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Natural Language Oral Communication in Humans Under Stress. Linguistic Cognitive Coping Strategies for Enrichment of Artificial Intelligence

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Abstract

Learning computer systems to recognize natural human speech is significantly easier and more effective when the cognitive process in humans is understood. Psycholinguistics, as an interdisciplinary study of language and cognition, is extremely helpful in this respect. The aim of this study is to understand which linguistic coping strategies people develop under stress, due to their physiological and psychological structure. Oral communication in a foreign language (English), of people with different backgrounds, will be examined under an isolation stressor. It is expected that the physiological parameters (adrenaline and noradrenaline blood-level amounts) and psychological parameters (anxiety tendencies) influence the linguistic performance in a stressful situation. Subjects who share a similar organization of the central nervous system and psychological structure, may also share similarities in cognition regarding language production in a foreign language. The value of the study for artificial intelligence research is applicable to natural language systems, i.e. by helping program a more precise speech recognizing system.

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Keywords: cognitive linguistics, natural language, AI theory

1 Cognitive patterns of linguistic performance

Psycholinguistics is an interdisciplinary study which aims to investigate the cognitive processes in humans through their linguistic performance, such as, language acquisition [1], oral production [2], perception [3], language learning [4], and so forth. Moreover, psycholinguistics conducts research by observing how the language an individuum produces or perceives reflects his/her cognition or behavioral patterns [5]. Therefore, psycholinguistic research is primarily based on Neuroscience, Psychology and Linguistics.

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Psycholinguistics is of great importance for the development of artificial intelligence because it analyzes natural language processes in humans. Consequently, IT should tremendously benefit through the various outcomes of psycholinguistic studies. By understanding human biological cognitive architecture, it will be possible to apply this new knowledge to enhance computer systems and enrich its potential [6].

One of the major fields in psycholinguistics focuses on unprepared oral language production. According to Levelt (1989) [7], there are 4 modules of oral language production: Conceptualizer, Formulator, Articulator, and Self-Monitoring:

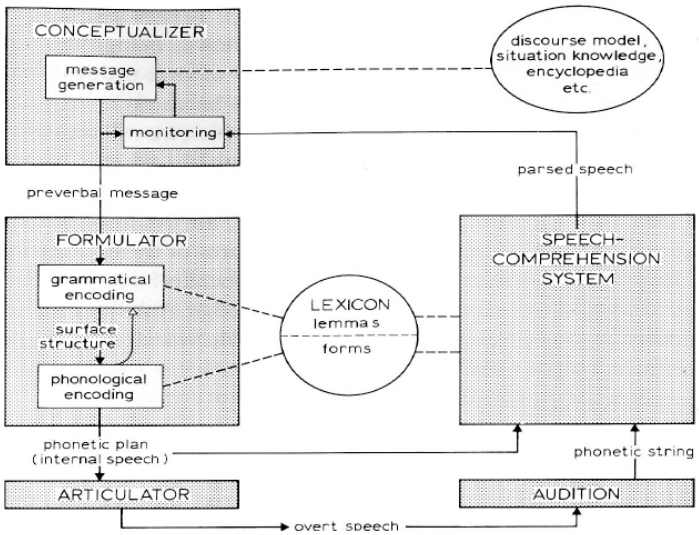

Fig. 1: "Blueprint for the Speaker" Levelt 1989

Different distractors can damage smoothly running cognitive systems, leading to false sentence/phrase/word emphasis, false naming, acceleration/deceleration of speech, and other speech disharmonies. The percentage of these errors increases because of cognitive overload, e.g., when one is speaking in a foreign language [8]. Thus, using a foreign language underlies a greater negative influence of stressors („*noxious stimulating conditions* [9]).

Another potent influencer is biological nature. Because humans differently react towards stressful conditions (*coping theory*), physiological studies provide evidence that anxious people have increased adrenalin cortical activity in both everyday life and in stressful situations, whereas the difference of adrenaline extension is less than that by emotionally stable individuals [10]; [11]. Moreover, anxious individuals tend to be less creative, worse at problem-solving during stressful situations, and slower at learning from negative experiences. [12]. Thus, there should be significant correlations between biological/physiological and psychological/behavioral characteristics of people performing under stress.

Regarding linguistic performance under stress, there are studies suggesting that stress negatively influences a subject's performance when they are forced into hostile environments, e.g., talking to a person with whom the subject is afraid of or not comfortable with [13].

Taking the biological, psychological and behavioral studies results into account, the present research investigates whether oral language production in a foreign language under stress may correlate with the two psychological/biological human constellations. Further, if a positive correlation is found, how would the linguistic performance depend on the psychological type of person? The stress factor in the current empirical research study is isolation of different durations

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