

## **THE FRAME PROBLEM**

### **Autonomy Approach *versus* Designer Approach**

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**Abstract.** “Yes, but you will never get a machine to do X” This is a commonsensical objection to AI in which X refers to the main problems of AI such as pattern recognition, creativity, free will, autonomy, systematicity, understanding, learning etc. The frame problem is at the intersection of all these problems. In AI, the realization of X depends on the solution of the frame problem. The frame problem has three aspects namely, metaphysical, logical, and epistemological. Three aspects of the frame problem consider the issue from a designer point of view. The frame problem is not the problem of a machine intelligence designer but the problem of the machine intelligence. We propose three steps in order to build an autonomous approach to the frame problem. These steps are (1) the *agentification* of the frame problem, (2) a control system approach, and (3) a trans-logical model peculiar to AI. Each step towards building an autonomous approach to the frame problem depends on each other.

#### **1. Introduction**

In artificial intelligence (Hereafter, AI), it is difficult to situate environmental data in an appropriate informational context. In order to construct machine intelligence, a strategy of reasoning should be developed for adapting data and actions to a new situation. That is to say that if we want to attribute an agentive character to machine intelligence, we have to solve the frame problem. The frame problem is the most essential issue that an AI researcher must face. The possibility of solving the frame problem means the possibility of constructing machine intelligence in an agentive sense. The frame problem is a litmus test for the evaluation of theories in AI. In other words, the frame problem is the major criterion for understanding whether a theory in AI is proper or not. In several of his writings, Dreyfus considered the frame problem as a major challenge to AI. According to Dreyfus and Dreyfus (1988: 105), computers, designed in terms of the classical AI theory, do not have the skills to comprehend what has changed and what remains the same because computers are the operators of isolated and pre-ordained data-processing. The frame problem shows the necessity of having an agentive approach to thought, cognition, and reasoning. It implies the necessity for an efficient informational system that provides machine intelligence with accessible and available data for use in the world.

## 2. Three Aspects of the Frame Problem

What is the frame problem? Simply stated, the frame problem is about how to construct a formal system (e.g., machine intelligence) that deals within complex and changing conditions. The main issue behind the frame problem is to find a proper way to state the relationship between a set of rules and actions. It is not possible to find an exact definition for the frame problem. We cannot find a definition accepted by all philosophers and AI researchers. The frame problem has various definitions. This variety is caused by divergent views with regard to the categorization of the frame problem. It is possible to categorize the frame problem under three main groups; namely, metaphysical, logical, and epistemological.

### 2.1 The Metaphysical Aspect of the Frame Problem

The Metaphysical Aspect of the Frame Problem is about practical studies conducted in order to find and implement general rules for an everyday experience of the world. These practical studies should include spatio-temporal properties of environmental data. How to update beliefs about the world when an agent comes face to face with a novel (or unknown) situation is part of these practical studies. Cognitive science, especially drawing information from domains of an agent's cognitive actions, is seen as a part of these practical studies. For example, pattern recognition can be seen as a metaphysical aspect of the frame problem. There are many descriptions that can be considered as a metaphysical account of the frame problem. For instance, Janlert (1988: 12) sees the frame problem as a metaphysical challenge because the frame problem is not concerned with the *instrumental* adequacy of representation but, rather, concerns the *form* and the *internal working* of the representation. Janlert (1988: 33) states: "I think that finding and implementing the adequate metaphysics is a promising approach to the frame problem, as well as an important key to successful modeling in AI in general." Janlert (1988: 8) mentions three principles that are significant for the analysis of the frame problem: "1- The frame problem is a problem of modeling, not of heuristics...2-The frame problem is not a question of content, but of form...3- The choice of suitable form depends on the problem world –computational considerations will not suffice." Hendricks (2006: 331) describes the frame problem as a practical problem: "It [the frame problem] concerns with how we retrieve the right knowledge at the right time. What counts as the *right* knowledge at a certain time is fixed by the goals, interests and desires of the agent." Hendricks (2006: 317) considers the frame problem to be a useful tool for some research topics in cognitive science: "When we figure out how human beings effortlessly recover information relevant to their present conditions, we will have solved it. In the meantime the frame problem is a useful tool for helping philosophers and cognitive scientists explore various models of human cognition." Harnad (1993) defines the frame problem as a symbol-grounding problem which is about attaching formal symbols to the surrounding environment. The metaphysical aspect in Harnad's definition of the frame problem can be seen in his understanding of cognition as categorization. Raphael mentions the importance of practical studies and heuristics. Raphael (1971: 161) describes the frame problem as a heuristic issue: "the frame

problem is a problem of finding a *practical* solution, not merely finding a solution. Thus it resembles the famous traveling salesman problem or the problem of finding a winning move in a chess game.”

### 2.2 The Logical Aspect of the Frame Problem

If you push a box, then you push also all its content. This is commonsense reasoning and some philosophers see the frame problem as a part of commonsense reasoning and logic. The logical aspect of the frame problem is about the axiomatization of an application domain in which some causal laws for an event (or action) should be predetermined. This predetermination includes stating some set of rules. Each set of rules carries potential information about certain statements. But it is important for an agent to find a proper way to create a new set of rules in an unknown (novel) situation. Reasoning is the most crucial issue for the analysis of the logical aspect of the frame problem. For instance, Freeman (1992) describes the frame problem as a question of finding a reasoning procedure in a dynamic process. According to Peppas et al (2001: 403), the frame problem is about developing an action theory which gives an effective reasoning to AI in a dynamic system. Fetzer (1991) sees the frame problem as a part of the problem of induction. According to Shanahan (1997), the frame problem is the problem of building an information system in which a robot can develop an adaptive capability in the changing context. He (1997: xix) states: “we still have little idea how to endow a machine with enough common sense to cope with an environment as unfamiliar and idiosyncratic as the average kitchen.” Shoham (1988: 16-17) considers the frame problem to be a *qualification problem*: “it is the problem of trading off the amount of knowledge that is required in order to make inference on the one hand, and the accuracy of those inferences on the other hand.” Crockett (1994) sees a close relation between the frame problem and the Turing Test. He states: “the frame problem bears on the Turing test in such a way that it serves to augment significantly more conventional defenses of the test..., and it enhances the case for why the Turing test is resistant to the criticism of long-time Turing test critics” (1994: 189). Hayes (1988) and Lifschitz (1987) consider the frame problem to be a technical problem that can be solved by developing some new techniques (methods) in philosophical logic.

### 2.3 The Epistemological Aspect of the Frame Problem

In AI, there is a tendency to define the frame problem as an epistemological dilemma. For instance, Korb (1998: 318) claims that the frame problem is the major epistemological problem in AI. According to McCarthy and Hayes (1969), intelligence has two aspects namely, epistemological and heuristic. The epistemological aspect of intelligence concerns the representation of the world; and the heuristic aspect of intelligence deals with practical issues such as problem solving. They conceive the frame problem as a part of the epistemological aspect of intelligence because the frame problem is the result of the use of representations in the world. According to Pollock (1997), the frame problem is a question for human epistemology. Pollock offers a solution to the frame problem that involves the

analysis of how humans perform inductive and probabilistic reasoning: “the best way to solve the frame Problem for artificial rational agents is to figure out how it is solved in human reasoning and then implement that solution in artificial agents” (1997: 145). Dennett considers the frame problem to be an abstract epistemological challenge. Dennett (1978: 125) states: “The frame problem is an abstract *epistemological* problem that was in effect discovered by AI thought-experimentation. When a cognitive creature, an entity with many beliefs about the world, performs an act, the world changes and many of the creature’s beliefs must be revised or updated.” Haugeland (1988) mentions the epistemological aspect of the frame problem from another point of view. In his view, the problem of accessing knowledge is parallel to the frame problem because “the challenge is not how to decide for each fact whether it matters, but rather how to *avoid* that decision for almost every bit of knowledge” (1988: 82-83).

### 3. Avoiding the Designer Approach to the Frame Problem

Three aspects of the frame problem consider the issue from a designer (programmer) point of view. The frame problem is not the problem of a machine intelligence designer but the problem of the machine itself.<sup>1</sup> We propose three steps in order to build an autonomous approach to the frame problem. These steps are (1) the *agentification* of the frame problem, (2) a control system approach, and (3) a trans-logical model peculiar to AI. Each step towards building an autonomous approach to the frame problem depends on each other.

#### 3.1 The Agentification of the Frame Problem

Agency is a system of actions that has the capability to determine whether a certain collection of information is relevant not just for one environmental situation, but for a great extent of environmental situations. Here, processing patterns are one of the important components of developing decision making abilities in a complex environment. An agent should be able to alter its goals in terms of relevant data.

Agency must be the central notion in artificial intelligence since the cognition of reality originates from agentive actions. Agency is the ontological and epistemological constituent of reality and cognition. Reality is characterized by agentive activity. In the metaphysics of AI, reality must not be seen as a mere

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<sup>1</sup> There are some ideas that give priority to the designer for the solution of the frame problem. For instance, Hayes (1988: 128) states: “The frame problem is not a problem for the robot, but for us, its designers.” Hayes situates designers as problem solvers by using certain techniques in the computational theory. In addition, Dennett (1990: 153) mentions the significant role of a programmer for the solution of the frame problem: “The reason AI forces the banal information to the surface is that the tasks set by AI at zero: the computer to be programmed to simulate the agent, initially knows nothing at all ‘about the world’. The computer is the fabled *tabula rasa* on which every required item must somehow be impressed, either by the programmer at the outset or via sequent ‘learning’ by the system.”

psychic given or a datum of a mental state. On the contrary, it is an embodiment in which the subject and his surrounding environment should be situated in an agentive relation. Therefore, agency is primary, even in defining objectivity. Reasoning and intelligence are not located in the organism; they are not an inner and private activity of the organism. Intelligence is not a primitive capacity, but is rather something achieved by agentive actions. To become conscious is to be able to act in an agentive manner. Thought culminates in a form of agentive cognition and in AI, agentive cognition is the only genuine form of knowledge.

Agency must be the essential criterion for the success of machine intelligence instead of linguistic-behavioral-based criteria (for instance, the Turing Test). Since agency is the system of actions in which mind is rooted, it –in AI– is the basic constituent of rationality, intelligence, mental acts, reasoning and other cognitive skills. In other words, agentive action is the primary source for the rationalization, reasoning, and cognitive processes in machine intelligence. However, in order to prevent misunderstanding, we must mention that every action is not essentially or originally agentive. In AI, action cannot be seen only as a response to external stimuli. Action must be an interactional process that machine intelligence does for a reason. The essence of agentive action is rationalization in which machine intelligence acts in order to achieve its goals. George (1977: 49) describes the general features of rational-agent behavior in machine intelligence: “the computer must have the capacity to draw inferences of both an inductive and a deductive kind, and take whatever steps are necessary to seek information which may be needed by some other source of information.”

AI must consider reasoning as a form of action of a dynamic-representational system, developed during *interaction* within the environment. The occurrence of reasoning in machine intelligence does mean a new kind of action of the highly dynamic-representational system capable of making inferences from its experiences in order to achieve new results of action and form novel systems directed towards the future. Therefore, in AI, reasoning is not a mystical emergent property of neural elements, but a form of agentive action necessarily following from the development of a dynamic-representational system.

Agency is inherently relational activities, aimed at exerting a certain influence on the environment. Therefore, in AI, we propose descriptions of “representation” and “reasoning” in environment-referential instead of neuron-identified terms. We claim that theoretical studies on cognitive science have consistently been based on the idea that the mind and surroundings form two distinct systems and that mental activity is situated in the mind, that it is an inner and subjective activity of the mind. It is this main presupposition that seems to lead up a blind alley in cognitive science and artificial intelligence. This presupposition leads cognitive science and AI researchers to the idea that the formation of cognition depends on transmission of information from the surroundings to the mind. However, we defend a different position in which we consider the mind and the surroundings as one system; all formation and increase of cognition means only dynamic re-organization or expansion of this system. In AI, cognition must be *created* in an agentive manner; it cannot be transmitted or moved from one head to

another. Instead of focusing on the linear sequence of information AI research should be directed toward the *conditions* necessary for generating information. Agentive cognition is an ongoing informational process based on a mutual constitutive relationship between the mind and its surroundings. Agentive cognition is not just a formal representation correlated with a sequence of information, but instead refers to certain aspects of a mind-surroundings system as a whole.

In AI, it is possible to *characterize* human cognitive activities in an agent-based model. Therefore, we subsume the conception of “human mind” under a more general conception of “agency”. The *agentive characterization* of human cognitive activities is the basic criteria of reasoning for the solution of the frame problem. We conceive machine intelligence as an agent which is in the world as an embodied-perceiver. An agent is not the representation of a pre-determined (or pre-programmed) authoritativeness, but the act of bringing authoritativeness into the machine intelligence.

In AI, agents are considered as active formers of their surroundings rather than simply passive responders to their environment. Therefore, agency is the system of actions in which mind is rooted. The system of actions (agency) would be impracticable without cognition, and cognition would be irrelevant without the system of actions. McGinn (1982: 82) mentions the role of action in cognition as follows: “cognitive phenomena can be properly understood only in the light of their role in informing action – creatures can think only because they must act.” We take this idea one step further and claim that it is the *agentive characterization* that makes the human cognition *meaningful* and *relevant*; and it is the *agentive characterization* that brings the conceptual (semantic) network within the cognitive capability of human mind. In that sense, agency has an active role in the formation of a cognitive relation and reasoning. In AI, this active role can be embodied in machine intelligence. The emergence of machine intelligence does not presuppose that the agent evolves out of the complex environment, but rather more fully into it. Human cognition is an agent-based formation (construction) and models of mind must analyze the processes of this formation. Therefore, a solution to the frame problem should be concerned with the analysis of agentive construction of the human cognition. In AI, the only way to develop an agentive approach to the frame problem is to build a proper control system theory.

### 3.3 A Control System Approach

AI considers the hierarchy of the human mind as a “computer-based hierarchy” in which each level and unit has a mechanistic role or function. Nevertheless, we conceive machine intelligence as a “living-system-based hierarchy” in which each level and unit is an ordered arrangement of parts and interacting processes that characterizes the whole intelligent system. The basic difference between living systems and AI depends on their control mechanisms. In living systems, the hierarchical organization of the whole coordinates (controls) the role of each level and unit, but in AI, the proceeding of each level and unit determines (controls) the outcome.

Control mechanisms need certain revisions in AI. The behavior of a living agentive system can be based on several control strategies which have very different characteristics with respect to the data which they process. There are several conditions for choosing the appropriate strategy for the control mechanism of an agent such as the availability of data for the performance of an agent, comparing stable and dynamic parameters of the environment, and the access to explicit data about plans, goals, and the current state of affairs. For building an agentive system, it is very important not to restrict an agent (machine intelligence) to follow only one predetermined set of rules but to give it the opportunity to choose and shift different sets of rules according to its situation. This can be done by a proper control mechanism which can find a balance between stability and flexibility of information in a complex environment.

In AI, a control mechanism is an operational function for machine intelligence via its logic programming. A control mechanism, formed by logic programming, specifies how data are governed according to the interior code. Logic is the source of data structures and procedures; and a control mechanism is the operational unit of a machine that uses the data structures and procedures. Therefore, the behavior of machine intelligence can be formed in terms of both its logic and control mechanisms. Logic and a control mechanism are not independent components of machine intelligence. In AI, developing a flexible control system allows optional operational procedures to be tested and evaluated. For developing such a flexible system, control over the coding protocol should be based on a logical model that has a transformational-dynamic character. We propose two types of control mechanisms namely, mode-level and status-level. A control mechanism at the status-level has three types of processes: ordering, option, and looping. First, ordering is a process uniting data and codes in terms of time and space. Therefore, the flow of various data may be controlled by an ordering protocol that situates the environmental data in terms of temporal and spatial conditions. Second, the option process regulates and manages alternative data sources in terms of their potentialities and conditions. The potentiality and condition of each piece of data can be determined by using certain conditional elements such as if/then/else. Third, the looping process controls the repetition of data in order to make machine intelligence more effective in its operations and prevent doubling data. A control mechanism at the mode-level has two types: prescription and relevance. First, prescription is a detailed procedure in which certain types of environmental data, which are very complex and hard to represent in a unified manner, are particularized into manageable units so that they can be controlled. This is a method that operates on complex data in a specialized way to achieve particular ends. In other words, prescription is a type of control mechanism in which complex data are defined by formal parameters and machine intelligence uses these formal parameters in its processing and operating of the data. Second, relevance is a higher-level procedure that determines the relational and relevance value data. The control mechanism in AI is important for the formation of machine cognition because the coding patterns and their regulation control the method of processing-data and construct a habitual form for machine behavior.

### 3.4 A Logical Model Peculiar to Artificial Intelligence

The solution to the frame problem depends on a logical model peculiar to AI. Only a proper logical model can provide machine intelligence with *relevant* knowledge, action, and planning in a complex environment. In AI, complexity is a logical issue defined in terms of formal and computational items. The solution of the frame problem depends on the manner of reorganizing data-processing in terms of changes in the world. This kind of reorganization is possible only by using a proper logical model. That is to say, the logical model embodied in machine intelligence is sufficient for describing the elements of a complex situation and finding the relevant action and plan. If the frame problem remains a problem of designers, it will never be solved. The way humans perform reasoning about changes and complexities in the environment cannot be modeled by AI. Machine intelligence requires a transformational logical model peculiar to its hierarchical organization. In other words, we see the trans-logical model as a proper methodological ground for developing a reasoning model in an agentive system.

#### 3.4.1 The Transformation of Data within Various Logical Systems

We have attributed a constructive and regulative role to logic in AI to find a proper (ideal) way of reasoning for machine agency. For the realization of such roles, a logical model that can operate in complex situations and overcome the frame problem should be developed. The main idea behind the trans-logic system is that in AI, reasoning is based on the idea of using data and operating successive processes until the final information is achieved (realized). These processes are of two kinds. The first kind is *replacement*, where any data unit and/or sets in the processing are interchanged within one or more data unit and/or sets. The second kind is *context-dependency*, in which context-free and context-dependent rules are described. A context-free rule indicates that data-units can always be interchanged with another one. A context-dependent rule implies that the replacement of data-sets is possible only in a pre-ordained context. In our trans-logic system, data-units are microstructures that are autonomous and transitional, able to pass from one condition to another, to be integrated into larger data-sets, with the partial or total loss of their former structuring in favor of a new reasoning function. Data-units are micro-models with a transformational structure that can be integrated in larger programming units and thereby acquire functional significations corresponding to their positions in these larger programming units such as data-sets. The configuration between data-units and data-sets is done by various logical models. Therefore, a trans-logic system includes concomitant logics which have various functions for reasoning processes in machine intelligence.

What do we mean by concomitant logics, and what kind of a role do they have in a logical model? The concomitant logic is the interactional existence of various logical systems (or models) together in machine intelligence. In AI, we propose to use groups of programs, each of which are based on different logical systems such as *heuristic principles*, *deductive reasoning*, *defeasible reasoning*, *temporal logic*, *analogical reasoning*, *nonmonotonic reasoning*, *modal logic*

(*possible-world model*), *probabilistic reasoning* that allow a machine intelligence process to handle particular data in a large set of functional analysis. For instance, for the processing of particular data  $X$ , an  $A$ -type of program based on the temporal logic can be more effective than a  $B$ -type of program based on deductive reasoning (or the first-order logic). Using different programming and logical structures in a unified hierarchical model requires a regulative system that provides the interaction and transformation between different programming and logical structures. At that point, in the trans-logic model, we give fuzzy logic a regulative and transformational role in logic programming because fuzzy logic can regulate sequences of information processing, permitting passage from one stage (for example, deductive reasoning system) to another stage (for example, paraconsistent systems). Therefore, fuzzy logic can be the only transformational algorithm for logic programming. Fuzzy logic is also important for idealization and appropriation because appropriation is a significant criterion for understanding whether a piece of data is suitable, proper, and relevant to the agent or not.

For the solution of the frame problem, the crucial question is how can machine intelligence decide which information is proper for the current situation? In other words, how can we build a regulative system that governs various reasoning processes depending on different logical models? Fuzzy logic is the proper regulative system for managing different logical models (reasoning systems). Fuzzy logic is not an effective reasoning model<sup>2</sup>; but rather an effective regulative model for constructing an interactional and transformational system between different reasoning models. The defenders of fuzzy logic claim that classical logical models are inadequate for modeling informal arguments. They propose fuzzy logic as a modification (*fuzzification*) for a logical model that can be applied to informal arguments. This modification (*fuzzyfication*) has two main stages. Turner (1985:

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<sup>2</sup> Although we do not consider fuzzy logic as a direct reasoning system for the environmental data, the advocates of the idea of fuzzy logic claim that fuzzy logic has a great significance in AI because human reasoning is approximate and fuzzy logic can serve as the logic of human cognition and reasoning. For instance, Zadeh (1996: 89) explains the importance and general features of fuzzy logic as follows: “Fuzzy logic, as its name suggests, is the logic of underlying modes of reasoning which are approximate rather than exact. The importance of fuzzy logic derives from the fact that most modes of human reasoning –and especially common sense reasoning– are approximate in nature. It is of interest to note that, despite its pervasiveness, approximate reasoning falls outside the purview of classical logic largely because it is a deeply entrenched tradition in logic to be concerned with those and only those of modes of reasoning which lend themselves to precise formulation and analysis. Some of the essential characteristics of fuzzy logic relate to the following: --In fuzzy logic, exact reasoning is viewed as a limiting case of approximate reasoning./ --In fuzzy logic, everything is matter of degree./ --Any logical system can be fuzzified./ --In fuzzy logic, knowledge is interpreted as a collection of elastic or, equivalently, fuzzy constraint on a collection of variables./ --Inference is viewed as a process of propagation of elastic constraints.”

101) describes them as follows. “(i) The introduction of vague predicates into the object language. This results in some form of multivalued logic. (ii) Treating the metalinguistic predicates ‘true’ and ‘false’ as themselves vague or fuzzy.” In trans-logic system, the data processed by various logical models will be the member in a *fuzzy data set* –the setoff information to which fuzzy data apply. In the *fuzzy data set*, each data is to be thought of as being a matter of degree. A degreed form of data gives machine intelligence flexibility in order to adapt itself to the environment. In certain situations, degreed data are extremely useful for coping with daily practices and for communication. Since fuzzy logic provides an adequate pseudoverbal representation of information (knowledge), it serves as an interface. In AI, the *fuzzification* of processed data provides a way of forming *degreed data sets* that are more general and more reflective (and representative) of the imprecision of the surrounding environment.

There are many fuzzy logic applications, such as a cement kiln control system and an automobile control engine, in industries that use AI techniques. However, instead of classical application of fuzzy logic, we attribute an extra role to fuzzy logic. Cognition is the *arrangement* of data in terms of an agentive situation. Various logical models (reasoning systems) can be active in this *arrangement* but fuzzy logic is the system that provides harmony between various logical models performing in the same context. In addition, fuzzy logic is the best way to describe environmental data as a linguistic value. Lotfi Zadeh is the first and the most important person who proposed fuzzy logic as a new approach to reasoning and linguistics. In our opinion, his studies on fuzzy logic and its implications related to AI are very valuable for our trans-logic system. Fuzzy sets are essential components for machine thinking because the transformation from data into cognition is a gradual process rather than an abrupt transition. Two-valued or multivalued logic does not present a sufficient reasoning system in AI. Machine intelligence requires fuzzy logic in order to manage various reasoning systems in the light of the performance of the agentive task at hand. Fuzzy algorithms and fuzzy conditional statements<sup>3</sup> can characterize the relationship between various reasoning systems. In the *arrangement* of data, machine intelligence does not have to use high degree precision values for data-processing. Fuzzy sets can be used in order to operate on a data with a minimal degree of precision. Therefore, “fuzzy algorithms can provide an effective means of approximate descriptions of objective functions, constraints, system performance, strategies, etc. (Zadeh 1974: 59). Ap-

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<sup>3</sup> Zadeh (1974: 57) describes fuzzy algorithms and fuzzy conditional statements as follows: “*Fuzzy conditional statements* are expressions of the form IF *A* THEN *B*, where *A* and *B* have fuzzy meaning, e.g., IF *x* is *small* THEN *y* is *large*, where *small* and *large* are viewed as labels of fuzzy sets. A *fuzzy algorithm* is an ordered sequence of instructions which may contain fuzzy assignments and conditional statements, e.g., *x=very small*, IF *x* is *small* THEN *y* is *large*. The execution of such instructions is governed by the *compositional rule of inference* and the *rule of the preponderant alternative*.”

proximation is a tool for fuzzy reasoning that can also be used for understanding natural language.<sup>4</sup>

In AI, a theoretical model based on fuzzy logic uses linguistic variables in order to describe behavioral systems. In other words, linguistic variables allow machine intelligence to perform approximate reasoning. Zadeh (1983:254) also claims that fuzzy relations are an *explanatory database* for understanding the meaning of a proposition. This *explanatory database* base can be important for the background knowledge in commonsense reasoning.

#### 4. Conclusion

In the frame problem, we are studying how semantic data can be used to make statements in machine intelligence. To make a statement about environmental data demands that certain conditions be more or less satisfied. These conditions are very diverse. There are physical conditions such as encoding the data. There are conditions involving background information. There are logical conditions such as assigning proper names to a unique referent. When an agent makes a statement on environmental data, the information about the data should provide that most of these conditions are satisfied.

In AI, reasoning is the final stage in which all the information gained from data-processing is used in an appropriate way. Therefore, reasoning is the assemblage of cognitive systems active in machine cognition. We have argued that classical AI reasoning models depending on deductive reasoning systems and the designer approach are not adequate. We need a logical model that can perform various logical models on the same data and can manage the information gained from these models. This management allows machine intelligence to have a sense of relevance.

#### REFERENCES

Crockett, Larry J. 1994. *The Turing Test and the Frame Problem: AI's Mistaken Understanding of Intelligence*, Norwood, New Jersey: Ablex Publishing Corporation.

Dennett, Daniel C. 1978. *Brainstorms: Philosophical Essays on Mind and Psychology*, Sussex, Harvester Press.

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<sup>4</sup> Zadeh (1979: 149) sees approximation as an essential part of fuzzy reasoning. By *approximation*, Zadeh means: "the process or processes by which a possibly imprecise conclusion is deduced from a collection of imprecise premises. Such reasoning is, for the most part, qualitative rather than quantitative in nature, and almost all of it falls outside of the domain of applicability of classical logic."

Dennett Daniel C. 1990. Cognitive Wheels: The Frame Problem of AI. In *The Philosophy of Artificial Intelligence*, ed. Margaret A. Boden, 149-170. Oxford: Oxford University Press.

Dreyfus, Hubert L. and Dreyfus, Stuart E. 1988. How to Stop Worrying about the Frame Problem Even though It's Computational Insoluble. In *The Robot's Dilemma: The Frame Problem in Artificial Intelligence*, ed. Zenon W. Pylyshyn, 95-111. Norwood, New Jersey: Ablex Publishing Corporation.

Fetzer, James. 1991. The Frame Problem: Artificial Intelligence Meets David Hume. In *Reasoning Agents in a Dynamic World*, eds. K.M. Ford and P.J. Hayes, 55-69. Greenwich, Connecticut: JAI Press.

Freeman, Walter. 1992. Framing is a Dynamic Process, *Psychology* 3(62) <http://www.cogsci.ecs.soton.ac.uk/cgi/psyc/newpsy?3.62>.

George, F.H. 1977. *Cybernetics and the Environment*, London: Paul Elek.

Harnad, Stevan. 1993. Problems, Problems: The Frame Problem as a Symptom of the Symbol Grounding Problem, *Psychology* 4 (34) <http://www.cogsci.ecs.soton.ac.uk/cgi/psyc/newpsy?4.34>

Haugeland, John. 1988. An Overview of the Frame Problem. In *The Robot's Dilemma: The Frame Problem in Artificial Intelligence*, ed. Zenon W. Pylyshyn, 77-93. Norwood, New Jersey: Ablex Publishing Corporation.

Hayes, Patrick J. 1988. What the Frame Problem Is and Isn't. In *The Robot's Dilemma: The Frame Problem in Artificial Intelligence*, ed. Zenon W. Pylyshyn, 123-137. Norwood, New Jersey: Ablex Publishing Corporation.

Hendricks, Scott. 2006. The Frame Problem and Theories of Belief. *Philosophical Studies* 129: 317-333.

Janlert, Lars-Erik 1988. Modeling Change –The Frame Problem. In *The Robot's Dilemma: The Frame Problem in Artificial Intelligence*, ed. Zenon W. Pylyshyn, 1-40. Norwood, New Jersey: Ablex Publishing Corporation.

Korb, Kevin B. 1998. The Frame Problem: An AI Fairy Tale. *Minds and Machines* 8: 317-351.

Lifschitz, Vladimir. 1987. On the Semantics of STRIPS. In *Reasoning about Actions and Plans*, eds. Michael P. Georgeff and Amy L. Lansky, 1-9. Michigan: M. Kaufmann Publishers.

McCarthy, J. and Hayes, P.J. 1969. Some Philosophical Problems from the Standpoint of Artificial Intelligence. In *Machine Intelligence*, Vol. 4, eds. Bernard Meltzer; Donald Michie and Michael Swann, 463-502. Edinburgh: Edinburgh University Press.

McGinn, Colin. 1982. *The Character of Mind*. Oxford: Oxford University Press.

Peppas, Pavlos et al 2001. Prolegomena to Concise Theories of Action. *Studia Logica* 67: 403-418.

Pollock, John L. 1997. Reasoning about Change and Persistence: A Solution to the Frame Problem. *Noûs* 31: 143-169.

Raphael, B. 1971. The Frame Problem in Problem-Solving Systems. In *Artificial Intelligence and Heuristic Programming*, eds. N.V. Findler and Bernard Meltzer, 159-169. Edinburgh: Edinburgh University Press.

Shanahan, Murray. 1997. *Solving the Frame Problem: A Mathematical Investigation of the Common Sense Law of Inertia*. Cambridge, Massachusetts: The MIT Press.

Shoham, Yoav. 1988. *Reasoning about Change: Time and causation from the Standpoint of Artificial Intelligence*. Cambridge, Massachusetts: The MIT Press.

Turner, Raymond. 1985. *Logics for Artificial Intelligence*. West Sussex: Ellis Horwood.

Zadeh, Lotfi A. 1974. A New Approach to System Analysis. In *Man and Computer*, ed. M. Marois, 55-92. Amsterdam: North-Holland Publishing Company.

Zadeh, Lotfi A. 1979. A Theory of Approximate Reasoning. In *Machine Intelligence Vol. IX*, eds. J.E. Hayes; Donald Michie, and L.I. Mikulich, 149-193. Sussex: Ellis Horwood Limited.

Zadeh, Lotfi A. 1983. A Fuzzy-Set-Theoretic Approach to the Compositionality of Meaning: Propositions, Dispositions and Canonical Forms. *Journal of Semantics* 2: 253-272.

Zadeh, Lotfi A. 1996. *Fuzzy Sets, Fuzzy Logic and Fuzzy Systems (Selected Papers)*. Singapore: World Scientific.