# CHAPTER IV

## GENERAL DISCUSSION

Results of the present experiment clearly indicate the differential effect of modifier positions upon perception of speech and short-term memory. Relative to the contemporary theories , hypothetical structure of human memory and mechanism of encoding process, some aspects in the interpretation of the results will be discussed and a model of speech perception will be proposed in this chapter.

In the present experiment, the mean of the number of words recalled in the immediate serial recall paradigm supports the concept of constancy in STM although the to-be-remembered item consists of two different kinds of material. Current issues in the study of human memory apparently indicates that recall is not dependent on simply the stimulus items but is effected by the nature of material to be remembered, thus the constancy of STM is somewhat peculiar in the unit of measurement. Miller (1956) suggested that STM might be constant for chunks, a chunk being a group of stimuli, possibly varying in information load, which is stored in memory as a single code unit. Evidences that support this concept came from Smith (1956), Cohen (1963), McNulty (1966) and Kleinberg and Kaufman(1971). The concept of chunking is applicable for the interpretation of the result of the present experiment. It is obvious that the conditional probability of the recall of modifier, given that noun is recalled, is much more than the probability of which noun is not recalled; and the error analysis apparently indicates a highly competitive encoding between noun and modifiers which results from the failure of instantaneous chunking, hence each word is encoded in a discrete unit and results in the decrement of the recall capacity. Taking into account that the result of position reversion analysis indicates a reorganization of the encoded codes together with the differential processing time, it is presumptive that the coding mechanism is delayed in the loop of reorganization for the sequentially encoded codes which are not congruent to the strategic operation of coding mechanism. This presumption of the reorganization of speech code leads to the controversial issue of acoustic code and semantic code in STM. A substantial body of research leads to a conclusion that STM employed acoustic phonetic code (cf. Conrad 1964,Wickelgren 1966, Baddeley 1966, Kintsch and Buscke 1969, Craik & Levy 1971). But some evidences showed that semantic coding was demonstrated in STM when the task required the subjects to process semantic characteristics of material (Shulman 1972, Wicken 1972). Since the results of the present experiment explicitly suggest the reorganization of speech codes and position reversion error indicates a trend of syntactic correction for the right - hand-branching language,it can be concluded that such reorganization in STM is operated by the derived strategies and techniques from LTM. Unquestionably, syntactic correction can not be performed without semantic encoding, thus acoustic encoding and semantic encoding take place in STM successively. It is the semantic and syntactic operation that leads to chunking of the speech codes, thus retention of the codes is facilitated by means of the economy of chunking.

Neuropsychological approach in the current studies of human memory tends to support the concept of neuronal circuits and synaptic modification for the storage of memory. As evidences have accumulated especially through the microelectrode experiments by Mountcastle(1957); Jung(1961); Maturana,Lettvin,Mc Culloch and Pitts(1960); Hubel and Wiesel(1962), the studies have identified neural units responsive only to one or another attribute of stimulating event. It is presumptive that one percept corresponds to one neural unit. In the three dimensional network of neurones in the brain, each neurone is connected to a few of adjacent ones and when a neurone in a certain layer receives a signal, it will send signals to a few of neurones in the next layer, then signals will propagate in the network in a permanently logical operation. The auditory mechanism studied by Desmedt(1960) and Dewson (1968) have supported the logical operation for the acoustic input and central nervous system control of auditory perception. To extrapolate these evidences and interpretation on to the speech perception mechanism, especially for the interpretation of the results of the present experiment,it can be explained in a stepwise mechanism that; firstly, speech signals, the sound waves which have multidimensional cues ( or redundant attributes) transmit through the mechanically operating devices (or organs) in the ear. The transmitted speech signals are converted into nerve impulses of particular patterns which are dependent on the cues of frequency, amplitude and duration. Such signals can be propagated through the certain circuits of neuronal network. As far as the operating neural network performing its function, there is a set of feedback loops of neuronal circuits operate as a servomechanism, or in a computerized term TOTE (Test - Operate - Test - Exit process). The transmitted neural codes must be congruent to the specific operation of such servomechanism or otherwise it will not be processed throughout the operation. This is the explanation for the syntactic reorganization loop in STM which has a limited capacity of $7 \pm 2$ code units and is operated by the derived strategies and techniques from LTM. The codes which match to the specific operation of each step are conveyed and the response of understanding occurs as a result. Those codes which are inappropriate for such stepwise operation can be modified to a certain degree which resulted in the decrement of accuracy and efficiency of speech perception.

## Speech Perception Model

According to the integrated approach in the discussion of the present experiment, a model of speech perception is obtained and is summarized in figure 8.

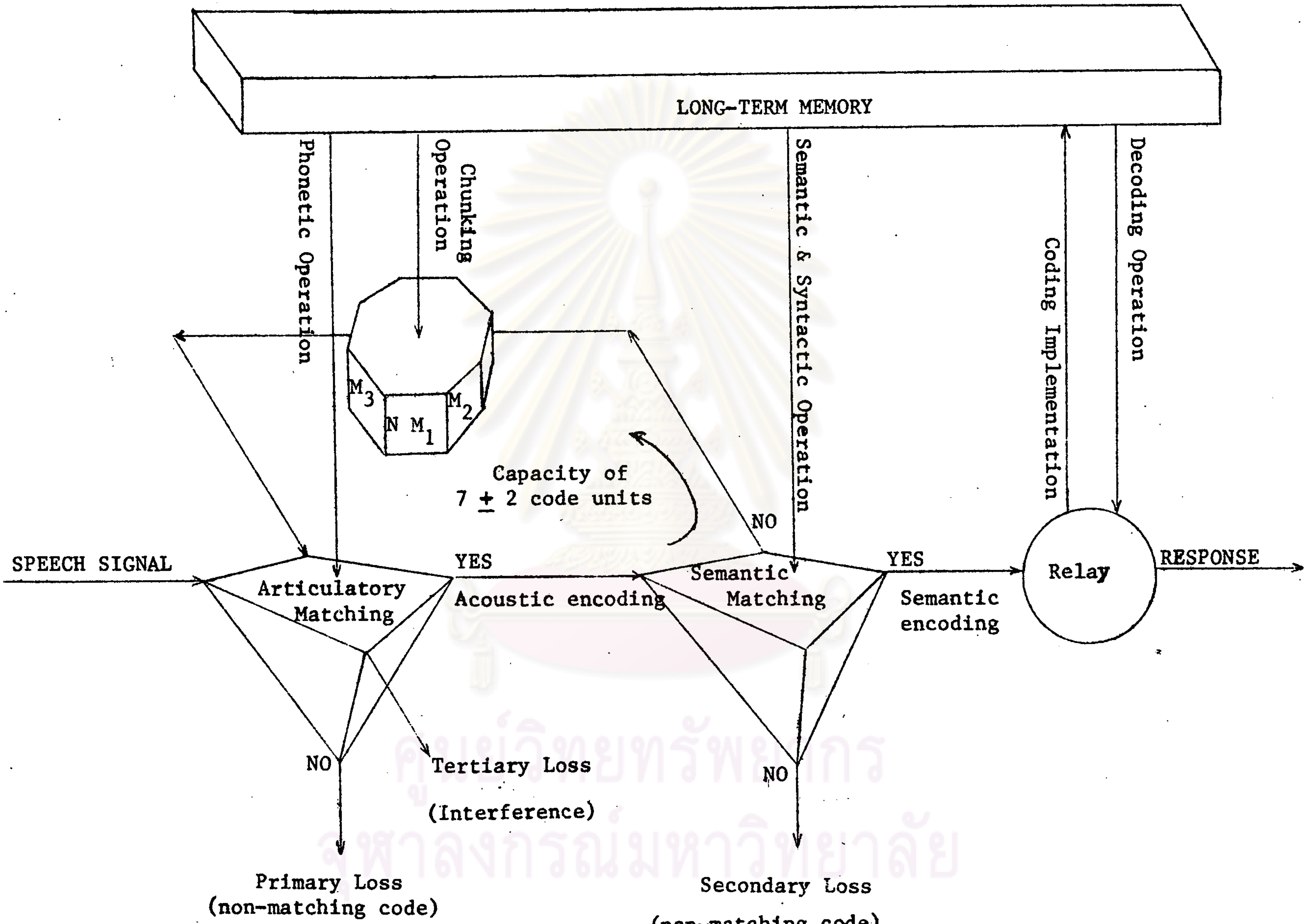


Figure 8. SPEECH PERCEPTION MODEL

In figure 8, speech waves of particular cues are converted into specific patterns of nerve impluses which enter the neuronal network of matching operation called articulatory matching. This matching network is operated by the phonetic operation derived from LTM. If the input is not congruent to the internal phonetic code or, according to Motor Theory, is not campatible to the capability of articulatory movements, the process will be ended up, and primary loss is the result. If the operation of this step is obtainable, the acoustic encoding will take place and the propagated signal will enter another matching operation called semantic matching. Again, if the input signal is not congruent to the internal semantic code, the process will be ended up, and secondary loss is the result. If the input signal is congruent but is not obtainable as a set of comprehensible codes, the series of acoustic codes are impeled into the reorganization loop which is able to retain and process merely $7 \pm 2$ code units at a time. Chunking operation takes place in this loop for the economy of processing. This looping is equivalent to the subjective rehearsal. The more times the codes circulate in the loop, the more probable the codes interfere (or are interfered by) the newly acoustic encoded codes which are excessive in the loop; thus produces PI and RI effects and tertiary loss is the result. When the set of reorganized semantic codes are comprehensible or congruent to the syntactic operation, the process will be continued and coding implementation is the result. Then decoding process will occur and the required response is obtained as the net product of the process. Although this model of speech perception is compatible to the findings of the early experimental research upon speech perçeption and human memory, further verification by means of neuropsycholinguistic approach and computer simulation is on the way to reveal the proposed mechanism.