Introduction
Speaking is a complex and unique ability which God has bestowed upon human beings to converse and communicate. Around 350 BC, Aristotle described this ability of humans as *zoon logon echon* (life form endowed with speech). Speaking involves the expression of thoughts in spoken words and phrases. According to Levelt (1999), during conversation, an adult individual produces approximately two to three words per second from a huge repository or a mental dictionary known as *mental lexicon* which is composed of fifty-hundred thousand words. In children, acceleration in vocabulary growth occurs between 18 months and 18 years with learning on an average of 9-10 new words a day (Bloom, 2000).

1.1 A prologue to Verbal Fluency

The process of retrieval of words from the brain has always been an enigma for researchers. Verbal Fluency (VF) or Controlled Oral Word Association (COWA) is one task of testing word retrieval. It involves rapid generation of words specific to a particular cue within a limited time span of sixty seconds (Lezak, 1995). The examinee is instructed to generate as many words as possible belonging to a semantic category such as *animals / fruits* (Semantic Category Fluency task) or words starting with a particular letter in the alphabet such as *F* or *A* or *S* (Initial Letter Fluency task). These tasks have been employed for assessing numerous linguistic and cognitive functions including spontaneous naming, extent of vocabulary, mental organization, search strategies, retrieval mechanisms, endogenous flexibility, lexicon or semantic storage, response speed and ease of verbal production, rule monitoring, inhibition of inappropriate responses, attention, and working memory (Auriacombe et al., 1993; Henry & Crawford, 2004a; Raboutet et al., 2010; Riva, Nichelli, & Devoti, 2000; Rosen & Engle, 1997; Ruff, Light, Parker, & Levin, 1997; Snyder & Munakata, 2010).

Studies in the literature have documented the evidence of coordinated activity of a number of brain areas, during verbal fluency production, particularly the frontal lobe (left dorsolateral prefrontal gyrus, right inferior frontal gyrus), temporal lobe (left inferolateral temporal lobe, superior-middle temporal gyrus), left superior parietal cortex, anterior cingulate gyrus of the left hemisphere and subcortical regions (thalamus, basal ganglia) with

1 http://www.academia.edu/859708/A_Philosophical_History_of_German_Sociology
variation in activation on phonemic and semantic fluency task (Baldo, Schwartz, Wilkins, & Dronkers, 2006; Mummery, Patterson, Hodges, & Wise, 1996; Thames et al., 2012). Due to its importance in clinical practice, verbal fluency task is a subtest in many screening and diagnostic standardized tests including Neuropsychological Assessment of Children (NEPSY) battery, Delis-Kaplan Executive Function System (DKEFS), Multilingual Aphasia Examination, Neurosensory Center Comprehensive Examination of Aphasia, Addenbrooke’s Cognitive Examination (ACE) and Consortium for the Establishment of a Registry for Alzheimer’s Disease-CERAD (Mitrushina, Boone, Razani, & D’Elia, 2005; Strauss, Sherman, & Spreen, 2006). The task has also been included in the panel of language tasks for fMRI language mapping in young children with neurodevelopmental disorders (de Guibert et al., 2011).

In both clinical and experimental research, literature provides evidence for verbal fluency task as being sensitive to various adult conditions. It has been utilized in aging, neurological conditions such as frontal and temporal injury, Parkinson’s disease, schizophrenia, depression, traumatic brain injury, multiple sclerosis, Alzheimer’s disease and Huntington’s disease (Beatty, Monson, & Goodkin, 1989; Fossati, Guillaume, Ergis, & Allilaire, 2003; Robert et al., 1998; Rosser & Hodges, 1994; Troyer, Moscovitch, Winocur, Alexander, & Stuss, 1998a; Troyer, Moscovitch, Winocur, Leach, & Freedman, 1998b; Troyer & Moscovitch, 2006).

Recently, with the shift in focus from aged to developmental period, the role of verbal fluency task has been emphasised in many childhood disorders also. It has been explored in prematurity (Allin et al., 2008), fetal alcohol syndrome (Kodituwakku et al., 2006), autism spectrum disorders (Kilincaslan, Motavalli Mukaddes, Sozen Kucukyazici, & Gurvit, 2010), Attention Deficit Hyperactivity Disorder (ADHD), developmental dyslexia (Cohen, Morgan, Vaughn, Riccio, & Hall, 1999), malnutrition (Chandler, Walker, Connolly, & Grantham-McGregor, 1995), specific language impairment (Henry, Messer, & Nash, 2012), hearing loss (Lofkvist, Almkvist, Lyxell, & Tallberg, 2012), developmental stuttering (Bahrami, Nejati, & Pooretemad, 2014), blindness (Wakefield, Homewood, & Taylor, 2006), head-injury (Levin, Song, Ewing-Cobbs, Chapman, & Mendelsohn, 2001), infections (Ezeamama et al., 2005), childhood stroke (Max, 2004), cerebellar lesions (Riva & Giorgi, 2000), epilepsy (Riva et al., 2006).
Chapter 1

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The analysis of verbal fluency performance in these clinical populations has focused predominantly on quantitative analysis of the number of correct words produced in response to each verbal fluency task. However, since late 1990s, researchers have also started evaluating verbal fluency performance in terms of qualitative analytic methods such as clustering-switching analysis, hierarchical exploration, time course analysis and error production analysis (Beatty et al., 1989; Hurks et al., 2010; Koren, Kofman, & Berger, 2005; Tallberg, Carlsson, & Lieberman, 2011; Troster et al., 1995; Troyer, Moscovitch, & Winocur, 1997) that focus on how the words are retrieved during verbal fluency task.

1.2 Need for Research

With reference to research concerning typically developing children, the interest in investigation of verbal fluency has gained importance only during the past two decades. This task has utmost importance in child developmental studies due to the ease of execution of the task within a short period (60 seconds per task) with the word generation to letters or category names (such as animals / words starting with a particular letter), making it more of a playful task than a testing procedure. Among the various executive function tasks, verbal fluency is the last to emerge in children. The sequential progression of these functions in children is considered as being parallel with the maturation of the frontal lobe and its connections (Jurado & Rosselli, 2007).

However, review of the existing literature in the area of verbal fluency in children, revealed the following lacunae:

- Despite extensive research in adult population, the process of how children organize semantic information and retrieve words (using qualitative analysis of clustering and switching) is still not clearly understood. Ironically, information on error production
during verbal fluency tasks remains under-reported in majority of the child related studies. Due to the differences in development and maturation of semantic system in children, direct adaptation of adult data findings may not serve the purpose of understanding the developmental trend of verbal fluency in children (Anderson, Anderson, Northam, Jacobs, & Catroppa, 2001; Ardila, Pineda, & Rosselli, 2000; Kempler, Teng, Dick, Taussig, & Davis, 1998; Prigatano, Gray, & Lomay, 2008; Sauzeon, Lestage, Raboutet, N'Kaoua, & Claverie, 2004).

Understanding of verbal fluency norms among typically developing children is paramount for interpretation of verbal fluency among disordered population. Generally, the practice by both medical professionals and speech language pathologists dealing with population is to use the norms based on the western population. The currently available normative data relates to Brazilian, French, Italian, Swedish, Hebrew, Dutch and Spanish (Charchat-Fichman, Oliveira, & da Silva, 2011; Filippetti & Allegri, 2011; Hurks et al., 2010; Kave, Kigel, & Kochva, 2008; Koren et al., 2005; Sauzeon et al., 2004; Tallberg et al., 2011) samples, inappropriate for evaluating Indian children. Linguistic factors (differences in word length, frequency of words / letters between languages), socio-cultural dissimilarity, extrinsic factors (differences on tasks) and developmental variations, prevent following of a universal protocol of verbal fluency testing. Moreover, there is a lack of consensus regarding the extent of influence of various demographic variables (age and gender), task effects and linguistic differences on verbal fluency in childhood. Given the importance of aforesaid factors, the use of demographically adjusted developmental data is vital and preferred for its enhanced sensitivity to impairment.

With respect to the Indian context, applicable to this study, the focus hitherto has only been on adults, geriatrics, persons with dementia, schizophrenia and right hemisphere damage (Krishnan & Karanth, 2013; Mathuranath et al., 2003; Ratcliff et al., 1998; Sosa et al., 2009), with no published studies on developmental changes on verbal fluency performance in Indian languages. Another shortcoming is the outcome measures employed in these studies in describing the verbal fluency performance. Studies done in Indian languages have focused only on understanding the quantitative
measure of total number of correct words produced on verbal fluency tasks.

Undeniably, recent literature evidences have shown that, studying measures of semantic organization (clustering and switching measures) and error production analysis enable a further direct insight into the processes underlying verbal fluency performance in children.

Therefore, to increase the usefulness of the verbal fluency measures in clinical and research settings and for better understanding of verbal fluency development in children, a need to create culture- and language-specific data for the Semantic Category Fluency and Initial Letter Fluency tasks is imminent. Based on these observations, the present study attempts to apply both quantitative and qualitative analysis of verbal fluency within the developmental context of Malayalam speaking children between five to fifteen years.

1.3 Aim and Objectives of the study

The present study aims at investigating the developmental changes in verbal fluency of Malayalam speaking children. The study objectives are:

- To explore the effect of age, gender and task on verbal fluency measures and organizational strategies
- To investigate the rate and type of error production in children during verbal fluency tasks