



## A Study of the Duration of Controlled Speech in Right Hemisphere of the Brain Damaged Male Participants

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**Abstract:** This is a neuro-linguistic research which compares Bangla speaking right hemisphere damaged (furthermore to be called RHD) male participants to age and gender matched normal males who have been selected from the same family as the right hemisphere damaged participants. RHD or right hemisphere damaged participants are those who have lesions or damages in the right hemisphere of the brain or both. This paper pertains to the understanding how a lesion or a damage in the right hemisphere can cause changes in the pattern of communication of adult males in the age group of 45 to 70. This paper discerns the difference in durations of controlled speech in RHD males compared to age and gender matched normal controls. It will be measured with the help a predetermined passage. A passage will be played to them, using a media player (to make sure everyone listens to the same recording, ruling out chances of error there) and then they will be asked to repeat the same passage, as much as they can remember. In this research, we will be looking at the time they would take to narrate the whole passage without missing out on anything.

**Keywords:** Neuro-linguistic, Controlled Speech, Hemisphere damage, Bangla

### About the Author



**Dr. Agniva Pal** is presently working as an Assistant Professor at the department of English language and literature, Adamas University. He completed his Masters, M.Phil and Ph.D. from Jawaharlal Nehru University, New Delhi. His current research focused on neurolinguistics and he has already published a few review articles on the same.

### 1. Introduction

The human brain consists of two hemispheres. Each hemisphere has localised as well as lateralised functions and through the unanimous working of both these hemispheres, we live and breathe the way we do. Everything we do is a result of the way the brain works and makes us think (Ahlsen, 2006, 103). Doctors sometime, decide to sever the corpus callosum in an individual, when a patient is suffering from epileptic seizures and fits. The paper Language, the Brain, and the Question of Dichotomies speaks about the lateralisation of functions in the human brain and how each of the brain hemispheres are responsible for tasks localised for them. In the long process of human evolution, the brain has developed certain localised functions which are lateralised to each sides of the brain. The left brain is responsible for language, math, analogy and reasoning while the right brain is responsible for the creative nature, metaphors, para-linguistic cues, discourse understanding and pragmatics. The voluntary activities of the brain are all contralateral, that is, the left hemisphere of the brain controls the right hemisphere of the



body and vice versa. The involuntary functions of the brain are mostly ipsilateral like the heart and the involuntary breathing. Present researches are more thorough and are trying to scan each and every localised and lateralised ability of each hemisphere with advanced technologies like the fMRI. The involvement of the right brain hemisphere in language production and understanding has been proved by many researched like that of Gazzaniga (Gazzaniga, 1972) and that subjects like P.S. who had an operation in which their corpus callosum was removed, rendered them unable to do many functions normal adults do (Thompson, 1984, 98-105).

It has been noticed that right hemisphere damaged subjects in comparison with left hemisphere damaged subjects have much lesser chances of going into permanent depression after suffering a stroke. A study on 184 patients in the University of Maryland Hospital has given an insight to the authors of the paper Mood Disorders in Stroke Patients: Importance of Locations of Lesions (Robert G Robinson, 1984). The authors have found out that subjects with stroke to the left hemisphere of the brain can enter a phase of severe depression after six months of the stroke. They have also found out that subjects with stroke to the right hemisphere of the brain generally grow a tendency to simplify things after the stroke. It has also been noticed that some subjects displayed themselves to be much more merrier after the stroke in comparison with left hemisphere damaged subjects who had sustained strokes (Robert G Robinson *et al.*, 1984, 81-93).

Further research in the same field has proved that the right hemisphere plays a pivotal role in the understanding of humour. A test was conducted on few subjects in the paper Comprehension of humorous and nonhumorous materials by left and right brain-damaged patients (Bihrllea, 1986). The left hemisphere damaged individuals had no issues in understanding humor. Right hemisphere damaged individuals, on the other hand had problems in understanding humor and lacked the understanding of coherence as well.

The article Dysphagia In Acute Stroke (Caroline Gordon, 1987) studied the incidence, duration and reason for dysphagia in stroke patients. Dysphagia is referred to a clinical condition in which a subject is unable to swallow food due to loss of motor control from the parts concerned. A total of 91 subjects were tested on as random selections. 41 subjects were admitted with dysphagia and 37 subjects out of the 41 subjects had a lesion in any one of the hemispheres. Seven subjects had lesions in both the brain hemispheres. Nineteen of these subjects regained back the ability to swallow in fourteen days from the date of their strokes. The authors conclude by stating that stroke in any one hemisphere of the brain can cause more incidences of dysphagia than unilateral stroke to both the hemispheres. In unilateral stroke cases, as the author states and hypothesises, due to cerebral oedema to the brain stem, one can lose control of the motor activities inside the mouth; but this does not explain all cases. The central cerebral artery is responsible for the supply of blood to many regions which are responsible for swallowing. Infarctions at such regions and ischemic strokes, can cause swallowing problems. There is also another scenario in which it has been noted that many apraxia subjects have displayed dysphagia. Regarding this, it has been hypothesised that brain regions responsible for swallowing might be near to the regions which cause apraxia in the brain. There is no hard and fast factor which can be pointed out for dysphagia in subjects. (Caroline Gordon *et al.*, 1987)

Scientists then realized that the right hemisphere of the brain is also specialized with many functions like creativity, intuition, art, music, metaphorical understanding and so on. After studying both the hemispheres of the brain, scientists have concluded that both the hemispheres of the brain work together to perform various day to day activities. The left brain alone cannot complete all actions on its own. It needs the right hemisphere to complete various processes. Tim J Crow was one of the pioneers in the field of bi-hemispheric brain study. In one of his papers, Right hemisphere language functions and schizophrenia: the forgotten hemisphere? he studied the functions of the right hemisphere in language. According to Tim J Crow, the right hemisphere helps in some language functions. He was one of the first persons to disband the view that the left hemisphere is the only seat and control of language in the brain. His paper suggested that the right brain was necessary to understand humour, sarcasm, discourse comprehension, emotional prosody and so on. Schizophrenia was primarily thought to be a disorder of the left hemisphere because it adversely affected speech and language. It was in due time that schizophrenics



were tested in the brain and damages to the right hemisphere were also found to create various manifestations of schizophrenia. (Rachel and Crow, 2005, pp 55, Sally P. Springer, 1993, pp 13)

The right hemisphere of the brain is responsible for either very high variations in sentence level pitch or much lower, robotic speech in test participants. Participants were seen with as low pitch variation at the level of sentence with 53 Hz and 40 Hz in comparison with the male control group average of 80 Hz. (Pal, Variations in Intonation at the level of sentences: A comparative study between RHD and normal controls, 2017)

Participants in an Right Hemisphere damage conducted by Pal (Pal, Pitch Range in Discourse for RHD Participants, 2019) was found to have a much higher pitch range than the normal controls; almost in a way such that it seems like a singsong voice. A tendency to over enthusiastically speak has been noted in RHD participants throughout the study.

Right Hemisphere Damaged Participants in a certain study by Pal (Pal, Fluency in Discourse for Female RHD Participants, 2017) has been seen to have a much lower rate of fluency in comparison with normal controls. RHD participants have been seen to use much lower number of words to explain a something, in comparison with normal controls. The study renders a belief that RHD participants in order to use the limited resources to their advantage, ration the number of words and pitch variations while speaking.

Chakrabarty (Chakrabarty, 2017) notes that consciousness and attention are two distinct neural and cognitive processes. The brain has to be considered in a wholistic manner and both hemispheres have their own function in the processing of the abovementioned procedures.

Chakraborty (Madhushree Chakrabarty, 2014) in another paper notes that as a result of abnormal lateralization, participants studied in one of her research proceedings interpreted conventional metaphors and novel metaphors differently. The difficulty of a task or in simpler words, the complexity of the metaphor is directly proportional to the amount of effort put in by individuals while interpreting them.

This paper intends to study the effects of damage to the right hemisphere of the brain in speech. This research paper studies how the duration of speech in a controlled environment changes with damage to the right hemisphere of the brain. The paper has been divided into a few sections. It starts with an introduction and literature review, followed by materials and methods. The next section houses a few individual participants and then goes in to the mean result of all male participants followed by a section on a few conclusive remarks. At the end, one may find a list of references.

## Research Methodology

The current paper is an experimental examination which includes assortment of essential information however is certifiably not a longitudinal report. It is a part of a dissertaion written for a PhD. Essentially, it is a cross sectional investigation which contemplates diverse RHD members alongside age and sex coordinated ordinary controls at different purposes of time post stroke. Recordings were directed either at the homes of the patients or at Dr. Ganguly's private chamber or at Bangur Institute of Neurosciences utilizing a PC. Information has been broken down utilizing Praat and Microsoft Excel. Affixed below are the passages played to the RHD participants and their age and gender matched controls. It is important to note that the passage was played out in Bangla since the whole research was conducted on Bengali participants but the English translations are here as well in order to help.

## Participants

44 right hemisphere damaged participants in comparison with age and gender matched controls were studied for the dissertation written for the PhD. However, the present study compares 2 RHD participants, 2 age and gender matched controls and 1 narrator and their data in the further sections to come.



## Passage 1 - The Hart and the Hunter

The Hart was once drinking from a pool and admiring the noble figure he made there.

"Ah," said he, "where can you see such noble horns as these, with such antlers! I wish I had legs more worthy to bear such a noble crown; it is a pity they are so slim and slight."

At that moment a Hunter approached and sent an arrow whistling after him.

Away bounded the Hart, and soon, by the aid of his nimble legs, was nearly out of sight of the Hunter; but not noticing where he was going, he passed under some trees with branches growing low down in which his antlers were caught, so that the Hunter had time to come up.

"Alas! Alas!" cried the Hart: "We often despise what is most useful to us"

একটা হরিণ ছিল। সে তার শিংটা খুব ভালোবাসতো। একদিন পিপাসা পাওয়া তে হরিণটা নদীর ধার এ গেলো। তারপর নদীর ধার এ গেলো জল খেতে। তখন নিজের প্রতিচ্ছবি টা দেখতে পেলো। নিজের শিং দেখে খুব খুশি হলো হরিণটা আর খুব প্রশংসা করলো হরিণটা। তারপর আর একটু এগোনোতে হরিণ টা নিজের শরীর টা দেখতে পেলো আর নিজের পাতলা পা গুলো ও দেখতে পেলো। হরিণটা নিজের পা গুলো দেখে খুব দুঃখ পেলো আর খুব নিন্দা করলো নিজের পা এর। পা গুলো এতো পাতলা যে মানায় না হরিণটার সুন্দর শিং তার সাথে। এসব হতে হতে হঠাৎ একটা শিকারী পেছন থেকে একটা তীর মারলো হরিণটার দিকেই তবে তীর টা সামনে দিয়ে বেরিয়ে গেলো। হরিণটা ভয় পেয়ে দৌড়াতে শুরু করলো আর শিকারী টা তারা করলো হরিণটা কে। দৌড়াতে দৌড়াতে হরিণটা জঙ্গল এর মধ্যে ঢুকেই গেলো আর তারপর একটা লতা পাতা ঝোপ এর মধ্যে হরিণটার শিংটা আটকে গেলো। হরিণ টা আর ছাড়াতে পারলো না শিং টা কে। শিকারী টা ধরে নিলো হরিণ টা কে। হরিণ টা বুঝতে পারলো যে যার প্রশংসা করছিলো সেই ধরা পরিয়ে দিলো হরিণ টা কে র যার নিন্দা করছিলো সে এ হরিণটাকে দৌড়াতে সাহায্য করছিলো।

## Passage 2 - The Frogs Desiring a King

A few frogs lived happily in a marshy swamp that was perfect but then they started to look for a king who would rule them. They prayed to God to give them a king. God sent them a big block of wood and it fell right into the marsh. At first, they were afraid of its size but then they slowly got used to it and realized it was not moving. They finally, climbed to the top of it and conquered their king. They prayed to God again, this time asking for a live king who would actually rule over them. Now this made Jove angry, so he sent among them a big Stork that soon set to work gobbling them all up.

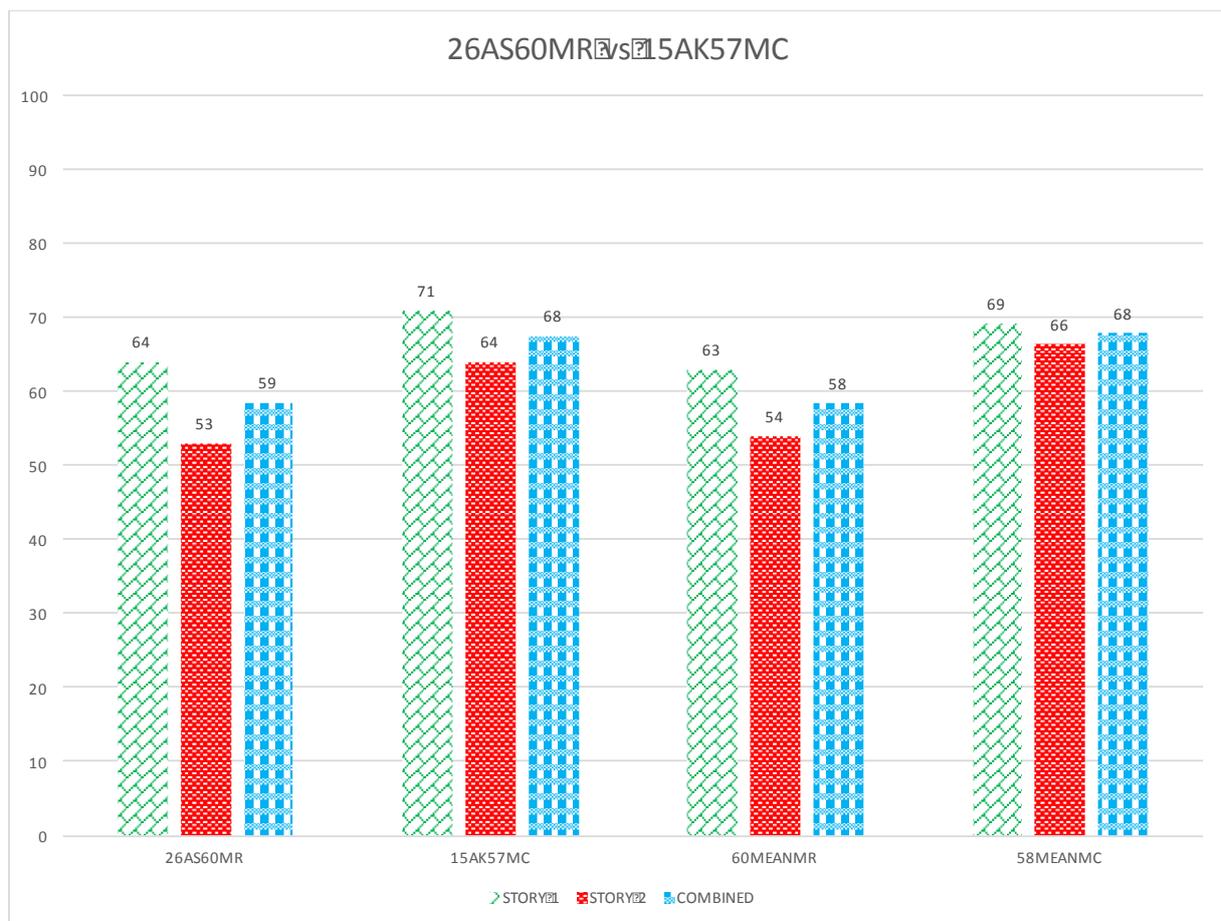
একটা হরিণ ছিল। সে তার শিংটা খুব ভালোবাসতো। একদিন পিপাসা পাওয়া তে হরিণটা নদীর ধার এ গেলো। তারপর নদীর ধার এ গেলো জল খেতে। তখন নিজের প্রতিচ্ছবি টা দেখতে পেলো। নিজের শিং দেখে খুব খুশি হলো হরিণটা আর খুব প্রশংসা করলো হরিণটা। তারপর আর একটু এগোনোতে হরিণ টা নিজের শরীর টা দেখতে পেলো আর নিজের পাতলা পা গুলো ও দেখতে পেলো। হরিণটা নিজের পা গুলো দেখে খুব দুঃখ পেলো আর খুব নিন্দা করলো নিজের পা এর। পা গুলো এতো পাতলা যে মানায় না হরিণটার সুন্দর শিং তার সাথে। এসব হতে হতে হঠাৎ একটা শিকারী পেছন থেকে একটা তীর মারলো হরিণটার দিকেই তবে তীর টা সামনে দিয়ে বেরিয়ে গেলো। হরিণটা ভয় পেয়ে দৌড়াতে শুরু করলো আর শিকারী টা তারা করলো হরিণটা কে। দৌড়াতে দৌড়াতে হরিণটা জঙ্গল এর মধ্যে ঢুকেই গেলো আর তারপর একটা লতা পাতা ঝোপ এর মধ্যে হরিণটার শিংটা আটকে গেলো। হরিণ টা আর ছাড়াতে পারলো না শিং টা কে। শিকারী টা ধরে নিলো হরিণ টা কে। হরিণ টা বুঝতে পারলো যে যার প্রশংসা করছিলো সেই ধরা পরিয়ে দিলো হরিণ টা কে র যার নিন্দা করছিলো সে এ হরিণটাকে দৌড়াতে সাহায্য করছিলো।

## Discussions

In this section we will look at a few individual cases and then look at the mean of the whole group in order to have a wider understanding of the damage caused to the participants. Pasted below are a few male participants whose damage was much more than others studied in this research.



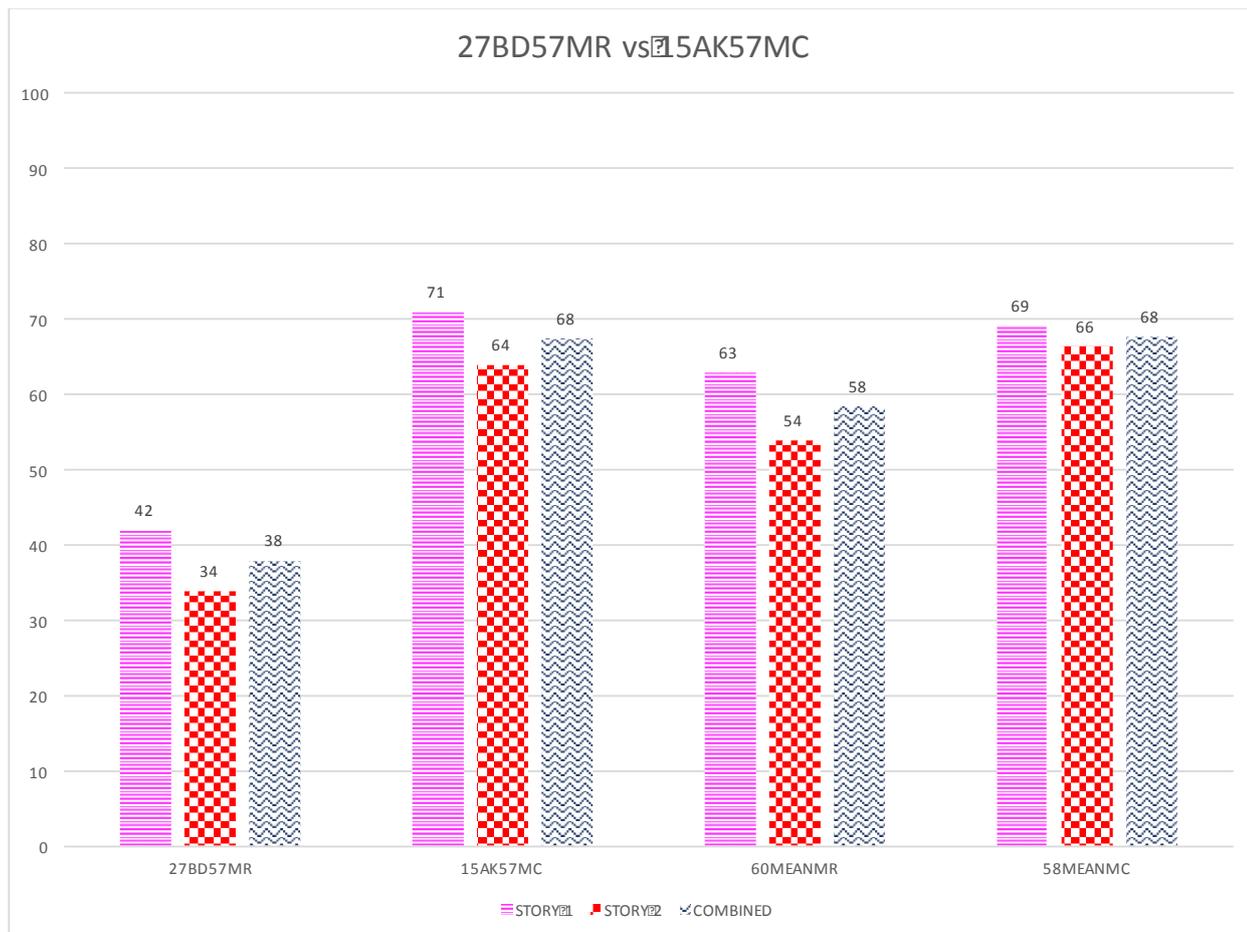
## Case Study 1 – 26AS60MR



**Figure 1** A graph comparing case study 1 to age and gender matched controls and with the mean of the control group.

We can observe the following from figure 1: 26AS60MR took 64 seconds (fluency – 84 words per minute) to complete narrating the first story in comparison with 15AK57MC, who took 71 seconds (fluency – 144 words per minute). 26AS60MR took 53 seconds (fluency – 84 words per minute) to complete narrating the second story in comparison with 15AK57MC, who took 64 seconds (fluency – 132 words per minute). 26AS60MR has a mean duration of 59 seconds (fluency – 84 words per minute) whereas, 15AK57MC has a mean of 68 seconds (fluency – 138 words per minute). We can see that 26AS60MR has taken lesser time than 15AK57MC in both the stories. This adds to the observation that the participant was speaking in a hurry. 26AS60MR also completed the stories faster than 58MEANMC with a duration of 68 seconds (fluency – 125 words per minute) and 60MEANMR with a duration of 58 seconds (fluency – 113 words per minute), in the mean of the two stories.

## Case Study 2 – 27BD57MR



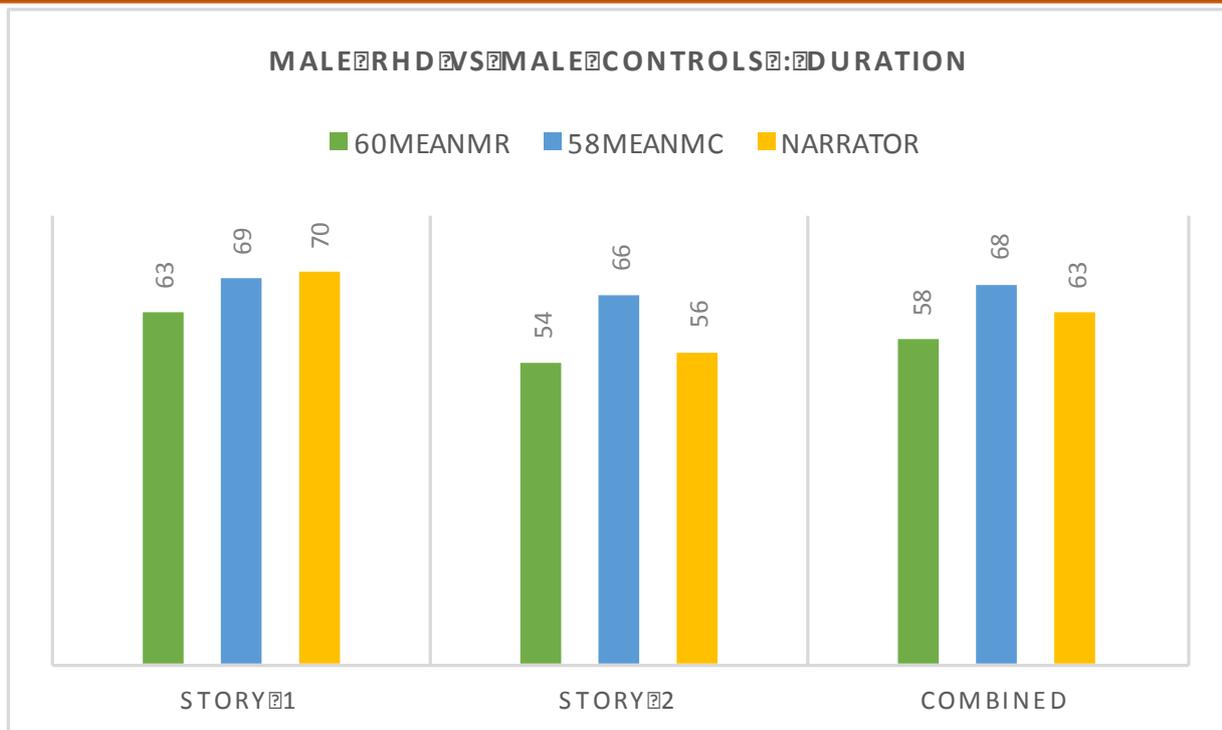
**Figure 2** A graph comparing case study 2 to age and gender matched controls and with the mean of the control group

We can observe the following from figure 2: 27BD57MR took 42 seconds (fluency – 132 words per minute) to complete narrating the first story in comparison with 15AK57MC, who took 71 seconds (fluency – 144 words per minute). 27BD57MR took 34 seconds (fluency – 96 words per minute) to complete narrating the second story in comparison with 15AK57MC, who took 64 seconds (fluency – 132 words per minute). 27BD57MR has a mean duration of 38 seconds (fluency – 114 words per minute) whereas, 15AK57MC has a mean of 68 seconds (fluency – 138 words per minute). We can see that 27BD57MR has taken lesser time than 15AK57MC in both the stories. This adds to the observation that the participant was speaking in a hurry. 27BD57MR also completed the stories faster than 58MEANMC with a duration of 38 seconds (fluency – 125 words per minute) and 60MEANMR with a duration of 58 seconds (fluency – 113 words per minute), in the mean of the two stories.

### Study and comparisons of the means with the original narrator

We can discern the following from the figure 3: The male RHD participants have taken 63 seconds to narrate the first story, in comparison with the male control group participants, who took 69 seconds. In comparison, the narrator took 70 seconds. The male RHD participants have taken 54 seconds to narrate the first story, in comparison with the male control group participants, who took 66 seconds. In comparison, the narrator took 56 seconds





**Figure 3** A chart comparing the durations taken by the male RHD group vs. the male control group vs. the narrator, to narrate the stories.

## Conclusion

Through this empirical research we have discerned the following:

1. RHD participants have taken lesser time than control group participants.
2. RHD participants had huge lapses in the amount of data they could reproduce while narrating the passage back to the researcher.
3. Some RHD participants have displayed a sense of haste and an urge to finish faster. This can be probably be attributed to the lesion on the right hemisphere of the brain.
4. It can also be stated that RHD participants in general speak faster than age and gender matched normal controls.
5. The male RHD participants have taken 58 seconds in the combined mean of both the stories, in comparison with the male control group participants, who took 68 seconds. In comparison, the narrator took 63 seconds.
6. The RHD participants have taken lesser time to narrate the stories in comparison with the control group participants. This can be attributed to the fact that many of the RHD participants had major lapses in the narrations of the stories and left out major details, unlike the control group participants.

## Abbreviations

**MR** – Male RHD participant

**MC** – Male control group participant

**MEANMR**- mean of all male RHD participants

**MEANMC** – mean of all male control group participants

**26AS60MR** – first 2 digits signify the case study number; the next 2 signify the initials of the participants; the next two digits signify the age of the participant and the last letters stand for the group being represented – either the controls or the RHD participants.



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## Ethics Approval

Approval was sought from the Institutional Ethics Review Board, Jawaharlal Nehru University.

## Does this article screened for similarity?

Yes.

## Conflict of interest

The Author has no conflicts of interest to declare that they are relevant to the content of this article.

## Availability of data

Ethics approval document was available with both the author and Editor.

## Informed consent

Written consent was obtained from the participants

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