ABSTRACTS OF CURRENT LITERATURE

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On Psychological Plausibility in Artificial Intelligence
Fowler, R. H., Slator, B. M. & Balogh, I.
CRL, MCCS-89-150

The Artificial Intelligence literature is liberally laced with claims about cognitive reality. Sometimes these are strong claims that cite empirical psychological evidence; but more often these claims take the form of weak appeals to "psychological plausibility." To examine the nature and scientific status of these claims, AI research is characterized along a particular dimension, cast as the "psychological evidence line." Then, some ideas about theory in AI are examined, especially the thorny notion of "models" in AI theories: what does it mean to use human intellect as a model in an AI theory, or in an AI program? Then, as is so often the case, further light is shed by an historical characterization, giving evidence for a particular grouping of "camps" in AI, according to how psychological evidence "matters" to them. These discussions set the scene, finally, for an examination of the role (really, roles) that psychological plausibility actually plays in AI; and this leads naturally into a discussion, and some conclusions, about which of these roles are appropriate, and which are not.

Neural-Net Implementation of Complex Symbol-Processing in a Mental Model Approach to Syllogistic Reasoning
Barnden, J.
CRL, MCCS-89-154

A neural net system called "Conposit" is described. Conposit performs rule-based manipulation of very short-term, complex symbolic data structures. This paper concentrates on a simulated version of Conposit that embodies core aspects of Johnson-Laird's mental model theory of syllogistic reasoning. This Conposit version is not intended to be a psychological theory, but rather to act as a test and demonstration of the power and flexibility of Conposit's unusual connectionist techniques for encoding the structure of data.

Belief, Metaphorically Speaking*
Barnden, J.
CRL, MCCS-89-155

The central claim of the paper concerns AI systems that attempt to represent propositional attitudes in realistic situations, and particularly in situations portrayed in natural language discourse. The claim is that the system, to achieve a coherent, useful view of a situation, must often ascribe, to outer agents, views of inner agents' attitudes that are based on rich explications in terms of commonsense metaphorical views of mind. This elevates the emasculated metaphors based on notions of world, situation, container, and so on that underlie propositional attitude representation proposals to the status of explicitly used, rich metaphors. A system can adopt different patterns of commonsense inference about attitudes by choosing different metaphors. The current stage of development of a detailed representation scheme based on the claim is described. The scheme allows different metaphors to be used for the explication of attitudes at different levels in a nested-attitude situation.

Constructing A Machine Tractable Dictionary From Longman Dictionary of Contemporary English
Guo. C.-M.
CRL, MCCS-89-156 Dissertation

It is the purpose of this research to design a machine-tractable dictionary (henceforth MTD) from *Longman Dictionary of Contemporary English* (henceforth LDOCE). The MTD is intended to be a basic facility for a whole spectrum of natural language processing tasks. The research adopts a compositional-reduction approach to obtain a formalized set of definitions of sense entries in a nested predicate form, where the predicates are a set of "seed sense." The focus of this research is on the derivation of these "seed senses" and their utilization in the construction of the MTD.

The construction of the proposed MTD involves the following four steps; including step 1: determine the "defining senses" of LDOCE, i.e. those world senses that are used in the definition of the meaning of 2,137 "controlled words" of LDOCE; step 2: derive the "seed senses" of LDOCE. The "seed senses" are a subset of the defining sense that are sufficient to define senses of step 1. The seen senses are taken as a natural set semantic primitives derived from LDOCE; step 3: hand-code the initial knowledge base for the natural set of semantic primitives derived from LDOCE; step 4: construct a MTD for the controlled words and the rest of LDOCE words by means of bootstrapping process, a process of knowledge acquisition from dictionary definition text.

Step 1 of the construction process has been completed. A total of 3,860 defining senses have been determined. Step 2 of the construction process has also been completed. A total of 3,280 word senses are found to be the seed senses of LDOCE. These seed senses are taken as a natural set of semantic primitives derived from the dictionary. The feasibility of Steps 3 and 4 of the coprocess have been demonstrated with implemented examples. What remains to be accomplished is to complete Steps 3 and 4 to build a full-sized MTD from LDOCE using as guidelines the results of initial implementation of the two steps.

Selected Dissertation Abstracts

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An Intelligent Simulation Generator with a Natural Language Interface
DAI V50(04), SecA, pp1012
Ford, Donnie Ray
The University of Alabama Ph.D. 1988, 153 pages
Business Administration, Marketing. Computer Science
University Microfilms International
ADG89-13853

With increasing frequency, scientists and engineers are turning to computer-based modeling of systems they hope to understand, build, or modify. Many tools have been produced to carry out the modeling process itself, e.g. statistical and numerical analysis packages, simulation languages, and the like. A number of studies have found simulation to be one of the most effective methods in use today. However, there are problems with using simulation. What is apparent from past research is that simulation is a power tool and one that would be more widely used if it were cheaper and easier to use.

What the decision maker needs is the ability to construct computer simulation models in less time and with less resources. In order to accomplish this, more intelligence needs to be added to programs that construct simulation programs. This is where knowledge-based systems techniques can contribute greatly In this research, a knowledge-based systems approach to generating simulation code is suggested. Also, a prototype system called the Intelligent Simulation Generator (ISG) is built. This system uses knowledge of how simulation models are formulated and knowledge about the SIMAN simulation language in producing computer simulation models from a constrained, natural language description.

The methodology is detailed, and two test scenarios are given to substantiate the ability of the ISG. While this approach has proven fruitful, there are some severe limitations that must be overcome to advance the capabilities of the system. In essence, a better understanding of model formulation is necessary, and then this knowledge must be captured and incorporated into the ISG.

Syntactic Analysis of English with Respect to Government-Binding Grammar
DAI V50(05), SecB, pp 2020
Correa, Nelson
Syracuse University Ph.D. 1988, 296 pages
Computer Science. Engineering, Electronics and Electrical. Language, Linguistics
University Microfilms International
ADG89-14562

An attribute-grammar formulation of the Government-binding (GB) theory of natural language is proposed in which attribute definitions capture the substantive aspects of transformations and most component subtheories in Government-binding. Attributed definitions are used in place of transformational rewriting to formulate an interpretive Chain rule, with similar empirical effects to the transformation move-α in the theory.

The principal claim associated with this thesis is that the attribute grammar (AG) formalism is sufficient and of major interest for the description of natural language. First, it is shown that under even a trivial kind of attribution domains and functions, attribute grammars have the expressive power of Type-0 grammars. Hence, the languages that can be described by the kind of linguistic devices assumed in current GB theory can also be described within the simpler and more uniform framework of attribute grammar. Although attribute grammars have the same generative power as Turing machines, they are of major linguistic interest, in the sense that generation of a string automatically defines relevant structural information.

The second and more substantive part of the defense of our claim involves an AG specification of English, assuming the notions and principles of the Government-binding theory. We provide, for each component of the GB theory, its counterpart in the AG specification. Of particular interest is the abandonment of transformations and the use instead of the interpretive Chain rule for the definition of trace-antecedent relations in derivation trees. We show that the various linguistic constraints that movement structures are subject to, including the Subjacency and Path Containment conditions, are easily embodied in the formulation of the interpretive rule.

The feasibility of the use of attribute grammar for models of linguistic

performance is shown by producing an extended LL(1) parser and attribute evaluator that constitute a practical analysis procedure for a subset of English. The analysis procedure is attribute-directed, effectively combining LL(1) derivation steps with attribute evaluation. The procedure is thus able to cope with the extreme ambiguity of the underlying context-free syntax. The procedure by which the attribute evaluator is derived from the grammer is described in detail. (Abstract shortened with permission of author.)

Word Sense Disambiguation in Descriptive Text Interpretation: A Dual-Route Parsimonious Covering Model
DAI V50(04), SecB, pp 1550
Dasigi, Venugopala Rao
University of Maryland College Park Ph.D. 1988, 259 pages
Computer Science. Language, Linguistics. Information Science
University Microfilms International
ADG89-12281

There has recently been growing awareness that natural language processing can be viewed as abductive inference. This research extends parsimonious covering theory, a formal model of abductive inference originally developed for diagnostic problem solving, to automate descriptive text interpretation. A mapping is identified between the concepts of natural language processing and the concepts of diagnostic parsimonious covering theory. Both syntactic and semantic aspects of language are addressed in an extended theory, and a dual-route parsimonious covering algorithm is developed for word sense disambiguation. In the space of irredundant covers, search is focused on plausible syntactic and semantic covers. The two routes of covering are integrated by attributing both syntactic and semantic facets to each "open class" concept.

An experimental prototype has been developed to test these ideas in the context of expert system interfaces. A natural language interface is generated by extracting vocabulary from a domain-specific knowledge base, augmenting it with domain-independent linguistic information, and superimposing a parsimonious covering procedure on this knowledge. The prototype has at least some ability to handle ungrammatical sentences, to revise inferences in the wake of new information, to perform cross-sentence inferences, etc. Using a different application-specific knowledge base, the same procedure can generate an interface for a different domain, opening the way to automated interface generation for certain classes of expert systems.

This work is significant for two reasons. First, it uses a nondeductive inference method for word sense disambiguation that exploits associative linguistic knowledge. This approach contrasts sharply with others, where knowledge has usually been laboriously encoded into pattern-action rules. The present work strives to use nondeductive inference for both syntactic and semantic processing, and to integrate these two aspects cleanly. It differes from other research on abductive inference in language in focusing on word sense disambiguation rather than pragmatics. Second, this work is significant because it extends parsimonious covering theory to an entirely new class of applications. This suggests that some basically similar abductive inferences underlie linguistic and diagnostic problem-solving activities, and it is hoped that further research will enable their unification.

Step-Logic: Reasoning Situated in Time
DAI V50(04), SecB, pp 1501
Elgot-Drapkin, Jennifer Jill
University of Maryland College Park Ph.D. 1988, 168 pages
Computer Science
University Microfilms International
ADG89-12283

The world in which a commonsense reasoning agent reasons, that is, the everyday world, is continually changing. These changes occur as the agent proceeds, and must be taken into account as the agent reasons. An often overlooked, but extremely important, change that occurs is simply the passage of time as the agent reasons.

A commonsense reasoner is frequently limited in the amount of time it has to reason. Conclusions that may be logically (or otherwise) entailed by the agent's information take time to be derived. But time spent in

such derivations is concurrent with changes in the world. This limitation must be recognized by the reasoner; that is, the agent should be able to reason about its ongoing reasoning efforts themselves. To do this, the agent's reasoning must be "situated" in a temporal environment.

The problem that I address is that of defining a formalism in which the ongoing process of deduction itself is part of that very same reasoning. This involves focusing on individual deductive steps, rather than the collection of all conclusions ever reached. This has led to the formulation of step (or situated) logic, an approach to reasoning in which the formalism has a kind of real-time self-reference that affects the course of deduction itself. Such a notion of logic deviates in a crucial way from traditional formal deductive mechanisms, for the proof process becomes part of the available information used in forming proofs.

A precise characterization of step-logic is given, with details of two particular step-logics. Two commonsense reasoning problems, the Brother problem and the Three-wise-men problem, are modeled using step-logic, providing real-time formal solutions to these commonsense reasoning problems. These solutions were then implemented on an IBM PC-AT.

It appears that step-logic is a promising formalism for modeling the fact that that reasoning takes time. Contradictions can arise and be subsequently resolved within the logic itself, permitting a genuinely computational solution to certain types of default reasoning.

Learning from Physical Analogies: A Study in Analogy and the Explanation Process
DAI V50(05), SecB, pp 2021
Falkenhainer, Brian Carl
University of Illinois at Urbana-Champaign
Ph.D. 1989, 256 pages
Computer Science
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ADG89-16244

To make programs that understand and interact with the world as well as people do, we must duplicate the kind of flexibility people exhibit when conjecturing plausible explanations of the diverse physical phenomena they encounter. This process often involves drawing upon physical analogies—viewing the situation and its behavior as similar to familiar phenomena, conjecturing that they share analogous underlying causes, and using the plausible interpretation as a foothold to further understanding, analysis, and hypothesis refinement.

This thesis investigates analogical reasoning and learning applied to the task of constructing qualitative explanations for observed physical phenomena. Primary emphasis is placed on two central questions. First, how are analogies elaborated to sanction new inferences about a novel situation? This problem is addressed by contextual structure-mapping, a knowledge-intensive adaptation of Gentner's structure-mapping theory. It presents analogy elaboration as a map and analyze cycle, in which two situations are placed in correspondence, followed by problem solving and inference production focused on correspondence inadequacies. Second, how is the quality of a proposed analogy evaluated and used for some performance task? A theory of verification-based analogical learning is presented that addresses the tenuous nature of analogically inferred concepts and describes procedures that can be used to increase confidence in the inferred knowledge. Specifically, it relies on analogical inference to hypothesize new theories and simulation of those theories to analyze their validity. It represents a view of analogy as an iterative process of hypothesis formation, testing, and revision.

These ideas are illustrated via PHINEAS, a program that uses similarity to posit qualitative explanations for time-varying descriptions of physical behaviors. It builds upon existing work in qualitative physics to provide a rich environment in which to describe and reason with theories of the physical world.

A Computational Treatment of the Comparative
DAI V50(04), SecB, pp 1502
Friedman, Carol
New York University Ph.D. 1989, 296 pages
Computer Science. Information Science. Language, Linguistics
University Microfilms International
ADG89-16068

This thesis develops a computational treatment of the comparative in English that is general, efficient, and relatively easy to implement, while not unduly complicating the natural language processing system. Implementation was accomplished using the Proteus Question Answering System, which translates natural language questions into database queries.

The comparative is a particularly difficult language structure to process, and presently only a few natural language systems handle it in limited ways. However, the comparative is an essential component of language that frequently occurs in discourse. The comparative is difficult to process because it corresponds to an amazingly diverse range of syntactic forms, such as coordinate and subordinate conjunctions and relative clauses, which are also very complex and often contain missing elements. Semantically, the comparative is cross-categorical: adjectives, quantifiers, and adverbs can have the comparative feature. The semantics of the comparative has to be consistent with that of different linguistic categories while retaining its own unique characteristics.

The computational approach of this thesis is based on a language model that contains functionally independent syntactic, semantic, and pragmatic components. Although the comparative relates to all the components, the syntactic component is the one that is mainly affected.

The syntactic stage of processing analyzes and regularizes the comparative structures. The analysis process utilizes existing mechanisms that handle structures similar to the comparative. The regularization process transforms all the different comparative structures into one standard form consisting of a comparative operator and two complete clauses. This process consists of two phases: the first uses a compositional approach based on Montague-style translation rules. The subsequent phase uses specialized procedures to complete the regularization process by expanding the comparative, filling in missing elements, and providing the appropriate quantified terms associated with the comparated elements.

After the comparative is regularized, the remaining stages of processing are hardly affected. Each clause of the comparative is processed using the same procedures as usual, and only minor modifications are required specifically for the comparative.

A Generative Taxonomy of Application Domains Based on Interaction Semantics
DAI V50(03), SecB, pp 1021
Hurley, William David
The George Washington University D.Sc. 1989, 343 pages
Computer Science
University Microfilms International
ADG89-10833

User interface designers need tools that actively encourage good user interface design, provide sophisticated software development support, and are easy to learn and use. Three goals for the next generation of user interface tools are helping designers to separate user interface from application, enhancing software reuse, and generating run-time user interface software from high-level specifications. Achieving these goals requires a better understanding of the interface between user interface and application—the UI–AP interface.

This study defines a model of the UI–AP interface and describes a methodology for generating a taxonomy of application domain descriptions based on the model. The UI–AP interface model consists of a set of modeling primitives with more descriptive power than those in traditional object-centered models, and serves as a template for describing interaction semantics: interactions between user interface and application and knowledge about the application required by the user interface to process these interactions. The model provides a high-level representation for describing interactive systems, and supports specification techniques that enhance opportunities for reusable software

components. The model is incorporated into a generative taxonomy system that defines a methodology for generating new application domain descriptions from existing descriptions, starting with descriptions of interaction semantics common across a broad range of applications. The application descriptions provide a framework for resolving trade-offs involving separation, facilitate identifying opportunities for reusable software, and serve as more detailed templates for design and implementation of interactive systems. The model and the generative taxonomy system are implemented as a knowledge-based tool that demonstrates the feasibility of the model and the generative taxonomy system as an architectural base for specifying interactive software and for creating an exploratory research environment.

A Computational Theory of Metaphor
DAI V50(04), SecB, pp 1507
Martin, James Hugh
University of California at Berkeley Ph.D. 1988, 309 pages
Computer Science
University Microfilms International
ADG89-16782

Metaphor is a conventional and ordinary part of language. A theory attempting to explain metaphor must account for the ease with which conventional metaphors are understood, and with the ability to understand novel metaphors as they are encountered. An approach to metaphor, based on the explicit representation of knowledge about metaphors, has been developed to address these issues. This approach asserts that the interpretation of conventional metaphoric language should proceed through the direct application of specific knowledge about the metaphors in the language. Correspondingly, the interpretation of novel metaphors can be accomplished through the systematic extension, elaboration, and combination of knowledge about already well-understood metaphors.

MIDAS (Metaphor Interpretation, Denotation, and Acquisition System) is a computer program that embodies this approach. MIDAS can be used to perform the following tasks: represent knowledge about conventional metaphors, interpret metaphoric language by applying this knowledge, and dynamically learn new metaphors as they are encountered during normal processing.

Knowledge about conventional metaphors is represented in the form of coherent sets of associations between disparate conceptual domains. The representation captures both the details of individual metaphors and the systematicities exhibited by the set of metaphors in the language as a whole. These systematic sets of associations were implemented using the KODIAK knowledge representation language.

MIDAS is capable of using this metaphoric knowledge to interpret conventional metaphoric language. The main thrust of this approach is that normal processing of metaphoric language proceeds through the direct application of specific knowledge about the metaphors in the language. This approach gives equal status to all conventional metaphoric and literal interpretations. Moreover, the mechanisms used to arrive at metaphoric and literal interpretations are fundamentally the same.

When a metaphor is encountered for which MIDAS has no applicable knowledge, MIDAS calls upon its learning component—the Metaphor Extension System (MES). The approach embodied in the MES asserts that a novel metaphor can best be understood through the systematic extension of an already well-understood metaphor.

MIDAS has been integrated as a part of the UNIX Consultant system. UC is a natural language consultant system that provides naive computer users with advice on how to use the UNIX operating system. By calling upon MIDAS, UC can successfully interpret and lean conventional UNIX domain metaphors as they are encountered during the course of UC's normal processing.

Semantic Constraints in First Order Theories: A Definition and Its Applicability
DAI V50(04), SecB, pp 1509
Noel, P. A. J.
Victoria University of Manchester (U.K.)
Ph.D. 1988, 202 pages
Computer Science
Available from UMI in association with The British Library. Requires signed TDF.
University Microfilms International
ADGD-85821

The form and content of conventional databases are usually restricted by syntactic and semantic constraints. Both kinds of constraints are contained in the schemas of the databases. It is likely that such constraints will also be required if the more expressive formalisms, such as first order predicate logic, are to replace the formalisms of conventional databases. Under the name of "integrity constraints," several definitions of semantic constraints are provided in the literature for deductive databases. However, these definitions apply only to restricted forms of first order theories. For instance, a definition due to Lloyd (1985), which has sometimes been referred to as "standard," concerns hierarchical databases, in which recursive definitions do not occur and negation is interpreted as nonprovability. The aim of this thesis is to propose a definition of semantic constraints that is more expressive than the current definitions and applies to a larger class of first order theories, and to investigate the possibility of implementing semantic checkers based on this definition.

The proposed definition may be stated informally as follows: a semantic constraint for a first order theory T is a first order sentence about the logical implication in T of formulae of the language of T. A constraint is said to be satisfied if it is true in some Herbrand model of a metatheory concerning the logical implication of formulae in T (the conditions that the suitable metatheories and Herbrand models must satisfy are identified in the thesis).

Semantic checkers have been implemented in Prolog for some restricted forms of theories. Some of the implementations concern theories under nonmonotonic assumptions.

Control of Mixed-Initiative Discourse through Meta-Locutionary Acts: A Computational Model
DAI V50(03), SecB, pp 1025
Novick, David Graham
University of Oregon Ph.D. 1988, 237 pages
Computer Science. Language, Linguistics
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ADG89-11322

Human–computer interaction typically displays single-initiative interaction in which either the computer or the human controls the conversation. The interaction is largely preplanned and depends on well-formed language. In contrast, human–human conversations are characterized by unpredictability, ungrammatical utterances, nonverbal expression, and mixed-initiative control in which the conversants take independent actions. Traditional natural language systems are largely unable to handle these aspects of "feral" language. Yet human–human interaction is coherent for the participants; the conversants take turns, make interruptions, detect and cure misunderstandings, and resolve ambiguous references. How can these processes of control be modeled formally in a manner sufficient for use in computers?

Nonsentential aspects of conversation such as nods, fragmentary utterances, and correction can be seen reflecting control information for interaction. Such actions by the conversants, based on the context of their interaction, determine the form of the conversation. In this view ungrammaticality, for example, is not a problem but a guide to these "meta" acts. This dissertation develops a theory of "meta-locutionary" acts that explains these control processes. The theory extends speech-act theory to real-world conversational control and encompasses a taxonomy of meta-locutionary acts.

The theory of meta-locutionary acts was refined and validated by a protocol study and computational simulation. In the protocol study, subjects were given cooperative problem-solving tasks. The conversants' interaction, both verbal and nonverbal, was transcribed as illocutionary and meta-locutionary acts. The computational model was developed using a rule-based system written in Prolog. The system represents the independent conversational knowledge of both conversants simultaneously, and can simulate their simultaneous action. Simulations of the protocol conversations using the computational model showed that

meta-locutionary acts are capable of providing control of mixed-initiative discourse. The model agents can, for example, take and give turns. A single agent can simultaneously take multiple acts of differing control. The simulations also confirmed that conversations need not be strictly planned. Rather, mixed-initiative interaction can be plausibly controlled by contextually determined operators.

This research has application to natural language processing, user interface design and multiple-agent artificial intelligence systems. The theory of meta-locutionary acts will integrate well with existing speech act–based natural language systems.

Explaining Knowledge Systems: Justifying Diagnostic Conclusions
DAI V50(04), SecB, pp 1512
Tanner, Michael Clay
The Ohio State University Ph.D. 1989, 293 pages
Computer Science
University Microfilms International
ADG89-13705

We would like problem-solving systems to explain themselves for a variety of reasons, including convincing users that problem solutions are correct and showing that solutions follow from appropriate methods. An important aspect of explanation is showing that the actions and conclusions of a problem-solving system are related to the logical structure of the task that the system performs. That is, the system and its users must share an understanding of what the task is. Explanations can then relate the goal-subgoal structure of the problem solver to this shared understanding. The shared understanding, or shared model, of the task represents the logical structure of the task, i.e. the features that characterize correct answers and correct problem-solving. One thing that a shared model for any task will show is the ways in which users might be puzzled, that is, the issues they will be concerned about and about which they may ask questions. In this dissertation I develop this idea in the concrete domain of diagnosis. In common with many others, I consider diagnosis to be an abduction problem—determine the disease, or set of diseases, that best explain a given set of symptoms. The logical structure of this task can be used to derive the questions that a diagnostic system can be asked; the questions are those that arise solely because the system does diagnosis. I give an architecture based on generic tasks for a system that can do diagnosis. Parts of this system serve parts of the diagnostic task; from this mapping of architecture to task it is possible to derive answers to the diagnostic questions. I illustrate these ideas by describing the development of explanation for RED, which is not actually a diagnostic system, but what it does is enough like diagnosis to be informative. There are many aspects to the problem of explanation, including the problem of how to present explanations to users. But central to any explanation is its content. This dissertation is about the content of explanations and how the content can be derived from the structure and memory of problem solvers by reference to the logical structure of their problem-solving task. The main ideas should transfer to tasks other than diagnosis.

The Design and Implementation of an Intelligent Interface for Information Retrieval
DAI V50(05), SecB, pp 2030
Thompson, Roger Howard
University of Massachusetts Ph.D. 1989, 227 pages
Computer Science. Library Science. Information Science
University Microfilms International
ADG89-17411

Commercial information (text) retrieval systems have been available since the early 1960s. While they have provided a service allowing individuals to find useful documents out of the millions of documents contained in online databases, there are a number of problems that prevent the user from being more effective. The primary problems are an inadequate means for specifying information needs, a single way of responding to all users and their information needs, and an inadequate user interface.

This thesis describes the design and implementation of IR, an intelligent interface for information retrieval the purpose of which is to overcome the limitations of current information retrieval systems by providing multiple ways of assisting the user to precisely specify his or her information need and to search for information. The system organization is based on a blackboard architecture and consists of a

number of "experts" that work cooperatively to assist the user. The operation of the experts is coordinated by a control expert that makes its decisions based on a plan derived from the analysis of human search intermediaries, end user dialogues, and user models. The experts provide multiple formal search strategies, the use and collection of domain knowledge, and browsing assistance. The operation of the system is demonstrated by four scenarios.

Application of an Intelligent CAI Tutoring System to Spelling Instruction for Learning-Disabled Students
DAI V50(04), SecA, pp 909
Stricker, Andrew Gerald
Texas A&M University Ph.D. 1988, 331 pages
Education, Psychology. Education, Language and Literature. Education, Technology
University Microfilms International
ADG89-13447

The purpose of this study was to investigate the impact of an intelligent computer-assisted instructional (ICAI) tutoring system on the spelling knowledge of students with learning problems. To do this, four pairs (2 male and 2 female) of learning-disabled students who were matched for age, sex, aptitude, and reading and spelling achievement were instructed in spelling for four weeks (45 minutes a day, five days a week) on two versions of a microcomputer instructional program (SPELLDOWN and LOBO). After becoming familiarized with the instructional environment, one subject from each matched pair was randomly assigned to the instructional treatment condition to begin the study. Corresponding matched subjects began instruction using the control version of the program. All subjects then alternated treatments on a weekly basis for the remaining three weeks of the study. At the beginning of each week, each pair was presented with a new 10 word spelling list that contained regular words and highlighted specific phonetic features. Pre-instructional assessment indicated the phonetic features that were problematic for students in each matched pair. One version of the instructional program (SPELLDOWN) included elaborated correction subroutines featuring scaffolded and faded cues customized to fit the students' individual responses. The control version of the program (LOBO) was designed to mimic drill and practice routines typical of classroom spelling instruction.

Analysis of the results may be interpreted to suggest that the instructionally enhanced version of SPELLDOWN produced improved quality in the students' spelling errors as well as increases in the number of words correctly spelled relative to performance attained using the control version of the program.