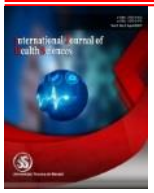

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# Non-verbal Amusement in Later Life: An Analysis of Age-related Shifts in Humor Comprehension

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***Keywords***

*cognitive flexibility;*
*funniness rating scale;*
*humor processing;*
*processing speed;*

**Abstract**

Humor is the ability to understand and express what is funny, serving a crucial social function, fostering connection, relieving stress, and navigating awkward situations encompassing language, gesture, visual imagery, and situation management. This study aims to investigate the impact of aging on non-verbal humor processing in Malayalam-speaking adults. 150 healthy Malayalam-speaking adults, aged 31-80 years, were divided into five age groups with all meeting the criteria of normal cognitive function with humor exposure. Participants underwent humor assessment using a specially developed material consisting of non-verbal stimuli, with funniness responses being rated using funniness rating scales. Statistical analysis involving mean scores, Kruskal-Wallis, and Mann-Whitney U test with Bonferroni corrections was used to compare humor processing across age groups. The study revealed a significant age-related decline in humor processing, particularly after the age of 60, with cognitive factors like working memory, processing speed, and cognitive flexibility significantly impacting the humor comprehension. The most intriguing part of the study was that participants in the age range of 51-60 years performed better compared to other age groups. Therefore, the study reveals that a complex interaction of cognitive, emotional, and social factors has a significant decline after the age of 60, suggesting the potential of humor-based intervention to enhance cognitive resilience, emotional well-being, and social engagement.



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## 1 Introduction

Humor is described as the capacity to comprehend and express the laughable. It is a form of communication that triggers laughter through stimuli from light-hearted to absurd, crucial for forming connections, releasing tension, and navigating strenuous situations that require diverse communication skills like language, gesture, visual imagery, and situational management to elicit enjoyment, typically manifested as smiles or laughter. The complex interaction of humor and the brain requires both physiological laughter and cognitive processes like perception, recognition, and interpretation, with the prefrontal and frontal cortices playing important roles, which indicates deep integration into human cognition, and the activation of extensive neural pathways displaying humor's significance in life and evolutionary history.

Humor and the brain have a complex relationship, as it involves both the physiological effects of laughter and the cognitive processes of perception, recognition, and interpretation. The prefrontal and frontal cortices are the two main areas in the brain that play a crucial role in creating, comprehending, and experiencing humor, which indicates that it is deeply integrated into human cognitive functions. Humor activates extensive neural pathways, which highlight its significance in human life and evolution history.

Humor is represented by a vast neural network capable of parallel distributed processing. Different types of humor activate distinct networks in the brain. Semantic jokes and puns engage separate pathways, with semantic humor utilizing the bilateral temporal lobe network and wordplays activating the left hemisphere neural pathway, which is centered around regions involved in speech production. Research has identified different networks for the cognitive and emotional components of humor. The cognitive feature includes understanding the joke, while the emotional component relates to the response as funny or not, meaning that one can understand a joke without finding it funny (Fry, 2002).

Non-verbal humor, unlike verbal humor, relies on visual cues and auditory cues to create a comedic effect, often without any spoken words. It encompasses a wide range of comedic expressions, including facial expressions, body language, visual gags, sound effects, and mimes. The brain processes non-verbal humor in a complex way, particularly the right frontal lobe, which plays a crucial role in processing non-verbal cues and understanding the emotional and contextual aspects of humor. Temporal lobes are involved in the processing of visual and auditory information, as well as recognizing patterns and understanding context. The prefrontal cortex is responsible for higher-level cognitive functions like evaluating and interpreting humorous stimuli as well as understanding the incongruence within the non-verbal humor (Tian et al., 2017).

As age advances, humor processing shifts chiefly towards cognitive comprehension, resulting in older individuals showing deficits in understanding and processing humor. This decline is characterized by frontal lobe cognitive function changes, in contrast with preserved affective responsiveness that may facilitate humor as a coping mechanism. Humor's complex cognitive demands, including social cue understanding and incongruity recognition, allow researchers to gain insight into underlying neural mechanisms (Shammi & Stuss, 2003). The cognitive, along with hearing and vision decline, can impact the ability to process complex visual information, perceive non-verbal cues, and recognize subtle gestures.

Researchers demonstrated that incorporating humor in the intervention/therapeutic process can activate brain functions and improve working memory and communication abilities. As a result, it has become crucial

to assess humor processing for intervention (Linge-Dahl et al., 2018; Takeda et al., 2010). The literature on the assessment of humor in Indian languages is relatively limited. Expanding research in this area can help in identifying the role of humor and its therapeutic implications in the Indian cultural context. Given the unavailability of humor assessment materials in Malayalam, the present study aims to develop and assess humor processing abilities in a healthy aging population of Malayalam-speaking adults.

*Aim of the Study*
The aim of the study is to assess and analyze the impact of ageing on non-verbal humor processing.

## 2 Materials and Methods

*Method*

The current study was done in three phases:
Phase I: Development of Test Material
Phase II: Selection of Participants
Phase III: Administration of the Test Material

**Phase I: Development of Assessment Material**

***Stimulus and Structure***

The assessment material was developed to assess the non-verbal humor processing ability in typical healthy ageing adults. A humor appreciation questionnaire was developed to identify exposure to humor content. For the non-verbal humor stimuli, ten videos were selected, which were used to assess the non-verbal humor processing. This stimulus was to be assessed using a funniness rating scale, which was developed (Kohn et al., 2011).

*Part A: Development of Humor Appreciation Questionnaire.*
The humor appreciation questionnaire was developed to select speech language pathologists for validating the assessment material and the participants for the study based on their exposure to humorous contexts and situations. Twenty questions were created for the questionnaire, out of which 15 were selected as the most appropriate by 5 speech-language pathologists. The questionnaire assessed humor enjoyment, preferences, and usage, with responses ranging from "very often" to "never". Scores were assigned (4 (very often), 3 (often), 2(sometimes), 1 (rarely), and 0 (never)) to each response, with a maximum of 60. 10 out of 20 speech-language pathologists, who scored above 80% (48/60) on the questionnaire, were selected to validate the stimuli.

*Part B: Development of Non-verbal Stimuli.*
20 Malayalam funny video clips (2-3 minutes) with physical humor and no dialogues were selected. 10 speech-language pathologists who obtained 80% or above in the humor appreciation questionnaire rated the clips with a funniness rating scale. The 10 highest-rated video clips were chosen for the study.

*Part C: Development of Funniness Rating Scale.*
A 4-point Likert scale (0-3) was created to measure participants' subjective humor perception of video clips, with 0, not at all funny; 1, slightly funny; 2, funny; 3, very funny. The scale was validated by two speech-language pathologists who scored 90% or higher on the humor questionnaire.

**Phase II: Selection of Participants**

The study consists of 150 participants. The participants were divided into five groups, consisting of healthy ageing Malayalam-speaking adults within the age range of 31 to 80 years. Each group consisted of 30

individuals, who were divided into 31 to 40 years, 41 to 50 years, 51 to 60 years, 61 to 70 years, and 71 to 80 years. The participants were selected based on the Mini-Addenbrooke's Cognitive Examination (Hodges & Larner, 2017) with a score ≥ 25/30.

***Inclusion criteria***

- Participants should be Malayalam speaking
- Participants should have normal/corrected hearing and vision
- Education of minimum 10th grade
- Participants with exposure to humor with a score of 80% or more on the Humor Appreciation Questionnaire.
- Participant should pass M-ACE with greater than 25/30.

***Exclusion criteria***

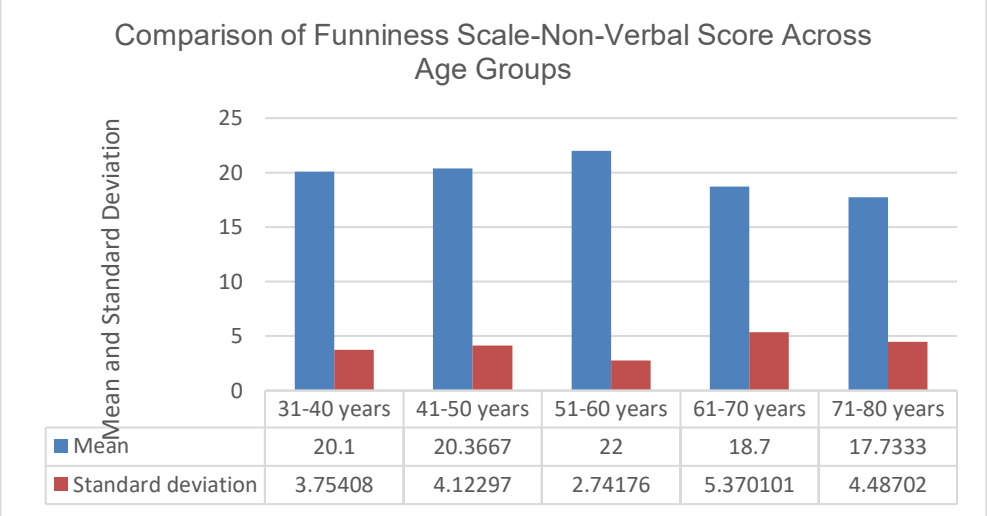
- Participants' neurological issues, cancer, psychiatric/psychological illness.
- Participants with speech and language problems.
- Individual with a history of CNS condition and head injury
- Individuals with dementia

**Phase III: Administration of the Test Material**

The test procedure was initiated with the obtaining of consent from each participant. The objective and nature of the study were explained. A clinical interview gathered demographic details, and other relevant details were collected. The Mini-ACE was administered to screen for cognitive dysfunction, along with the Humor Appreciation Questionnaire to assess their exposure to humor content. An informal hearing screening was performed. The participants were seated comfortably in appropriate lighting to view the video clips, and instructions regarding the assessment procedure were given. Each video clip was asked to rate using the funniness rating scale. The test administration duration was approximately 20 minutes. Funniness rating scores had a maximum score of 30, which is considered the non-verbal humor processing ability.

## 3 Results and Discussions

*3.1 Results*




*The bar graph depicting the mean and standard deviation of the funniness rating scale non-verbal score across the age groups*

The descriptive statistics for the Funniness Scale-Non-Verbal Score across the five age groups (31-40, 41-50, 51-60, 61-70, and 71-80 years) show varying patterns in the scores. The mean scores reveal that the 51–60 year age group had the highest mean value, followed by the age groups 31-40 years, 41-50 years, with the age groups 61-70 and 71-80 years having the lowest scores. Interpreting that 51-60 finding the non-verbal humor the funniest and older groups 61-70 and 71-80 least funny, suggesting a potential decline in non-verbal humor processing. The standard deviation reveals that the variability in scores was lowest for 51-60 years and highest variability in 61-70 years.

These descriptive statistics suggest that the middle-aged group (51-60 years) has the highest and most consistent non-verbal funniness scores, while the older age groups (61-70 and 71- 80 years) exhibit lower average scores and greater variability. This highlights a possible decline in non-verbal humor processing ability as age increases, particularly in the older age groups.

| Total N | 150 |
|---|---|
| Kruskal-Wallis H | 16.379 |
| Degree of Freedom | 4 |
| p-value | 0.003 |

*Kruskal-Wallis test scores comparing the funniness scale non-verbal score in five age groups*

The Funniness Scale-Non-Verbal Score was compared using the Kruskal-Wallis test in five age groups (31-40, 41-50, 51-60, 61-70, and 71-80 years). The test statistic (H) is 16.379, with four degrees of freedom and a 0.003 p-value. We reject the null hypothesis since the p-value is less than 0.05, showing that the Funniness Scale-Nonverbal Scores differ significantly between age groups.

| Sample 1-Sample 2 | Test Statistic | p-value |
|---|---|---|
| 71-80 Years-61-70 Years | 12.667 | 1.000 |
| 71-80 Years-51-60 Years | 42.950 | 0.001 |
| 71-80 Years-41-50 Years | 26.483 | 0.179 |
| 71-80 Years-31-40 Years | 22.233 | 0.467 |
| 61-70 Years-51-60 Years | 30.283 | 0.068 |
| 61-70 Years-41-50 Years | 13.817 | 1.000 |
| 61-70 Years-31-40 Years | 9.567 | 1.000 |
| 51-60 Years-41-50 Years | -16.467 | 1.000 |
| 51-60 Years-31-40 Years | -20.717 | 0.639 |
| 41-50 Years-31-40 Years | -4.250 | 1.000 |

*Post-hoc pairwise comparison to compare the significant difference in the funniness scale score among the age groups*

The post-hoc pairwise comparisons for the Funniness Scale-Non-Verbal Score across the age groups show that the age group 71-80 scored significantly lower on the Funniness scale nonverbal score compared to the age group 51-60 years. They showed no significant difference compared to the age groups 61-70, 41-50, and 31-40 years. There was a marginal non-significant difference in the age range of 61-70 years when compared to 51-60 years, with strictly no significant difference between the age groups 41-50 and 31-40. No significant differences are found between the 51-60 years and 41-50 years age groups or between the 51-60 and 31-40 years age groups. Finally, no significant difference is observed between 41-50 years and 31-40 years.

The results suggest that the primary significant difference is between the 71-80 years and 51-60 years groups, with the older group showing a much lower score. Other comparisons did not reveal significant differences.

### *3.2 Discussion*

Findings of the current study indicate that a reduction in the ability to process non-verbal humor begins from 60 years onwards. This can be explained as non-verbal humor processing relies on the integration of cognitive, emotional, sensory, and social abilities. Each contributes to the ability to perceive, interpret, and

appreciate humor that is conveyed through actions, gestures, facial expressions, or situational incongruities without the use of language. Age-associated neurobiological changes impact an individual's cognitive abilities, such as attention control, working memory, abstract reasoning, problem-solving, and rapid recognition of visual or physical incongruities. It can also affect emotional abilities like recognizing and interpreting emotional expressions (e.g., a mischievous grin or exaggerated frustration) that are essential cues in non-verbal humor and the ability to relate to the emotional context of the humor. The present findings can be correlated with the report of Mak and B.D. Carpenter (2007) found that older adults performed poorer than younger adults in comprehending nonverbal humor (Mak & Carpenter, 2007).

The findings of the present study can be explained with the fact that sociocultural abilities like understanding social norms, relationships, and behaviors have prominent role in individuals' ability to identify when actions deviate humorously from expectations and the ability to infer the intentions or mental states of others, such as understanding why a character performs an absurd action. Humor often relies on cultural references or shared knowledge. Recognizing the context or societal norms along with cultural awareness underlying the humor plays a critical role in processing non-verbal humor, as it often relies on cultural references or shared knowledge. Familiarity with the individual's ability to relate situations or actions being depicted helps individuals find humor in scenarios that mirror their own experiences, and also influences. Ageing may limit an individual's social interactions, and it can hinder an individual's socio-cultural abilities, which have an inevitable role in humor processing. The participants of the current study often exhibited reduced attention, especially towards the end of the assessment, and an inability to recognize the incongruities of the stimulus presented. Individuals with less social interaction were observed to obtain lower scores on the funniness rating scale (Ku et al., 2017).

The highest mean score and lowest standard deviation, as observed in the participants aged 51-60 years, is a significant finding warranting further exploration. Their performance suggests a unique assemblage of cognitive, experimental, and cultural factors contributing to their ability to perceive and enjoy humor beyond words. This age range represents the phase of life where cognitive functions are generally well-preserved, yet beginning to manifest subtle age-related changes. The delicate balance appears to be the leading factor in their improved humor processing. Cognitive functions like pattern recognition, contextual understanding, and incongruity resolution are all crucial for humor appreciation. All these abilities are either typically at their peak or slightly declining during this period. Even though processing speed might slightly decline in this age group, years of accumulated experience enhance cognitive efficiency, meaning that they can process information more effectively in a slightly slower pace. This enhances their efficiency in interpreting and appreciating various non-verbal humor styles, compensating for a potential decline in processing speed. The performance of the participants showed that they enjoyed the assessment more than other age groups, with more facial expressions and laughter in almost all the participants. Most of the individuals scored better in funniness, indicating good cognitive function, while a few exhibited average performances in funniness score, even with meeting the criteria in M-ACE, which may be due to emotional and social factors.

The rich library of social and visual patterns has been endowed by individuals through years of accumulated experience by witnessing a wide spectrum of human interactions, cultural nuances and situational differences. This extensive exposure enhances their ability to quickly recognize deviations from expected norms, which often form the basis of non-verbal humor. Humor is rarely isolated and often depends on contextual understanding and the surrounding situation to create a comedic effect. The ability to swiftly grasp the context of a respective scenario allows them to fully appreciate the humor embedded within it.

The fundamental aspect of humor is incongruity resolution, that is, the unexpected twist or deviation from expectations. This age group possesses a heightened ability to detect these incongruities and understand their humorous implications. This cognitive flexibility allows one to quickly shift perspectives and appreciate the comedy of a situation (Logue & Gould, 2014).

Apart from cognitive functions, emotional stability plays an important role in humor processing. This age group carries a greater degree of emotional maturity compared to younger individuals. They are less reclined to emotional volatility and more versed at maintaining a balanced perspective, allowing them to approach humor with a sense of detachment, enabling them to fully appreciate the humor elements. Part of emotional stability, life experience plays a huge role. As they have seen more of life, they understand more of the subtle nuances of human interaction that are often the basis of non-verbal humor.

Thus, comparing them to younger adults with faster processing speed, often lack this accumulated experience and contextual understanding that are crucial for appreciating non-verbal humor. Moreover, this could be because participants in the age range of 31-40 and 41-50 are at a life stage where they are more focused on career development, family responsibilities, and social status, and might perceive these scenarios as too simplistic or lacking the nuance they expect from adult humor.

Additionally, younger adults may be more accustomed to humor prevalent in the contemporary digital media, often relying on trolls, internet memes, and specific online platform trends, whereas older adults may be more into traditional forms of physical humor like those found in classic films and television shows. The participants of the age ranges 31-40 and 41-50, even though they had good humor comprehension but rated funniness with lesser scores, commenting that they were not able to find the stimuli with the highest rating, in essence 'very funny' as the physical humor was lacking the subtlety present in humor that they enjoyed better.

From the above findings, it can be concluded that non-verbal humor processing changes with age, reaching its peak in middle adulthood and declining in later years. These patterns are influenced by intricate interactions between cognitive, emotional, and cultural factors, providing valuable insights into humor processing throughout the lifespan.

## 4 Conclusion

The study researched the impact of aging on humor processing in healthy aging Malayalam-speaking adults. 150 participants were divided into five age groups. The Humor Appreciation Questionnaire was used to select the participants based on their humor exposure. Their non-verbal humor processing was assessed using 10 video clips, which were rated using a funniness rating scale. The study found a significant age-related decline in non-verbal humor processing, particularly after age 60, with cognitive factors like working memory, processing speed, and cognitive flexibility. The interesting finding from the study was the higher performance in the 51-60 age group, indicating the strongest humor processing ability. Non-verbal humor processing peaked in the 51-60 age group, characterized by consistent and high scores. Individuals in this age range often exhibit a unique combination of cognitive strengths and subtle age-related changes that make them particularly adept at processing non-verbal humor. This group benefits from a balance of life experience, emotional stability, and relatively preserved cognitive functions, making them highly effective at interpreting and appreciating non-verbal humor compared to younger age groups, 41-50 years and 31-40 years. A decline in the processing of non-verbal humor was observed after 60 years, with the lowest scores in the 71-80 age group. This decline in processing non-verbal humor was observed after 60 years, with the lowest scores in the 71-80 age group. This decline was attributed to diminished cognitive and emotional abilities and reduced social exposure to humor. Verbal humor elicited stronger laughter responses in younger groups of the age range of 31-60 years compared to older groups' age range of 61-80 years.

The findings highlight the multifaceted nature of humor processing, emphasizing the interaction of cognitive, emotional, and social factors. Younger and middle-aged adults benefit from preserved cognitive functions, rich life experiences, and active social engagements, all of which support humor appreciation and response. In contrast, older adults experience declines linked to neurobiological changes, such as reduced processing speed, working memory, and emotional reactivity. Additionally, generational differences in humor preferences and reduced exposure to humor further exacerbate age-related declines. These results underscore the importance of promoting humor and laughter in older adults as a means of fostering social engagement, emotional well-being, and cognitive health. Future interventions could focus on culturally tailored humor styles and social opportunities to enhance the quality of life for aging populations.

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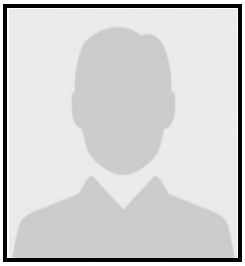

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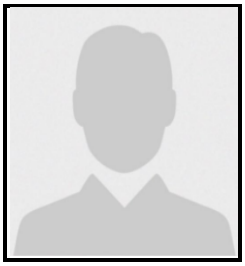

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