

Researchers use a TV sitcom to uncover something about how the brain processes jokes

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Researchers at Western University, Canada, have investigated the neural mechanisms underlying humor processing, specifically focusing on humor comprehension and appreciation. The researchers aimed to delineate the roles of two key brain regions, the dorsal and ventral

striatum.

In a paper, "Establishing the roles of the dorsal and [ventral striatum](#) in [humor](#) comprehension and appreciation with fMRI," [published](#) in *The Journal of Neuroscience*, the team finds the dorsal striatum (DS) was identified as being specifically involved in the [cognitive processes](#) of humor comprehension, while the ventral striatum (VS) played an unexpected role in humor comprehension and was involved in the rewarding aspects of humor appreciation.

The cohort for the study consisted of 26 young, healthy individuals with an average age of 22. Neuroimaging (fMRI) was used to demonstrate the specific roles of DS and VS in humor comprehension and appreciation across different tasks.

In the first "Joke" task, participants were presented with jokes and non-jokes, and they had to identify and categorize them as either jokes or non-jokes. Participants rated the funniness of both joke and non-joke stimuli.

A Seinfeld-viewing task required the participants to watch an episode of the television sitcom Seinfeld. Half watched "The Airport," episode 12 from season 4, while the other half watched "The Movie," episode 14 from the same season.

Moments of humor comprehension were defined as the two seconds preceding the onset of laughter in the laugh track. Incidents of humor appreciation were defined as the middle two seconds of laughter in the laugh track.

The DS was implicated in humor comprehension. Activation in the DS was observed during the contrast of joke stimuli versus non-joke stimuli in both the Joke task and the Seinfeld-viewing task. This suggests that

the DS is involved in cognitive processes underlying the understanding of humor, including inhibiting prepotent responses, cognitive flexibility, and working memory.

Contrary to expectations, the DS did not activate significantly during humor appreciation. The study suggested that DS activation during humor processing is linked explicitly to the cognitive aspects of humor comprehension rather than the rewarding nature of humor appreciation.

The VS was unexpectedly found to be activated during humor comprehension. This suggests that the anticipation of a potential reward or resolution of incongruities may motivate the process of understanding humor, contributing to the cognitive effort involved in humor comprehension.

Consistent with previous literature, the VS showed significant activation during humor appreciation. This aligns with the role of the VS in reward processing and prediction error, indicating its involvement in the rewarding nature of humor appreciation.

While the study mainly focused on the DS and VS brain regions, the researchers captured various other brain regions involved in humor processing. Whole-brain analyses revealed activation in several cortical and subcortical regions during both humor comprehension and appreciation tasks.

The [inferior frontal gyrus](#) was activated during humor comprehension in the Joke and Seinfeld-viewing tasks. Activation in this region is consistent with its role in [language processing](#) and semantic integration, which are crucial for understanding verbal jokes.

The middle temporal gyrus (MTG) showed activation during both humor comprehension and appreciation tasks. The MTG is associated with

semantic processing and plays a role in integrating incongruities or contradictions in information, which is essential for humor processing.

Activation in the temporal pole was observed during humor appreciation in both tasks. The temporal pole has been implicated in [social cognition](#) and understanding complex emotions, making it relevant to appreciating humor.

The right amygdala was activated during humor comprehension in both tasks. The amygdala is linked to emotional processing, and its activation may indicate the emotional response associated with perceiving humor. The amygdala is also involved in alerting to dangerous situations and could be triggered by some of the social dangers associated with the predicaments characters in a Seinfeld episode find themselves in.

The left putamen showed activation during humor comprehension, particularly in the Joke task. The putamen's involvement aligns with its role in cognitive flexibility and inhibition, supporting the cognitive processes underlying humor comprehension.

The left midbrain was activated during humor comprehension in both tasks. Given its association with dopamine signaling, this activation may suggest a role for dopamine in humor comprehension.

The involvement of midbrain dopaminergic signaling in humor processing suggests that future research could explore this aspect using neuroimaging, clinical cohorts, and pharmacological manipulation to gain a deeper understanding of dopamine's role in humor comprehension and appreciation.

Given the involvement of the [dorsal striatum](#) and ventral striatum in humor processing, future research could explore potential clinical implications. For instance, investigating how individuals with disorders

affecting these brain regions, such as Parkinson's, might experience deficits in humor comprehension. Sudden deficits in humor [comprehension](#) or appreciation could also indicate specific [brain regions](#) undergoing stress.

More information: Margaret Prenger et al, Establishing the roles of the dorsal and ventral striatum in humor comprehension and appreciation with fMRI, *The Journal of Neuroscience* (2023). [DOI: 10.1523/JNEUROSCI.1361-23.2023](#)

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