# Artificial Intelligence Linguistic, and The Written Word

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## INTRODUCTION

The concept of artificial intelligence had its beginnings in the early '60s with the advent of computers, or what people thought were computers. These first machines were really more like the rudimentary forms of the hand-held calculators we know of today. Early electronic calculators were the first examples of machines that could think, or more precisely, calculate. The '70s and '80s saw exponential growth in computer usage and capabilities that paralleled no other forms of technological expansion in modern times. Computers went from large, cumbersome main frames that only a few of the wealthier companies could afford to today's inexpensive desktop models with enormous power and versatility.

Computers have touched almost every facet of modern life. Every industry where quantitative data exists, the computer is alive and well and busily crunching numbers. Industrial, service and transportation sectors have embraced the computer with such zeal that computers can now tell machines how to make other machines, your banking can be handled right at home, and cars are now available with computer mapping systems that guide you on your way around town or on the highway. It is easier to figure what aspects of life the computer has not touched rather than what it has touched.

With all the number crunching, information processing and desktop publishing firmly in hand, high-tech computer mavens are launching into the final frontier - mimicking inductive and deductive human thought. It is this last bastion of logical processing, or in some cases illogical processing, that separates man from machines. The last 10 years have seen some heavy advances in the use of "Artificial Intelligence" (AI), the name given to the technological arena of computers that try to function in the same manner as the brain. Clancy [2] describes AI as the basic hardware platform and software instructions that enable computers to mimic some aspects of human thought.

A subset of AI is the technology that is known as "Expert Systems" (ES), described by Cook and Schleede [1] as the "intelligent computerized software package that uses an expert's knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution." It is this use of ES that has the greatest advantage for the field of advertising.

## MARKET STATUS

The situation that many companies find themselves confronted with is how to utilize this wealth of computer capability to their advantage. Not only is this question titillating, but it is also compounded by the fact that "it has been estimated that the development and implementation of an expert system may cost at least $15 million, and require 3 to 5 years to produce results." [4] With the understanding that ES's are coming out of the research labs and finding their way into more mainstream applications, marketing and advertising professionals are faced with a paradox of their own. Should they invest in new and expensive technology that will aid them in their decision making, or should they invest in more rudimentary forms of information discernment?[5] Clancy [2] postulates that "Firms which fail to adapt to the changes will clearly

fail and fade away in an apocalypse of marketing and financial failures." Of the ten developments that Clancy discusses in his article "The Coming Revolution in Advertising," the advent of artificial intelligence and expert systems may cause the greatest stir.

The problem is not whether the technology exists to construct an ES that will embrace the needs of the advertising world, but rather how effective will this type of system be and to what extent can ES be applied to various aspects of the advertising domain. When you consider all the aspects that make up the advertising function, there are only a few that can be adequately addressed by an ES. For the sake of examination, let's compartmentalized some of these functions in order to visualize what aspects may be realistically embraced by ES. Those functions, in order of their occurrence, are as follows:

1) Market Research
2) Creative Strategy Development
3) Media Selection
4) Rough Design
5) Copy Development
6) Selection of Visuals
7) Final Layout
8) Printing or Media Placement

After the research has been conducted, the front end of any advertising campaign is the development of the creative strategy. It is here that the central plan for an ad or a whole campaign of ads will take shape. It is also here that an advertisements success or failure will be conceptualized only to incubate throughout the rest of the advertising process and eventually hatch in full view of its audience. Because this aspect of the advertising process is so vital, and because AI is not far enough along or financially feasible in realistic terms, this process of creative strategy development will be left up to the human mind. It is here that the logical and illogical thought processes can meld to develop what hopefully will be accepted by the target audience. But, the information that is derived from the creative strategy session will be the fuel that will empower the Expert System Design Engine. All the other aspects of items #3 through #7 of the development process can be (and some of them have) tackled by an appropriately designed ES.

At this juncture it is necessary to focus on one function of the three main processes of advertising development - design, copy development and selection of visuals. One of the most difficult tasks for an ES to perform is the generation of text that is associated with the creative strategy, design and body copy requirements of any given execution. What an ES will be asked to do is to understand the creative strategy, work within the physical design parameters of the ad and comprehend the essence of the design in order to select the appropriate language elements. It may seem very straight forward to those in the advertising world, but to program a computer to juggle it all is like asking an adolescent to understand calculus. The thrust of this research is to explore the possibility of computer hardware and software actually being able to select or create relative body copy based on its understanding of a particular advertising

environment and the knowledge domain from an expert in the field.

## LITERATURE REVIEW

The purpose of Cook and Schleede's article, "Application of Expert Systems to Advertising", is "to present the advantages of applying Expert Systems to advertising decision-making; suggest fruitful applications of expert-system technology to advertising; and describe the methodology used in developing an expert system."[1]

An Expert System according to Cook and Schleede "is an intelligent computerized software package that uses an expert's knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution."[1]

Cook and Schleede stress that there are 9 characteristics that an ES must possess in order for advertising managers to have significant advantages over using other decision support tools. An ES should: process qualitative information; process incomplete and potentially inaccurate information; streamline reasoning; provide transparent reasoning (transparent reasoning provides managers with the rationale behind the expert's reasoning); adjust its reasoning based on the problem solving it has experienced; offer permanent, documented expert knowledge; provide duplicative expert knowledge; deliver consistent expert knowledge; and be easy to maintain and modify. The authors also outline briefly the development process for building an ES. The process discussed is typical of most systems' development methodologies.

Clancy's article, "The Coming Revolution in Advertising: Ten Developments Which Will Separate Winners From Losers", discusses 10 developments that may be a part of the advertising world by the year 2020. The author's intent is to make agencies and advertisers aware of developments that, if managed successfully, will add to their ability to promote products and services that are in their charge. Of the ten developments that the author feels will embrace the advertising world, the use of Artificial Intelligence, and more specifically the use of Expert Systems, will cause a dramatic change in the way advertising and creative design is developed.

Artificial Intelligence according to Clancy is "computers or computer programs which think - or seem to think - the way humans do." Expert Systems "represent specialized intelligence in a particular field such as geology, neurology and advertising." "Firms which fail to adapt to the changes will clearly fail and fade away in an apocalypse of marketing and financial failures."[2]

The use of AI and ES will be based on the most innovative of computer hardware and software to bring about a system that will solve qualitative and quantitative problems in a manner similar to the end results arrived at by humans. It is important to understand the differences between AI and ES. AI is the basic platform by which computers have the ability to mimic certain aspects of human thought. This is much the same concept that is at work in present day computers, such as the common desk-top models we all know about, in that AI is the basic

architecture and command sequencing that allows the computer to think just as an operating system like MS-DOS is the basic instructions for PC's. ES on the other hand consists of an "expert" data base and specialized application instructions that allow the computer to think and solve problems in a specific field of knowledge similar to application software in the PC world. ES is a subset of AI.

Biles, Cost, Johnson and Reek's article, "Using Expert Systems in Typographical Design" proposes "the use of expert system technology in future electronic publishing software to aid the author in making reasonable design decisions. Rules that are used by printing professionals in the design processes are discussed, along with proposals for expert system integration in this domain."[3]

The authors illuminate on the concept of transparent typography that was explained by Beatrice Warde, who discussed the subtle art of typographical design in the early part of this century. For Ms. Warde, "If type is 'seen' by the reader, it fails to perform its proper function. Typography that announces itself is bad typography."[3] This idea is the fundamental substance that separates the untrained beginner from the professional designer. A professional designer will know how to set type such that the physical lettering will not obscure the flavor of the words; like a crystal goblet does not diminish the color of wine within. The authors reflect on the fact that with inexpensive desktop publishing software available to the masses, a greater need exists for assistance in helping those inexperienced beginners with developing publications.

One of the main ideas of the article is the anatomy of an ES. A highly simplified illustration of the major components of a typical expert system is offered with cursory explanations of each component. Since the focus of an ES is based on knowledge, the "knowledge base" is where all the facts, rules-of-thumb, and heuristics reside that would be employed by the "expert" in attacking problems in the domain of interest. The "Inference Engine" is a program that searches the knowledge base looking for information that applies to a given problem. The Inference Engine gets information on a particular problem from the user through the "user interface." It then explains the judgements it makes to the user through the "explanation facility". The front end of a competent ES is orchestrated by the "knowledge engineer" who acquires his/her information from the "domain expert", the person whose expertise is cloned to form the knowledge base. This is an ongoing activity that is interactive and always in a state of upgrade.

Bile, et al. believe there are many ways that an ES can be used in the publishing environment. The simplest would be as an advisor to the publisher. A dialogue between the ES and the publisher would allow for the most appropriate selection of type faces and sizes given the nature of the publication and the media in which it will appear. "An electronic publishing system that allows the author to be more successful and productive in typography design will succeed."[3]

Stevenson, Plath and Bush's purpose in writing this article,"Using Expert Systems in Industrial

Marketing", was to correct what they considered to be an imbalance in the cases of ES, in effect were receiving considerable attention among finance professionals and consumer marketers and yet potential applications within industrial marketing had been ignored to a large degree.

The authors contend that U.S. corporations will spend $4 billion annually in 1990 on ES. Each system will cost at least $15 million to develop and 3 to 5 years to produce results. Why then, with so much financial and managerial resources required to implement the development of ES's would any organization want to pursue it? The answer, a combination of large financial and man-hour payoffs, highly motivated professionals, evolving techniques and an increase in the capabilities of computers are making the development of ES's not only viable but also a necessary part of management decision making. The ability to "separate decision-making skills from human decision makers not only allows the transformation of novice managers into experts, it also permits human experts to focus their efforts on difficult and challenging problems which defy computer analysis."[4]

Rappaport's article, "Expert Systems Enter The Mainstream", illuminates on the fact that knowledge-based systems are no longer limited to the domain of the research and development department. The new classes of expert system shells are making this kind of technology practical and expedient for other functions in business.

The author contends that expert system software will radically redefine the traditional programming paradigms. It will do this by allowing software programmers to create knowledge bases that are used by applications that will implicitly solve problems. It is the ability to solve problems based on reliance of new and innovative hardware platforms and software programs that will visually track the interrelationships and interactions between knowledge, data and the end user.
Harmon and Sawyer's book, Creating Expert Systems For Business and Industry, is designed to take the artificial intelligence/expert system layman and quasi-computer expert through the ES development process. It explains the basics behind ES principles and progresses through the development stages to the end result of an working system. The authors site several existing applications of ES systems that can be applied to the realm of advertising; although they themselves did not make the associations.

It is the authors contention that the next great frontier in computer science will be the realm of AI. Those who wish to ride the wave that will come along by being a part of the technological advances in AI/ES development will reap the benefits of being on the cutting edge.

Chaing-Choon and Hongjun [9] describe in their article "Multi-Domain Expert Systems", the physical and logical aspects of propelling ES to the next plane of development - linking several ES and knowledge domain systems together to form a more exhaustive and synergistic package for problem solving. This is of particular interest in the development of a CAES ("Creative Advertising Expert System") because three knowledge domains will be functioning either concurrently or sequentially to produce the end result of a finished ad. The controller systems for interfacing the various knowledge domains together is know as the "Meta-Knowledge"

engine. It has cursory information about each knowledge domain data base and manipulates input and output between them and the Design Engine and System Shell, and ultimately the user interface.

One of the most readily available examples of expert systems on the market are grammar checkers. There are several commercial packages available at this time. The most powerful is "Grammatik" which will run under the DOS operating system, or under Windows from Microsoft. Lombardi and Carlson [10] explain briefly the merits of various grammar checkers available and some of the syntactic and semantic logic that is involved in their programming. A CAES would use the logic of grammar checkers, but only in reverse order. Instead of parsing (breaking down sentence construction into individual elements of word meaning and grammar) an existing sentence, a CAES would use this rule-based logic to construct a new sentence from facts derived from the question and answer session between the end user and the System Shell.

Deransart and Ferrand's [11] article about PROLOG, a linguistic parsing program, describes the main sub-component of the Meta-Knowledge system. PROLOG will be the main program component that will drive the creation of text.

"Fuzzy Logic in Man-Machine Systems" by Toshiro [12] is an interesting article about the development of software that thinks in generalities instead of logical specifics as all computers do. Instead of needing exact information to produce exact output, Fuzzy Logic machines will construct a best-fit output scenario based on information provided. This concept is very important given the ambiguities that surround the English language.

## SYSTEM DEVELOPMENT

The development of an ES for creative advertising design is still in its infancy, while the computer technology to support that kind of system is not. The multi-tasking, multi-processing capabilities of the 80386 and 80486 CPU's in the DOS world are quite capable of handling the heavy load of a system of this type. In the Mac world the high speed 68030 and 68040 CPU's are again very capable of doing the job, yet they lack the plethora of hardware and software support that the DOS world has. At this point it is better to address the DOS users as far as a hardware platform are concerned because there are almost 10 times the number of DOS machines verses Mac machines in the U.S. today. Any marketer would tell you that you go were the biggest market is if you want to increase chance of success.

Similar to the anatomy of an ES that Bile et al.[3] developed, a CAES would be based on an expert's knowledge of the creative domain. An expert could be any one or all of the advertising greats known in the last 50 years. At the front end of a CAES are the Input Devices (see Exhibit #1), a set of peripherals such as a keyboard, voice recognition system or a scanner that would be used to load in all the data regarding the creative situation. Next comes the System Shell, a hybrid of the computers operating system that would bridge the gap between the user and the ES software. The Shell would also function as a session moderator to gather all the

necessary information that would be derived from a creative strategy session. Most often this would take the form of a question and answer session between the user and the computer. Once all the data is in, the Expert Knowledge Design Engine, the main work horse of software programming that contains all the "experts" design know how, would search the expert knowledge domain for the macro creative logic that would be the backbone of the creative design. It would then select micro creative elements from a Language Data Base, Visual Data Base and a Layout Data Base. At the end of the macro logic and micro element sessions, the CAES would interface with the user to explain its rational and ask for additional information to augment or alter the creative process. This interaction allows the user the option of taking what the CAES would develop on its own, or manipulate the design by the injection of additional information.

After the user is satisfied with the direction of the creative strategy, the macro creative logic and the micro creative treatments are sent to the Page Assembly Engine - software that will manipulate off-the-shelf programs similar to todays page description languages and word processors. Here the copy, visuals and basic design are assembled into a mechanical proof and then output to the screen, laser or Linotype printer. As with any creative process there may be several more iterations before the final artwork is developed.

## LANGUAGE GENERATION COMPONENTS

The most difficult aspect of CAES is to generate text from cursory elements that are input during the query session that is moderated by the System Shell and acted upon with the help of the end user. It is here that software technology is at its weakest. That's not to say that text generation can not be executed, but rather, it is extremely difficult to provide enough rule-based information for even the fastest computers to generate language based on a few "tips" from the end user. Current technology is quite capable of understanding text that is already constructed. It is quite another thing to develop a text string (words and punctuation in a logical, readable form) based on minute amounts of information.

The English language, as well as most other languages, is logically based in both content and structure. Individual letters have a meaning and a mathematical value. When these letters are combined to form a word, this word takes on a higher level of meaning and value. Each word in the English language has a mathematical value (a serious of "0" or "1" in a string in binary code) that a computer can act upon. In addition to its math value, words have logical values that designate there meaning and relationship to other words around them. If one were to look at a sentence in the logical sense, it would look like a algebraic equation. This is of the greatest importance to the computer since it can recognize only numerical values and not the visual representation of words that we may see on a computer screen.

Language is actually 4-dimensional consisting of word meanings, sentence meanings, paragraph meanings and cultural or regional overtones. For the sake of simplicity we will ignore the cultural implications and their impact on language generation. Cultural or regional bias is generally not present in advertising text anyway, so it won't be addressed here. That leaves us

with language as a 3-dimensional construct.

Initially, it is possible to think of language as 2-dimensional. Meanings of individual words and meanings of a sentences composed of words is the basic element of written and spoken language. Exhibit #2 shows the 2-dimensionality of basic language. As you can see, language is composed of an "X" and "Y" axis components depicting the syntactical and semantic aspects of words and sentences. The Y axis is composed of the syntax and semantic representations of each individual word. The X axis is composed of the syntax and semantic meaning of the individual words and the synergistic meaning of the complete sentence. As far as the computer is concerned, it sees only numbers, figures and mathematical demarcations for representing words in the sentence body.

To further complicate the process, language becomes 3-dimensional when it is taken in the context of word-sentence meanings in the body of a paragraph or document. Exhibit #3 illustrates this aspect of language construction. The third dimension comes into play when the sentence is combined with other sentences to form a composite whole. Given the context of the subject matter and the writing style of the author, words and sentences may take on different meanings when thrown together with other sentences and words. As you can see, language generation is beginning to look very complicated. Fortunately, the immense power of text synthesis software such as the PROLOG compiler makes it reasonably easy for computers to understand what is being written.

***NOTE: The actual process that is used for a computer to generate language from cursory information developed in the query session between the System Shell and the end user is quite involved. In the interest of brevity, only an overall description will be explained here.***

PROLOG, a text parsing compiler, is the main element of language generation for the CAES system. What PROLOG does is take existing text, break it down into its syntactical and semantic elements, and recompose it according to instructions provided by the end user. In the context of the CAES, the Expert Knowledge Design Engine (see Exhibit #1) will develop text parameters based on information fed into the computer by the end user. With the help of Fuzzy Logic systems development, the Expert Knowledge Design Engine reconstructs the text parameters by allowing ambiguities and approximations to be embraced in the construction of text. This information is sent to the Meta-Knowledge Control Engine which will orchestrate the assembly and interpretation of the various data bases - namely the Visual Knowledge Data Base, Layout Knowledge Data Base and the Language Knowledge Data Base through the PROLOG compiler.

The part that the Meta-Knowledge Control Engine plays in the process is very important. It keeps in mind, during the ad development process, all the various aspects of design parameters, image selection and its summary information, and textual overtones that will come into play in developing the final advertisement. Therefore, based on the design parameters, the image that is selected and the basic elements of speech that have been developed by the Expert Knowledge Design Engine, the Meta-Knowledge Control Engine will begin accessing the

language data base for the appropriate text that will be linked to the visual element selected (if that is desired by the end user) and the headline. Exhibit #4 presents a flow chart of the language development process.

PROLOG maintains all the rules of syntax and semantics that modern English has incorporated in it. The various permutations of language construction take on a exponential feature given the complexity of our language. If a language data base has 120,000 words defined in it, the various combinations of words and syntax would explore $1.44^{10}$ combinations in developing even the simplest sentence. One of the nice attributes of PROLOG is that it generates rationale data that is fed back to the end user. This aspect allows the end user to monitor language development process and augment it by providing additional information to the system.

The language development process goes something like this (see Exhibit #4). The Expert Knowledge Design Engine takes marketing, product and media information feed into it by the end user during the query session and reconfigures it according to how the domain "expert" would interpret the data. All this information is then sent to the Meta-Knowledge Control Engine which coordinates the interface between the various knowledge data bases to assure compliance and adaptability between the products that the data bases rule-oriented logic produce. Textual attributes are read into the PROLOG compiler where it begins a forward-chaining search routine (rules that are applied look for the most logical fit for a word and then link it to the next word that is to be found) to find the most logical fit available in the language lexicon. Through a series of iterations, the sentence is build up word-by-word until all the syntax and semantic rules have been met. This information is fed back to the end user who decides if the sentence is appropriate. The process begins all over again with the added element that any subsequent sentences are linked logically to the proceeding sentences. When all the text is generated that relates to the visual treatments and headline, it prompts the user to accept of reject and augment what has be developed. A physical representation of the final process worked through in Exhibit #4 is found in Exhibit #5.

The end result of the entire advertisement development process is found in Exhibits #5 and #6. The CAES combines design parameters, visual treatements and generated text into a rough ad that can be visualized by the end user on a monitor before printing.

## MARKET IMPLICATIONS

Given that it is possible for a computer to mimic the creative processes of some of the advertising greats, the opportunity for phenomenal advancement in the state of the art is here and the technology is available to put it all together. The CAES would incorporate current hardware available in the market place, dedicated software that constructs inference algorithms, an off-the-shelf data base manager to handle the expert's information, a page layout language to produce type set quality material and a system shell to pull all the components together and produce a finished piece of art. This system would be able to produce low end ads and brochures for a niche in the market place that is not being adequately serviced by the

advertising industry - the small dollar end that ad agencies are reluctant to deal with. It would also be a product for those small in-house ad departments that lack the tools and talent to produce ads and brochures that can really sell product.

In considering this type of system in relation to the advertising market place at large, it would seem that a CAES would be competing directly with the very advertising experts that would be father to its knowledge base. If this were true why would they support it? Fortunately this is not the case. Small, medium and large full service advertising agencies provide many more services than a CAES would. Aside from research, planning and strategising, the creative minds of a competent ad agency are able to apply subtle nuances and the "gut feel" that often times go into any creative strategy. Since a CAES is based almost entirely on historical data from the expert, it does not allow for "true" creativity - that which has never been designed before. Essentially a CAES will be based on what rules the expert uses, both past and present, to design ads or brochures for its more pedestrian clients. For truly innovative work there is really only one option - consult the expert or his/her agency. Nonetheless, the experience of all the creative mavens in this country that can be cataloged will be more than enough to handle the lion's share of the small advertisers in the market place.

If a CAES is not competing with advertising agencies for business then what is its market? Its market is where even smaller agencies are reluctant to go - the $5,000-or-less per project customer. In my own experience in a small agency there is a general breakeven point at the $3,000 per project price range. Any project that is less money than that is generally not profitable. It takes just as many man hours to coordinate a $15,000 project as it does anything less. What the market needs is a means of developing ads that borrow from the creative minds of the industries greats without the costs associated with consulting the likes of a Bill Burnbach. That's the product niche for a CAES.

The market niche would be typically a small advertiser with a $100,000 a year or less marketing budget, (includes production, media and printing) a small marketing department and little desire to spend precious dollars with a advertising agency. But, they still need good creative design to develop ads that sell their products and/or services. Since most companies this size have computer systems, only the CAES software on an external hard drive, a laser printer and maybe some upgrades to the existing computer system would be required. At present, a rough cost figure to the advertiser for an ES system on an external hard drive would be in the neighborhood of $5,000 to $10,000. That is roughly the cost to have an advertising agency develop a medium size 4 color ad. So, for the price of an ad done by an agency, an advertiser could have the capability to create all the ads they want.

An untouched market is there and the technology is available. A CAES could produce low end ads and brochures for small companies that are not economically serviceable by advertising agencies. This type of system would give small companies access to some of the knowledge that the best and brightest advertising minds in the country work with at an economical price. It would be like having David Ogilvy working in your company. The concept is a sound one, the technology is there, all that is required is someone to put it all together.

# END NOTES

1. Cook, Robert L.; Schleede, John M.; "Applications of Expert Systems to Advertising", The Journal of Advertising Research, Vol. 28, June/July 1988, pp. 47-55.

2. Clancy, Kevin J., "The Coming Revolution in Advertising: Ten Developments Which Will Separate Winners from Losers", The Journal of Advertising Research, Vol. 30. February/March 1990, pp.47-52.

3. Biles, Al; Cost, Frank; Johnson, Guy and Reek, Ken; "Using Expert Systems in Typographical Design", IEEE Transactions on Professional Communication, Vol. PC-30, June 1987, pp. 102-111.

4. Stevenson, Thomas H.; Plath, D. Anthony and Bush, Chandler M.; "Using Expert Systems in Industrial Marketing", Industrial Marketing Management, Vol. 19, August 1990, pp. 243-249.

5. Rappaport, Alain, "Expert Systems Enter The Mainstream", Computing Canada, Vol. 16, July 1990, pp. 36.

6. Harmon, Paul; Sawyer, Brian; Creating Expert Systems For Business and Industry, 1990.

7. Wyatt, Allen, Computer Professional's Dictionary, 1990.

8. Faulk, R. D.; Gustavson, Goertzal; "Segmenting Discrete Data Representing Continuous Speech Input", IBM Systems Journal, Vol. 29, No. 2, 1990, pp. 287-295.

9. Chiang-Choon, Danny Poo; Lu, Hongjun; "Multi-Domain Expert Systems", Expert Systems, May 1991, pp. 67-72.

10. Lombardi, John, "Grammar Checkers: Keep Your Writing In Line", INFOWORLD, October 28, 1991, pp. 64-72.

11. Deransart, Pierre; Ferrand, Gerand; "An Operational Formal Definition of PROLOG: A Specification Method and Its Application", New Generation Computing, 1992, pp. 121-171.

12. Terano, Toshiro, "Fuzzy Logic in Man-Machine Systems", New Generation Computing, 1987, pp. 131-132.

13. Ray, Kenneth; Driscoll, James; "New Directions For Microcomputer-Based Hypertext Systems", DATABASE, August, 1990, pp. 60-74.

14. Krallmann, Hermann; Marzi, Ruth; "Syntactic and Semantic Postprocessing For Speech Recognition", Decision Support Systems, 1991, pp. 253-261.

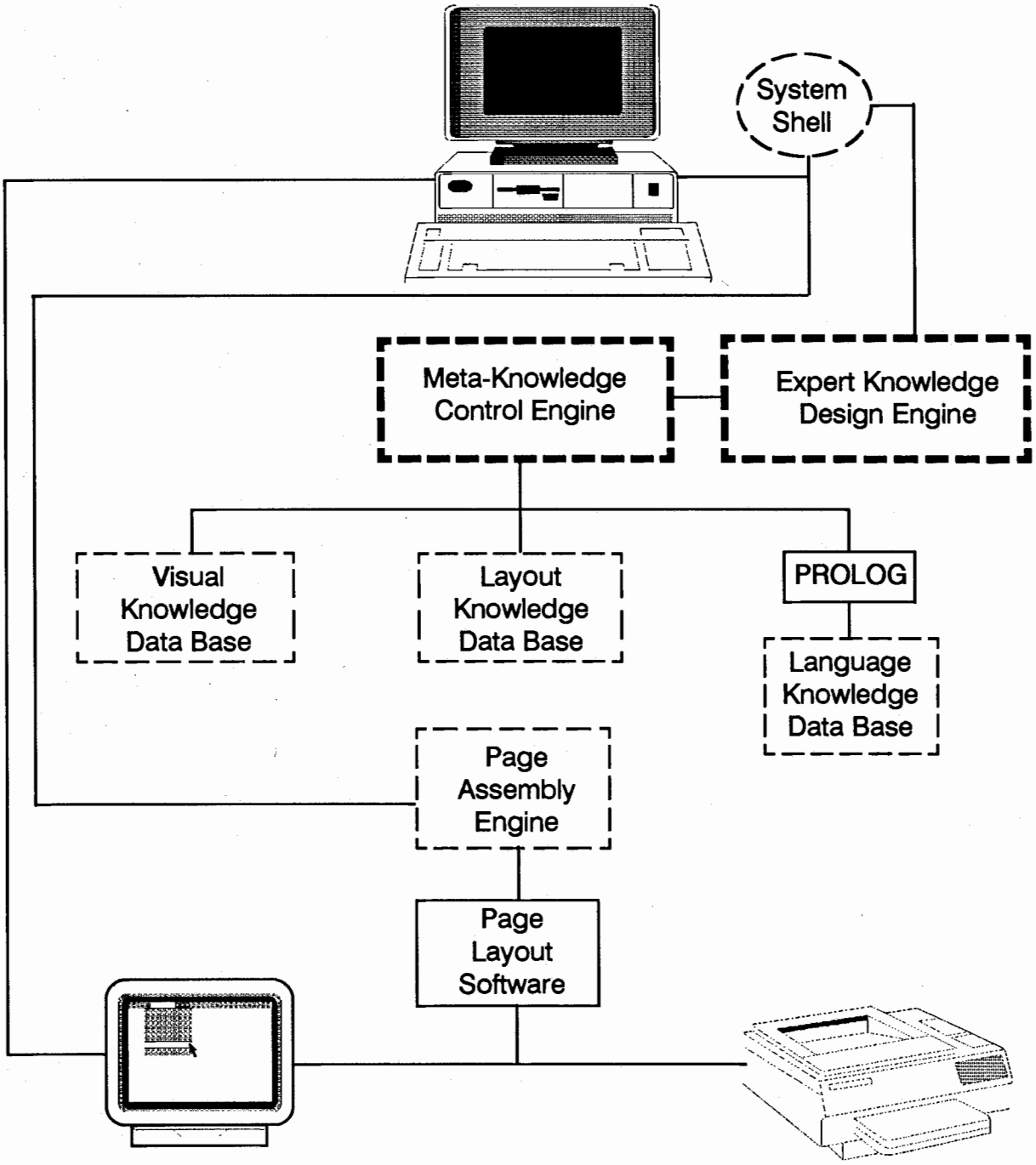
15. Nash, James, "The Many Tongues Of Computers", COMPUTERWORLD, February 18, 1991, pp. 20.

16. Hahn, Udo, "Topic Parsing: Accounting For Text Macro Structures In Full-Text Analysis", Information Processing & Management, Vol. 26, 1990, pp. 135-170.

# EXHIBITS

Exhibit #1

# Expert System for Creative Advertising Design




System control interface, ie. DOS hybrid

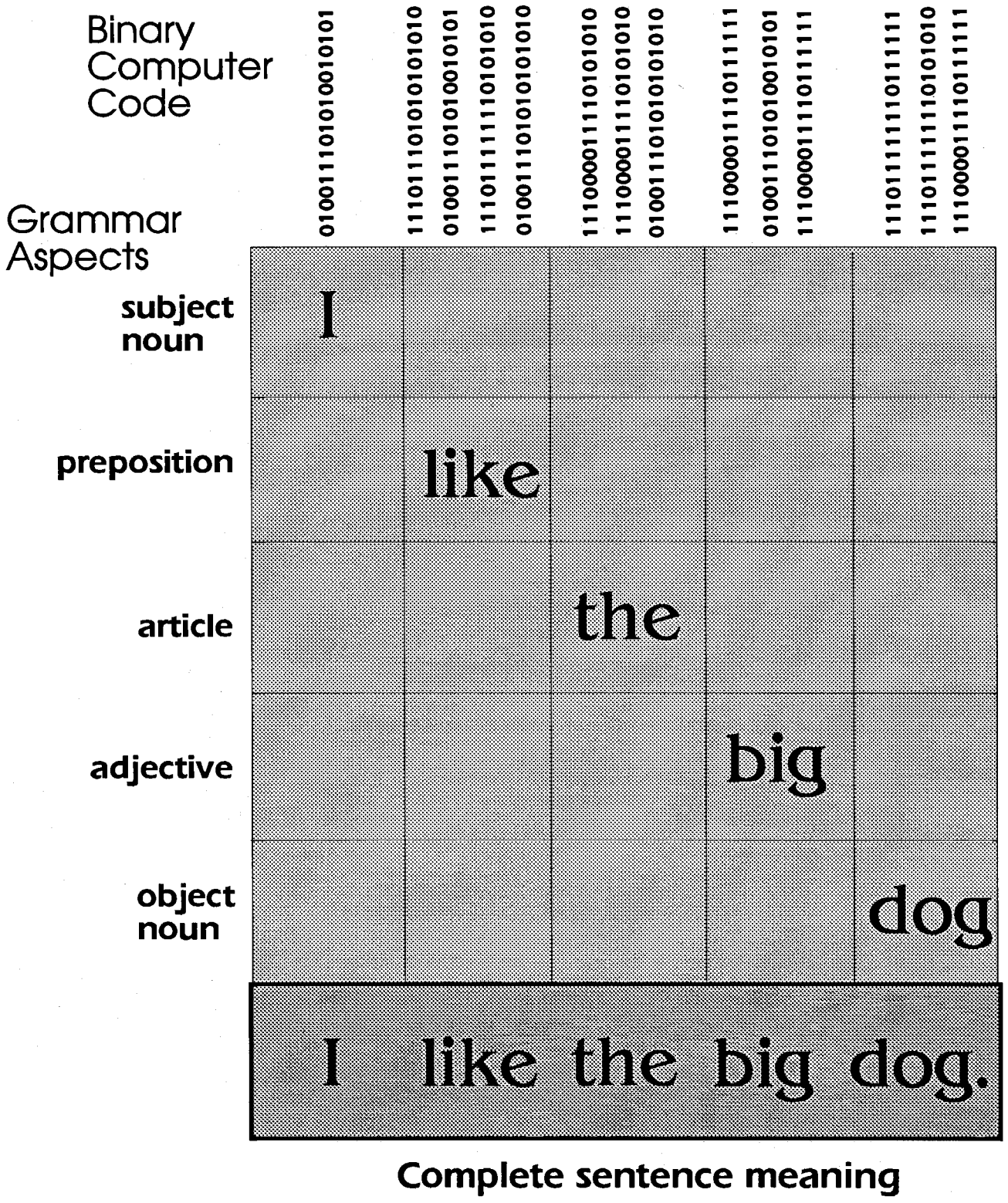
Off-the-Shelf software, eg. Pagemaker, Word Perfect

Static object-oriented data bases

Variable rule-based expert knowledge inference engine

Exhibit #2

# LETTER - WORD - SENTENCE CONSTRUCTION
# TWO DIMENSIONAL ASPECT




**Complete sentence meaning**

Exhibit #3

# LETTER - WORD - SENTENCE - PARAGRAPH CONSTRUCTION
# THREE DIMENSIONAL ASPECT

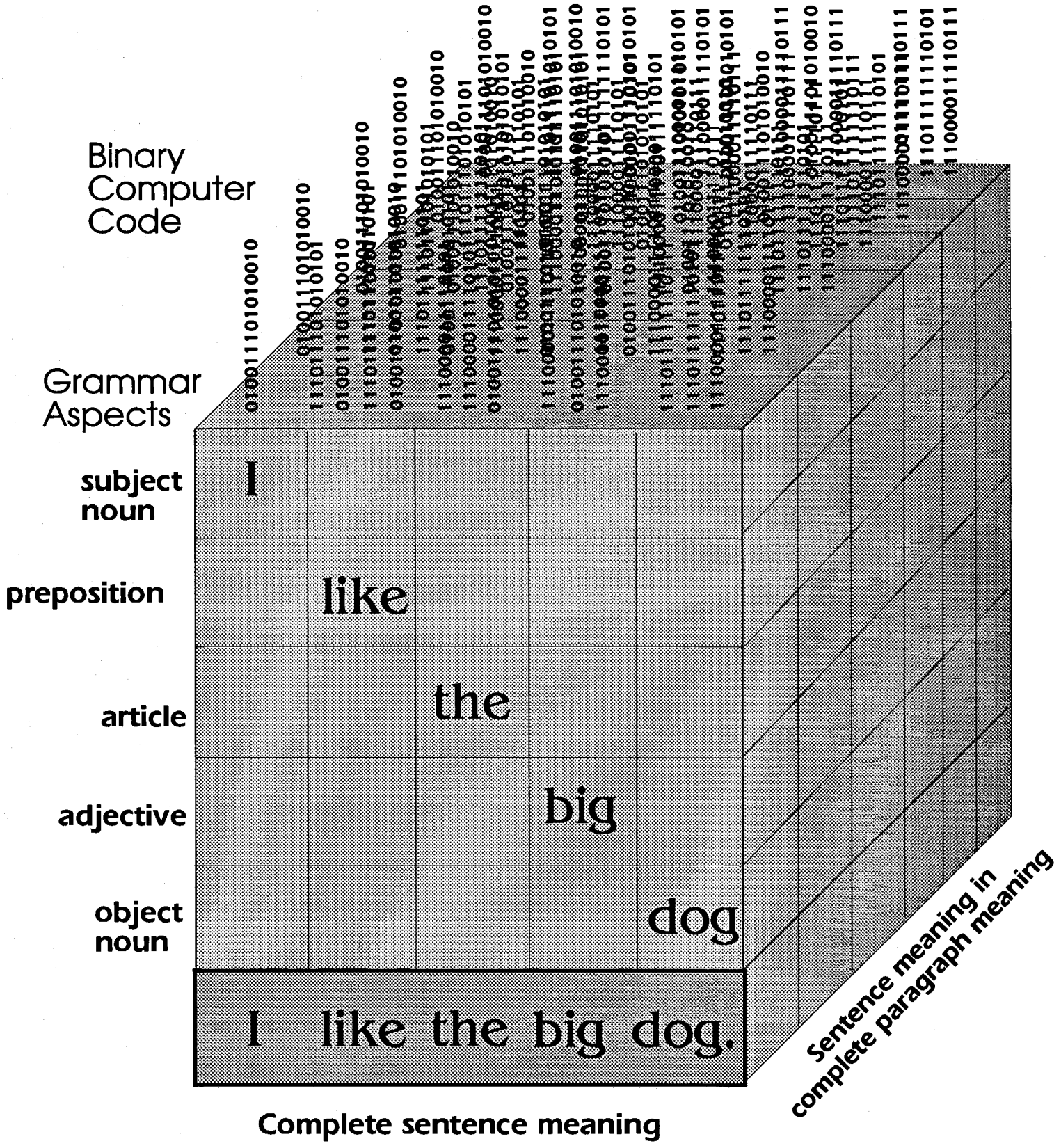


Exhibit #4

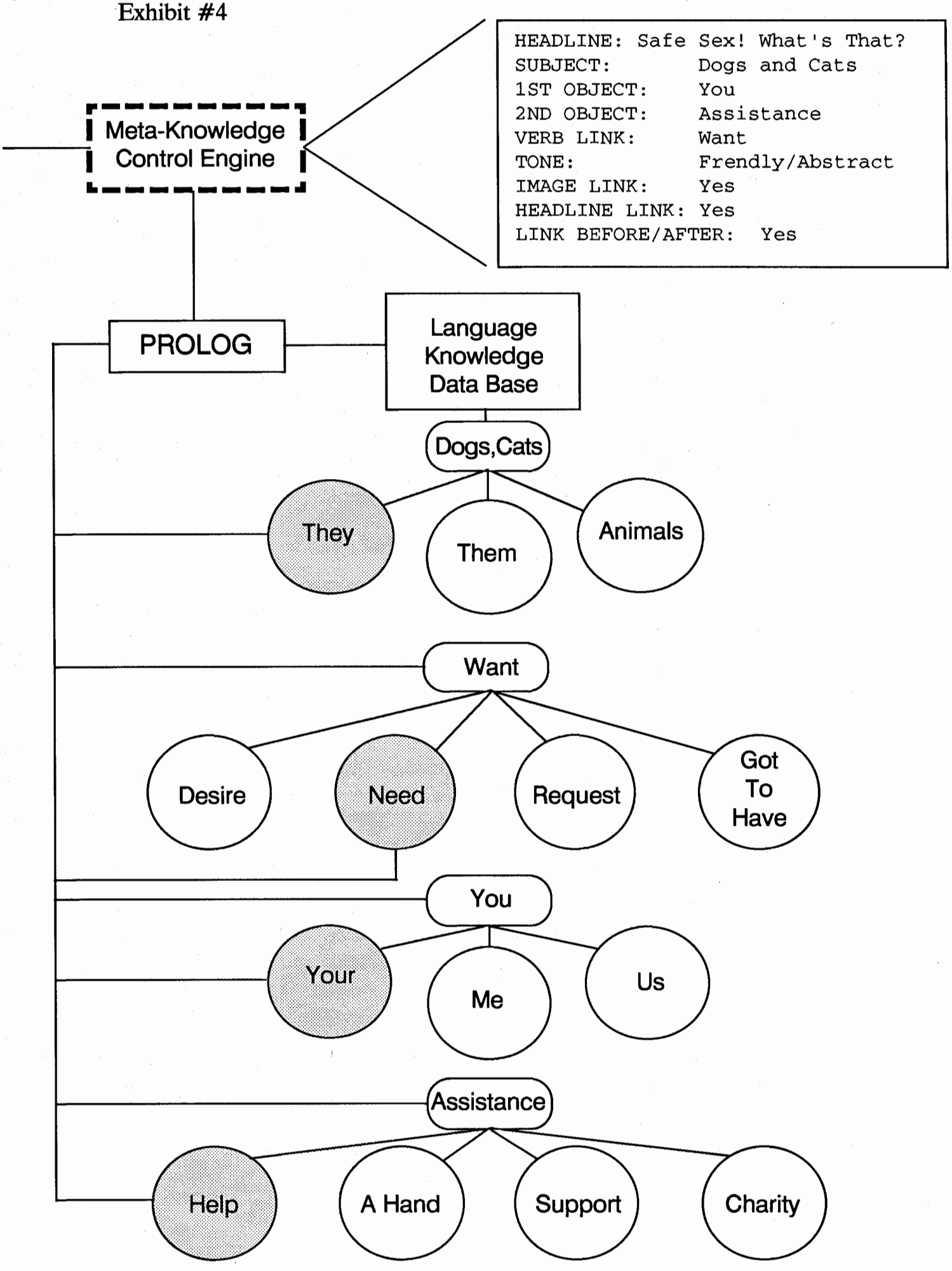

HEADLINE: Safe Sex! What's That?
SUBJECT: Dogs and Cats
1ST OBJECT: You
2ND OBJECT: Assistance
VERB LINK: Want
TONE: Frendly/Abstract
IMAGE LINK: Yes
HEADLINE LINK: Yes
LINK BEFORE/AFTER: Yes
Meta-Knowledge Control Engine
PROLOG
Language Knowledge Data Base
Dogs,Cats
They
Them
Animals
Want
Desire
Need
Request
Got To Have
You
Your
Me
Us
Assistance
Help
A Hand
Support
Charity

Exhibit #5

Illustration courtesy of S. Ruth Jones

# Safe Sex! What's That?

Fido and Fluffy don't know. They need your help. Prevent unwanted pregnancies. Spay and neuter your pet. It's good for you. It's great for them.

For more information contact your local veterinarian or The Knox County Humane Society at 573-9675.

**KCHS**

**THE KNOX COUNTY HUMANE SOCIETY**

Exhibit #6

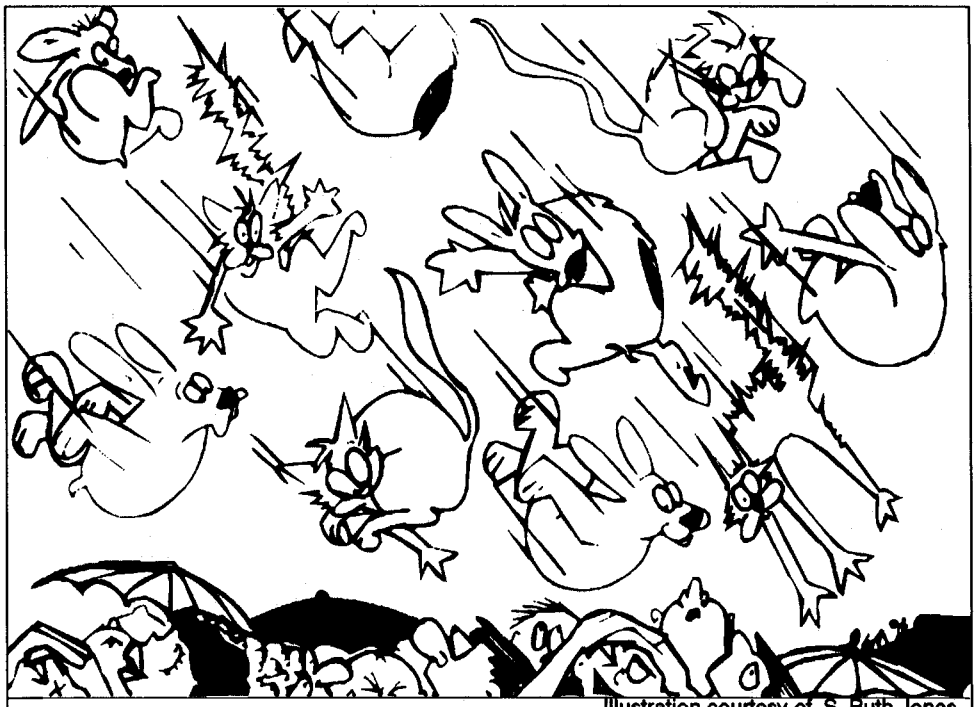


Illustration courtesy of S. Ruth Jones

# It's raining cats & dogs!

Pet over-population is a real problem. Every year over 11,000 lost or unwanted dogs and cats have to be put to sleep in Knox County. It's a sad thought. But you can help. Spay or neuter your pet. It's safe. It's easy. And it will help control the flood of unwanted pets in Knox County.

For more information contact your local veterinarian or The Knox County Humane Society at 573-9675.

**KCHS**

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