



Maze Production in Children with Mental Retardation

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Abstract

Mazes are defined as these normal dysfluencies in speech of an individual. It can be in words, or any unattached fragment of a spoken utterance. Mazes are those utterances which do not contribute any meaning to the ongoing flow of language. Maze types and frequency are considered as a significant diagnostic indicator to judge language impairments. It provides a clear view of language competency in typically developing children and children with mental retardation. Thereby, the present study focuses on comparison of types and percentage of maze words over total words, produced by children with intellectual disability across language age-matched TD children. The results indicated an overall higher percentage of mazes in children with mental retardation compared to typically developing children, thus signifying a poorer flow of language. The control group, however, produced an improved narrative and thus a better control over language. This implies disfluencies can occur when a child the demands for speech fluency disfluencies are not met (Starkweather, Gottwald, & Halfond, 1990) either in the form of stuttering or increased mazes (deJoy & Gregory, 1985). The study concludes that children with mental retardation possess a less developed linguistic system and thus employ limited processing strategies in formation of speech, its monitoring and any type of repair in language so as to meet the demands of story narration.

Keywords: Mazes, Intellectual Disability, Linguistic competence.

Introduction

Mazes are considered an important variable to understand the underlying processes of speech and language. These are the normal dysfluencies which occur in usual speech output^{1,2}. Mazes are defined as these normal dysfluencies in speech of an individual. It can be in words, or any unattached fragment of a spoken utterance. These utterances do not contribute any meaning to the ongoing flow of language³. These include filled pauses (*um, uh*), revisions (*The girl, I mean, the lady left*), repetitions, false starts, repairs etc. Mazes are those hesitant language behaviors in conversational and narrative tasks which seem to have differences in children's ability to integrate language and monitor its output⁴. Mazes can be considered an important variable, in conversational and narrative tasks which helps in both integration and monitoring of language output⁴. These verbal repairs are a result of self monitoring at the level of meaning⁵ and also a marker of word utterance formulation problems⁶. Thus, fluency may be reduced as a result of both significant linguistic demands as well as the complexity of relationship among events.

Classification of Mazes: Mazes can be classified as filled pauses, revisions (grammatical revisions, lexical revisions, and phonological revisions; Dollaghan and Campbell⁷, Thordardottir

and Weismer⁸ and repetitions. DeJoy & Gregory¹, Starkweather² claimed filled pauses and repetitions to be immature dysfluencies which reduce with increasing language development. Examples of various types of mazes are described in Table-1⁹, along with a few examples in English and Malayalam.

Mazes in Typically Developing Children: As typically developing (TD) children mature the speech fluency increases². However, this is not mandatory for production of mazes. When children attempt to understand and convey complex ideas, the maze occurrences also increase. Maze usage generally occurs during spatial, temporal, or causal relationships¹⁰. Mazes are primarily manifested in the speech of individuals when expressing an idea that is abstract, complicated or not yet fully developed.

It has been demonstrated prior that only modest changes in frequency of disfluencies occur from kindergarten to high school². Contrarily, some hypothesize the frequency of mazes to remain consistent or perhaps increase with age, rather than decrease¹⁰. Formulation problems without an attempt by the speaker to repair them may suggest specific difficulties with the processing of complex linguistic information¹¹.

Table-1
Classification of Mazes, along with examples from English and Malayalam

Maze types	Description	Examples
Filled Pauses	Nonlinguistic vocalizations that occur at the beginning of utterances or between words.	(Um) he's in the water. Avan (um) vellathilaanu
Repetitions	Sound, part-word, whole-word, or phrase repetition	The (f*) frog jumped out the window. (Tha) thavala janaaleenu purathu chaadi
Phonological Revisions	Correction of phonological errors	And the (poy) boy was singing Aankutti (putti) paaduga ayirunu
Lexical Revisions	Correction of overt word choice errors; to add or delete lexical information.	And (they) he said goodbye. (avar) avan tata paranju
Grammatical Revisions	Correction of overt grammatical errors.	And (the) he threw the dog off too. (Athe) avan nayiye kallu erinju
Connectors	Repetitive use of conjunctions or time markers at the beginnings of utterances.	(And then) the frog he's over there. (athinu shesham) thavala avide unde

Loban³ proposed that computing the average words per maze and maze words as a percentage of total words would yield a measure of the subject's *linguistic uncertainty*. He reported least usage of maze behavior by individuals with High Language Proficiency. However, irrespective of this, all individuals maintain their initial (1st grade) proportion of maze words to total words, despite the fact that increasing chronological age reduces the occurrence of Mazes.

Mazes in Language Impairment: Mazes (filled pauses, repetitions, revisions, and abandoned utterances) have been used to draw inferences about processing difficulties associated with the production of language. Parallel to TD children, children with specific language impairment (SLI) show increased maze frequency with linguistic complexity, being greater in narrative than conversational contexts and in longer utterances⁸. In particular repetitions and pauses are observed to be more prominent in children with SLI than their controls. These repetitions are more often of part-word length and affect lexical and functional words equally in the children with SLI compared to the control group where the affect is mainly on function words¹².

In addition, SLI and typically developing children show a higher occurrence of content mazes (lexical and syntactic revisions) relative to filled pauses. However, this difference was bigger for the children with SLI. Thus, content mazes are especially susceptible to processing factors and increases with increased sentence length⁸. Navarro-Ruiz and Rallo-Fabra¹³ revealed the quality of maze production to be similar in typically developing children and children with specific language impairment (SLI). However, children with language impairment were more likely to produce false starts and select simpler forms than to self-correct in order to produce complex forms.

Leadholm & Miller¹⁰ Navarro-Ruiz & Rallo-Fabra¹³ reported presence of reduced number of mazes in typically developing children in both conversation and narrative samples. Moreover,

the use of mazes increases in narrative contexts relative to conversational contexts. Gutierrez-Clellen & Kreiter¹⁴ compared the syntactic skills of Spanish-speaking children with children having low and average achievement in schools, using narration tasks. He revealed no significant difference between the two groups.

Mazes in Bilinguals: The term "bilingualism" is defined as an individual's native-like control of two languages¹⁵. It has been seen that children who learn two languages differ in their language learning experience, compared to the monolinguals. The bilinguals and monolinguals experience different cognitive environments and thus use different resources to communicate. The linguistic knowledge of bilingual learners is not necessarily the same as that of a monolingual speaker¹⁶ and that there are many possible configurations of language dominance patterns among bilingual speakers¹⁷.

Bilinguals may employ unique processing strategies in each language, specifically in the formulation, monitoring and repair of language in order to meet the demands of storytelling⁹.

A comparative study between monolinguals and bilinguals revealed increased number of grammatical revisions in bilinguals, irrespective of the language used. This suggests that the role of language is important in maze use and bilinguals do not have greater linguistic uncertainty compared to monolinguals¹⁸.

Fiestas et al⁹ also concluded a higher though insignificant percentage of maze use in bilinguals compared to monolingual children thereby reflecting the possibility of rapid language growth among these children. Also, lexical revisions appeared more frequently in bilinguals. Thus, indicating a higher level of difficulty with semantics compared to syntax or phonology. Moreover, bilinguals used twice the number of repetitions compared to monolinguals.

Thereby, various studies suggest that in bilinguals the capacity and demand of acquiring and using two languages may result in language processing which is somewhat different from the monolingual speaker.

Bilinguals may employ unique processing strategies in each language, specifically in the formulation, monitoring and repair of language in order to meet the demands of story narration. Therefore, a cautious interpretation of maze usage for the identification of language formulation deficits should be used when assessing the narrative language samples of bilingual children.

Need for the Study: The literature reveals adequate amount of research done on typically developing children. However, at the time of review, limited amount of research were found focusing on comparison of maze production between TD children and mental age-matched children with Mental retardation (MR). Thus, the present study focuses on maze production in children with MR. Children with MR, who demonstrate differences in linguistic knowledge, are at risk for being misclassified when tested for language or learning disabilities.

Mazes have been considered as an important variable to investigate and identify problems with the underlying formulation of speech and language.

Maze production is influenced by the speaker's linguistic knowledge and their language production skills. For a child who is in the process of acquiring a second language, may mismatch between knowledge and production skills. This is true not only for TD children but also for children with limited speech and language skills. One of such group being children with MR. The amount of language specific knowledge the child has, will influence the ability to monitor and modify language production.

Thereby, in Indian context where a large percentage of the children are mentally retarded, there is a need to focus on production of mazes and thus compare them with TD children, mainly for identification of language formulation deficits when assessing the narrative language samples of these children.

Aim: The study aims at comparison of types and percentage of maze words over total words produced by Malayalam-dominant typically developing children and children with MR.

Methodology

Participants: Forty Malayalam-dominant children in the age range of 6 to 8 years (mean age 7years) participated in the present study. All of the participants were recruited from Malayalam medium schools, within Kottayam district of Kerala. The participants were divided into two groups, Group I involved twenty children with ID with mild to moderate degree of retardation and mental age of 6 to 8 years. Group II, on the other hand, involved twenty TD children who were selected based on random sampling. All the participants were matched based on their language age of 6-8 years, assessed using *Assessment of Language Development* (Bhat, 2001). None of these children were receiving speech and language services at the time of their participation in the study. The participants were grouped based on their age and degree of retardation, as described in Table-2.

Procedure: All the participants were assessed on narratives of the story "Thirsty Crow". The narratives were recorded in a quiet room. In order to extract the narrative, the children were given a picture book of the story "Thirsty Crow", in the presence of the examiner. Each child was asked to recall the story with minimum prompts with the help of pictures. A minimum of fifty utterances were generated from each participant in Malayalam language, using a picture book of the same story. The following prompts were used by the examiners when eliciting the narratives⁹.

Prompt 1: Before looking at the story, the examiner stated in Malayalam, "We're going to look through all the pages of this book and think about what's happening in the story."

Prompt 2: After looking through the book with the child, the examiner said, "Now you tell me the story," or **Prompt 3:** If the child was only describing the scene and not telling a story, the examiner said, "What's going on here?" or

Prompt 4: "Yes", "Go on" or were used throughout the story to encourage the child.

Prompt 5: At the end of the story, the examiner asked, "Is that all you wanted to tell me?" For narratives elicited in Malayalam, the examiner asked

Recording: The recordings were made in PRAAT software (version 4.6.09) using a Lenevo z 560 laptop and digital sound stereo headphones (SSD-HP-202).

Table-2
Classification of children based on degree of retardation

GROUPS	CA (Chronological age)	MA (Mental Age)	LA (Language age)	Degree of retardation
Group-I	10-20 yrs	6-8 years	6 to 7.11yrs	Mild to moderate
Group-II	6 to 8 yrs	6-8 years	6 to 7.11 yrs	Normal

Transcription: The recorded samples were analyzed for number of mazes and types of mazes (filled pauses, repetitions, lexical revisions, phonological revisions and connectors) for both Groups. Trained speech language pathologists transcribed and coded the narratives using the International Phonetic Alphabet. Mazes were coded for the different types of speech and language behaviour. Six different codes were used to analyze the content of the mazes produced by the children. Maze content was coded for filled pauses [FP], repetitions [REP], connectors [CON], grammatical revisions [GREV], lexical revisions [LREV], and phonological revisions [PREV]⁹. Also reliability checks were performed by another speech language pathologist, who listened to each recorded sample again and cross checked it with the transcriptions provided. Complete and intelligible utterances were included in the analysis; abandoned utterances and partially or completely unintelligible utterances were excluded from the analysis.

Results and Discussion

The comparisons of maze types and percentage of mazes over total number of words, were made across the two groups and also within each group (TD or children with MR). The Mean and standard deviations were extracted for the distribution of mazes produced by each children with MR and TD children.

The results for both the groups are clearly indicated in Table-3.

Table-3
Means of mazes produced over total words and percentage of maze words produced by intellectually disabled and typically developing children

Types of mazes	Group-I Intellectually disabled	Group-II Typically developing
Connectors	5.27	4.3
Repetition	4.72	3.69
Filled pauses	4.08	2
Lexical revisions	0.3	0.27
Grammatical revisions	1.07	0.63
Phonological revisions	0.07	0
% of mazes	34.93	27.75

Percentage of Maze Production: Percentages of maze words were calculated over total number of words per narratives of the story. With respect to this, comparisons were made between both the groups. The results revealed that in Malayalam-dominant children with MR, the overall maze percentage over total number of words is much higher than language age-

matched TD children. All the dysfluencies seem to have an increased incidence in Group-I (Mean: 34.93) than in Group-II (Mean: 27.75).

Pattern of Maze Production- MR Vs TD: Across Group Comparison: All the dysfluencies seem to have an increased incidence in children with MR with connectors being the maximal in use (Mean, ID: 5.27; TD: 4.3), followed by Repetitions (MR: 4.72; TD: 3.69). Usage of Filled Pauses were slightly higher in children with intellectual disability than in Typically Developing children (MR: 4.08; TD: 2). The phonological revision (MR:0; TD:0.7), lexical revision (MR:0.63; TD:1.07) and grammatical revisions MR: 0.27; TD:0.38) were used minimally with negligible difference across the groups.

Within Group Comparison: Figure-2 depicts the types of mazes within the groups. In comparison within the MR group, results illustrated that connectors (Mean 5.27) occur most frequently followed by the repetitions (Mean 4.72), filled pauses (4.08). In addition, for all children showed minimal usage of lexical revisions, phonological and grammatical revisions.

In typically developing children, connectors (4.3) and repetitions (3.69) were dominates over the other types of mazes, filled pauses (2), lexical revisions (Mean 1.07), phonological revisions (Mean 0.03), grammatical revisions (Mean 0.05).

Hence, a comparison within groups showed that Malayalam-dominant children with MR produced an overall high percentage of mazes. In addition, TD children also showed significant amount of maze production within the narrative sample. Among the type of mazes, in both the groups, connectors were found to be used maximally, followed by repetitions and then filled pauses. However, all the children showed minimal usage of linguistic revisions.

Thus, overall results indicated following results: Firstly, across group comparison revealed a significantly higher percentage of mazes in Group I as compared to Group II. Secondly, connectors & repetitions were found to occur more frequently in both groups.

Overall, both groups follow a similar trend in the types of mazes produced even though percentage of mazes differs.

Discussion: Mazes are considered a medium by which one may view the internal processes of language formulation^{3,10,19}. The current study analyzed the use of mazes among TD and children with MR in order to make comparisons regarding use of overt correction methods in the spoken language of these children. The within-group results of study indicate a high frequency of mazes produced by children with MR, thus signifying a poorer flow of language. The control group, however, produced an improved narrative with lesser frequency of mazes and thus a better control over language. The second observation includes a

significant usage of connectors, repetitions and false starts among both groups and a minimal usage of revisions. A connector and repetition could indicate linguistic uncertainty at phonological, lexical and semantic level. Perhaps, repetitions

serve as a process to allow for a second opportunity to employ audition to monitor speech output. Moreover, filled pauses and repetitions are considered immature dysfluencies^{1, 2} compared to revisions, more evident in adult speech¹.

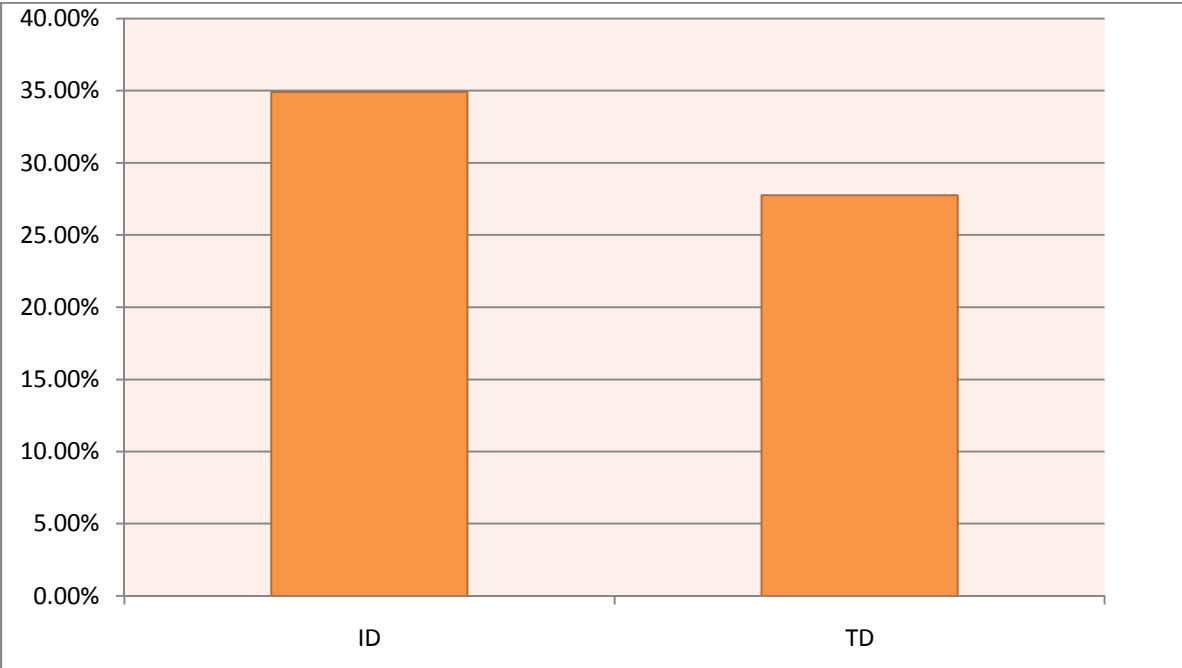


Figure-1
Percentage of maze words over total number of words produced by children with intellectual disability & typically developing children

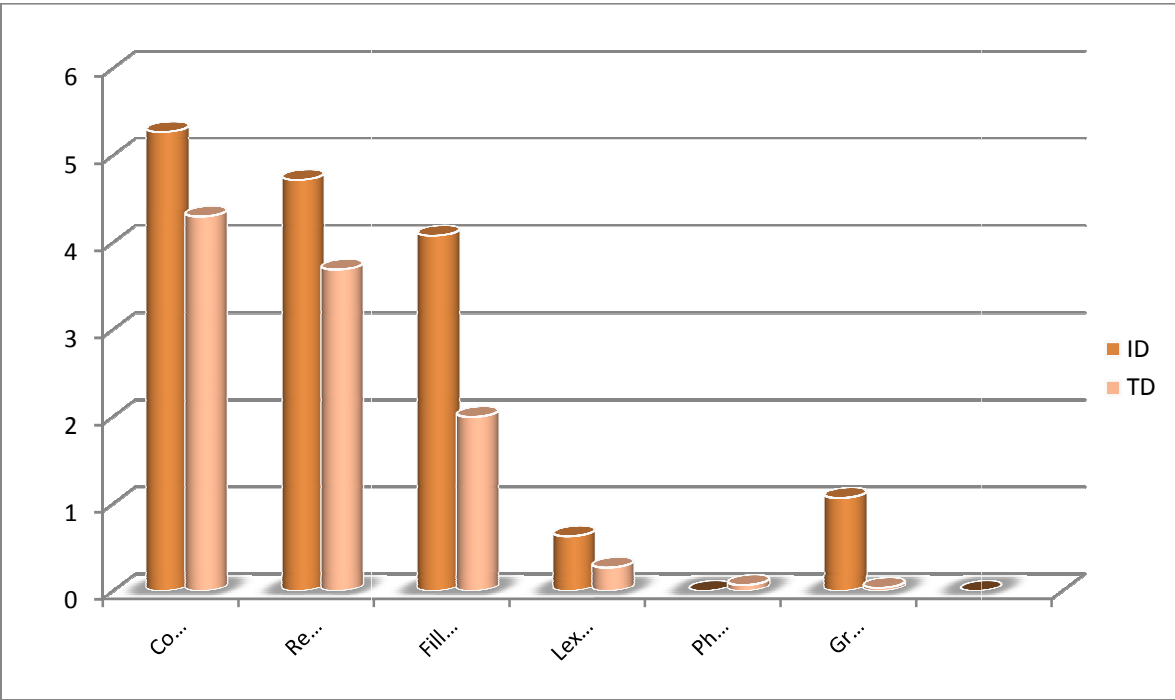


Figure-2
Mean standard deviations of maze types produced Children with Intellectual disability & Typically developing children

Across group comparison revealed a significantly higher percentage of mazes in Group I as compared to Group II. This could be explained by the fact that the demands of language formulation combined with social demands of language use can interfere with the speaker's capacity to plan and coordinate what s/he wants to say. When a child lacks the capacity to meet the demands for fluency, disfluencies occur² either in the form of stuttering or increased mazes¹.

Thereby, the study reveals a developing linguistic knowledge with limited production capability in children with intellectual disability as manifested by higher percentage of mazes compared to the Typically developing children who have a comparatively better control in language and word finding processes. These results are comparable with previous research done on linguistically impaired children^{8,13}.

Conclusion

The study clearly concludes that Mazes are considered an important variable to investigate and identify problems with the underlying formulation of speech and language. The maze profiles of children with Intellectual disability appear to be a less developed linguistic system and thus they employ limited processing strategies in the formulation, monitoring and repair of language in order to meet the demands of story narration. However, typically developing children may employ unique processing strategies in their language, due to a stronger control over the areas of language. Therefore, as mentioned prior, Maze evaluation can be considered diagnostically significant in the identification of language formulation deficits in various language disordered population.

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