

## ANALYZING THE INTERRELATIONS OF COGNITIVE PROCESS AND LOGIC ON LANGUAGE

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### **Abstract**

*Latin language is used every day by mathematicians, philosophers, computer scientists, linguists, and experts of artificial intelligence. It is the universal language of the symbolic sciences. Although it is not so frequently used in disciplines like medicine and finance, it is a beneficial form to understand these disciplines. Thus, the primary problem is between object and subject and how the object is defined.*

*Idealizing, defining and verbalizing are crucial aspects of philosophy of logic and language acquisition. Philosophy has been encountering the rules of language acquisition for a long time. Plato and Aristotle tried to define these aspects of philosophy in the ancient times. While Plato put the emphasis on nature regarding acquiring knowledge, Aristotle put it on nurture. Later on philosophy embarked on a linguistic orbit with Wittgenstein.*

*We came across the rules and bases of language acquisition by the early years of philosophy. The essential cross point between philosophy and language is logic. Logic is considered to be the name of the "truth" of reasoning. Logic can tell us how to evaluate the truth or falsity of any statement or group of statements. Aristotelian logic is mainly confined to the analysis of short statements.*

*Understanding signs and symbols is a very important thing for the human mind. Logic clarifies that what is black, what is white, what is true and what is false. Nowadays the following question is being asked. Logic showed us what is black, what is white, what about the grey?*

*Additionally, cognitive perspective approaches to learning of conceptual contents that recognizing objects in our surroundings and understanding their meaning is crucial for the human mind. In this paper the relationship between logic and language is studied. It also analyzes the relationship between logic and cognitive perspective on language and language learning.*

**Keywords:** *Philosophy, Cognitive, Logic, Idealizing, Defining.*

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## ***Dilde Bilişsel Süreç ve Mantığın Karşılıklı İlişkisinin Analizi***

### **Öz**

*Latince; matematikçiler, filozoflar, bilgisayar bilimcileri, dilbilimcileri ve yapay zekâ uzmanları tarafından her gün kullanılmaktadır. Sembol bilimlerin evrensel dilidir. Tıp ve maliyede olduğu kadar kullanılmasa da, bu dalların idrakında önemli bir etkidir. Böylece, ana problem nesne ve özne arasında ve objenin nasıl tanımlandığıdır.*

*İdealize etmek, tanımlamak ve açıklamak, mantık felsefesinin ve dil edinmenin (kazanının) önemli biçimlerindedir. Felsefe uzun bir zamandır dil edinme kuralları ile karşılaşmış, antik zamanlarda da Plato ve Aristotle felsefenin bu biçimlerini tanımlamaya çalışmışlardır. Plato bilgi edinmek için doğaya önem verirken, Aristotle terbiyeye (bakım, büyütme) ehemmiyet vermiştir. Daha sonradan felsefe Wittgenstein ile dilbilimsel bir yönüğe binmiştir.*

*Dil edinmenin kurallarına ve temellerine felsefenin ilk yıllarında rastlanılmıştır. Felsefe ile dilin kesiştiği ana nokta mantıktır. Mantığın, muhakemenin "doğruluğunun (gerçekliğin)" adı olduğu kabul edilmektedir. Mantık bize bir ifadenin veya bir grup ifadelerin doğruluğunu (veya yanlışlığını) nasıl değerlendireceğimizi söyler. Aristocu felsefe genellikle kısa ifadelerin analizi ile kısıtlıdır.*

*İşaretlerin (delillerin) ve sembollerin idrakı insan aklı (zihni, beyni) için çok önemlidir. Mantık neyin siyah neyin beyaz, neyin yanlış neyin doğru olduğuna açıklık getirir. Günümüzde ise aşağıdaki (sonraki, sonradan gelen) şu soru sorulmaktadır. Mantık bize neyin beyaz neyin siyah, neyin doğru neyin yanlış olduğunu gösterdi, peki ya gri? İlaveten, bilişsel (idrak ile ilgili) bakış açısının kavramsal içeriklerin öğrenimine yaklaşımı etrafımızdaki nesnelere tanımanın (teşhis etmenin) ve anlamlarını idrak etmenin (anlamamanın) insan aklı için gayet önemli olduğu yönündedir. Bu makalede mantık ve dilin ilişkisi incelenmiştir. Mantık ile dil ve dil öğreniminin bilişsel perspektifi arasındaki ilişki de incelenmiştir.*

**Anahtar Kelimeler:** *Felsefe, Bilişsel, Mantık, İdealize Etmek, Tanımlamak.*

### **Introduction**

Philosophy is the oldest social science that is the study of not only general problems but also problems such as existence, knowledge, reason, mind, and language.

The philosophical thought starts with knowledge which is also acquired an ability learned or culturally influenced in an instructional setting in different environments. People start thinking with their acquired knowledge. Knowledge like this informs supports and provides a context for symbolic thinking. Thinking is a mental process characterized by the use of symbols and concepts to represent both inner and outer reality. A symbol is a word, mark, sign, drawing, or object that stands for something else.

Plato claims that physical things can never be made without qualification. Plato divides reality into two realms, the physical world of existence, and a world of being full

of eternal and perfect forms. It would gradually analyze concepts and draw us closer to the truth. Before we can explain anything we should find out in what way it is useful. For instance, it is possible because we are not really learning anything new, we were aware with prior to birth.

Aristotle was being deeply influenced by Plato, who points out that knowledge must be based on what it is possible to experience. In order to think effectively, it is necessary to think in a logical manner. Moreover, according to Wittgenstein, mental states are closely connected to a subject's environment, particularly their linguistic social-environment, otherwise it is misguided.

The Chomskian revolution has therefore deeply affected the relationship between logic and linguistics. It is not surprise that language appears to be a major topic in cognitive science. There are literally amounts of related language topics in cognitive science such as natural language processing, social cognition and language, voice recognition, knowledge acquisition, cognitive development. Cognitive basis, principles and findings of cognitive psychology are applied to the field of language learning. Later on, Richard Montague's studies serve new perspectives about logical grammar which is related natural language and formal languages (Montague 1974).

This paper tries to analyze the cognitive process and logic which have critical on language and language learning. In particular, this study tries to examine the role and relations of cognitive process and logic on human language learning. The paper applies the major framework of cognitive learning theory, and logic identification of the interrelation and interaction.

### **The mutual relations of Logic and Language**

Logic is used in most mental activities, but it is basically used in the disciplines of philosophy as well as mathematics, semantics, and computer. Logic was given the principal discipline as a social science by Aristotle. The eminent philosopher, Aristotle granted it a primary place in philosophy. Today, logic is both a branch of mathematics and a branch of philosophy. As a branch of philosophy, logic is the study of correct reasoning that reasoning is an epistemic, mental activity. Philosophically, logic is being known as knowledge representation and problem solving.

Unlike Aristotle, who used logic as a tool for analyzing language, one of the main perspectives was emerged by Kant. Kant expected that logic is a requirement, not only for language, but for all rational thought. Richard Montague (1970) added Kant's statement: "I reject the contention that an important theoretical difference exists between formal and natural languages." That statement recognized and motivated much of the research in artificial intelligence and formal linguistics. Frege, Russell, and Carnap, and later Wittgenstein considered logic to be superior to language. As logicians, those two groups were agreed on, but later on they recognized the limitations of logic and the power of language.

The amount of different forms of logic is used in different areas. However, logic played a crucial role until the 80s as the perspective of linguistics and semantics. Language was tried to explain by natural language and formal logic. Aristotle designed formal logic as a tool (organon) for analyzing and reasoning about the ontologies hidden in language. They are also words and phrases for everything that anyone has ever revealed, assumed, or imagined. Unlike Aristotle, some linguists and logicians stated that there is a superior kind of logic at the basis of all native languages.

However, Russell and Norvig explain the logic in a different perspective that can be applied to other problems as well. (Russell & Norvig, 2003). For instance, formal logics are too strict to be the basis of language. Logic and ontology are abstractions from language. This problem between logic and language seem to be leaving the many theories about language meaningless. In addition, Frege, Russell, and the Vienna Circle have tried to make formal logic the universal language of science, however this attempt failed.

Later on, linguistics focused on computer sciences. So the term Fuzzy logic is used against the traditional logic. Fuzzy logic is a form of probabilistic logic. In addition, fuzzy logic variables may have a truth value that ranges in degree between 0 and 1. In 1999 a handful of studies about fuzzy logic that has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false (Novák, V. Perfilieva, I. and Močkoř, J. 1999).

Fuzzy logic rules focus on human differences and personal level. So in the perspective of fuzzy logic, personal level stands for knowledge. In addition, fuzzy logic has been applied to many fields, from control theory to artificial intelligence. Not only variables in mathematics take numerical values but also the non-numeric linguistic variables are frequently used to facilitate the expression of rules and facts (Zadeh, 1996).

In conclusion, the relationship between language and logic that are constructed on vocal signs and forms of signs, whose more stable forms are classified as vocabulary and grammar. Grammar and logic describe constant patterns of signs or invariants under transformations of perception. Those constant forms develop as each individual interacts with the world in it.

### **The mutual relations Cognitive process and Language**

Cognitive psychologists who search for explanations of language cognition and language learning focus on mental representations, consciousness and perceptual process. Cognitive process has a huge complex definition which is linked to brain, and functions of the brain.

Language learning is a product of the complex interaction of the linguistic environment and the learner's inner mechanisms. The crucial notion, (memory) is a process that contains the encoding, storage, and recovery of cognitive information. Moreover, encoding supports recovery of memory. Encoding is a process characterized by giving an

informational input a more useful form, and the knowledge storage refers to the fact that memories are retained for a certain period of time.

Behaviorism was very influential between the 1940s and 1950s. Behaviorists came up with a different approach and view stating that learning is a product of stimulus-response and the environment. Behaviorism traditionally defines human behavior, which was shaped and controlled robotically and automatically by environmental stimuli. A neutral stimulus is not responding first later on the organism learns to respond to stimuli with the help of reinforcement. So negative and positive transfer can help with language learning. Positive transfer occurs when the rules are used correctly for the language learning. Negative transfer, occurs when the rules are used incorrectly for the language learning. Transfers affect the whole system of learning acquisitions.

Contradicting the Behaviorism, the theory of Piaget's as mind and schema, analyzes how infants function in the world surrounds them and how this influences their mental stability. Learning happens with environmental issues, especially equilibrium. When the infant solves a problem, that's how the infant learns, and that's how the knowledge is constructed by the action of that child. The cognitive theory asserts that knowledge is acquired through communication and mind.

Cognitive language studies purposes explaining language in terms of other resources and mechanisms of the human mind and body (Verspoor, M., Lowie, W., & Van Dijk, M. (2008). They state that language is part of human cognition, perception and categorization. Cognitive studies mention that language offers a perspective to put into cognitive functioning, the nature, structure, and organization of thoughts and ideas. Like the Chomskian perspective, language is an independent system, separate from other cognitive and social abilities.

Langacker, one of today's prominent linguists, has developed a model of language which presents linguistic structure and organization as reflecting general cognitive organizational principles. He also mentions that the assignment is of relative importance to entities at the perceptual and cognitive levels, it is also a major design piece of language. Moreover, Langacker (2000, 2008) proposes that the units that make up an individual's mental grammar are resulting from language use. Language is interacting closely with other mental faculties, vision, sensory-motor skills, and memory. In particular, mechanisms related to cognitive characteristics of attention are demanded to underpin the organization of linguistic structure.

### **Cognitive Process and Logic in The Process of Language Learning**

The brain doesn't work like a specialized computer device which has a large number of automatic responses. The left and right side of the functions of hemispheres have evidence in neurological researches. The result of the experiments showed that the left hemisphere is related with mental, logical and analytical functions which are related with brain, memory, schema and knowledge. These concepts are the main notions of both cognitive process and philosophy which need symbols.

During 60s and 70s various languages and related fields were attracted by linguistic educators. Frege (1879) mentioned that “to break the domination of the word over the human spirit by laying bare the misconceptions that through the use of language often almost unavoidably arise concerning the relations between concepts.”

Signs and symbols are crucial for working of the human mind, for gathering and transmission of knowledge in human culture, and are widely used in intelligent and multi-level combination systems. But somehow symbol is the most misused word. Scientific theories of signs and symbols, however, are not well developed and even the exact meaning of these words is often confused. We use sign and symbols for unimportant cases, such as say to traffic signs or for in the most profound cases of cultural and religious symbols.

Wittgenstein, though it's certainly related to language, which is naturally social; hence, there is no 'inner' space in which thoughts can happen. Also Wittgenstein's thought is captured in the following claim: "An 'inner process' is in need of outer criteria. This comes primarily from his conclusions about personal languages: similarly, a personal mental state (a sensation of pain, for example) cannot be effectively discussed without public criteria for identifying it Wittgenstein, L (1953/2001).

According to Wittgenstein, mental states are intimately connected to a subject's environment, especially their linguistic social-environment, and arguments that claim if not are misguided. Wittgenstein agreed that language can be misleading, but he denied that an artificial language could be better. Furthermore, Wittgenstein criticized that definitions emerge from what he called "forms of life". That is generally the culture and society in which they are used. Wittgenstein points out that the social aspects of cognition; as well as works of language for most cases, and its functions for specific social situation.

Wittgenstein also rethinks the possibility of a language which talks about those things which are known by the user. So the content is inherently private. The usual instance is that of a language in which one names one's sensations and other subjective experiences, such that the meaning of the term is decided by the individual.

Wittgenstein conducted a simple experiment: to come up with a definition of the word "game". While this may at first seem a simple task, he then goes on to lead us through the problems with each of the possible definitions of the word "game".

During the 1950's, the agreement that seemed to have been reached regarding the primacy of sentences in semantic questions began to define the collapse of the movement of logical positivism and the powerful influence exercised by the philosophical investigations of the later Wittgenstein.

In the *Tractatus*, Wittgenstein claimed that “the totality of facts” about the world can be stated clearly in language or logic, and “Whereof one cannot speak, thereof one must be silent.” That book set the agenda for formal semantics in the 20th century. In the middle 1950's logic and the new linguistics science lived in a "splendid mutual isolation" Bar-Hillel (1969, p. 182).

Moreover, the computer research results are much closer to human perception than ever before. Combination of these technological innovations influenced the theory of the

learning, such as cognitive knowledge theory, long term –short term memory, sensational memory. This has led to a new science called neuro-fuzzy logic.

Nowadays, Logic, both fuzzy logic and neural network concepts were developed during the last few years independently to understand human behavior patterns, especially the thinking processes in relation to problem solving. While fuzzy logic uses approximate human reasoning in knowledge-based systems, the neural networks aim at pattern recognition, optimization and decision making.

Fuzzy logic is constructed by the learning power of simulated neural networks. An essential side of dynamic logic operation is that the early stages of cognitive and language models are unclear and fuzzy, and are uncertainly related to absent or uncertain knowledge. But on the other hand, Fuzzy logic is not so accessible to consciousness, but certain models are more accessible to consciousness.

With this said, language is being affected by psychological approaches, and also advancements in cognitive perspectives and logic related fields.

### **Conclusion**

Human beings lead very complex lives. We have all kinds of problems to solve. Life is full of challenges every day. And it is necessary to think clearly and effectively if one is to be successful in facing the problems and challenges of life that needs imagination recognizing objects in the environment and understanding their meaning. Logical thinking is thinking that employs valid reasoning to reach a correct conclusion. It is the foundation of rational thought, thought that fits the real world and allows us to function well. Some of the linguists agree that, it is necessary to think in a logical manner. Signs and symbols give a chance to help the memory to work with the human mind, human knowledge in human culture. The study of Logic, Language and Modularity, Fox (2010) mentioned the relationship of logic and language with signs and symbols. Logic has made some progress that attempts to simulate the structures inside human and animal brains that give rise to this skill. Idealizing, defining and verbalizing has not only become essential notions for the logician but for cognitive linguists as well.

Chomsky's original ideas of Universal grammar also relied on logical rules. In addition Pinker (2010) explains the language is as complex and logical tree structures. As mentioned, cognitive perspective put the functions of mental activities as central focus for analyzing how learning expertise develops. It is not surprise that language appears to be a major topic in cognitive science, assuming memory and the function of the memory are the breaking point of logic and the cognitive process.

The extensive relationship between logic and cognitive system has fully been covered in this article yet, which is beyond its scope. Instead, it is meant to serve a preliminary framework to explore this relationship from a different perspective in an effort to provoke ideas for further research and discussions.

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