

# MIRRORED LANGUAGE STRUCTURE AND INNATE LOGIC OF THE HUMAN BRAIN

## As A Computable Model Of The Oracle Turing Machine

Han Xiao Wen  
Weimingbosi Corporation  
PKU Biocity No. 39 Shang Di Xi Lu, Haidian  
Beijing, 100085 China

We wish to present a mirrored language structure (MLS) and four logic rules determined by this structure for the model of a computable Oracle Turing machine. MLS has novel features that are of considerable biological and computational significance. It suggests an algorithm of *relation learning and recognition* (RLR) that enables the deterministic computers to simulate the mechanism of the Oracle Turing machine, or  $P = NP$  in a mathematical term.

A concept of mirrored language structure for the human brain has already been proposed by Chomsky [4] as Universal Grammar (UG). His model consists of a hierarchical (deep and surface) dual language structure and a possible set of innate rules. He also proposed the concept that language is the mirror of the mind [3]. His model has been well acknowledged. The challenge that remains is to determine the universal rules between deep and surface language.

A concept of mirrored hierarchical language structure for the Oracle Turing machine was proposed by Turing [11]. Turing's model can be roughly described as follows: A language  $L$  consists of two languages: Oracle language  $L_o$  and Turing language  $L_t$ . The member  $x$  of  $L_t$  can be accepted or rejected correctly by  $L_o$  as member  $y$  of  $L_o$ . This model has been only an abstract concept, and has not been implemented due to lack of an efficient means [5, 6].

The present RLR approach is to apply a model of the human brain [10] as a computable model of the Oracle Turing machine. The human brain model has a pair of "mirrored" languages denoted by  $L_p = L_c$ , where  $p$  stands for perceptual and  $c$  for conceptual. That is, there exists correspondent relations between the two languages denoted by  $L_p \ni p = c \in L_c$ . In this structure, the member  $|c|$  of language  $L_c$  is the class of the member  $|p|$  of language  $L_p$  denoted by  $L_p \ni |p| \in |c| \in L_c$ , where  $|p|$  and  $|c|$  denote the length of  $p$  and  $c$ , respectively. That is, there also exists member-class relations between the two languages, where the member of the perceptual language is also the member of the members of the conceptual language iteratively, shown as Fig.1:

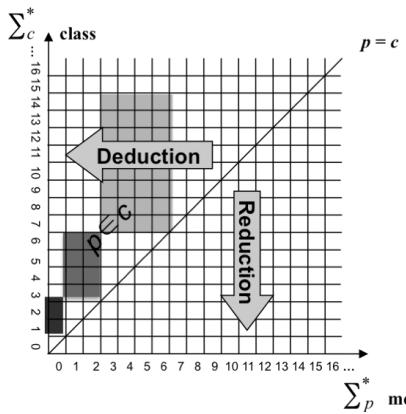


Figure 1. The continuum of member-class relations between perceptual and conceptual language

This mirrored structure embeds four innate *cognitive logic* rules. They can be considered as the universal grammar (UG) that Chomsky has foreseen, and they are specified as follows.

*Sensation:* Input information is stored in both languages  $L_p$  and  $L_c$  as correspondent relations denoted by  $L_p \ni p = c \in L_c$ .

*Induction:* Input relation is stored in between languages  $L_p$  and  $L_c$  as member-class relations denoted by  $L_p \ni |p| \in |c| \in L_c$ .

*Deduction:* Output information is retrieved from language  $L_p$  to  $L_c$  as the class relation mapping denoted by  $L_p \ni p \geq L_c$ .

*Reduction:* Output information is retrieved from language  $L_c$  to  $L_p$  as the membership relation mapping denoted by  $L_p \ni |p| \leq L_c$ .

Formally the model of the human brain is a *relation learning and recognition* language  $L_r$  over  $\Sigma_r$ ,  $r = p, c$ . Let  $\Sigma_p$  and  $\Sigma_c$  be two identical (mirrored) finite alphabets, and let  $\Sigma_p^*$  and  $\Sigma_c^*$  be two sets of finite identical strings over  $\Sigma_p$  and  $\Sigma_c$ . Then the language over  $\Sigma_p$  is a subset  $L_p$  of  $\Sigma_p^*$ , and the language over  $\Sigma_c$  is a subset  $L_c$  of  $\Sigma_c^*$ . Thus  $p \in L_p \Leftrightarrow c \in L_c$ , iff  $L_p \ni p = c \in L_c$  and  $L_p \ni |p| \in |c| \in L_c$  for all  $p \in \Sigma_p^*$  and  $c \in \Sigma_c^*$ .

By definition *relation learning and recognition* language  $L_r$  is an Oracle Turing machine (nondeterministic Turing machine). *Relation learning and recognition* language  $L_r$  is also a deterministic Turing machine, which is defined and specified [6] by:

- a countable set of domain  $D = \Sigma^*$ ,
- a countable set of range  $R = \Sigma^* = \{\text{ACCEPT}, \text{REJECT}\}$ ,
- a finite alphabet  $\Delta$  such that  $\Delta^* \cap R = \emptyset$ ,
- an encoding function  $E: D \rightarrow \Delta^*$ ,
- a transition function  $\tau: \Delta^* \rightarrow \Delta^* \cup R$ ,

such that relation recognition  $r(p, c) \Leftrightarrow p \in L_r$  for all  $p, c \in \Sigma_r^*$ .

It has not escaped my notice that this model immediately suggests an iterative conception of set that was preliminarily described by Gödel [1, 2, 8], based on which Gödel was able to foresee a polynomial algorithm [9] to solve Yes-or-No problems. However there was a missing link between the iterative conception of set and the algorithm of Yes-or-No problems; as Parsons stated, “it is not so clear as it should be what this conception is.” [7] It is the *mirrored language* with *relation learning and recognition* rules that can bridge the gap. Specifically RLR provides a polynomial means of member-class relation storage and a polynomial means of deductive and reductive relation recognition.

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