

Envy and Schadenfreude Domains in a Model of Neurodegeneration

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Abstract : The study of moral emotions (i.e., Schadenfreude and envy) is critical to understand the ecological complexity of everyday interactions between cognitive, affective, and social cognition processes. Most previous studies in this area have used correlational imaging techniques and framed Schadenfreude and envy as monolithic domains. Here, we profit from a relevant neurodegeneration model to disentangle the brain regions engaged in three dimensions of Schadenfreude and envy: deservingness, morality, and legality. We tested 20 patients with behavioral variant frontotemporal dementia (bvFTD), 24 patients with Alzheimer's disease (AD), as a contrastive neurodegeneration model, and 20 healthy controls on a novel task highlighting each of these dimensions in scenarios eliciting Schadenfreude and envy. Compared with the AD and control groups, bvFTD patients obtained significantly higher scores on all dimensions for both emotions. Interestingly, the legal dimension for both envy and Schadenfreude elicited higher emotional scores than the deservingness and moral dimensions. Furthermore, correlational analyses in bvFTD showed that higher envy and Schadenfreude scores were associated with greater deficits in social cognition, inhibitory control, and behavior. Brain anatomy findings (restricted to bvFTD and controls) confirmed differences in how these groups process each dimension. Schadenfreude was associated with the ventral striatum in all subjects. Also, in bvFTD patients, increased Schadenfreude across dimensions was negatively correlated with regions supporting social-value rewards, mentalizing, and social cognition (frontal pole, temporal pole, angular gyrus and precuneus). In all subjects, all dimensions of envy positively correlated with the volume of the anterior cingulate cortex, a region involved in processing unfair social comparisons. By contrast, in bvFTD patients, the intensified experience of envy across all dimensions was negatively correlated with a set of areas subserving social cognition, including the prefrontal cortex, the parahippocampus, and the amygdala. Together, the present results provide the first lesion-based evidence for the multidimensional nature of the emotional experiences of envy and Schadenfreude. Moreover, this is the first demonstration of a selective exacerbation of envy and Schadenfreude in bvFTD patients, probably triggered by atrophy to social cognition networks. Our results offer new insights into the mechanisms subserving complex emotions and moral cognition in neurodegeneration, paving the way for groundbreaking research on their interaction with other cognitive, social, and emotional processes.

Keywords : social cognition, moral emotions, neuroimaging, frontotemporal dementia

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