

# LOGIC AND NATURAL LANGUAGE: SIMILARITIES AND DIFFERENCES

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## Abstract

Logical thinking and language are closely correlated. An enriched study of this correlation demonstrates that while on the one hand mastering the knowledge of logic, and developing logical thinking is quite critical and significant for all, on the other hand, it facilitates our conscious application of the forms and rules of thinking. That is, to help us enhance the level of "technique" of thinking, creating thinking habits "more intelligent", contributing to the augmentation of the definiteness, accuracy, non-contradiction, continuity, thoroughness, and provability of the argument; enhance the effectiveness and confidence of thoughts and words; correct orientation and direction for human cognitive and practical activities.

**Keyword:** Logic, natural language, relationship between language and logical thinking.

## INTRODUCTION

Cognition is a necessity in the process of existence and development of human beings. While cognizing reality and phenomena in the objective world, human being has formed categories, judgments, and inferences. In order to express this thinking process, man has to use "natural language". Because of natural language, man can communicate with each other. Therefore, natural language not only performs communicative function, but also acts as a functional tool for thinking. Logic, unlike philosophy, carries out research on natural language in order to investigate thinking. Therefore, while investigating natural language, logic abstracts communicate components and situational elements to reach the "direct real language" of thinking. In other words, "logic de-contextualizes sentences of natural language to have simple truth-value sentences, propositions". Thus, logic is closely associated with natural language: Both similarities and differences exist between logic and natural language.

## THE BASIC CONCEPTS

### Logical Thinking

Logical thinking is a skill that involves using reasoning in a way that allows an individual to come to a viable solution. Logical thinking presupposes several reasoning skills and the ability to look at a situation objectively and work towards a solution based on the facts at hand. Logical thinking is the process of applying a chain of reasoning to overcome a problem and reach a conclusion. A reliable example of logical thinking in action is the game of chess. Playing chess involves working through a sequence of individual steps which take you closer to victory. Logical thinking is important because it can help us reason through important decisions, solve problems, generate creative ideas and set goals, all of which are necessary for developing our career. The elementary purpose of logic is to demonstrate how to draw valid inferences. Logic

provides a systematic way of showing how we can arrive at a conclusion through applying inferential rules to premises (premise is a proposition that is believed to be known). In other words, the aim of logic is the elaboration of a coherent system that allows us to investigate, classify, and evaluate “good and bad” forms of reasoning. Logical truths are generally well-thought-out to be necessarily true, so much so that no situation could arise in which they could fail to be true. The view that logical statements are necessarily true is sometimes treated as equivalent to saying that logical truths are true in all possible worlds. In fact, it is routinely wrong. For example, it can often be heard that two people might be debating religion, politics, or something else passionately. Both can have arguments that are logically correct but end with contradictory conclusions. Similarly, logic is the dynamics of truth, so while our current models of the dynamics of truth might be wrong, namely we could be using logical fallacies without knowing it, logic itself is by definition true because it just describes what is already true. Logic is only as reliable as its starting point. Every logical proposition is based up one or more premises. Depending on the reliability of these premises, logical processes can be used to 'prove' just about anything. Many conclusions or premises might be logical, but actually false. This is because logic is not the only tool required to measure whether something is true. A logical person uses precise language so that her/his listener knows exactly what s/he is talking about and can adequately evaluate the truth of her/his claims. If s/he refers to more complex terms such as “freedom” or “equality,” s/he makes sure to establish her/his particular understanding of those terms. In metaphysics and the philosophy of language, the property of sentences, assertions, beliefs, thoughts, or propositions that are said, in ordinary discourse, to agree with the facts or to state what is the case. Believing what is not true is apt to defeat people's plans and may even cost them their lives.

### **Language and Natural Language**

Various definition of the language has been proposed by linguists. Language is a form, not the substance (Chaer Lyons 1995). While Chaer (1995) mentions the characteristics that constitute the essence of language as a symbol of the sound system, are arbitrary, productive, dynamic, diverse, and humane. A language is a structured system of communication used by humans. Languages can be based on speech and gesture (spoken language), sign, or writing. The structure of language is its grammar and the free components are its vocabulary (Nicholas Evans, 2009). Human language is unique among the known systems of animal communication in that it is not dependent on a single mode of transmission (sight, sound, etc.), is highly variable between cultures and across time, and affords a much wider range of expression than other systems (Nicholas Evans & Stephen Levinson, 2009). According to Richard Nord Quist (2019), language is a tool for thinking and acting. Language is a set of symbols, which are used mainly for communication. Language indicates each of its nation, a parable once say so. If its meaning pondered deeper, may make us wiser in understanding and addressing all cases that linked between language and attitude or behavior of groups of speakers of the languages (Alwi, 2004:21). Wisdom is likely to strengthen believe about the role of language in the development of the culture. In terms of the approach of Chomsky in 1957 and 1965, the nature of language can be considered as a function of knowledge attained. Thus the language faculty may be regarded as a fixed function, a feature of the species, one important component of the human

mind, a function which integrates experience into grammar. In other words, language is all at once a tool and the mechanism that determines how we relate to the world, to each other, and, even to ourselves. Language is what makes us human. The scientific study of language is called linguistics.

Questions concerning the philosophy of language, such as whether words can represent experience, have been debated at least since Gorgias and Plato in ancient Greece. Thinkers such as Rousseau have argued that language originated from emotions while others like Kant have held that it originated from rational and logical thought. 20th-century philosophers such as Wittgenstein argued that philosophy is really the study of language (Mustafa Güleç, 2021). Human languages have the properties of productivity and displacement, and rely on social convention and learning. Estimates of the number of human languages in the world vary between 5,000 and 7,000. Precise estimates depend on an arbitrary distinction (dichotomy) being established between languages and dialects (Kamusella, Tomasz, 2016).

Natural languages are spoken, signed, or both; however, any language can be encoded into secondary media using auditory, visual, or tactile stimuli – for example, writing, whistling, signing, or braille (Kıran, Zeynel & Ayşe Kıran, 2006). In other words, human language is modality-independent, but written or signed language is the way to inscribe or encode the natural human speech or gestures. Depending on philosophical perspectives regarding the definition of language and meaning, when used as a general concept, "language" may refer to the cognitive ability to learn and use systems of complex communication, or to describe the set of rules that makes up these systems, or the set of utterances that can be produced from those rules. Language is thought to have originated when early hominines started gradually changing their primate communication systems, acquiring the ability to form a theory of other minds and a shared intentionality (the Birregurra Preschool Centre, 2022). This development is sometimes thought to have coincided with an increase in brain volume, and many linguists see the structures of language as having evolved to serve specific communicative and social functions. Language is processed in many different locations in the human brain, but especially in Broca's and Wernicke's areas (the Birregurra Preschool Centre, 2022). Humans acquire language through social interaction in early childhood, and children generally speak fluently by approximately three years old. The use of language is deeply entrenched in human culture. Therefore, in addition to its strictly communicative uses, language also has many social and cultural uses, such as signifying group identity, social stratification, as well as social grooming and entertainment (the Birregurra Preschool Centre, 2022).

## **SOME SIMILARITIES AND DIFFERENCES BETWEEN LOGIC AND NATURAL LANGUAGE**

### **Some Similarities between Logic and Natural Language**

We know that while logic indicates inner relationships of the constituting components of thinking, natural language is a tool – a “material cover” – that expresses the thinking process into the outer world. Therefore, commonalities exist between logic and natural language:

First, natural language and logic are both systems of signs and have some similarities but also have some differences. For example, the signs of logic are artificial and formal. Therefore, they are homogenous, single-valued, and invariable. In contrast, the signs of natural language, due to the impact of many factors like temporal and spatial changes, variability of locality, occupations, and social status, are natural, non homogenous variables<sup>1</sup>.

Second, logic and natural language share basic elements and units. While the basic units of logic include concepts, judgments, and references, correspondently the basic units of natural language are words, sentences, and sets of sentences. Thus, concepts are correlative to words, judgments to sentences and references to sets of sentences. For example, “matter” is a word in natural language and its correlative in logic is the concept of matter. “Ho Chi Minh is a famous, cultural man” is a sentence in natural language, in logic it is a confirmative judgment based on deductive logic, for example, all men are mortal, Socrates is man. Socrates is mortal...in logic a net of sentences is combined into a syllogism.

Third, if there are active elements or logical connectedness, the conjunctions in natural language play similar roles in connecting sentences. For example, in logic we have “and” and “or” which are the basic elements for connecting propositions, while in natural language we have connecting words and conjunctions to connect sentences.

We know that man’s cognition is a dialectical process, which is gradually coming into an absolute truth. Besides, natural language is always in the process of change and development, so today’s standards can be constructed from non-standards of the past because natural language itself is under the impact of several external factors: time, space, the development of thinking and society...

### **Some Differences between Logic and Natural Language**

Apart from similarities mentioned above, there exist differences between logic and natural language, discusses as follows:

First, natural language is richer than logic. For example, a judgment “she is not beautiful” can describe the attribute of “not being beautiful” – a negative attribute of the girl, or deny other judgments. In natural language (here Vietnamese) there exist many ways to express the same content:

1. Is she beautiful?
2. She is in no way beautiful
3. How could she be beautiful?
4. She’s not beautiful
5. In which way is she beautiful?
6. How can she be beautiful with such a face?
7. Oh my God! Can she be beautiful?
8. Who says she is beautiful?
9. It is not true that she is beautiful

Apart from those constructions, philologists also show many other examples with the same content. However, the matter is, within formal logic people care about truth-values of judgments, while in natural language people pay attention not only to whether a sentence's structure is grammatically correct, but also to its meaning. Therefore, researchers claim that expressions of formal logic are structurally single-valued while expressions of natural language are structurally multi-valued.

Second, albeit concepts and judgments are basic units of logic and corresponding words and sentences are basic units of natural language, they must not be construed as identical. This is because a concept may be expressed by a word, but other concepts may be expressed by a set of sentences. And there exist some words that express no concept at all. Alternatively, different words may express the same concept. For example, the concept of "death or to die" in Vietnamese can be expressed in different ways: sacrifice, die, pass.

*Away, go to meet ancestors, go to the golden Stream, sleep with  
worms, sell salts, go to Heaven, or to rest in peace.*

In many cases, the same word can express different things. For example, the word "ngu" has different meanings, in accordance to different contexts. The word "ngu" means stupid idea or stupid opinion, implying modesty and humility or initiative, and peace, but not stupidity as ordinarily understood, as the case of the word "Ngu" in the national name of Vietnam in the Ho dynasty (1400-1407) "Dai Ngu" (the national name "Dai Ngu" was replaced that of "Dai Viet" by Ho Quy Ly in the 15th century).

Judgments are expressed in the form of sentences of natural language. However, this is not the case for all sentences of natural language. Not all sentences of natural language are judgments. For example, questions, exclamatory, or imperative sentences such as: "How painful is the fate of the women!", "What is terrorism?", or "Go away from here!". Those three sentences are not judgments because we cannot determine their truth-values.

Third, laws and principles in logic are generalized from laws and forms of exact thinking. Therefore, they are universal and invariable. In contrast, laws and principles of natural language are generalized but also dependent of the contents, historical conditions, and specific features of different natural languages. Within logic there exist referent relations between judgments. There are some similar relations in Vietnamese language. However, some logical inferences cannot be applicable for natural language.

Conjunction judgments in logic contain inferential relations:  $a \supset b = b \supset a$ . However, in Vietnamese the correlative complex sentences using the word "and" cannot express that similar feature. For example, "he mumbles and all people laugh at him" and "all people laugh at him and he mumbles". We must not claim that the two sentences have the identical meaning despite the fact that they have comparable logical structure of  $a \supset b = b \supset a$ .

In logic we say that if  $a=b$  then  $b=a$  so  $a$  and  $b$  are equal. Similarly, when we say that Binh and Thu love each other we infer that Binh loves Thu and Thu also loves Binh. However, in natural language when comparing parents and offspring we always set the parent as the starting point.

Hence we say that the daughter resembles her mother and not that the mother resembles the daughter. Although this might be true, the convention is to compare the offspring with the parent.

Some differences can be applicable in logic and natural language. For example, from the judgment “some students like Hip-hop”, we can infer “there exist some people who love Hip-hop and are students”. However, some inferences can only be seen in logic.

In natural language we have following sentences:

- 1, “He came to class late again”. We can infer that “he used to come to class late”.
- 2, “He became boasting”. We can infer that “he had never boasted before”

We can infer this because our references are based on the words like “again” and “became”, which are called pre-suggestive words.

In natural language a form of intention exists for reference while in logic there exists the form of rational reference. Intention references are applicable in everyday life, therefore are popular in natural language. However, intention references are situational and depend on the contexts and cannot be rigorous as rational references of logic.

The following example could be presented as a problematique for the logicians. “There was a captain in a boat who supported the law for alcohol prohibition (in the USA during 1920-1933). However, the Vice-Captain is often a habitual drunkard and has no sympathy from the Captain. One day, during his work he saw that the Vice-Captain was drunk. The captain was angry and wrote in the Boat’s diary “today, March 25, the Vice-Captain was drunk”. The next day in his duty when the Vice-Captain saw that remark, he was frustrated and wrote to the diary “today, March 26, the Captain was not drunk”. That comment seems to be right but it also implies that “the captain likes drinking and is often drunk except today (March 26) when he did not drink”. Here the Vice-Captain abused the rule of reference: if someone reports something, which is not worthy of reporting, it often might be concluded that something infrequent and unfamiliar is happening”.

Apart from commonalities shared with all natural language, Vietnamese has its own logic. The explanation and analysis of the phenomena of natural language in some cases is very difficult and complicated, and even some cases cannot be explained or analyzed.

In grammar there exist sentences in the form of question but the contents are confirmative. For example, in Vietnamese there is saying “which chili is not hot?”. Everyone can infer that it means all chilies are hot. Today this phenomenon is very popular in the way of speaking of the people living in the North. For example, when we watch show games on television, we often hear the speaker give questions with various answers a, b, c, d. If the player chose the answer b as the correct one but she answered with the question “is it b?”. Clearly, formally speaking the answer is a question but the player can use it to confirm her answer. Logic investigates reporting statements as judgments, however in some special cases, logic does not investigate sentences of such categories.



Let us consider a sentence like “Cấm không được hút thuốc”. From the view of philologists, this is a subject-less sentence expressing prohibition. It means it is correct in terms of linguistic form, but from the viewpoint of logicians the sentence is not logically rigorous because “Cấm” means “not...to”, “Cấm không được hút thuốc” means “smoking is allowed” (as there are two negations in the sentence). Therefore, from the logical standpoint the sentence should be rewritten like “Cấm hút thuốc”, which is precise and informative.

In natural language, we also face many other specific phenomena. In fact, people often say “Thuyền chạy trên sông” or “Thuyền chạy dưới sông”, “Anh ấy đang đi ngoài mưa” or “Anh ấy đang đi trong mưa” “Juan Martin del Potro đánh thắng Roger Federer trong trận chung kết US Open 2009”; “Hôm qua, tôi đi mua một chiếc tủ lạnh” or “Hôm qua, tôi đi mua một chiếc áo ấm”.

We can see that words like: trên – dưới, ngoài – trong, đánh thắng – đánh bại, áo lạnh – áo ấm are contradictory in meaning when they are separate, but when they are together, like in the above sentences, they are synonyms. In the above sentences, “áo lạnh” means a piece of clothing to wear against the cold “áo ấm” means a piece of clothing to wear to keep you warm... Here we cannot intone if the first sentence is correct and the second is not correct because those phenomena can only be explained on the basis of the inner logic of Vietnamese language. Apart from above-mentioned cases, there exist many complicated and interesting cases of logic and natural language in the everyday life as well as in scientific research activities.

In order to speak of pluralities, natural language sentences presuppose no domain of discourse, in the technical sense in which this concept is used in predicate logic semantics. A domain of discourse is a necessary component of the semantics of the predicate calculus, which has no parallel in the semantics of natural language. Of course, context is needed in order to determine, for instance, which students one refers to when one says, ‘Some students were late’. But the context does not do that by first determining a domain of discourse, a domain which may also contain some particulars that are not students. Similarly, when one says, ‘Nam was late’, the context determines which Nam one refers to, without determining a domain which may also contain some unmentioned Trung and Bac. In the predicate calculus, the context determines a domain of discourse, which may contain many particulars that will not be mentioned at all. In natural language, the context directly determines the reference of the concepts used. This semantic difference results in a syntactic one as well. If the plurality is referred to by some plural referring expression, the quantifier has to be related in some syntactic way to the plural referring expression, in order to indicate the plurality of which a quantified claim is made. Consequently, in natural language the quantifier is attached to a noun that is used to refer to a plurality, and together they form a noun phrase. However, if no expression is used to refer to a plurality, but the plurality is presupposed by the quantified construction, then the quantifier does not have to be attached to any specific component of the quantified sentence.

#### 4.CONCLUSION

To conduct deep research in the areas of logic and natural language and consider them in dialectical relationships will certainly help us to find much more new valuable information. Therefore, the attention to the research of these phenomena will help us think more clearly, and have coherent and correct expressions of the issues we face in our everyday life, as well in our scientific research activities. In the history of logic, there have been many cases in which the positive results and findings of the research on logic and natural language have contributed to the development and perfection of both logic and natural language. On the other hand, an artificial language may replace natural language in certain domains, being a better tool to convey what we want to say about certain matters. The formulas of arithmetic constitute such a language, as well as musical notation. If we used only natural language in arithmetic or music, it would be practically impossible to convey what is easily expressed by means of those artificially devised languages. Moreover, one language can replace another even if they are very different, both semantically and logically.

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