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## Background

Studies on internet gaming disorders indicate that especially online role-playing games have a high addictive potential in particular in male adolescents. These games enable the parallel gaming of multiple users in online virtual worlds with or against each other via their graphical agent (avatar). Recent findings suggest online role-playing addicts to have a deficient self-concept. The latter's potential compensation by means of a higher identification with the own avatar might be an etiological factor in the development of an online role-playing game addiction. On a neurobiological level, especially the left Angular Gyrus (AG) seems to be associated with identification and empathy processes. An according fMRI-based study on long-term gamers of online role-playing games indicated increased brain activations in the left AG during the rating of personality traits referring to the avatar relative to self-referencing and the referencing of close others (Ganesh et al., 2011). However, the extent to which these results represent specific neurobiological mechanisms that are associated with self-concept deficits or a stronger identification with the own avatar in the development of online role-playing game addiction remains unknown to date.

## Methods

N=16 addicted and n=17 regular gamers of online role-playing games (mean age=28 and 26 years, respectively) underwent functional Magnetic Resonance Imaging (fMRI) while 1) completing a Giessen-Test (GT)-derived paradigm assessing participants' concepts of self, ideal and avatar and 2) while viewing and evaluating images of the own person, the own avatar as well as unknown persons. Additionally, a questionnaire referring to the own body image and a Visual Analogue Scale (VAS) for the evaluation of the own as well as avatar's attractiveness, sympathy and gender identity were applied.

## Results

Addicts of online role-playing games rated their body image, gender identity and social response (i.e. social popularity) significantly lower. Neurobiologically, they showed increased left AG activations during the reflection about their avatar (relative to their ideal and/or their self) compared to non-addicted gamers. Furthermore, within-group differences revealed left AG response during the perception of images showing their avatar (relative to images of themselves). In addition, addicted gamers had hypoactivations in the bilateral AG during the perception of images of their own person compared to the perception of unknown persons. The left-lateral AG hypoactivation positively correlated with the degree of the gender identity.

## Discussion

In line with previous findings, our results indicate self-concept deficits in online role-playing game addicts and a stronger identification with the own avatar, which might neurobiologically be reflected in AG activations. The results could point towards problems in the formation of an own identity as a cause for online role-playing game addiction development. Longitudinal studies may shed light on these potentially causal relations.