EFFECT OF GARDEN PATH PARSING ON WORKING MEMORY OF SPEAKERS OF NATIVE LANGUAGE AND LEARNERS OF SECOND LANGUAGE UNDER EXPERIMENTALLY CONTROLLED EMOTIONAL STATE.

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Introduction

There has been a fundamental issue at the interface of linguistics and natural language processing in the form of analysing how parser and competence grammar are interrelated (Li and Sheng, 2017). It is believed that garden path processing sentences have correct grammatical sense where the interpretation of readers is likely to be wrong and they are lured into a parse leading to a dead-end or unintended meaning. Garden path processing (GPP) is a part of the language processing system where the autonomous syntax is not influenced by semantics and pragmatics. GPP occurs within a sentence. For example, "The Horse raced Past the Barn Fell". In this sentence, the verb "raced" is active rather passive. However, after reading the word, "fell", the initial interpretation does not make any sense, if "raced" is active then "fell" does not have a subject.

This requires reprocessing of sentence for reaching a correct interpretation where the verb "raced" is passive. This issue arises because of a garden path structure. Additionally, parsing is important in grammatical exercises helping in breaking down texts into its component parts of speech by explaining the function, form, and syntactic relationship of each part with a view of understanding the text. Parsing is done by breaking sentences and then placing them under distinct grammatical categories for identifying the grammatical relationship.

For example, "the man opened the door". In this sentence, *the* (article), *man* (noun), *opened* (verb), *the* (article), *door* (noun). The sentence has only one verb (opened) that leads to the identification of the subject and object of the verb. Additionally, several scholars (Pan et al. 2015 and Hopp, 2013) also believed that grammar and parser are related directly, but the relationship remains to be discovered. There is also a shifting paradigm to discover independent principles reflecting human cognitive functions. Pan et al. (2015) added that the working memory of speakers of native language and English as a second language is affected by garden path parsing.

To analyse the extent to which working memory of learners is affected, the research will be based on using experiments controlled emotional state (MacIntyre and Gregersen, 2015). **(Explanation will be in methodology)**

The Novelty of the Study

There are limited research works concerning the effect of garden path parsing under different emotional states. Additionally, the research will involve intensive eye-movement analysis and regression from the first disambiguation directly to the adverb. Parsing in regard to the garden path has been studied in a simple manner by not relating social behaviour, learning and psycholinguistic. This study will assess how emotional state affects garden path parsing along with critically analysing studies on GPP and its relation to the process of parsing among speakers of native language and second language learners. For example, both groups will be exposed to an emotional stimulus like a video highlighting a positive or negative emotion. The participants will then be provided sentences based on the principles of GPP. They will also be given a task related to memory in terms of recalling a few words in the sentences. The higher the number of recalls better will be the memory. Thus, the study through the experiment aims to understand the learning and memory of native and second language speakers driven by the garden path parsing under emotional states. This will help in understanding the difference between the learning, memory, and interpretation of learners with English as a first and second language.

Aim

The research aims to analyse the effect of garden path processing under emotional states like sad, happy, angry, excited, and agitated. Additionally, emotional conditions will be experimentally controlled and its effect on working memory will be studied.

Objectives:

1. To analyse how parsing affects the working memory of native speakers and people learning English as L2 (second language)
2. To analyse the impact of garden path parsing under emotional states like sad, happy, angry, excited, and agitated using intensive eye-movement analysis and regression from the first disambiguation directly to the adverb
3. To identify the difference in working memory of native speakers and people learning English as L2 when affected by garden path processing parsing

Research Questions

1. What is the effect of garden path processing under emotional states like sad, happy, angry, excited, and agitated?

2. What are the useful results related to emotional conditions being experimentally controlled and its effect on working memory?

Literature Review

The literature review presents critical insights on the concept of garden path processing, garden path processing with the second language, the relationship between garden path processing and working memory, and impact of garden path processing under different emotional states.

Garden Path Processing

In psycholinguistics, garden path processing involves sentences that are ambiguous in nature often confusing. This is mainly because they contain word group which seems in line with structural analysis that is known as syntactic garden-path sentence. Kapa and Colombo (2014) agreed to this notion and added that this would have been avoided if the interpretation of a sentence was deferred until it was heard or read in its entirety. Juffs (1996) added that garden path processing is aimed to trick readers in interpreting adjectives and nouns and ignoring definite and indefinite articles that is useful in helping readers to a correct interpretation of a sentence. Pan et al. (2015) argued that the garden path arises when a word or suffix has multiple meanings highlighting commonality and rareness. In the sentence, “The Horse Raced Past the Barn Fell", the use of the verb, "raced" as a transitive verb is common than its use as the past participates in a reduced passive.

In the above sentence, there is an evidence of strong meaning dominating the weak meaning. When readers are known of the mistakes, the weak meaning is immensely supressed by strong meaning compelling readers to understand the meaning of the sentences from the beginning. Another sentence is “‘rapid righting with his uninjured left hand saved from destruction the contents of the capsized canoe.’ While reading this sentence, “righting” rather than “writing” is a common phenomenon affecting the understanding and speaking prowess of readers.

Second Language

For proficient sentence processing, it is important to have a great deal of coordination of different interactive sources of linguistic and non-linguistic information that is used to integrate interpretation and meanings. There are multiple cues for both first and English as a second or foreign language helping in understanding the meaning of sentences along with deriving key interpretation (Trueswell and Gleitman, 2007). Additionally, learners with ESL focus more on semantic rather than structural cues and the role of discourse information is also evident (Snedeker and Trueswell, 2004).

The available evidence further suggests that adult L2 learners can face problems in interpreting especially when interpretations are plausible and supported by the context (Roberts and Felsers, 2011). Pozzan and Trueswell (2015) added that as per the cognitive immaturity view, there is not much difficulties or challenges faced by L2 learners in relation to garden-path recovery and the likelihood of garden path theory helping in enhancing the learning is not challenged much. However, there might be difficulties in initial interpretation from the cognitive load associated with incomplete language representations.

This also means that learners with ESL might find it difficult to comprehend meanings and interpret sentences but with repeat tasks and activities, there is a possibility of improving learning in a systematic manner. This is mainly true in learners with ESL as learners with English as their native language might not face such difficulties (Trueswell and Gleitman, 2007). Snedeker and Trueswell (2004) added that first and second language affects the understanding, interpretation, and learning in a significant manner. This also means that useful interventions bridging the gap between native speakers and ESL speakers is essential for adding value to the learning and interpretation of sentences.

Garden Path Processing and Working Memory

Jacob and Felser (2015) added that preferences established regarding ambiguities in garden-path sentences are not because of the preference for a syntactic structure but because of the parsimonious mental model. During the parsing process, syntactic analysis is pursued in a parallel manner and only those compatible with the parsimonious mental model are kept.

There is also a close relationship between parsimony and mental model in the form of presuppositions that need to be adjusted while integrating new information and complexity in the number of entities that need to be represented in a mental model.

This also means that increasing the number of entities will lead to an increase in the complexity of the model. Additionally, preference for parsimonious model assures construction of the mental model with minimal entities required to represent the discourse. Hopp (2010) added that in L2 learners working memory often differs because of the lack of recognition and recall ability. In addition, emotions also play an important and crucial role. When learners are in a happy state of mind, there is a possibility of recalling happy incidents and learning more than when driven by a sad or agitated emotion (Liu et al, 2018). However, in order to identify the relationship between emotions and memory in L2 learners when exposed to garden path processing require a close analysis of individual thought and learning process. It also requires a careful assessment of learning behaviour, emotional impact, ability to comprehend sentences based on reading and writing, and language assessment. As per the findings of Liu et al (2018) emotions play an important and crucial role in influencing text comprehension and vocabulary learning. Additionally, positive and negative emotions affect the morphosyntactic rules in a foreign language. Negative emotions increase the accuracy of syntactic learning and positive emotions did not have any impact on learning outcomes. The findings also suggested that affective states affect the foreign language learning process.

Methodology

The research aims to analyse the effect of garden path processing under emotional states and additionally emotional conditions will be experimentally controlled and its effect on working memory will be studied. For the purpose, a sample size of 100 will be considered whose first language will be Arabic and 50 having English as their first language. Inclusive criteria will be respondents below the age of 25 years pursuing degree of post graduate course in any field. There will be no gender bias and the focus will be on including males and females as per their availability. This will also help in ascertaining whether there is a difference in emotional states of males or females, or it remains the same.

Procedure

The respondents will be made to sit in a comfortable environment and extraneous variables will be taken care of. The respondents will then be exposed to stimuli in the form of materials like videos, pictures or written material that would evoke emotional responses from the subjects in terms of joy, fear, despair or anger. The respondents will be provided with garden path literature and would be asked to decipher the content. Just after this they would be presented with a list of nonsense syllables and will be asked to recollect them. The greater number of correct responses, the better will be recall. Responses will be recorded and compared between native speakers and learners of second language. This will also help in understanding the difference the working memory of respondents with different first language under different emotional conditions driven by GPP. For example, eye tracking and facial expression technique will be used. During reading, there is a possibility of rapid eye-movement and these movements are known as “saccades”. Saccades are always fast and there is a limited possibility of new information input occurring during such movements. The eye remains stationary and such movements are known as “fixations” (Clifton et al, 2007).

Thus, analysis of fixation will be done in terms of duration and numbers. This will be helpful in collecting valuable information in regard to the texts being processes. Mean fixation in skilled alphabetic languages is around 200-250 ms and the mean saccade length is around 7-9 letter spaces (Levy et al, 2009). Additionally, words that are highly predictable and shorter gives shorter fixation duration. The research will focus on saccades and fixation using eye tracking machine and cameras for capturing emotional state in the form of being confused, happy, laughing, or irritated during the process (Kreiner et al, 2008).

Additionally, eye movement recordings alongside facial expressions can tell what exactly has been fixated or refixated along with the duration. This series of fixations, saccades, regression, and skipping can give richest account of real-time human language processing using garden sentence processing (Drieghe et al, 2008).

Research Design

Correlation research design will be employed during the course of experiment. The main purpose will be to analyse whether emotional states affect GPP process alongside the working memory. For this purpose, regression analysis using SPSS will be used. This makes the research quantitative in nature with little focus on qualitative analysis.

Additionally, validity and reliability will be enhanced using triangulation based on relating the quantitative findings with the literature findings in a critical manner. The research design derives motivation from the deductive approach and interpretivism philosophy aims to rediscover and analyse new findings based on quantitative assessment. It does not support accepting existing realities but challenging them to generate new sets of findings that are helpful in deriving interesting findings capable of filling the research gap.

Statistical tools

The study will use SPSS where dependent variables (GPP and Working Memory) and independent variables (emotional states) will be analysed using 10 different questions based

on the Likert Scale. Descriptive, correlation, and regression analysis will be used to validate key findings in relation to the effect of garden path processing under emotional states on working memory. The use of graphs and charts with numerical findings will be used to support the interpretation.

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