing field through accomplishments on behalf of the Federation.

Dr. Astrahan organized and was first chairman (1952-53) of the Institute of Radio Engineers Professional Group on Electronic Computers, predecessor to the IEEE Computer Society. He has been with IBM for more than 25 years: the 701, SAGE, associative memory using program interrupt for I/O control, and two years in France.

NATIONAL SCIENCE FOUNDATION
NEW PROGRAM OFFICER FOR LINGUISTICS·
P A U L G . C H A P I N

Dr. Chapin goes to the National Science Foundation in August from the University of California, San Diego, where he has been since 1967 except for a year at the University of Hawaii (1971-72).

His doctorate is from MIT (1967). While a graduate student, he worked in Donald Walker's group at the MITRE Corporation. At UCSD he has taught and conducted research in descriptive and theoretical syntax. computational linguistics, psycho-linguistics, and comparative Polynesian linguistics. Since 1973, he has been an Assistant Provost of John Muir College, one of UCSD's four undergraduate cluster colleges.

In Hawaii Dr. Chapin studied Polynesian history and culture with the support of an ACLS Study Fellowship.

Dr. Chapin succeeds Alan Bell as NSF Program Director for Linguistics; Dr. Bell returns to the Department of Linguistics at the University of Colorado, Boulder.

Announcing 1975 ACM George E Forsythe Student Paper Competition

An opportunity to submit your original ideas on any topic related to computers and their applications.

Best papers will be published in Communications of the ACM and the authors will receive awards.

Any student who has not received a bachelor's degree before April 1, 1975, is eligible. Due date for paper is September 15. Due date for stating intent to send a paper is June 30. Receipt of paper will be acknowledged. For details, see April 1975 issue of Communications of the ACM.

Write to
ACM Student Editorial Committee
Department of Computer Science
University of Toronto
Toronto, Ontario, Canada M5S 1A7

acm
Association for Computing Machinery

1976
NATIONAL COMPUTER CONFERENCE

NEW YORK CITY JUNE 7-10

EXHIBITS: COLISEUM
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MANAGER OF APPLIED TECHNOLOGY
IBM SYSTEMS DEVELOPMENT DIVISION
GAITHERSBURG, MARYLAND

DR. HAMMER is a member of the AFIPS Board of Directors and Adjunct Professor at American University and the Industrial College of the Armed Forces.

DR. WINKLER is Adjunct Professor of Computer Systems at American University

A A A S S E C T I O N T

INFORMATION, COMPUTING, AND COMMUNICATIONS

The section has adopted a new name and is looking for ways to give its subject matter greater visibility in Science: reviews of the state of component arts; editorials; program and committee participation; etc.

The section, with 1234 members has 106 Fellows and a quota of 8 nominations for election to fellowship this year

The secretary of the section can supply information about the Congressional Science Fellowship Program which provides a stipend of about $15,000 to scientists and engineers who spend one year on the staff of a congressman, a congressional committee, or the Office of Technology Assessment.

The Secretary is Joseph Becker, 11661 San Vicente Boulevard, Los Angeles 90049.

LINGUISTICS
DOCUMENTATION
CENTRE

University of Ottawa
K1N 6N5 613-231-6578

LINGUISTIC BIBLIOGRAPHY SERIES

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ACCESSION LIST OF THE CENTRE SINCE 1974
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MACHINE (AIDED) TRANSLATION

HERBERT BRUDERER

Haslerstrasse 12
3008 Berne, Switzerland

This preliminary list will be followed by a complete report (see AJCL Card 29). The surveyer requests information on other MT systems and projects.

* Users
\+ Practical systems
o Only second-hand information as yet

MT SYSTEMS

AMERICA	Canada	*Universite de Montreal*
		Lakehead University
	United States	*Atomic Energy Commission - Georgetown University*
		Air Force, Dayton, Ohio
		N A S A, Texas
		University of Texas, Austin
		University of California, Berkeley
		Brigham Young University
		Latsec, Inc.
		Logos Development Corporation
		Xonics, Inc.
		XYZYX
		Smart Information Corporation

M T SYSTEMS

ASIA	Hong Kong	*Chinese University*
	Japan	*Kyushu University*
		Kyoto University
		Electrotechnical Laboratory, Tokyo
EUROPE	Bulgaria	*Academy of Sciences, Sofia*
	Germany	*Universitat Heidelberg-Konstanz*
		Universitat Köln
		Universitat Saarbrucken
		Zentralstelle für Textildokumentation und information, Dusseldorf
	France	*Universite de Grenoble*
		Institut Textile de France, Paris
	Great Britain	*University College, Cardiff*
	Italy	*EURATOM, Ispra*
	Switzerland	*Institute for Semantic and Cognitive Studies*
	Soviet Union	o *Leningrad University*
		Language Statistics Group, Leningrad
		o *Institute of Applied Mathematics, Moscow*
		o *Institute of Electrotechnics, Moscow*
		o *Institute for Control Systems, Tiflis*
	Czechoslovakia	*Charles University, Prague*

COMPUTER-AIDED TRANSLATION SYSTEMS

AMERICA	Canada	+ *Universite de Montreal*
	United States	* *CETA, Kensington*
		+ *IBM, New York*
EUROPE	Germany	* *Bundessprachenamt, Hürth*
		+ *IBM Deutschland, Stuttgart*
		* *Siemens AG, Munchen*
	East Germany	+ *Technische Universitat Dresden*
	Luxemburg	* *European Communities*

PROJECTS FOR C A T SYSTEMS

AMERICA	Canada	*Secretariat d'Etat, Bureau des Traductions, Ottawa*
EUROPE	Germany	*Auswartiges Amt, Bonn*
		Bosch GmbH, Stuttgart
		Bayer AG, Leverkusen
	Netherlands	*Foreign Ministry*
		Philips, Eindhoven
	Switzerland	*Brown, Boveri & Cie AG, Baden*
		United Nations, Geneva
ASIA	Japan	*National Translating Institute of Science and Technology, Tokyo*

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Mr. Creps, Executive Director of Ei, is a member of the U.S National Committee for the International Council of Scientific Unions Abstracting Board. While employed at BioSciences Information Service, he developed and conducted marketing and educational activities for Biological Abstracts.

WORLD INVENTORY OF

A B S T R A C T I N G A N D I N D E X I N G S E R V I C E S

A machine-readable inventory was expected to be complete by July 1, 1975; publication is planned by the end of the year. Gaye Hoffman is Project Coordinator at the National Federation of Abstracting and Indexing Services and Toni Carbo Bearman is Principle Investigator of the National Science Foundation grant recently supplemented with $26,650. The Federation Internationale de Documentation and UNESCO UNISIST are supporting the development of the inventory.

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THE A T E F AND C E T A SYSTEMS

J. CHAUCHE

Mathematiques Appliquees - Informatique
Universite Scientifique et Medicale
Grenoble

SUMMARY

ATEF converts an input string into a labeled tree; the label evolves under the control of a grammar. A set of labels is associated with each segment of the string, and several functions permit control of the number of alternative labels. CETA simulates a transformational grammar. It uses a set of grammars with conditional linkages. The applicability of a transformation can be determined in part by conditions on the resulting tree.

Computer processing of natural languages requires more or less polished algorithmic models. The two systems presented here represent a choice of a large class among the algorithms proposed in recent years to solve these problems. The principal choice determined by these systems lies in the formal use of labeled trees (*arborescences*). Freedom of choice of these labels and possible structures gives these systems broad fields

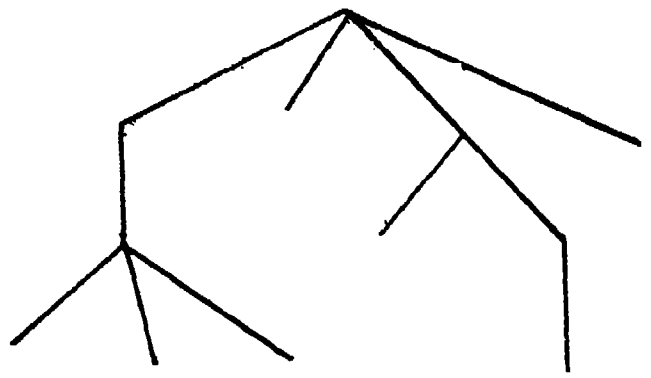
of applications in several domains and notably in that of the automatic processing of natural languages. The ATEF system has the purpose of transforming a string of words into a tree which is manipulable by the CETA system. The definition of labeled trees determines what objects CETA can manipulate and the objectives of ATEF. This note therefore begins with the definition of labeled trees. To obtain a tree of this type beginning with an input string, ATEF uses a dictionary and a finite-state grammar. The result of this system can be manipulated by CETA in order to obtain the desired type of structure. The example of analysis given here shows the possibilities of the CETA system with two different manipulative strategies: search for constituent or dependency structure.

1. LABELED TREES

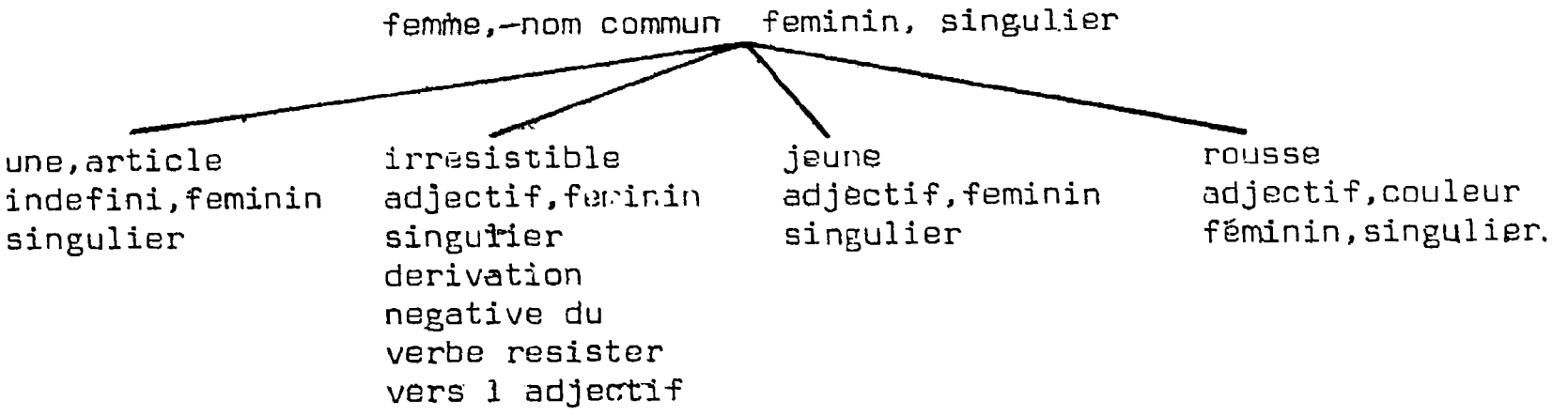
A tree is a set of points with which is associated a structure, that is to say a relation having the properties:

> The relation between two points is directed (one point depends on the other)
>
> A point cannot depend on a point belonging to its own descent set (the descent set of a point is the set of points that depend on it, the points that depend on them, etc.)
>
> A unique point descends from no other.

It is possible to draw a tree placing below a point all of its descendants, linked by lines. (See the example on the next frame.)



A labeled tree is a tree such that with each of its points is associated a label This label is formed of a set of data. The figure below represents a labeled tree.



2: THE ATEF SYSTEM

The purpose of the ATEF system is to transform an input string of words into a labeled tree, each word in the string possibly, leading to one or several points in the final tree (ambiguity). The determination of the label originating in an input word results from its analysis. This analysis proceeds by segmentation of the input word according to elements from different dictionaries . A correct segmentation therefore gives a label for a point of the final tree . In advance of any

analysis, the definition of the elements employed in the composition of different labels is required and is supplied by two files called variable declaration files.

A label will consist of a set of variables. Each variable must be defined with its set of possible values. Thus if one defines the variable "category" the set of "categories" that can be used must be specified. The set is written

category = (NOUN, ARTICLE, PRONOUN, ADJECTIVE, VERB, ...)

(A constraint requires that the name of a variable must not be longer than 7 characters. Thus the preceding variable could be written, for example, CAT = (NN, ART, PRN, ADJ, VRB, ...))

The definition of a particular label consists in an enumeration of the variables relevant to the label. A set of labels can be predefined and is collected in a so-called format file. The ATEF system analyzes the words and thus employs dictionaries A dictionary is a set of segments (character strings), with each of which is associated a label, a processing pointer, and a lexical unit pointer. The processing pointer specifies the particular process which must be associated with the segment.

The analysis of the input word by the ATEF system resides at first in a label processing, that is to say in an evolution of the empty label toward a final label characteristic of the analyzed word This evolution is controlled by the grammar, which at each moment has access to two labels. the label being developed (noted by the symbol C) and the label associated with the segment which was read in the dictionary (noted by A) The

analysis of a word aims to produce a segmentation of the word simultaneously compatible with the segments of the different dictionaries (the word must be an assembly of dictionary segments) and compatible with a correct evolution of the grammar Thus the segmentation of the input word is tightly bound to the evolution of the grammar which controls the coherence of the segmentation In the course of a segmentation operation the state of the system takes into account for the analyzed word

the label resulting from the analysis of the segments already obtained for this word

the label associated with the segment found in a dictionary

the remaining characters of the input word

the complete form of the input word

Thus for example in the course of the analysis of the word irresistible and after analysis of the segment "ible" and in the course of reading the segment 'resist" the following elements are obtained

C the label resulting from the analysis of "ible" This label contains for example the variable derivation with value verb-adj, the variable gender with value masculine and feminine, the variable number with value singular.

A the label associated with the segment "resist This label contains notably the lexical unit "resister", the variable category with value verb

The characters IR

The complete form IRRESISTIBLE

The purpose of the grammar is to permit or prevent the evolution of label C starting with label A Here, the label will evolve and obtain the variable category with value adjective. A rule associated with the segment "resist" by means of its pointer will therefore describe this evolution of the label C. When no evolution of the label C is possible, the corresponding segmentation is blocked and considered nonsignificant.

The set of labels plays a fundamental role in this system and forms the set of states of the finite state transducer corresponding to the logical model of the system Each coherent segmentation of a word (a word can have several coherent segmentations leading to ambiguities) provides a labeled point in the final tree Three elements are fundamental to the system

the choice and evolution of the segmentation

the calculation of the set of labels associated with a word

the positioning of the labeled points created by the analysis of a word in the final tree

The choice and evolution of the segmentation has to do with the sequence of input characters. The segmentation forces, above all, a prior linguistic choice. Thus with the segment "UN" two possibilities can be conceived

either accept "UN E" as a coherent segmentation

or have the segment "UNE" in the dictionary and refuse the segmentation "UN E"

For each initial form several segmentations are possible to arrive at the same results and only a linguistic study of the phenomena permits a decision on the strategy to be adopted. In any event, this strategy is left to the user of the system In the course of a segmentation the system can operate directly on the nonsegmented characters in order to force them into a "canonical" form. Thus in the case of the word reel several possibilities arise to accept a word like realite

> put the segment "real" in a dictionary as well as the segment "reel", the former will generate words like realite, irrealite, etc.
>
> put the single segment "reel" in the dictionary and the analysis of the word realite will follow the schema
>
> réalité => 1st segment found "ité", remainder "real"
> modification réal ->réel => 2nd segment found "réel"
> segmentation "réel ité"
>
> N B In this analysis, it is to be noted that the search for successive segments is performed from left to right for the input word. This depends on the strategy adopted and, for a given use, the direction of the segmentation of a word can be either left to right or right to left.

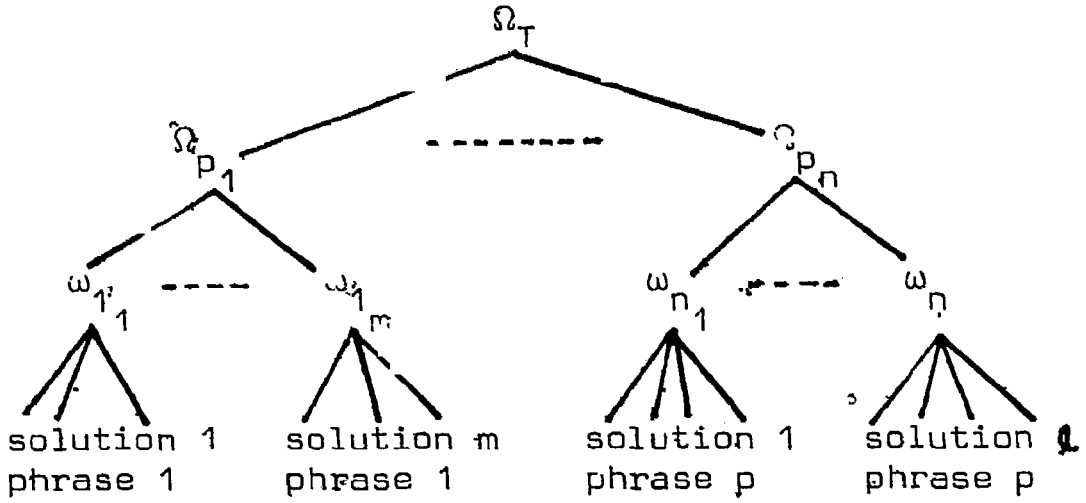
To avoid a proliferation of possible segmentations and therefore of possible solutions, several functions provide for intervention in the segmentation A first possibility is offered by the management of the dictionaries In fact, the system includes several dictionaries and after isolation of each segment the system can "open" or "close" a dictionary

This method makes it easy to avoid, for example, looking for two consecutive prefixes. Another mode of intervention which is more direct, is provided by the presence of functions acting on the enumeration procedures by which the system counts off solutions. For example, the system analyzes all possible segmentations starting with a given segment beginning with the segmentations containing most characters. An intervention at this level makes it possible not to analyze but to reject sub-segmentations of a segment. The analysis of the segment "UNE" can, for example, reject the analysis of the subsegment "UN E" (Observe that the segmentation of the word "chacune" will then be obtained as CHAC UNE because the segmentation CHACUN E will be rejected as a subsegmentation of "UNE" This problem can easily be resolved because these functions appear in the rules of the grammar and are consequently conditional. One can at the same time forbid the subsegmentation "UN E" in the word "UNE" and authorize this segmentation in the word "CHACUNE")

The calculation of the set of labels associated with a word is produced and controled by the grammar. This calculation corresponds above all with a conditional modification of the label C or current state starting from the label A or argument state. The condition for the evolution of this label is such that if no evolution is possible then the corresponding segmentation is rejected. This condition can refer to the labels of the preceding analyzed words and can condition its result on the analysis of the following form. Thus for example in the course of the analysis of the word "LA" in the sequence "il la voit", the

segmentation taking "la" as article can be rejected. The transfer of information to different labels can be realized through assignment to the following label S. When this label has been assigned in the course of the analysis of a word the analysis of the following word will begin with the assigned label instead of the null label.

The final result of the system is a labeled tree. With no supplementary specification in the course of analysis, this tree appears in the following form:



The solution for a sentence (*phrase*) consists of a string of labels (one for each word of the sentence), each of which represents an interpretation of a word of this sentence. In this case, the sentence is not structured; simply the ambiguities are separated. In the course of the analysis of the words, a first sketch of a construction can be made and give as result a more developed tree. These functions specify the position that the point to which the calculated mask applies must take in the final tree. This position is determined in all cases below a point ω_i and is relative to the root (first point on the left

below ω_i) and to the rightmost point of the tree already constructed. Thus this point can become itself the root, the rightmost leaf, etc.

With, for example, the analysis of the string "une belle maison", we can have

during the analysis of "une", no tree

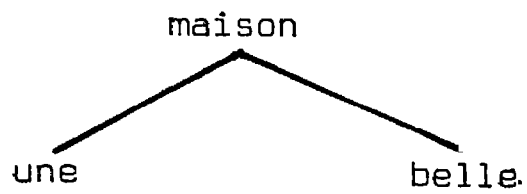
during the analysis of "belle", the tree contains the single point "une". A function can render the point "belle" as root and give belle

une

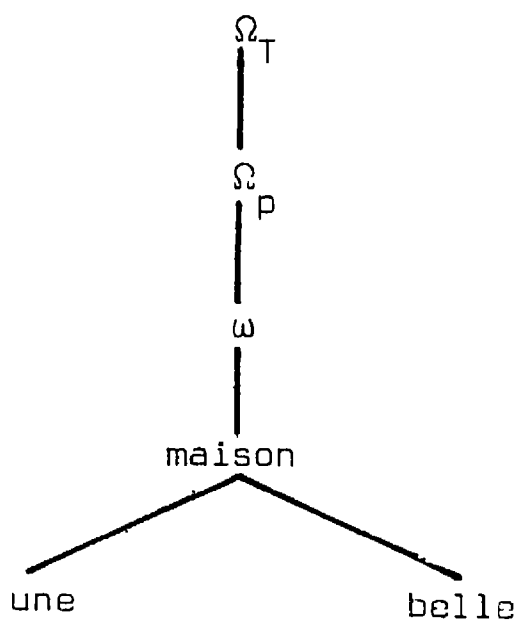
during the analysis of "maison", if the constructed tree is belle,. a function can provide for swapping

une

the root with the occurrence in work and give the tree



In this case, the result for the system will be



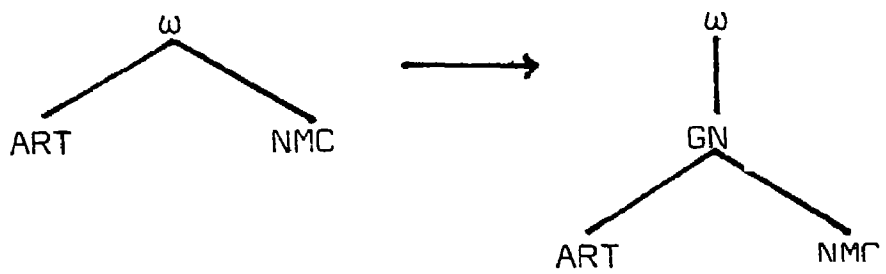
5. THE CETA SYSTEM

The CETA system provides for writing and simulating a transformational grammar. This system manipulates labeled trees of the type described above (labeled trees produced by the ATEF or other system). To construct a transformational grammar with this system two complementary elements are necessary:

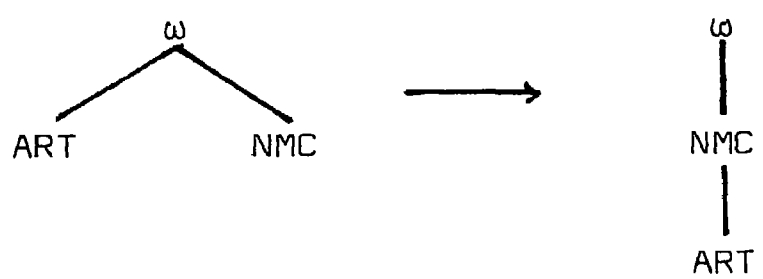
> the set of rules used defines the set of primitives of the system for a given application
>
> The set of grammars and the definition of their linkage defines the mode of use of the primitives

The definition of a transformation rule defines a mode of potential transformation of the tree considered. A rule is defined by a lefthand part representing the subtree to be modified and a righthand part defining the resulting subtree. For example, let the following be two rules:

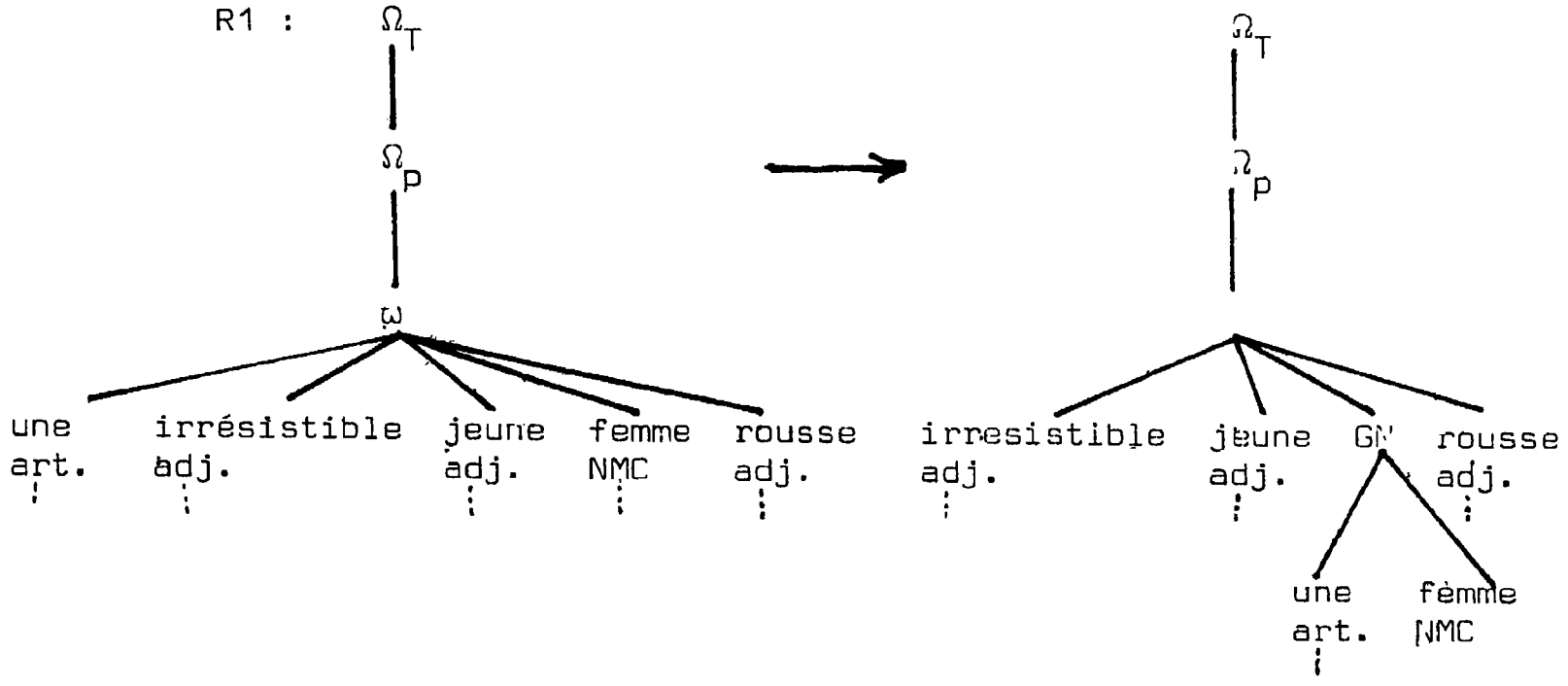
R1 :

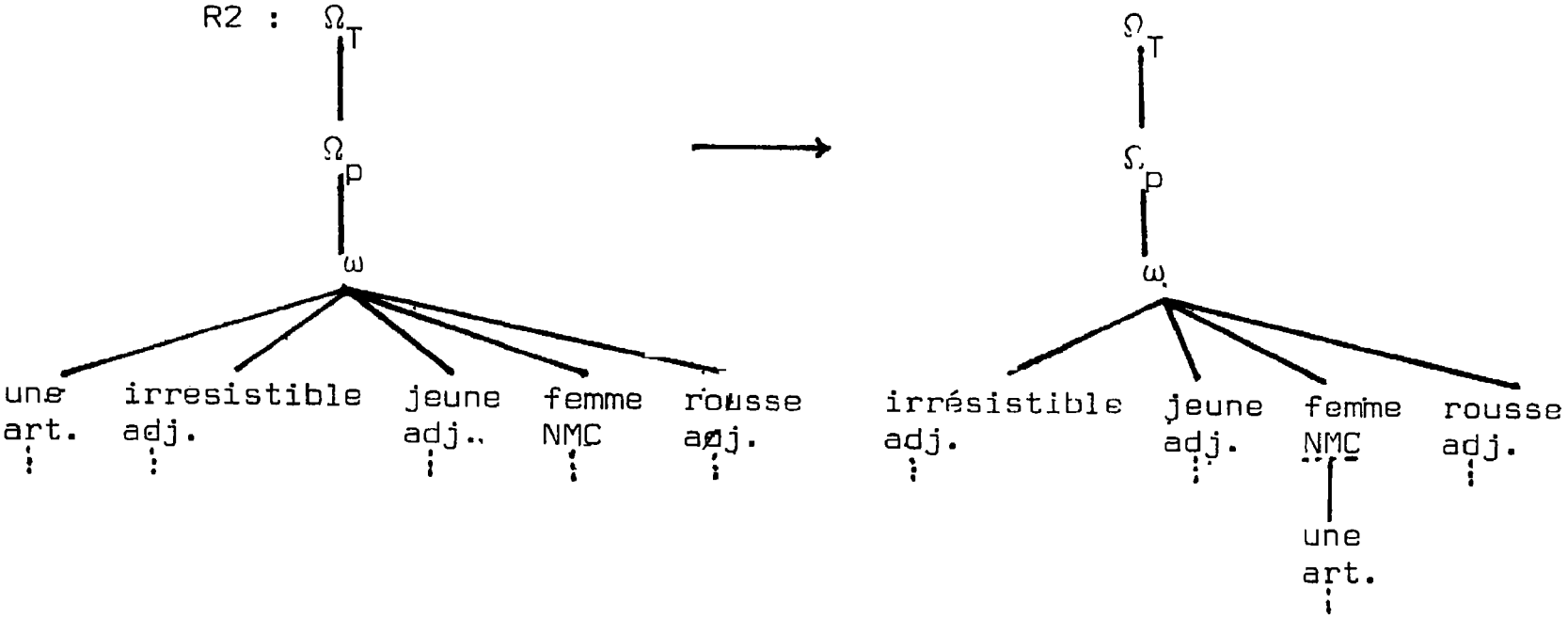


R2 :



On the tree resulting from the analysis by the ATEF system of the sentence "une irrésistible jeune femme rousse", we will have the following applications:

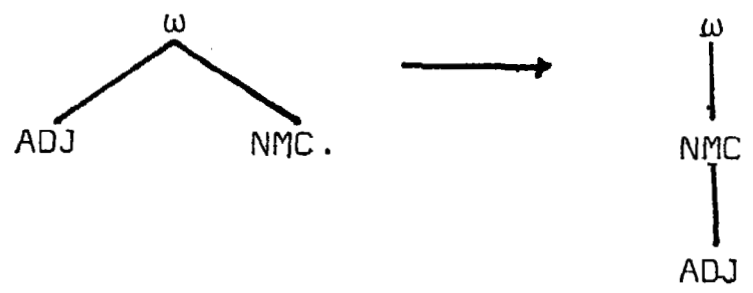




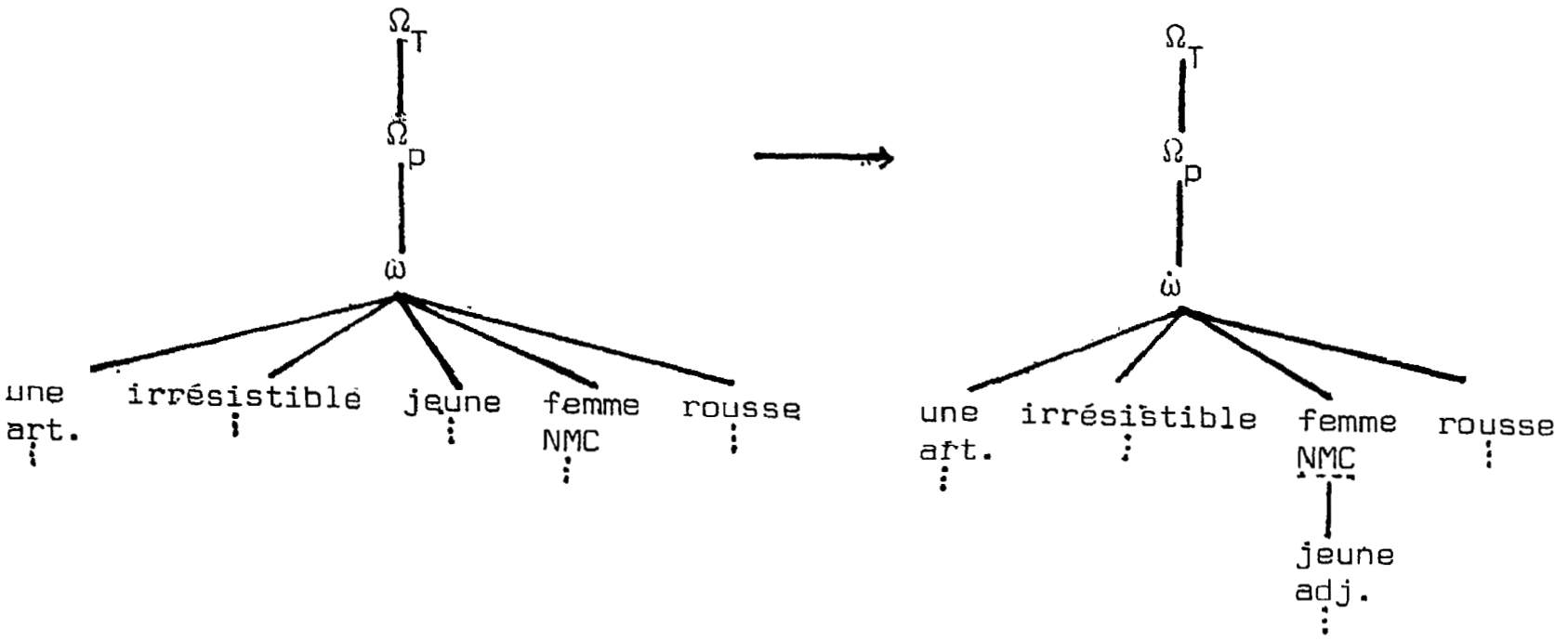
In fact, the definition of a transformation can call on a hierarchical set of subtrees. In the example taken here, the input tree is not very "deep" and most often only one-level trees are applicable. However, in the course of development of a complete structure, the considered tree is arbitrary and the definition of a complex transformation constructed beginning with

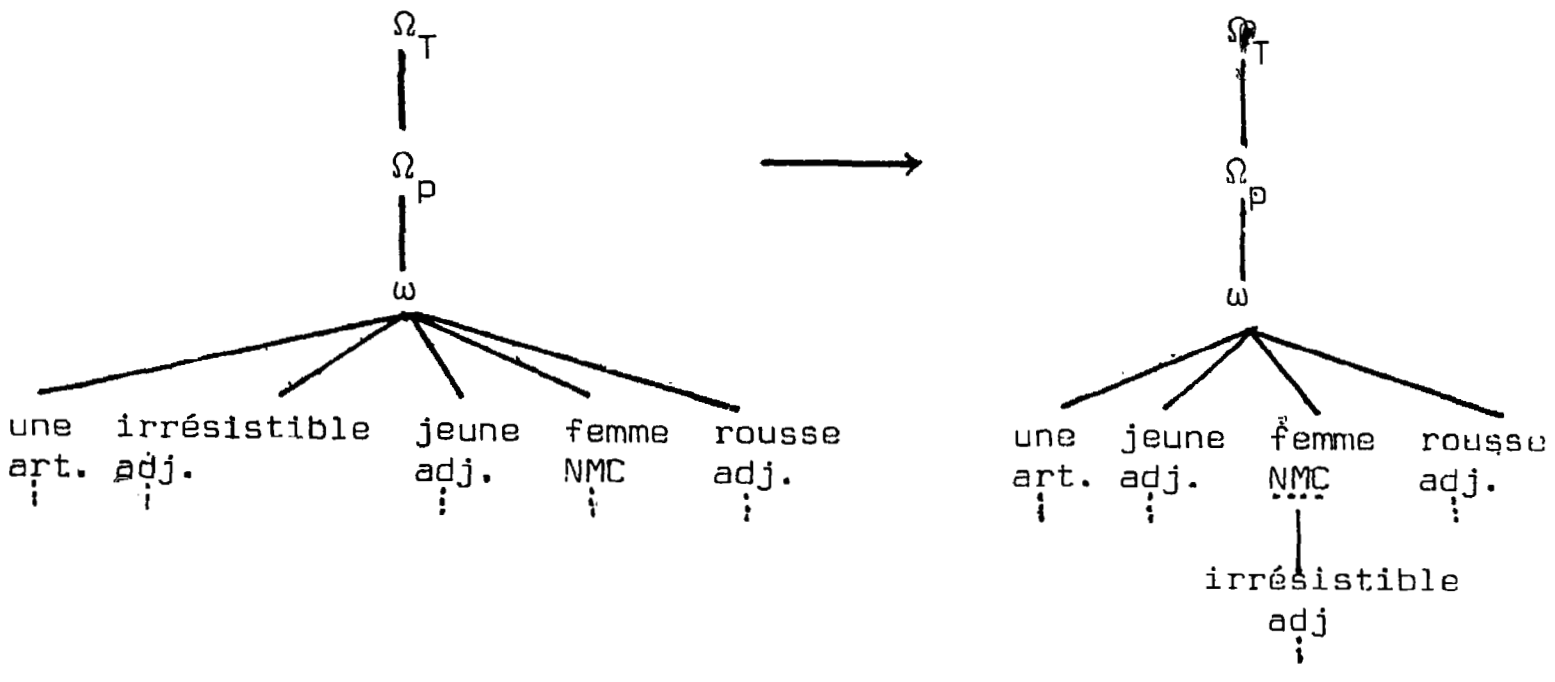
several subtrees is very refined. The subtrees defined in a rule can likewise be considered ordered or unordered Let rule R3 below be considered as unordered:

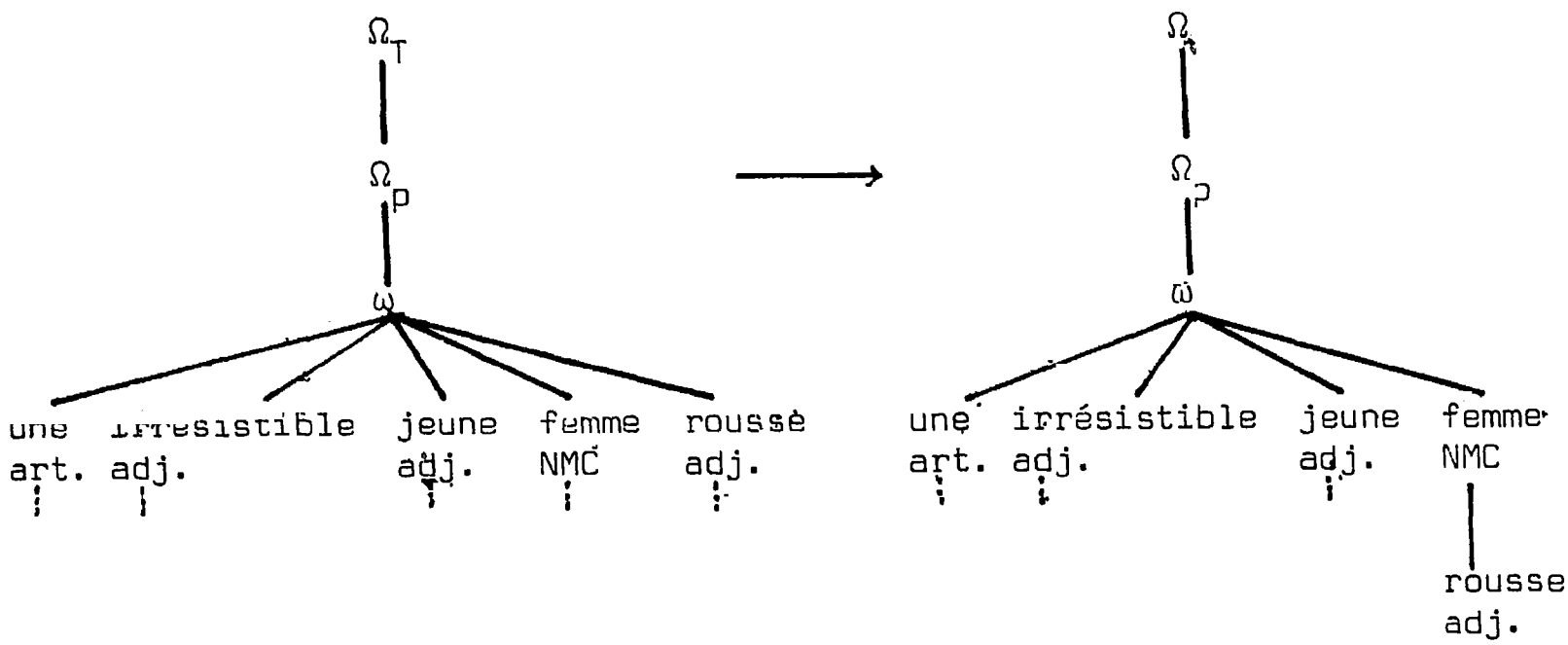
R3 :



Several applications of this rule are possible on the same input as before.





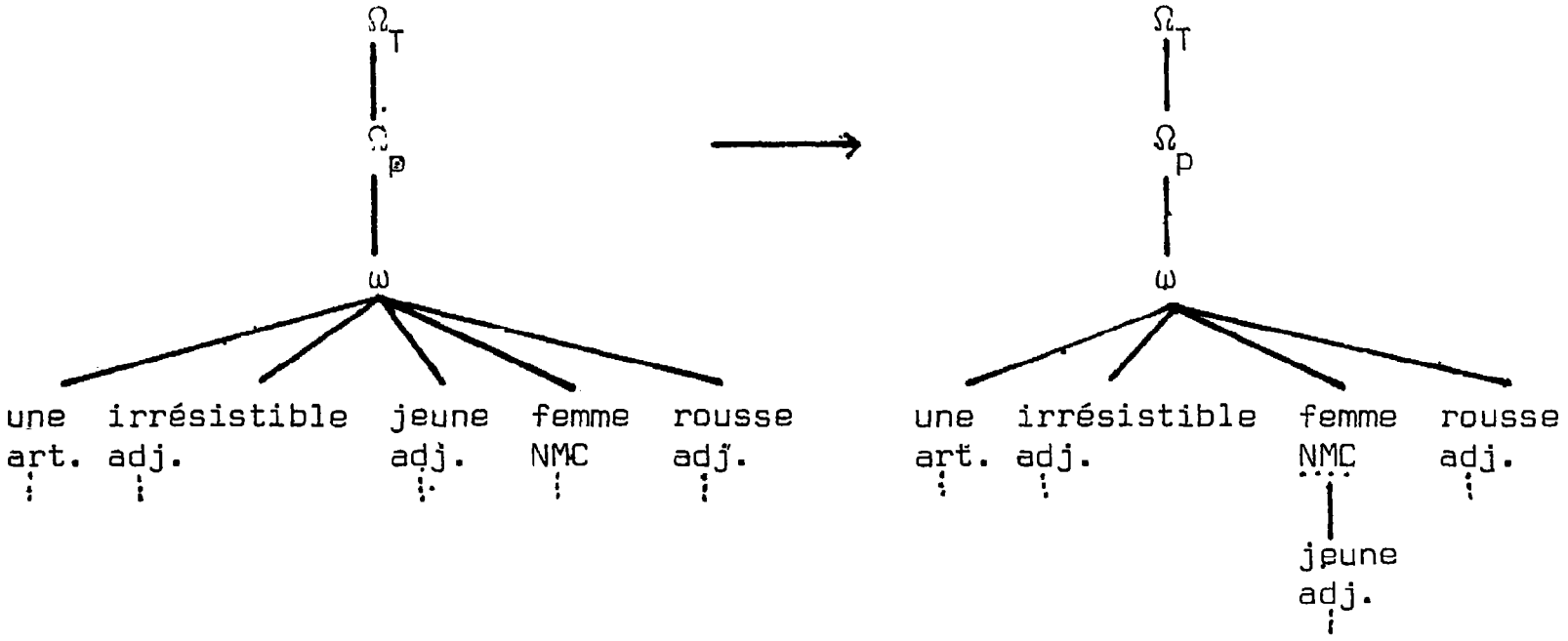


The linkage of the different rules previously described is defined by the set of elementary grammars. An elementary grammar consists of ordered rules. A rule R_i will be applied prior to an R_j if the order of R_i is less than the order of R_j An elementary grammar has furthermore a mode of execution. An elementary grammmar unitarily executable is such that its result will be obtained after an application of a part of the set of rules mentioned. (An application of the rules mentioned can cause to appear new possible applications which will not be performed in this case.) Another mode of application of an elementary grammar is exhaustive. In this mode, the set of rules of the grammar will be applied up to the maximum but the application of a given rule has the effect of eliminating it from this elementary grammar. (That is, for a given point.) With this second mode of application, the number of possible steps for a given tree is always finite. Within an elementary grammar which is unitarily or exhaustively executable, the presence of recursive

rules makes it possible to obtain complex constructions by simulating repetitive procedures. A recursive rule is characterized by a call to a new grammar (which can obviously be the same as that in which the recursive rule is found). The result of the application of a recursive rule consists of the tree obtained after transformation by the called grammar of the tree transformed by the rule in question.

For example, let R3 and R2 be the rules previously described. The elementary grammar G consisting of these two rules will furnish as result,

In unitary mode: application of R3. (Priority is given by the order of enumeration of the rules.)



In exhaustive mode: application of R3 then R2.

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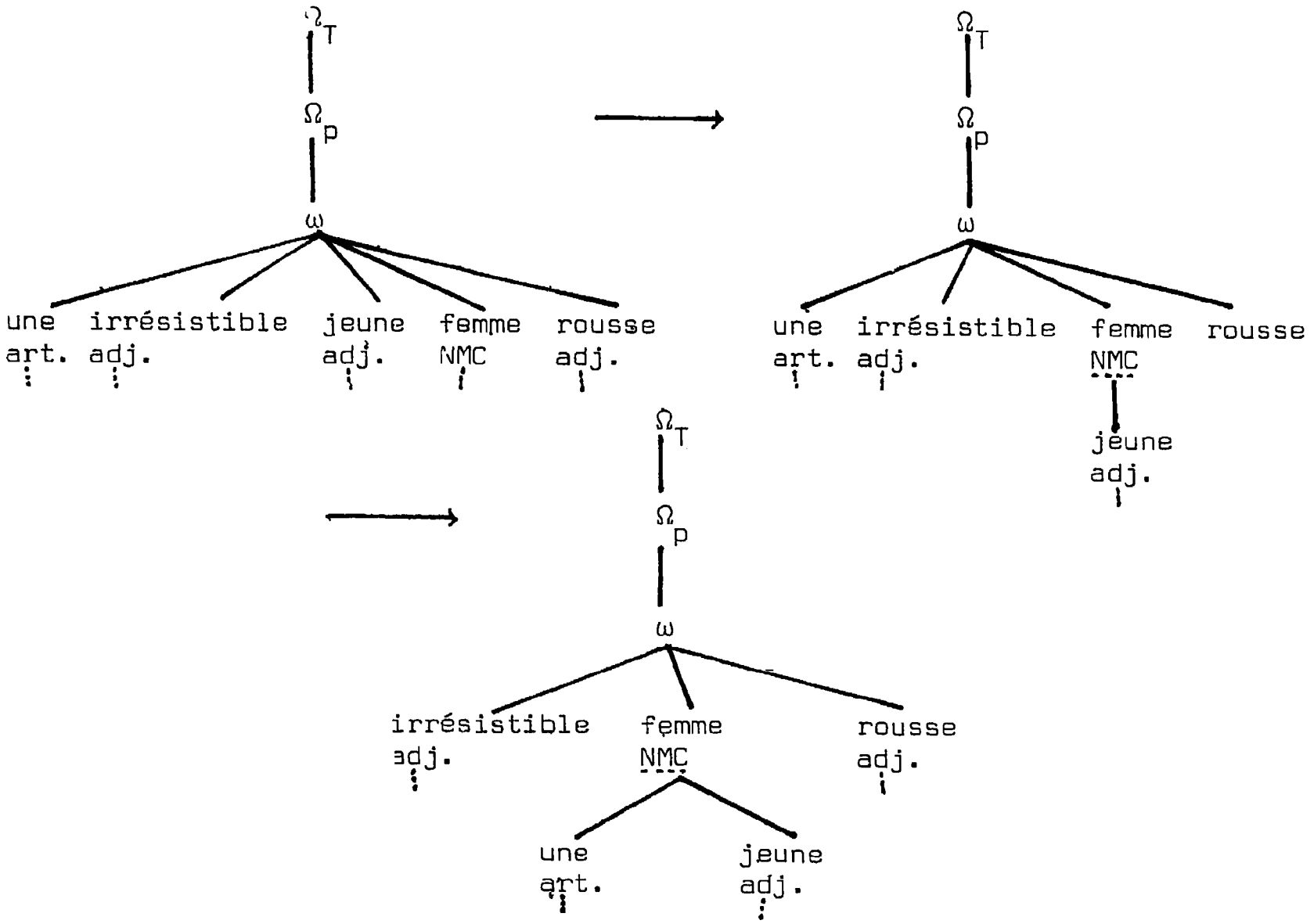
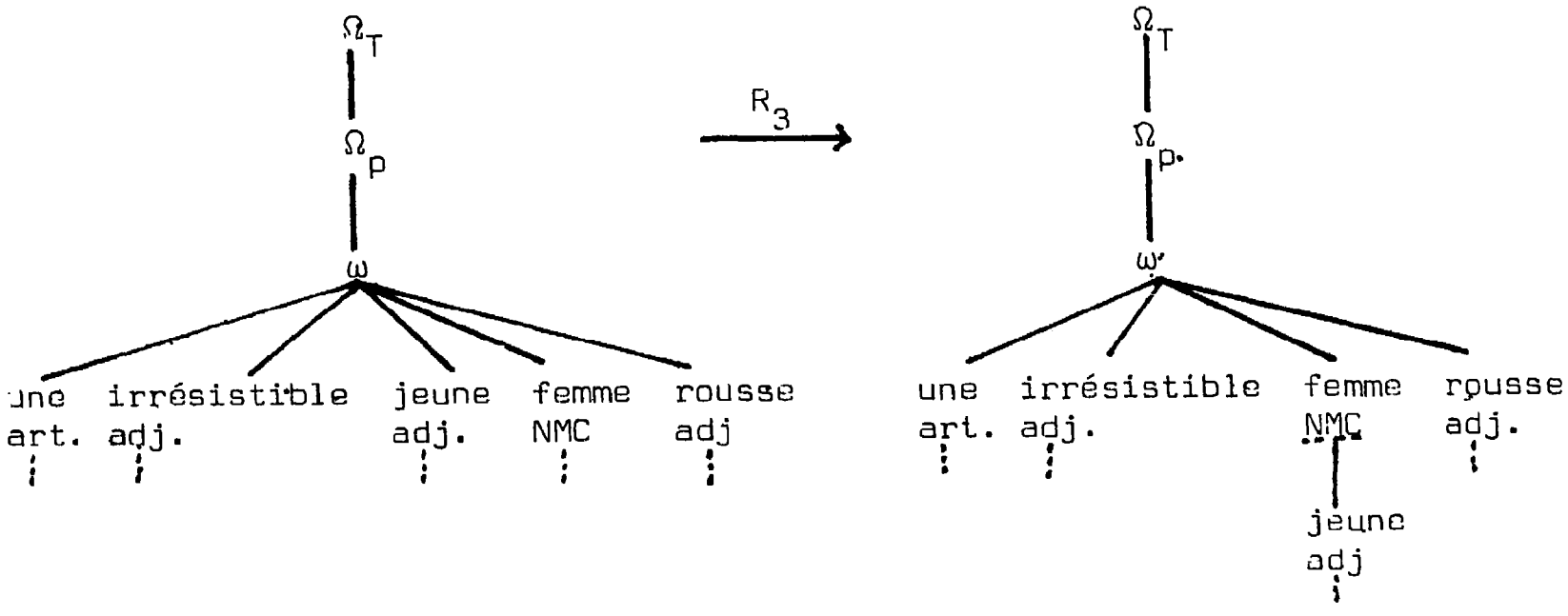
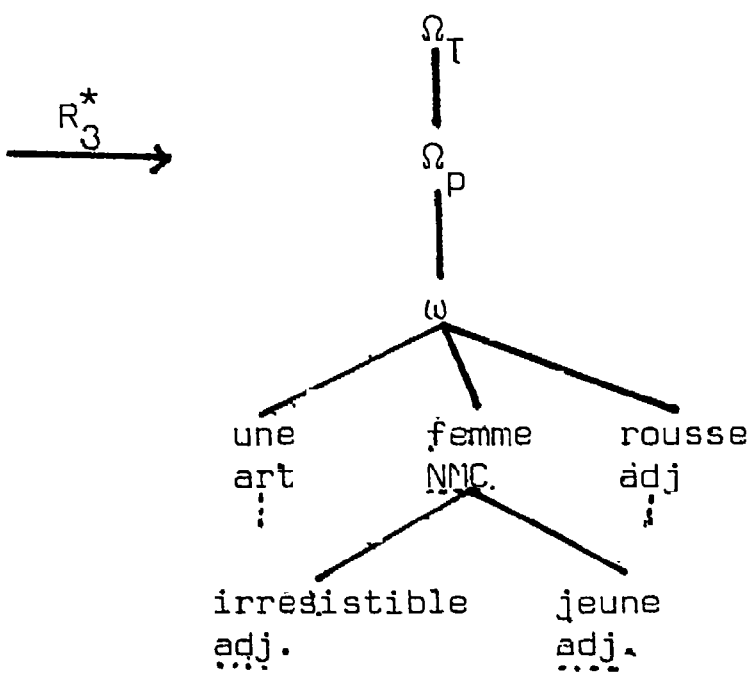


With Grammar G' containing rules R3 and R2, but specifying that R3 must be recursive and call G', we have:




R_3^*
Ω_T
Ω_P
ω
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irrésistible
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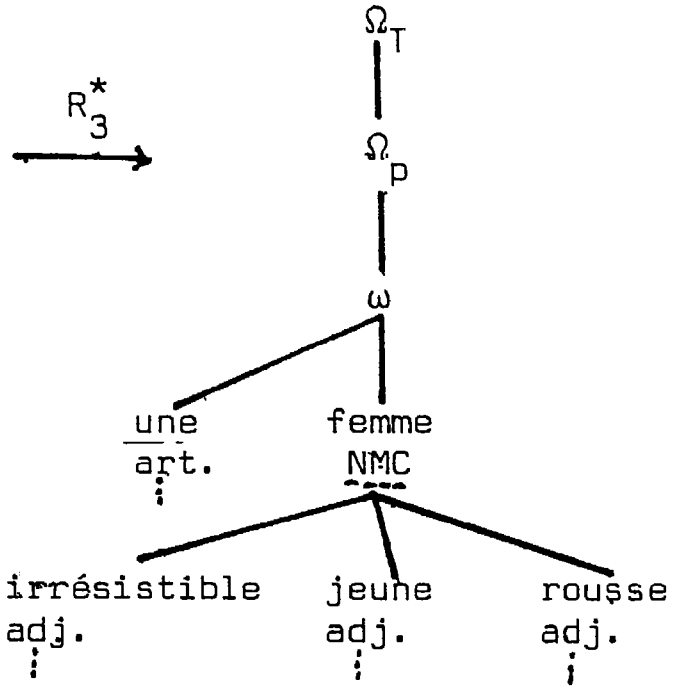
R_3^*
Ω_T
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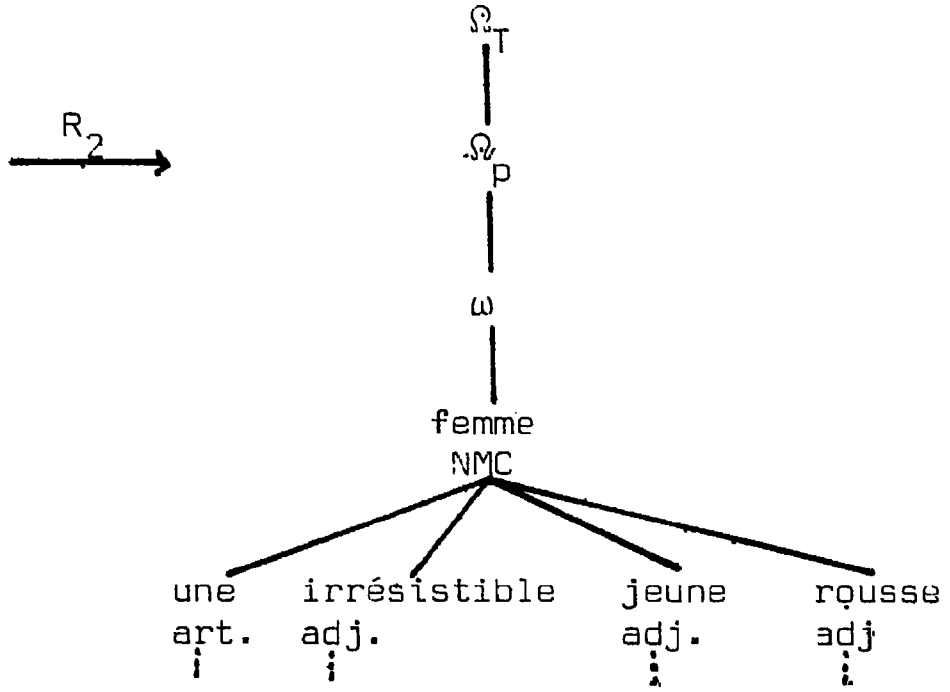
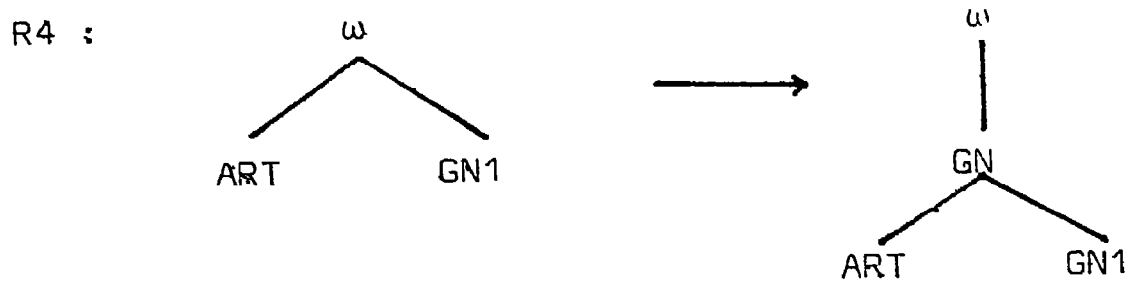
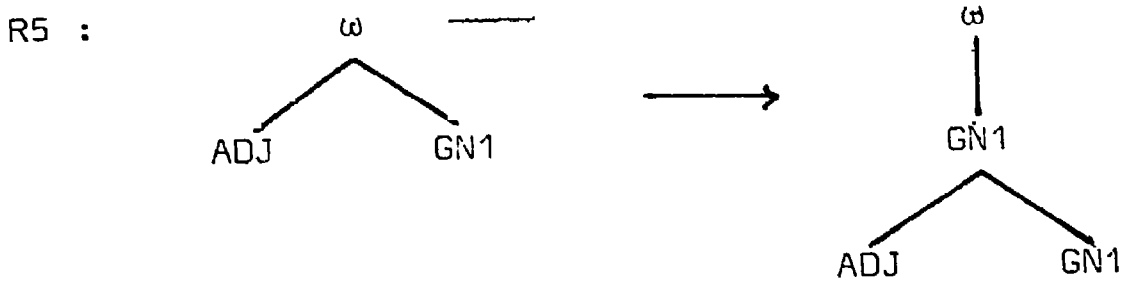
adj.

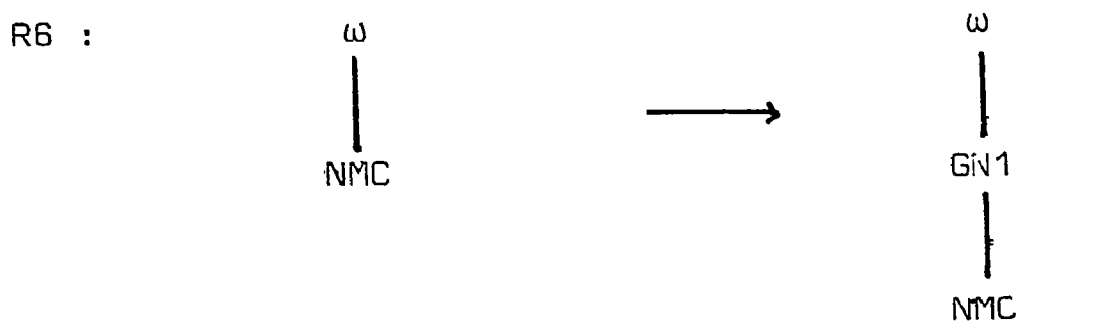

R_2
Ω_T
Ω_P
ω
femme
NMC
une
art.
irrésistible
adj.
jeune
adj.
rousse
adj

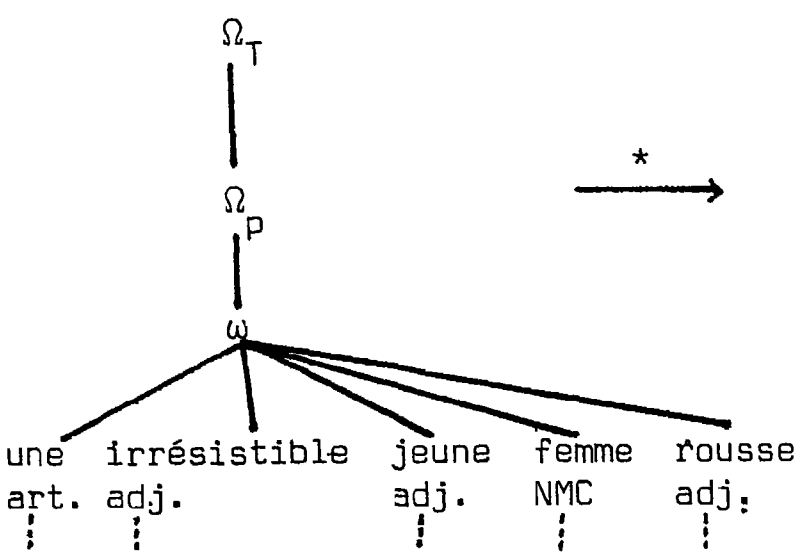
Application of rule R3* corresponds to the recursive call of this rule, terminating when the rule is no longer applicable.

With rules R4, R5, and R6, the construction is









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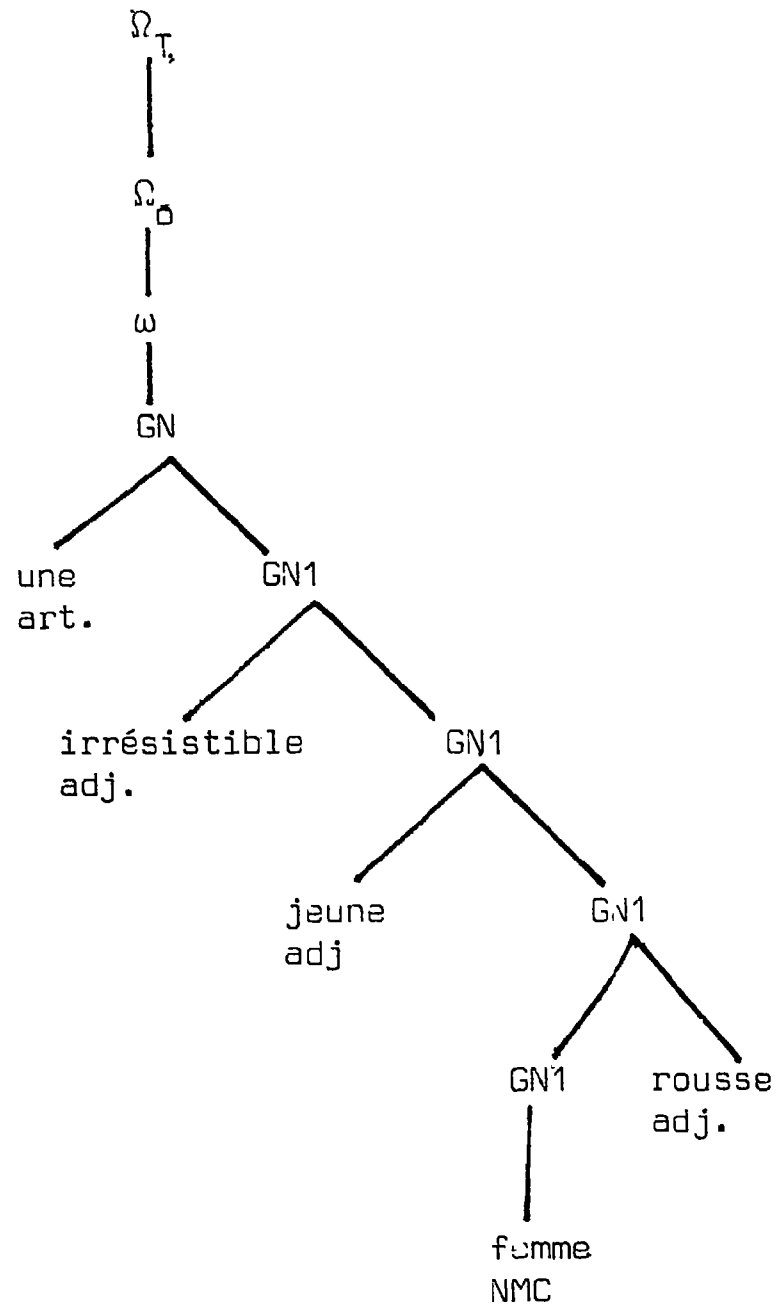

The definition of a CETA grammar consists of a set of elementary grammars and a conditional linking procedure over them. The linking must be such that the corresponding graph is loop-free. An elementary grammar from which no linking is possible yields as result the input tree in place of the transformed tree. This procedure permits one to obtain a method of analysis involving several criteria of acceptance, each consisting in the presence of a tree schema in the terminal tree.

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Chauche, J. P. Guillaume, and M. Quezel-Ambrunaz. Le systeme A.T.E.F. Internal document, G.E.T.A. December 1972.

Chauche, J. Arborescence et transformation. Thesis, Grenoble. December 1974

Chauche, J. Presentation du systeme C.E.T.A. Internal document, C.E.T.A. January 1975.

Translation of a text prepared for the First National Conference on Computational Linguistics, Varna, May, 1975.

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CONCEPTUAL ANALYSIS

INVENTORY AND ANALYSIS OF TERMINOLOGY IN POLITICAL SCIENCE

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Box 1830, Station B ,
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Nashville, Tennessee 37235

At the 1970 International Political Science Association Congress in Munich, the first informal meeting was held of what became Research Committee Number One of the Association, the Committee on Conceptual and Terminological Analysis (COCTA) This committee (which includes political scientists, sociologists, anthropologists, linguists, and philosophers) has been moving toward several objectives of concept clarification in political and social analysis. COCTA has organized panels at many political science and sociology associations, including its formal association with the C mparative Interdisciplinary Studies Section of the International Studies Association as the Internet on Conceptual and Terminological Analysis. Over the half-decade of its existence, COCTA has developed several separate stages of conceptual analysis including special foci on metalinguistics, concept construction and reconstruction, and clarification of the theoretical usages of concepts. Underlying these and other interests is a prerequisite need for an inventory of concepts-in-use. The rationale for attempting to develop the inventory, and discussion of its potential usages, are fully stated in my *Commencement of a Systematic Concept*

Collection This statement sets forth the description of the resulting official COCTA Concept Inventory[2].

The inventory is a rather ambitious project that will depend upon the contributions of interested scholars. It will begin with special focal points within political science and sociology as a pilot project. The logic of this pilot collection, however, is to provide a framework within which the collection can be expanded into other social sciences and related fields in the humanities. The immediate task is to commence the collection of social science concepts-in-use and to demonstrate the inventory's utility. Since the inventory can be commenced only by volunteers, the aid of scholars from several disciplines is essential to its success. Any concepts can be listed by interested scholars.

The present procedures for entering concepts into the inventory are simple. Scholars in the fields record concepts and related information according to the inventory's format and mail them to me. These materials will be edited and sent to Carl Beck at the University of Pittsburgh where the concepts and information will be recorded and stored (the Pittsburgh

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[1]Pittsburgh: University Center for International Studies, No. 9, 1974. See also the other COCTA papers listed therein.

[2]The final design of the collection has seriously benefitted from comments from Fred W Riggs, from those who attended a special workshop on the inventory at the 1975 International Studies Association Meeting in Washington (including Carl Beck, James Bjorkman, Judy Bertelsen, Ray Corrado, David Hays, Ray Johnston, R. J. Kirkbride, David Nasatir, Stephenie Neuman, Jonathan Pool, Charles Powell, Fred Riggs, Henry Teune, Theodore Tsukahara, and Alan Zuckerman), and special responses from David Hays and Glenda Patrick.

system also houses, among other important resources, the United States Political Science Information System--UPSIS)[3] Except for the labor and postage costs, to be absorbed by scholars one way or another, Beck's technical and storage assistance permits commencing the inventory without funds. Once the inventory is seriously commenced, funds should quickly follow.

INVENTORY FORMAT

For each definition of a concept from the literature, the following information should be recorded by typing the information on 8½ x 11 inch paper. The identification of field and its contents should follow as below, with the information replacing the field descriptions. The information for some fields may either not be available or not be relevant, but NO RECORD WILL BE STORED THAT DOES NOT COMPLETE THE INFORMATION FOR THE FIRST, SECOND, AND THIRD FIELDS. Each definition of a concept will be assigned an entry number when placed in the inventory because of multiple definitions for a specific term, but this will not affect the records sent from the field.

FIELD	DESCRIPTION OF CONTENTS
1	THE TERM USED BY THE AUTHOR TO REFERENCE A CONCEPT, e.g consensus' (If the term is not English, it should be followed by a comma and the closest English translation
2	ORIGINAL LANGUAGE DEFINITION DIRECTLY FROM THE TEXT. If the term and definition are in a language other than English, the definition should be followed by an EXACT

[3]The UPSIS is a special abstracting and retrieval system of political science articles, books, papers, etc., published in the United States which are indexed and retrieved by using the American Political Science Association's *Political Science Thesaurus*, eds. Carl Beck, Eleanor D. Dym, and J. Thomas McKechnie (Washington, D.C.: American Political Science Association, 1975).

English translation. (Because exact translation may require familiarity with the article, these entries require exceptional care.)

3 The source of the definition should be fully cited by AUTHOR, TITLE OF PUBLICATION (article and journal title if appropriate), PUBLICATION INFORMATION (full standard references for book, journal, or other paper or publication), and PAGE(S) from which the DEFINITION is drawn If guidance for full citations is needed, the most complete reference is *A Manual of Style,* (12th ed.; Chicago and London: University of Chicago Press, 1969)

4 RELATED CONCEPTS should be noted by identifying terms associated with the meaning identified by the definition. The use of a term is, of course, arbitrary since meaningful associations must be with other concepts, but the associations of terms will provide guidelines specified by the individual recording the entry. Each related concept (identified by terms) listed should be preceded by BC, NC, RC, or OC as follows:

BC BROADER CONCEPT of which the recorded concept is a less extensive definition

NC NARROWER CONCEPT of which the recorded concept is a more extensive definition

RC RELATED CONCEPT of which the recorded concept is on the same LEVEL of extension, though different in extension

OC OVERLAPPING CONCEPT of which the recorded concept shares extension

5 Category of concepts as either THEORETICAL or OPERATIONAL INDICATOR should be noted simply by entering either "theoretical" or "operational" in this field. This will facilitate searches for sets of measures for concepts in devising research designs.

6 ENGLISH LANGUAGE DESCRIPTIONS OF THE USE OF THE CONCEPT should be recorded. For example, "Revolution is defined only for use when analyzing third world nations from the

perspective of demographic measures." These descriptions should attempt to characterize the type and level of theory employed as completely as is possible. Several sentences can be used. Retrieved definitions then CAN be limited to only those concepts which ALSO have description terms of interest in this file For example: REVOLUTION/THIRD WORLD/DEMOGRAPHIC. (Since the collection will be stored in the same retrieval network as USPSIS, the APS Thesaurus terms provide useful guides for types of descriptors that can be used in both systems.)

7 IF A TERM FOR THE CONCEPT IS INCLUDED IN ESTABLISHED RETRIEVAL THESAURI, THESE SHOULD BE LISTED. The term associated with the definition may or may not be listed in the *Political Science Thesaurus* of the American Political Science Association, or some other thesauri IF THE TERM IS LISTED in any available thesaurus, the name(s) of the thesaurus should be listed. If in more than one, a comma should separate each listing. IF THE TERM IS KNOWN NOT TO BE LISTED IN A THESAURUS, the recorder is. asked to select the term(s) closest to the assigned term and list it, followed by the thesaurus s name (e.g., "APPEASEMENT, *Political Science Thesaurus*"). The internal structure of the thesaurus will provide, without recording for the storage system, broader, narrower, and related TERMS, in contrast with the recorder-listed set of related CONCEPTS recorded under 4.

8 THE NAME AND LOCATION OF THE INDIVIDUAL RECORDING THE CONCEPT'S DEFINITION.

The clarification of concepts will inevitably lead to restatements of definitions from the literature, to metalinguistic information worth storing, etc. Any restatements not contained in papers, articles, books, etc., can be sent in the same for-

mat as the above with the third category filled in as a COCTA PARTICIPANT RESTATEMENT If the restatement is in a form subject to citation, it is simply entered as any other concept-in-use.

Because the COCTA Concept Inventory is designed to facilitate research and concept clarification in the social and related sciences, the COCTA Board[4] and the Director of the COCTA Concept Inventory hope to draw upon and share the mutual rewards and costs with active scholars. The enterprise depends upon scholars taking the time to record the concepts they are using and promises, in return, to facilitate the efforts of scholars by providing an expanding list of concept meanings-in-use.

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[4]General information about activities can be received. from Giovanni Sartori, COCTA Chairman, Instituto di Scienza Politica, Universita degli Studi di Firenze, 48, via Laura, 50121 Firenze, Italy, or Fred Riggs, COCTA Secretary, Department of Political Science, University of Hawaii, Honolulu, Hawaii 96822.

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A REPORT ON THE TUTORIAL ON

COMPUTATIONAL SEMANTICS

Institute for Semantics and Cognitive Studies
Villa Heleneum, Lugano-Castagnola

March 17-22, 1975

SUZANNE HANON
Institute of Romance Philology, Odense University

GREGERS KOCH
Department of Computer Science, Copenhagen University

GEORG SØNDERGAARD
Institute of Scandinavian Language and Literature
Odense University

The Institute, a branch of the Fondazione dalle Molle, is carrying on research on artificial intelligence (AI); about ten scholars devote themselves to the study of communication between man and machine, under the direction of Manfred Wettler.

The tutorial was a week of lectures, seminars, and discussions conducted by the staff of the Institute, supplemented by evening discussions and presentations of their own results by participants. About 100 persons from Germany, Great Britain, Italy, Holland, Denmark, France, Belgium, Switzerland, Norway, Israel, Canada, and Japan attended. They were teachers, students, or researchers with various fields of interest and

background: linguistics, psychology, philosophy, automatic translation, computer science, social sciences, engineering., etc. The courses offered embraced a wide range of topics related to semantics. Some of them were introductory courses, others were survey courses including the lecturers' own scientific results and discussions of these in relation to recent research. This variety of fields taught at different levels was well suited to the audience.

Below we will account for the lectures chronologically, describing at greater length those which were most relevant to us

PARSING ENGLISH - *Yorick Wilks*

A survey and comparison of some of the better known AI systems, this course began with certain fundamental concepts and general characteristics of relevance for all the systems in question. A principal issue is parsing. Wilks defined it as "procedural ascription of structures to sentences, where the structures are not syntactic at all, but semantic." Parsing may be done in two different ways: TOP-DOWN or BOTTOM-UP. Bottom up is the more straightforward way. The words of the sentence are listed and each word is replaced by its category Then pairs of category symbols (for instance Verb + NP) are rewritten by reversing the grammar's rewrite rules (Verb + NP --> VP) until the final sentence symbol S is reached. The lines of the derivation can then be considered as the parsing.

Top-down parsing is the reverse procedure starting with the generations and continuing from left to right until the last word is reached. Another important pair of technical terms is BREADTH-FIRST and DEPTH-FIRST. Breadth-first is the parallel treatment of all possible alternative structures at a given time, none of which is given precedence. In depth-first parses, the alternative structures are treated sequentially. So far the description may apply to any kind of parsing, but it was Wilks's aim to demonstrate parsing procedures where the structures are not syntactic but semantic. He described his own view of semantics as a version of the "meaning is procedures" attitude, i e. the procedures of its application give a parsed structure its significance.

After mentioning what he called the "problem of natural language", by which he meant the problem of systematic ambiguity, Wilks gave a brief historical sketch of the first approaches to machine translation, the failure of which he put down to the ambiguity problem.

Terry Winograd has proposed a distinction between "first" and "second" generation AI language systems. This distinction that seems now to be widely accepted also lies behind the survey below, where the systems of Winograd and Woods are considered first-generation and those of Simmons, Schank, Charniak, and Wilks belong to the second generation. Winograd's well-known dialogue system SHRDLU operates in a closed world of colored blocks and

pyramids. The grammar of SHRDLU is not the conventional list of rules but small subprograms that actually represent procedures for imposing the desired grammatical structure. In terms of the notions set out earlier, Winograd's parsing is top-down and depth-first. After the syntactic parsing a number of "semantic specialists" attach semantic structures to specific syntactic structures. These semantic structures can then be used by the deductive component of the system. Woods's system, too, is considered first-generation, but both Woods and Winograd have argued that their systems are essentially equivalent, which is the reason why Wilks described only one of them in detail.

What the second-generation systems have in common is the assumption that understanding systems must be able to manipulate very complex linguistic objects, or semantic structures, and that no simplistic approach to understanding language with computers will work. A common feature in connection with second-generation systems is what Minsky (1974) calls a FRAME. It is described as a data-structure representing a stereotyped situation and attempting to specify in advance what is going to be said, and how the world encountered is going to be structured.

Colby s system, too, is a dialogue system, by which an interview between a doctor and a paranoid patient called PARRY is carried out. The input text is segmented by a heuristic that breaks it at any occurrence of key words. Patterns are then matched with each word string segment. Stored in the same format as the patterns are rules expressing the consequences

for the patient of detecting aggression and overfriendliness in the interviewer's questions and remarks. The matched patterns are then tied directly, or via these inference rules, to the response patterns which are generated. A very interesting aspect of the PARRY system is the fact that the answers of the system cannot be distinguished from those of a human patient This fact suggests that many people on many occasions seem to understand the information they receive in the same way that PARRY does.

Schank's is a rich system of semantic representation. It consists of the following three components:

1. an ANALYZER of English, due to Riesbeck
2. a SEMANTIC MEMORY component, due to Rieger
3. a GENERATOR OF ENGLISH, due to Goldman

The aim of Schank's system is to provide a representation of meaning in terms of which different kinds of analysis and machine translation can be carried out; a representation, moreover, that is independent of any particular language,. and of syntax, and, indeed, of all traces of surface structure

After a detailed description of Schank's so-called CONCEPTUALIZATIONS, built up by conceptual categories, primitive acts, cases, etc., Wilks gave his own comments on Schank's system.

Like that of Schank, Wilks's system has a uniform representation, in the shape of structures and primitives, for the content of natural language. It is uniform in that the

information that might conventionally be considered syntactic, semantic or factual is all represented within a single structure of complex entities (called FORMULAS and PARAPLATES), all of which are in turn constructed from 80 primitive semantic entities. The formulas are tree structures of semantic primitives, stored in the dictionary of the system. The main element in any formula is its "head", i.e. the fundamental category to which the formula belongs. Sentences and their parts are represented by the socalled TEMPLATE STRUCTURES, built up as networks of formulas. Templates always consist of an agent node, an action node, and an object node, and other nodes that may be governed by these. A formula for, say, the noun."drink" can be thought of as an entity at a template action node, selecting a liquid object, that is to say a formula with FLOW STUFF as its head, to be put at the object node of the template (sentence structure). This seeking is preferential in that formulas not satisfying a given requirement will be accepted, but only if nothing satsifying it can be found. The template ultimately established for a fragment of text is the one in which the most formulas have their preferences satisfied. This preference principle is of essential importance in connection with solving the many ambiguity problems in natural language texts. When the local inferences have been done that set up the agent-action-object templates for fragments of input text, the system attempts to tie these templates together so as to provide an overall initial structure for the input called a CASE TIE.

Case ties are made with the aid of another class of ordered structures called PARAPLATES, each of which is a string of functions that seek inside templates for information. The last step in the parsing is the inference procedure in which commonsense inference rules attempt by a simple strategy to construct the shortest possible chain of rule-linked template forms, on the principle of preference.

The other main section of this course was a comparison of the parsing systems described, including Charniak's system. This comparison was based on the following principal aspects:

LEVEL OF REPRESENTATION. At this point there are two opposite views: that language can be realized or represented at different levels depending on the subject matter, or that the appropriate level of computation for inferences about natural language has to be to some degree reduced. The different level attitude is supported mainly by Colby and Charniak, while Schank and Wilks hold that a certain primitivization is necessary

CENTRALITY OF INFORMATION. This aspect concerns the degree of specificity of the information required. Some systems, like Charniak's, are based on information highly specific to particular situations, while the sorts of information central to Schank's and Wilks's systems are of a much more general nature, consisting mainly of partial assertions about human wants, expectations, and so on. This problem of centrality is of great theoretical importance, which Wilks illustrated by an example: A person might know nothing of a particular type of

situation, for instance a birthday party, but could not for this reason be accused of not understanding the language. Yet, if he did not have available some very general inference such as for instance people getting sleepy at night, then it is possible that his failure to understand quite simple sentences would cause observers to think that he did not know the language. Wilks went on:

> An interesting and difficult question that then arises is whether those who concentrate on central and less central areas of discourse could, in principle, weld their bodies of inference together in such a way as to create a wider system; whether, to put the matter another way, natural language is a whole that can be built up from parts.

PHENOMENOLOGICAL LEVEL. This is a question of degree of explicitness. Here Schank s system is distinctive. Wilks's opinion is that the amount of detailed inference that a system may perform must be limited not to go beyond 'common sense'.. As an example he mentioned Schank's analysis of the action of eating (performed by moving the hands to the mouth) and described it as "going too far from the 'meaning' of eating, whatever that may be, towards generally true information about the act which, if always inferred about all acts of eating, will carry the system unmanageably far. ... There clearly is a danger of taking inferences to a phenomenological level beyond that of common sense," he concluded.

DECOUPLING. The issue is whether the actual parsing of text into an understanding system is essential. Charniak and Minsky believe that this initial parsing can be decoupled. In Wilks's opinion this is not so, because he believes semantic analysis to be fundamental and because many of the later inferences would actually have to be done already, in order to have achieved the initial parsing. Also the problem of systematic ambiguity may be met much more efficiently with a system that does not decouple the parsing from the inference procedure.

AVAILABILITY OF SURFACE STRUCTURE. In first and second generation systems it is generally accepted that word-sense is closely associated with the surface structure of the sentence, but Schank has made a point of the nonavailability of the surface structure, on the grounds that an ideal representation should be totally independent of the input surface structure and words. In connection with this claim of Schank's, Wilks pointed out two things: in many cases the order of the sentences in a text is part of its surface structure, and this information should be available in some way. The other point concerned the form of representation employed Wilks was not sure that a structure of primitives is sufficient for specifying and distinguishing word senses adequately without transferring information specifically associated with the input word.

APPLICATION. This concerned the way in which different systems display, in the structures they manipulate, the actual procedures of application of those structures to input text or

dialogue Here the most distinctive system is that of Winograd where the procedural notation, by its nature, tends to make clear the way in which the structures are applied. In his view, as stated in some of his more recent writings, the control structure of an understanding program is itself of theoretical significance, for only with a control structure, he believes, can natural language programs of great size and complexity remain perspicuous.

FORWARD INFERENCE. Is it necessary to make massive forward inferences as one goes through a text, as Charniak and Schank do, or can one adopt some laziness hypothesis' about understanding and generate deeper inferences only when the system is unable to solve, say, a referential problem by more superficial methods? Charniak's argument is that, unless forward inferences are made during the analysis, the system will not in general be able to solve ambiguity or reference problems that arise later. Wilks had some theoretical difficulties in arguing against this view, and he admitted the difficulty of defining a degree of forward inference that aids the solution of later semantic problems without going into unnecessary depth

THE JUSTIFICATION OF SYSTEMS. Finally Wilks tried to contrast the different modes of justification implicitly appealed to in terms of the power of the inferential system employed, of the provision and formalization, of a system's actual performance, and of the linguistic or psychological plausibility of the proffered system of representation.

In his conclusion Wilks concentrated on those areas where the greatest problems within the field of AI are found. The following needs seem to be the most pressing ones the need for a good memory model (stressed by Schank), the need for an extended procedural theory of texts and for a more sophisticated theory of reasons, causes, and motives for use in a theory of understanding. Wilks ended his survey by stressing the fact that there is an AI paradigm of language understanding which embraces first and second generation approaches and goes back to a considerable amount of earlier work in computational linguistics

INFERENCE AND KNOWLEDGE – *Eugene Charniak*

Why do we make inferences? We do when we use language and when we decode the information conveyed by language, i.e. in the case of structural disambiguation as well as in word-sense disambiguation, reference determination, question answering, translation, summarizing, etc., everywhere a thing not stated explicitly has to be assumed. In so doing we are looking for a piece of information, for knowledge beyond the given text or situation Charniak poses five questions about how knowledge is used to make inferences:

1 *What concepts, and in what combinations, do we need to record our impressions of the world?* (semantic representation)

2. *Under what circumstances and why do we make inferences?* (inference triggering)

3. *How do we locate the needed information?* (organization)
4. *Once located, how do we know how to use the information?* (inference mechanism)
5. *What is the knowledge that we have of the world that enables us to understand language?* (content)

After this program had been put forth, Charniak presented two partial answers to the questions the first order predicate calculus (FOPC) and the programming language PLANNER.

FOPC consists of a language for expressing facts and rules for deriving new facts from old. The language consists of constants, variables, predicates, functions, logical connectives, and quantifiers. There are rules for inference. Charniak then outlined RESOLUTION THEOREM PROVING. It is a system for setting up proofs for deciding which rule of inference to use. Charniak proceeded to look at the five questions he had set forth and examined what answers FOPC provides to them. He concluded that FOPC is primarily a theory of inference mechanism, but that it says very little about semantic representation. As FOPC does not tell how one is to locate the facts which are to be used to prove the derived result, theoretically we come up against a huge amount of possibilities when we combine the number of possible clauses with the number of possible resolutions. This is called the "combinatorial explosion" and is a serious problem in most inference systems, not only for FOPC.

Charniak then examined the problem of when we make inferences. There are two obvious occasions when we may make one:

1. When a question is asked which requires an inference to be made (question time)

2. When the system has been given enough input information to make the inference (read time)

Although the inference making restricted to question time would seem to be more economical since inference is done only when we must, in order to answer the system user's question, there is some evidence that inference is done at reading time (e.g. psychological experiments on recall of texts). Furthermore, it is not possible to do word sense or structural disambiguation without making inferences. Wilks makes a distinction between "problem occasioned" and "nonproblem occasioned" inference. A typical example of the latter is given in "Janet shook her piggy-bank. There was no sound." We assume that there is nothing in the piggy-bank although the problem has not yet arisen in the story. Charniak believes that to do question answering on complex stories the system must perform nonproblem occasioned inference. He gives examples from children's stories where persons lie about things and where the system has to guess why the person is lying

An alternative to FOPC is to use the natural properties of some programming language to make inferences. Bertram Raphael (1968) did this in the system SIR when he used LISP to construct a data base. Another way is making the programming languages more suited to the needs of inference making. Such a system has been designed but not implemented: PLANNER

(Hewitt 1969) In this system we are able to pick up an assertion by knowing parts of it If no appropriate assertion can be made, we can try to have theorems (i.e. programs) investigated An antecedent theorem is one where we are given the antecedent and we assert the consequent, while with a consequent theorem we are asked to prove the consequent and we try to find the antecedent. PLANNER has the ability to choose which theorems to use on the basis of their patterns. This is called PATTERN DIRECTED INVOCATION. Furthermore, the system can back up to see if any earlier choices might be changed. This feature is somewhat controversial, since it might encourage the construction of programs which depend on blind search.

PLANNER's advantage over FOPC is that it offers several built-in organizational features, the primary one being pattern directed invocation. A disadvantage about it as theory of knowledge and inference is that it is too vague Charniak (1972) illustrates the pros and cons of PLANNER using children's stories. Given a piece of simple narration, the system should be able to answer reasonable questions about it. Charniak stresses the need for looking ahead in the story to make inferences For this he uses an antecedent theorem or a "demon". The routines which are available to set up demons he calls BASE ROUTINES. In addition he makes use of BOOKKEEPING for updating the assertions and of consequent theorems called FACTFINDERS: the basic idea behind factfinders is that they are used to establish facts which are not too important so that we do not want to

assert them and store them in the data base. The main advantage of this system is that it provides a good theory of organization. It states in particular that "given a particular assertion, the way we find those facts which we should use to make inferences from the assertion is to look in two places, first the base routine for assertions of that form, and second for any demons which happen to have been activated which are looking for assertions of that form". Charniak concluded his lectures by examining the recent works of three scholars:

1. McDermott's system TOPLE (1974) is mainly concerned with the problem of beliefs, describing a simple world consisting of a monkey and an experimenter in a single room. The program listens to a present-tense account of what is happening in the room; it tries to understand why things happen and what can be expected to happen as the story goes on. It tells us at the end of every sentence what new assertions it has assumed as a result of hearing. TOPLE's restrictions are the following: it does not answer questions, it does not handle actual natural language but rather a formal-looking input language. On the other hand, it tries to visualize concretely a situation. It is based on a "multiple world structure"

2. Rieger (1974) is the first to have attempted to use Schank's conceptual dependency theory within a theory of inference and knowledge. Rieger's program has as its main purpose to make reasonable inferences from the input it is given. The

input is expressed in a suitable formalism, i.e. conceptual dependency representation. It is also designed to understand stories, engage in dialogues, figure out references and word-sense ambiguity, answer questions about the way the world normally is

3. Minsky's (1974) frames are reinterpreted by Charniak as "a collection of questions to be asked about a hypothetical situation. Frames specify issues to be raised and methods to be used in dealing with them."

Charniak also gave a double lecture on SYNTAX IN LINGUISTICS. This was an introduction to generative grammar for those who had not had a formal course in linguistics.

MEMORY MODELS - *Greg W. Scragg*

After introducing SEMANTIC NETS, Scragg discussed their most important properties and compared several systems including some with partial semantic nets, some with partially quantified semantic nets, some with fully quantified semantic nets, and some with executable semantic nets.

He compared semantic net representations and predicate calculus representations.

Attempts to construct proofs in the predicate calculus will show the difficulty of selecting the relevant information for making a particular deduction from a specific fact. The techniques currently employed in theorem proving programs are even less efficient at selecting the most relevant material.

In comparison of predicate calculus and semantic nets, most problems center around the question of quantification. How does one quantify relations in a semantic net? Scragg mentions three different approaches.

1. There are six possible quantifications for a two-place predicate Pxy

$\forall x \forall y Pxy$, $\exists x \forall y Pxy$, $\exists y \forall x Pxy$, $\forall x \exists y Pxy$, $\forall y \exists x Pxy$, $\exists x \exists y Pxy$

In Scragg (1973) the claim is made that the first three forms are so rare in everyday (nonscientific) situations that they may be ignored. The remaining ones may be distinguished with a type-token flag.

2. Palme (1973) tries to represent quantification by introducing a third quantifier, ITS (meaning something like the possessive pronoun "its"). With three quantifiers, he now can define six separate relations for each previous relation: Quantifying with FOR-ALL or EXISTS on the left and FOR-ALL, EXISTS, or ITS on the right of the old relation. One disadvantage of this is that he potentially has six times as many relations to work with and has to keep track of the relationships between each of the six versions of the same relation.

3. Schubert (1975) treats quantifiers in a different way. He first puts the predicate calculus representation of the statement into SKOLEM FORM (a form which has no existential quantifiers and with all universal quantifiers outside of the body of the expression). Any node that is existentially

quantified but dependent on a universally quantified node is connected to that governing node. An event is asserted if and only if there is no arrow pointing to that node in the diagram. The semantic net structures here tend to become very complex.

It is not clear that any of the three approaches give really practical (or intuitively satisfying) results.

What we need at present is a theory of more complex actions. For example, how do we link the descriptions of the various substeps of the process of cake making into a single description of the overall action of making a cake?

There are those who claim that all knowledge is stored in the form of procedures and there are those who claim that it is stored as a collection of facts.

Scragg (1974; see also Norman 1973 and Norman et al 1975) takes an intermediate approach by making use of ambiguous (data or procedure) representations to store information about actions. The system knows how to simulate various human actions such as toasting bread, making spaghetti or cleaning up the kitchen. The information about how to perform these simulations is stored as procedures. However, these procedures can be used as data by other parts of the system to answer such questions as "How do you make a ham and cheese sandwich?", "How many utensils do you use if you make a mushroom omelette?" or "Why did Don use a knife?"

SEMANTICS IN LINGUISTICS

SEMANTIC MARKERS AND SELECTIONAL RESTRICTIONS. Phillip Hayes discussed in detail the influential paper by Katz and Fodor (1963). He concluded that their semantic theory is not quite adequate even for the purely linguistic system they try to outline. Nevertheless, it can be a useful component of an AI theory of natural language comprehension.

GENERATIVE SEMANTICS. Margaret King outlined the defining characteristics of this theory and then concentrated on its relationship with AI. As a conclusion, she stated that the definition of grammar logically should be extended to embrace not only wellformedness and semantic acceptability but also all possible aspects of the context of use of a sentence. This is contradictory to the traditional view of grammar understood as the sole means of determining which sentences are grammatical for the majority of speakers of the standard form of the language.

CASE GRAMMAR. Wolfgang Samlowski surveyed Fillmore's theory with special reference to its influence on American linguistic theories of semantics and on leading researchers within AI. The survey consisted of a presentation of case grammar, an examination of some explicit and implicit traces left in AI by the case grammar theory, and a demonstration of some of the complications that the acceptance of the case grammar theory by language-understanding researchers would cause

DIVERSE

PHILOSOPHY OF LANGUAGE. Yorick Wilks, in a double lecture, compared and contrasted modern philosophy with relation to linguistics, in particular systems of formal logic, represented by the works of Ludwig Wittgenstein and Richard Montague. The survey had special reference to the application of such systems of formal logic to the preparation of language understanding systems.

PSYCHOLOGY OF LANGUAGE AND MEMORY.: Walter Bischof gave a selective historical survey of the prevailing concepts in the field: association, organization of data, Gestalt, meaningfulness of data, temporal structure of memory, reaction-time paradigm to investigate semantic memory and the network models of representation as proposed by Collins and Quillian (1969) Recent work based on the same assumption has shown that the structure of semantic memory is not quite the logical, hierarchical and economical structure proposed by Collins and Quillian. Bischof gave a list of possible relationships between artificial intelligence and cognitive psychology and concluded that these two disciplines have little to say to each other because of their different aims and because the available experimental tools proposed by psychology are too poor.

LISP. Margaret King taught an "O-level" course and Philip Hayes a more advanced introductory course, to this programming language, which is being used widely by AI researchers, in its original form or in some of its extensions (CONNIVER, PLANNER).

TUTORIAL GROUPS. Work consisted of discussions between participants in smaller groups and one or two of the lecturers Some evening lectures were given by the participants. These included H. Harrell, R. Güntermann, and G. Zifonun, who presented ISLIB (Information System on a Linguistic Base), a system for answering questions to an input in restricted German, carried out at the Institut für deutsche Sprache at Mannheim. A. McKinnon of McGill University, Montreal. discussed his work on the Kierkegaard indices. Some lectures caused vivid discussion. For example that of V. V. Raskin, Hebrew University, Jerusalem, advocated corpus dependent semantic models and recommended his own "restricted sublanguages"

APPRECIATION

Altogether, the tutorial in Lugano was very inspiring and profitable for the participants. It was well organized and gave good opportunity for discussions. The teachers in the tutorial being familiar with each other's work succeeded in giving a comprehensive view on the topic of computational semantics. Some of us, however, felt a need for more precise definitions of standard notions. this being a very acute problem in view of the heterogeneity of the participants' backgrounds. We are, however, aware that this is an inherent and recurring problem at such gatherings, where people with different qualifications meet to discuss common problems We would like to express the wish that the Fondazione dalle Molle will be able to arrange more tutorials of a similar kind in the future.

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"FORMULAE" IN COHERENT TEXT : LINGUISTIC RELEVANCE OF SYMBOLIC INSERTIONS

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Some difficulties in automatic analysis and translation bound to symbolic insertions in mathematical texts are discussed. Rules dealing with these difficulties are proposed. These rules are based on the use of the whole text of the article incorporating a formula.

For satisfactory automatic analysis of texts, it is necessary to provide in the dictionary exhaustive semantical information ascribed to its entries. But this information can appear to be insufficient in cases where the meaning of linguistic elements is ascribed to their occurrences by the very text in which they are encountered cf. for example, pronouns.

The other example is provided by symbolic insertions in mathematical texts, which we shall call "formulae". So not only 'a = b', 'x > y' etc., but also

'x' ' $\sqrt{2}$ ' and so on are "formulae".

Mathematical formula resembles pronouns in one respect: it is semantically "void" being out of context.

For example, 'G' may be "set", "subset", "group", "operator", "function", "string", "element", "rule of grammar", etc.

The meaning is ascribed to a formula by the context. There are a few types of formulae with fixed meanings. For example, 'dx/dy' is 'derivative'. But this situation is not typical.

One of the basic usages of formulae consists of naming by formula A some individual object a belonging to some class b of objects such that there exists some noun block Cl(A) that names b.

For example, in the expression 'set R' the formula 'R' names some individual set belonging to the class of "sets". Noun block 'set' (consisting in this case of a single noun) names this class.

So here

$$Cl(R) = \text{'set'}.$$

Consider some difficulties arising in translation because of the absence in a source sentence of the Cl(f) for a formula f.

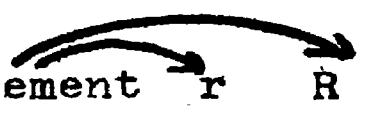
Let us try to translate from English to Russian the sentence

(1)

(Previous surface syntactical analysis is assumed, its results being represented in dependency-tree form).

Syntactically, this sentence is very simple, but even an experienced "human" interpreter would not be able to properly understand this expression and translate it.

In Russian, the element corresponding to the English preposition 'of' is, generally, the grammatical meaning "genitive". We can ascribe this meaning to the formula 'R' (governed by the preposition 'of'):



(Syntactical links are also shown).

At this point, the process of translation is suspended because of the fact that in Russian two non-coordinate formulae cannot depend on the same noun.

Similar examples are provided by other languages:

French: 'L'image X de Y'.

German: 'In jeder Umgebung V von X'.

Armenian: 'X-i x arzhekhə '. etc.

A human interpreter does not usually hesitate to properly translate such expressions only because he understands their meaning from a general background or vast context. We can point out some characteristic constructions in mathematical texts that are sufficient as contexts in such cases. Consider, for example, such a context (i.e. an expression from the same text):

'Let R be a ring with a unity 1'. (2)

for expression (1), and let us formulate very simple rules:

'Let f be a N' → Cl(f) = 'N' ; (R_1)

'Cl(f) f' ← 'f' ; (R_2)

N f' → Cl(f) = N ; (R_3)

Here f is some "formula", N - a noun block, ⌒ means syntactical link, → reads: 'if ... then', and ← means substitutability.

With the aid of the rules R_1 and R_2 we can obtain from (1) and (2) the following expression:

We first find an element r of ring R

which is easily translatable to Russian:

(The relevant syntactical links are shown; the two "formulae" depend on different nouns).

Of course, 'ring R' is not substitutable for R in the expression 'ring R'

The expression

'Components x_i are nonnegative'

with the aid of the rule R_3 provides us $Cl(x_i)$ and helps to translate the expression:

'A unique value a of x_i '

Cf. also the contexts:

'L'espace topologique Y' and

'Ein topogener Raum X'

for the French and German examples above.

Let us now try to translate to Russian the following expressions:

'H is cyclic' (3); 'A smallest k' (4).

A predicative adjective in Russian must be put in grammatical agreement with the subject of the sentence; an attributive adjective - with the governing noun. That is, the Russian adjectives for cyclic' in (3) and for 'smallest' in (4) must agree in gender

with 'H' and 'k' correspondingly. It is clear that the information about the gender of a "formula" can be provided by Cl(f). Having defined Cl(H) = 'matrix' for which the translation

'MATRITSA'

is feminine, we receive for (3) the translation

'H javljajetsja tsiklicheskoj'.

There exist numerous other expressions for which the finding of Cl(f) is very desirable, for example:

We define j and k by j = m + n; k = m - n'. (5)

The "direct" translation of (5) to Russian:

'Opredelim j i k putjom j = m + n; k = m - n'

is not smooth enough; the translation:

'Opredelim j i k s pomoshju sootnoshenij

j = m + n; k = m - n'.

("We define j and k by correspondences j = m + n; k = m - n") is much better.

Cl(f) can be sometimes defined from the very formula f. For example, 'a = b' is "equality", 'a > b' is "inequality", and so on. Sometimes the "meaning" of a formula f can be derived from words syntactically linked to this formula or from a more complex formula F incorporating f.

For example, from the expression

'T : A $\longrightarrow$ B'

we can derive that 'T' is a "transformation" and that 'A' and 'B' are "sets". From the expression

'a $\in$ B'

we can derive that 'B' is a "set" and that 'a' is an "element".

In

'Subset of A'

'A' is a "set". In

'Differentiation (or: integration) with respect to x', 'x' is a "variable", and so on.

Cl(f) for a formula f can be sometimes a more or less bulky expression consisting of a noun with words depending on the noun directly or indirectly.

Example:

'Tous les ensembles L_i d indices inferieurs a un nombre donne K' (Cl(L_i) is underlined). (6)

In this case we can reduce Cl(L_i) to only one word 'ensembles'. But in rare cases such reduction will produce absolutely inadequate translations.

Example:

In the expression

'Pour les fonctions x(t) de L' (7)

with a context

'La partie commune L de tous les ensembles L_i'

(Cl(L) is underlined),

we cannot reduce Cl(L) to only one word 'partie', which is its syntactical governor.

It is very difficult to formulate a general rule to discriminate between cases of types (6) and (7).

The expression (7) can be translated using a synonym for Cl(L), for example, 'ensemble', having in mind that the intersection of several sets is also a set. The computability of such synonyms can, of course, be questioned.

* *
*

Now we shall consider some problems arising in translation of Russian mathematical texts into European and other languages.

The construction

in Russian has two syntactical meanings,

(a) appositive:

'podmnozhestvo B'
= "subset B";

(b) genitive:

'podmnozhestvo B'
= "subset of B".

The cause of this difficulty is the omission of Cl(f) in the surface syntactical structure of some Russian sentences:

'podmnozhestvo mnozhestva B' ⟶ 'podmnozhestvo B'

"Subset (of) set B" "Subset (of) B".

In such cases the genitive link is rare (5% of all occurrences of constructions of type N ⌒ f, i.e. several-dozen occurrences in a mathematical article). The task of automatic choice here is very difficult. It was solved only partially. We can choose from the text of an article about 70% of all occurrences of the appositive links and also some occurrences of genitive links. The rest of occurrences remain ambiguous.

The proposed procedures were checked in exhausting manual experiments, but their adaptation for computer is quite feasible.

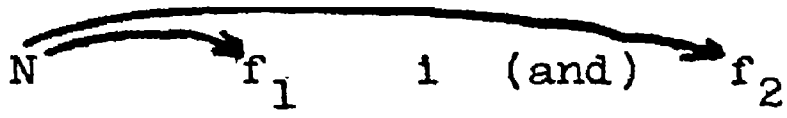
Choice of appositive links

Let us consider the following empirically stated axioms to be valid:

(A_1) In the same Russian text every two different occurrences of the same expression of type N ⌒ f are or both appositive or both genitive.

So, if we have succeeded in clarifying the meaning of a link in one occurrence of a construction, we can ascribe this meaning to every occurrence of the same construction.

(A_2) In a construction of the type



where f_1 and f_2 are two syntactically co-ordinate formulae, the two links are both appositive or both genitive.

For example, having a construction

'mnozhestva A i B'
("sets A and B" or "sets of A and B")

and knowing that in

'mnozhestva A'

the link is appositive, we can consider the link in

'mnozhestva B'

to also be appositive (i.e. "sets A and B").

(A_3) Let us call constructions of the type

'f jest' N'
("f is N")

and

'oboznachim N cherez f'
("Let us designate N by f")

introductory constructions. Every introductory construction ascribes the meaning to the formula which it introduces.

> In every construction $N \overset{\frown}{\quad} f$, for which an introductory construction exists in the same text, the link is appositive

(A_4) Sometimes the meaning is ascribed to a formula without any introductory construction.

> The link in an occurrence r of a construction of type $N \overset{\frown}{\quad} f$ is appositive, if the expression f has not occurred in the text before r.

In this case the formula f must also not occur before r as any coherent part (subformula) of some other formula F, because the meaning can be ascribed to a formula f by its place in F (see above). But to use the distinction between a coherent and a non-coherent part of a formula (Cf. 'a + b' in '(a + b)/d' and in 'ca + bd'), we need a calculus of all mathematical symbolic notations, of which only small portions exist (Cf. arithmetic expressions of programming languages). Because of this A_4 was formulated in the above form,.

(A_5) Sometimes there occur in mathematical texts expressions where verbal and symbolic parts are interwoven

so that in syntactic analysis a symbolic insertion appears not as a single unit but as a complex construction having its own structure. Some parts of a formula can have links of their own with the external verbal parts of the sentence.

Examples:

1. 'funktsija $L \in H(R)$'.
("Function $L \in H(R)$").

Here ' $\in$ ' is the predicate of the sentence, 'Function' is its subject and 'H(R)' - an indirect object. The sentence can be read as 'Function L belongs to H(R)'.

2. 'Dlja ljubogo $l \in B$ imejem' ...
("For every $l \in B$"...)

Here '$\in$' is an attribute of l and can be read as 'belonging to'.

3. 'funktsija $L \in H(R)$ opredeljajetsja'...
"Function $L \in H(R)$ is defined by"...)

Here '$\in H(R)$' is an attribute of 'Function', and 'L' is an apposition modifying the same word. But the whole string $L \in H(R)$ can also be considered an apposition modifying the word 'function'. So, we can formulate a rule: If the link in some construction of the type N $\overset{\frown}{\quad}$ f is appositive, then the link of the same N with the formula f R f', where R is one of the symbols $=, \neq, <, \leq, >, \geq, \supset, \supseteq, \subset, \subseteq, \in, \equiv$ or $\not\equiv$ and f' is a (coherent) part of the

formula f R f' is also appositive.

The inverse also holds true.

Using the axioms A_1 to A_5 cyclicly, we receive the 70% mentioned above.

Example:

Let us assume that the following Russian expressions belong to the same mathematical text (and the preliminary syntactical analysis has already been done):

(1) 'Oboznachim etu tsepochku cherez A'
("Let us designate this string by A");

(2) 'tsepochki A i B = D'
("strings. A and B = D"? Strings of A and B = D"?);

(3) tsepochki B i F'
("strings B and F"? "Strings of B and F"?);

(4) tsepochka F'
("string F"? "String of F"?)

Using axioms A_3, A_1, A_2, A_5, A_1, A_2 and A_1 we can ascribe the meaning "appositive" to the link in (4).

Assuming that in a text expressions (2), (3) and (4) are present, and that the occurrence of 'F' in (4) is the first occurrence of this formula, we can ascribe to the

link

'tsepochki A'

in (2) the meaning "appositive" with the aid of axioms A_4, A_1, A_2, A_5 and A_2.

So, we receive for expressions (2) to (4) translations: "strings A and B = D"; "strings B and F"; "string F"

It is worthwhile to mention that the same formula may occur in a text being linked appositively to several different nouns, for example,

'mnozhestvo R' ("set R")

and 'mnogoobrazije R' ("manifold R").

Different N's in expressions of the type $N \overset{f}{\curvearrowright}$ (with the same f) can refer to each other as genus and species or can name objects for which the fact of their identity has been proven in the text. Using the axiom A_4 we can (very rarely) make an error. An error can occur in a case where the formula has the meaning specified once and for all independently from the text. So, without any previous definition of the meaning in an introductory construction or in a construction with the appositive link, a formula can <u>at once</u> be linked genitively to a noun.

This situation is not typical in mathematical texts. In this case we have a hieroglyphic word (cf. '&', '$' in common English) and not a freely chosen notation. Such a word must be stored in the dictionary (with the

specific meaning ascribed to it). For example, 'dx/dy' is 'derivative'.

Using Cl(f) in every case of occurrence of every formula, authors of mathematical texts would make the above procedures unnecessary. The problem of standardizing the language of scientific publications is not new, and in many cases some format of texts is prescribed.

The problem of choosing occurrences of genitive links in constructions of the type N ⌒ f from the set of all occurrences of such constructions in mathematical texts and, also, of choosing the only semantically relevant governor for a formula which has several formally equivalent ones is considered in (1). The general procedure for resolving ambiguities in surface syntactical analysis using broad context is proposed in (2).

R e f e r e n c e s:

1. S.A. Djulmisarjan, F.A. Dreizin, Z.T. Ter - Misakjants. Mathematical Formulae in Broad Context. Scientific & Technical Information, Series 2, No. 3, Moscow, 1971, p.p. 33-38.

2. F.A. Dreizin. A Computational Approach to the Choice of Analysis in the Case of Syntactic Ambiguity. Mechanical Translation and Applied Linguistics, No. 10, Moscow 1967 p.p. 3-20.

American Journal of Computational Linguistics Microfiche 17 : 86

All you ever wanted
to know about
afips constituent societies
(but could never find
in one place!)

American
Federation of
Information
Processing
Societies, Inc.

210 Summit Avenue
Montvale
New Jersey 07645
201 391-9810

The American Federation of Information Processing Societies acts on behalf of 15 national organizations engaged in the design and/or application of computers and information processing systems. These societies range in areas of interest from the highest degree of technology in software and hardware to accounting and education, and they represent a total membership in excess of 100,000.

Inherent in the relationship between AFIPS and its Constituent Societies are the common goals of promoting understanding between societies and the general public.

This brochure provides a short overview of each society, its goals, membership requirements, activities and publications. Every individual society has more extensive information available for you, should you be interested in learning further about its specific areas of interest and expertise.

Contents

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American Institute of Aeronautics and Astronautics (AIAA)

Purpose
AIAA is an organization of people who have a common interest in space, the atmosphere and the sea. They see in the exploitation of these elements an opportunity to expand and enrich human life in countless ways and have set themselves to the study of the physical characteristics of these elements and to the development of machinery that will bring them more fully to humanity's service. AIAA s objective is to the advancement of the profession and the individual in these pursuits.

Membership Requirements
All persons engaged in the professional practice of the arts, sciences or technology of aeronautics, astronautics or hydronautics are eligible for membership in AIAA: Others whose work contributes to the advancement of these fields are also eligible.

Activities
Each year AIAA sponsors or co-sponsors from 25 to 30 national meetings in different parts of the country at which AIAA members have an opportunity to hear, present and discuss papers of importance to the advancement of aerospace science and engineering Many of the meetings include aerospace exhibits and field trips to nearby aerospace plants and laboratories.

Publications
Astronautics and Aeronautics
AIAA Bulletin
AIAA Journal
Journal of Aircraft
Journal of Spacecraft and Rockets
Journal of Hydronautics
Student Journal
Reference Publications as warranted.

Dues
Members under 30 ..... $30 00
Members 31 and over 35.00
Student ..... ,7.00
Publications are extra.

For Further Information Contact:
Dr. Jerry Grey
American Institute of Aeronautics and Astronautics
1290 Sixth Avenue
New York, N. Y. 10019

American Institute of Certified Public Accountants (AICPA)

Purpose
The American Institute of Certified Public Accountants is the national professional association of CPA s. The many activities of the Institute are designed to help members improve the quality of their professional services, the effectiveness with which they manage their practices, and their status as CPA's in the communities they serve. The Institute serves to unite the profession and to maintain the standards of the CPA qualification and the practice of accounting in the United States.

Membership Requirements
An applicant must be a Certified Public Accountant and be engaged in work related to accounting. International Associate memberships are also available.

Activities
The Institute s annual meetings and conferences are aimed at keeping professional issues and problems before its members. The Institute prepares and grades the CPA examination used throughout the United States and supports the Financial Accounting Standards Board which sets accounting standards. Other activities are promulgation of auditing standards, creation and administration of continuing education courses and programs, establishment of rules of professional conduct and conducting investigations in connection with alleged violations, maintenance of a Washington, D.C. office for liaison with the Internal Revenue Service, Securities and Exchange Commission, and other federal agencies, monitoring of state legislation pertaining to CPA's, operation of an on-line, real-time computer-based information retrieval system,, and research into accounting, auditing and computer subject areas. "

Publications
The Journal of Accountancy — Monthly
The Tax Adviser — Monthly
The CPA Letter — Semimonthly
Special technical publications,,books, and pamphlets.

Dues
Established by the Council, dues are levied on a graduated scale, according to longevity as a CPA, position in practice. and occupational status.

For Further Information Contact:
Donald L. Adams
American Institute of Certified Public Accountants
1211 Avenue of the Americas
New York, New York 10036

American Society for Information Science (ASIS)

Purpose
The American Society for Information Science is a nonprofit national and professional association organized for scientific, literary, and educational purposes and dedicated to the creation, organization, dissemination, and application of knowledge concerning information and its transfer. ASIS is dedicated to the improvement of the information-transfer process through research, development, application and education. The Society acts as a bridge between research and development and the requirements of diverse types of information systems. ASIS provides a forum for the discussion, publication and critical analysis of work dealing with the theory and practice of all elements involved in the communication of information.

Membership Requirements
Regular membership in ASIS is open to any interested person who applies for membership and pays the prescribed dues. No formal educational qualifications for membership exist. Student memberships are available for a period of not more than three years to persons regularly enrolled at a college or university in one or more courses of training or study for which degree credits are given in the fields of documentation, library science or information science. Institutional memberships are also available.

Activities
The Annual meeting of the Society, usually held in October, provides a focal point for the discussion of formal papers and an opportunity for informal talks with people of diverse interests. The Society also conducts a mid-year meeting, usually in May; participates in programs of other professional societies; and, is an active participant in the National Computer Conference. ASIS operates a member placement service. The Society has 24 major regional, local chapters throughout the U.S., Canada and Europe.

Publications
Proceedings of the ASIS — Annual
Journal of the ASIS — Bimonthly
Annual Review of Information Science and Technology — Annual
bulletin of the ASIS — 10 times a year

Dues

Regular	$ 35.00
Student	10.00
Institutional Sponsor	250.00

For Further Information Contact:
Robert (Skip) McAfee, Jr.
American Society for Information Science
1155 16th St., N.W., Suite 210
Washington, D.C. 20036

American Statistical Association (ASA)

Purpose
Quoting from the Constitution of the ASA, "The objectives of the American Statistical Association, a nonprofit organization, shall be to foster, in the broadest manner, statistics and its applications, to promote unity and effectiveness of effort among all concerned with statistical problems, and to increase the contribution of statistics to human welfare."

The Association is composed of persons interested in statistics, applied or theoretical. Through the Association, members mutually help each other with the exchange of professional knowledge and the reporting of new developments, insuring that statistical techniques discovered in one field are made known to workers in others.

Membership Requirements
There are several types of memberships available in ASA, including Regular and Institutional. Contact ASA Headquarters for further information on qualifications for membership.

Activities
The annual meeting of the Association is held in August, typically in conjunction with annual meetings of other scientific societies concerned with statistical practice. In addition, local meetings are held by the ASA chapters and regional meetings are arranged when desired within the geographical districts into which the Association is divided. Since these meetings are smaller than the annual meetings, they further opportunities for still more intimate discussion on statistical matters of local or regional interest.

Publications
The Journal of the American Statistical Association — Quarterly
The American Statistician — Quarterly
Newsletter — Ten times yearly
Technometrics — Quarterly
Proceedings — Annual

Dues

Regular	$20.00
Student (Full-time)	9.00

For Further Information Contact:
Fred Leone
American Statistical Association
806 15th St., N.W
Washington, D.C. 20005

Association for Computational Linguistics (ACL)

Purpose
The Association for Computational Linguistics was founded in 1962 by a group of researchers who shared a common interest in a broad class of problems involving both languages and computation. Their purposes were: (1) to promote research and development activities in the field of computational linguistics, (2) to promote cooperation and information exchange among related professional and technical societies; (3) to represent computational linguistics to foundations and government agencies and to represent the United States to similar organizations in other nations and in international organizations which include computational linguistics as a proper concern.

Membership Requirements
Any person who is interested in computational linguistics is invited to join the Association.

Activities
The Association meets annually, usually with the National Computer Conference and Exposition or with the Linguistic Society of America at their summer meeting.

Publications
The American Journal of Computational Linguistics, the primary journal of the Association, appears quarterly. The *AJCL* is published on 4" x 6" units, each an index card or a microfiche. For each article, bibliography, or survey, two units are supplied — an index card bearing a summary and a microfiche containing the full text. Announcements and advertisements appear on index cards. A yearly index is provided on tabbed index cards.

Dues

Individual	$10.00
Institution	25.00

For Further Information Contact:
A. Hood Roberts
ACL Center for Applied Linguistics
1611 North Kent St.
Arlington, VA 22209

Association for Computing Machinery (ACM)

Purpose
To advance the sciences and arts of information processing including the study, design, development, construction, and application of modern machinery, computing techniques and appropriate languages for general information processing, storage, retrieval, and processing of data of all kinds, and for the automatic control and simulation of process.

To promote the free interchange of information about the sciences and arts of information processing

To develop and maintain the integrity and competence of individuals engaged in the practice of the sciences and arts of information processing.

Membership Requirements
Member: Persons qualified to be members: a) subscribe to the purposes of ACM; b) have attained professional stature as demonstrated by intellectual competence and ethical conduct in the arts and sciences of information processing; c) have earned a Bachelors Degree or academic equivalent, or have four years' full-time experience in information processing; d) are endorsed by two members of ACM and who attest to the above. Associate Member: Persons qualified to be associate members subscribe to the purposes of the Association. Student Members: Individuals registered in an accredited educational institution full-time are qualified for student membership.

Activities
ACM conducts the Annual ACM Conference, the Annual Computer Science Conference, and participates in the organization of the National Computer Conferences. In addition, regional and chapter meetings are held. Special Interest Groups in a variety of disciplines are also available to ACM members. Special Interest Groups publish newsletters and sponsor meetings in their technical areas. There are over 240 chapters and student chapters providing locally sponsored programs.

Publications
The Journal of the Association for Computing Machinery — Quarterly
The Communications of the ACM — Monthly
Computing Reviews — Monthly
Computing Surveys — Quarterly
Transactions on Mathematical Software — Quarterly

For Further Information Contact:
Joseph Cunningham
Association for Computing Machinery
1133 Avenue of the Americas
New York, N. Y. 10036

Association for Educational Data Systems (AEDS)

Purpose
The Association for Educational Data Systems is a private, nonprofit educational organization founded in 1962 by a group of professional educators and technical specialists in educational applications. Its intention is to provide a forum for the exchange of ideas and information about the relationship of modern technology to modern education.

Membership Requirements
AEDS membership is currently at 1,700 with membership open to all interested in learning more and keeping informed about current developments and directions in educational data systems and computer technology.

Activities
An annual international conference is held to bring together key people from education and technical specialists. Executives, administrators from all levels of education, and all types of research, manufacturing and commercial service organizations are represented at this conference

An annual computer programming contest is held for secondary school students in grades 7-12. The contest is on the approved list of contests and activities published by the National Association of Secondary School Principals.

Local chapters regularly sponsor workshops and seminars on relevant topics designed to advance education by developing a greater awareness of the impact of educational technology.

Publications
AEDS Monitor — Monthly
AEDS Journal — Quarterly
Convention Proceedings — Annually
AEDS Handbook and Membership Directory — Annually to members only
Large School Survey
Layman's Guide to Use of Computers

Dues

Student	$ 10.00
Individual	20.00
Institutional	100.00
Sustaining	300.00

For Further Information Contact:
Shirley Easterwood
Association for Educational Data Systems
1201 16th St., N.W.
Washington, D.C. 20036

Data Processing Management Association (DPMA)

Purpose
DPMA is an organization serving the information processing and computer management community. Among its primary objectives are: (1) education and research activities focused on the development of effective management programs for the self-improvement of the membership, (2) encouragement of high standards of competence, and promotion of a professional attitude among the membership and (3) fostering of a better understanding of the vital business role of data processing in society, and the proper relationship of data processing to management.

Membership Requirements
Membership is granted only through a local chapter, except in areas outside North America where there is no chapter. Regular membership is granted by the Chapter Board of Directors to persons engaged in managerial or supervisory positions in data processing, educators, and executive personnel with a direct interest in data processing. Affiliate membership may be granted by the Board to graduates of an accredited college or university who are former members of a DPMA student organization; college graduates with one year of EDP experience; or individuals whose major source of income is direct selling or leasing of EDP equipment, supplies, or educational courses.

Activities
The Association sponsors INFO/EXPO, the annual International Data Processing Conference and Business Exposition which features seminars, panels, workshops, special sessions, on technical and especially management subjects. In addition, DPMA participates in the organization of the National Computer Conference. Other programs and services offered by the Association include: regional conferences; individual chapter educational meetings; video tape seminars under chapter sponsorship featuring nationally known industry experts, with particular emphasis on management-oriented topics; AIM (Advanced Instruction for Management) one-day, on-site seminars co-sponsored by chapters; and all-day chapter-sponsored seminars on Business & Management Principles.

Publications
Data Management — Monthly
Special technical publications, books, and pamphlets

Dues

International	$ 30.00
Chapter	10-30.00
Affiliate	30.00

For Further Information Contact:
Donn Sanford
Data Processing Management Association
505 Busse Highway
Park Ridge, Illinois 60068

IEEE Computer Society

Purpose
The IEEE Computer Society is actually part of a much larger organization, the Institute of Electrical and Electronics Engineers. With so many special interests among its members, it was natural for those who wanted to exchange knowledge or who wished to concentrate on one area of electronics to create Special Interest Groups. The IEEE Computer Society was formed to advance the theory and the practice of computer and information processing technology and exchange of technical information among its members. The scope of the Society encompasses all aspects of design theory and practice relating to digital and analog devices, computation and information processing.

Membership Requirements
You are eligible for Computer Society membership if you (1) are a member of the IEEE or an approved society; (2) have graduated from a 4-year course of study, or its equivalent in a school of recognized standing; (3) have been involved professionally in the computer field for a period of at least five years; (4) are a registered student interested in the Society's field of interest.

Activities
The IEEE Computer Society sponsors the Annual Computer Society Conference and participates in the organization of the National Computer Conference. In addition meetings for the presentation of technical papers and local chapter meetings are held regularly. The technical committees sponsor many seminars, symposia and sessions for the benefit of its membership. They also arrange the Distinguished Visitors Program which provides for leading computer professionals to speak to the local chapters of the Society and educational institutions.

Publications
Computer Magazine — Monthly
Transactions on Computers — Monthly
Transactions on Software Engineering — Quarterly
Proceedings (and special books as warranted)

Dues

IEEE Members	$ 6.00
Non-members applying to IEEE Computer Society and IEEE	
U.S. and Canada	46.00
Other Countries	41.00
Affiliate Membership	24.00

For Further Information Contact:
Harry Haymah
P.O. Box 639A
Silver Spring, Maryland 20901

The Institute of Internal Auditors, Inc. (IIA)

Purpose
The Institute of Internal Auditors is an international organization dedicated to the advancement of the profession of internal auditing. The Institute seeks the enrichment of its members through the interchange of ideas, information, and contacts. It is dedicated to maintaining the highest possible standards of competence, morality, and dignity in the profession.

Membership Requirements
All practicing internal auditors, those responsible for the function, public accountants, educators, and auditing students are invited to join The Institute.

Activities
The Institute offers many benefits to its members through a wide variety of services from its international headquarters and its chapter organizations. In the field of EDP auditing, in particular, a special department helps the auditor keep up with this changing field and provides hard-to-locate EDP auditing information. An "EDP Systems" department in the Institute's award-winning bimonthly technical journal, *The Internal Auditor*, and a monthly EDP-updating service, *EDPACS*, are additional helps published for those involved in the audit and control of EDP systems. A continuing program of seminars, workshops, and lectures conducted by the Cadmus Education Foundation of The Institute, along with annual area and international conferences, serve to keep the internal auditor "on top" of the latest developments in techniques and practices in the field. An examination in internal auditing and related subjects is offered to those who meet certain requirements. Those qualified will be entitled to use the professional designation of 'Certified Internal Auditor (CIA). The Institute also publishes research reports on such topics as electronic data processing, statistical sampling, inventory control, organizational control, and the behavioral sciences.

Publications
The Internal Auditor — Bimonthly
Auditing News — six times a year
Edpacs — Monthly
Special research reports and books

Dues

Member or Associate Member	$60.00
Educational Associate	25.00
Retired Member	13.00
Student Member	10.00

For Further Information Contact:
William E. Perry; CIA
The Institute of Internal Auditors, Inc.
5500 Diplomat Circle
Orlando, Florida 32810

Instrument Society of America (ISA)

Purpose
The Instrument Society of America is a nonprofit scientific, technical and educational organization dedicated to advancing and reinforcing the arts and sciences related to the theory, design, manufacture and use of instruments and controls in the various sciences and technologies for the benefit of mankind

Membership Requirements
The types of memberships available in ISA are predicated upon specific individual qualifications. Senior Membership requires either a B.S. or engineering degree and at least six years work in instrumentation, two years having been in a position of responsible charge; or no degree but ten-years work in instrumentation, two years having been in a position of responsible charge. A Regular Membership is open to any person interested in instrumentation and the programs of the Society. An Associate Membership is limited to those whose principal interests and occupations are not specifically in instrumentation. Student Members are either enrolled as full-time students or enrolled in a formal apprenticeship course.

Activities
The scope of Society activities embraces these areas of instrumentation: aerospace, analysis, automatic control systems, bio-medical sciences, chemical and petroleum, cryogenic instrumentation, data handling and computation, food, maintenance, marine sciences metals, metrology, mining and metallurgy, power process measurement and control, pulp and paper scientific instrumentation and research, telemetry test measurement, textile and transportation.

ISA publishes and disseminates information develops standards; conducts conferences, symposia and exhibits: provides educational services and honors individual achievement.

Publications
Instrumentation Technology — Monthly
Proceedings — Annual
Advances in Instrumentation — Quarterly
ISA Transactions — Quarterly
Special Publications — As warranted

Dues

Senior Member	$25.00
Regular Member	25.00
Associate Member	15.00
Student	5.00

For Further Information Contact:
Executive Director
Instrumentation Society of America
400 Stanwix Street
Pittsburgh, Pa. 15222

Society for Computer Simulation (SCS)

Purpose
The Society for Computer Simulation is the principal technical society devoted to the advancement of simulation through the use of computers and similar devices which employ mathematical or physical analogies. The purpose of SCS is to promote the development of simulation technology and to widen its application in all fields. In most of its activities SCS seeks to accomplish these ends through the exchange of information among people who are using simulation to advantage in their endeavors.

Membership Requirements
Full membership is open to people who have been professionally engaged in any phase of simulation and allied computer technology for at least four years. This requirement may be met by graduation from a four-year course of study in an appropriate field of science, engineering, or mathematics at an accredited institution of higher learning or by its equivalent

Associate Membership in the Society is available to anyone who is interested in the technology of simulation or in applications of the computer arts and sciences. Student Memberships are open to any person regularly enrolled on a substantially full-time basis in an institution of higher learning, including graduate students who hold teaching fellowships, upon certification of their status by a member of the faculty of such institution.

Activities
SCS co-sponsors the Summer Computer Simulation Conference and the Winter Simulation Conference, and participates in the organization of the National Computer Conferences. Individual Regional Council meetings present papers and panels on selected topics and offer attendees an opportunity to take guided tours of the hosting organization's simulation facilities

Publications
Simulation — Monthly
Proceedings — Semiannually

Dues

Full Member	$25.00
Associate Member	25.00
Undergraduate & Graduate Student Member	15.00
Senior Member	Special Application Necessary

For Further Information Contact:
Alex McKenna
The Society for Computer Simulation
P.O. Box #2228
La Jolla, California 92038

Society for Industrial and Applied Mathematics (SIAM)

Purpose
The Society for Industrial and Applied Mathematics was formed in 1952 to further the applications of mathematics to problems in industry and science. Recognizing the gap in a professional structure where the rapid expansion of industrial research had created a need for basic analytical thought and new mathematical methods, SIAM developed new media to bridge this gap and foster the exchange of ideas among all who are interested in the applications of mathematics.

Membership Requirements
Membership in SIAM is available to those people interested in the goals and objectives of the Society. Formal applications are directed to a Membership Committee for approval.

Activities
SIAM conducts two national meetings each year in the Spring and Fall. Such meetings are structured on a central theme to discuss an important and timely subject in mathematics. In addition, with the support of the National Science Foundation, the Office of Naval Research, and the Air Force Office of Scientific Research, SIAM sponsors special international symposia on various topics in mathematics. SIAM also created the SIAM Institute for Mathematics and Society in January 1973 to foster the application of mathematics to the major problems of society.

Publications
SIAM Journal on Applied Mathematics — 2 volumes per year, 4 issues each
SIAM Journal on Computing — Quarterly
SIAM Journal on Control — Bimonthly
SIAM Journal on Numerical Analysis — Bimonthly
SIAM Review — Quarterly
SIAM Journal of Mathematical Analysis — Bimonthly
Theory of Probability and Its Applications — Quarterly
SIAM News — Bimonthly.

Dues

Regular Members	$22.00
Student Members	10.00

For Further Information Contact:
R. K. Windsor
Society for Applied and Industrial Mathematics
33 South 17th Street
Philadelphia, Pa. 19103

Society for Information Display (SID)

Purpose
The Society for Information Display was chartered as a nonprofit technical corporation in 1962, with the following goals and purposes:

Encourage and contribute to the scientific advancement of Information Display
Promote the use of Information Display
Maintain a central file of display information for use by members
Provide forums for the exchange and dissemination of ideas and knowledge related to Information Display
Promulgate definitions and standards pertaining to the field of Information Display
Stimulate new ideas in Information Display and foster their development

Membership Requirements
Current membership in SID is approximately 2,000 and is open to all who can benefit from the Society and wish to further its goals. Membership is open to both individuals and companies.

Activities
The Society sponsors an Annual Technical Symposium and occasional shorter meetings. In addition, all SID members are affiliated with one of ten local chapters located throughout the world, which serve as the focal points of regular technical meetings, field trips, seminars, and tutorials. Members are encouraged to participate in all Society activities and to present their technical achievements and views in SID publications.

Publications
Proceedings of the SID — Quarterly
SID Journal — Bimonthly
Symposium Digest — Annual

Dues

Member and Associate	$ 15.00
Sustaining	150.00
Student (full-time)	3.00

Proceedings not included

For Further Information Contact:
Violet Puff
Society for Information Display
654 North Sepulveda Blvd.
Los Angeles, Ca. 90049

Special Libraries Association (SLA)

Purpose
The Association encourages and promotes the utilization of knowledge through the collection, organization and dissemination of information. SLA is an association of individuals and organizations with educational, scientific and technical interests in library and information science and technology, especially as these are applied to the selection, recording, retrieval and effective utilization of man's knowledge. Special libraries serve industry; business, research, educational and technical institutions, government, special departments of public and university libraries, newspapers, museums, and all organizations, both public and private, requiring or providing specialized information.

SLA and its members are concerned with the advancement and improvement of the communication, dissemination and ultimate use of information and knowledge for the general welfare and the advancement of mankind.

Membership Requirements
Membership category depends on the applicant's background. Members are assigned to the highest membership class for which they are qualified. Applications may be obtained from the Association's office in New York.

Activities
The Special Libraries Association holds an Annual Conference in June, which includes sessions of both general and specific professional interests, discussion of new equipment and technology, division program and business meetings, field trips to outstanding special libraries and information centers, continuing education seminars, and an extensive exhibit area.

Publications
Special Libraries
Scientific Meetings
Technical Book Review Index.
Books and Monographs

Dues

Regular	$ 30.00
Associate	30.00
Student	8.00
Retired	10.00

For Further Information, Contact:
Dr. Frank McKenna
Special Libraries Association
235 Park Avenue South
New York, N. Y. 10003

About AFIPS

The American Federation of Information Processing Societies represents 15 national organizations engaged in the design and/or application of computers and information processing systems.

Dedicated to nonprofit scientific and educational purposes, the Federation acts in behalf of these Constituent Societies in carrying out programs designed to advance information processing as a responsible profession.

Its primary objectives include:

- Undertaking of joint information processing activities on behalf of its Constituent Societies
- Promotion of cooperation and information exchange among professional and technical societies, governmental organizations, and nonpolitical international groups
- Participation in nonprofit international organizations concerned with computers and information processing
- Undertaking of research and development activities in the information processing field
- Provision of services to Constituent Societies
- Dissemination of reliable information on information processing and its progress to interested groups and to the general public

In addition to the National Computer Conference & Exposition which is sponsored annually by AFIPS ACM, DPMA, IEEE-CS and SCS, the Federation also sponsors conferences, seminars and symposia on behalf of its membership and maintains a major Washington activities program.

AFIPS Press publishes the Proceedings of the National Computer Conference, in addition to the Proceedings of special seminars and symposia, statistical research reports, and information booklets.

Educational projects include the development of career information, assistance in the development of educational guidelines, and teacher training programs, and a Computer Internship Program designed to assist developing countries.

Important programs are continually being carried out by the Public Information office, the Statistical Research and the Social Implications Programs.

On the international scene, AFIPS is the U.S. representative to the International Federation for Information Processing and participates actively in the IFIP Group for Administrative Data Processing (IAG).