Neuroscience Campus Amsterdam

Associations between subjective happiness and parietal cortex structure

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Introduction

Recent research on the neurobiological foundations of subjective happiness and life satisfaction points to an association of subjective happiness with volumes of parietal lobe structures, especially of the precuneus (Sato et al., 2015). In the present study we further investigated possible relations of subjective happiness with parietal cortex surface area and thickness.

Methods

Participants (Table 1, top):

In total 341 twins (125 male and 216 female) from the Netherlands Twin Register participated with informed consent.

Subjective Happiness

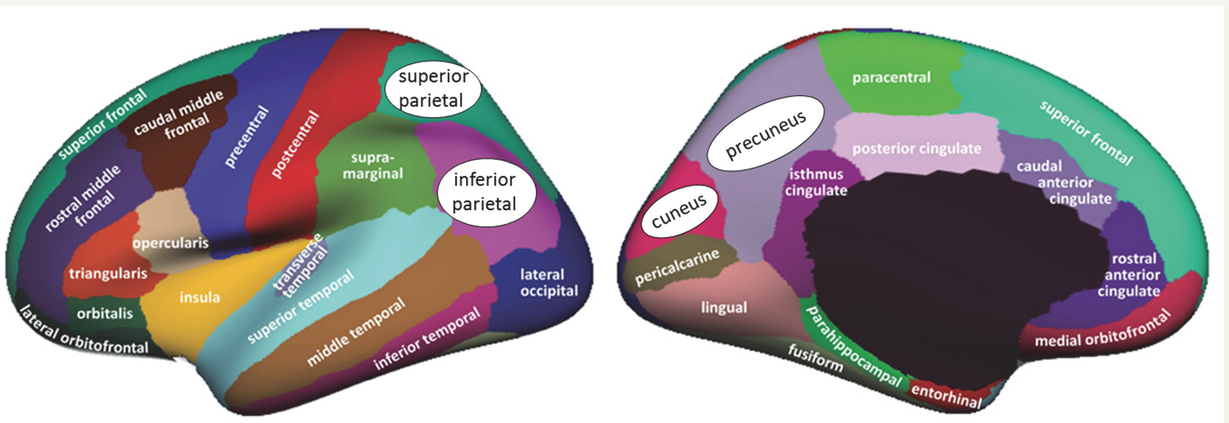
Subjective Happiness was assessed longitudinally (Bartels and Boomsma, 2009) with a 4-item Subjective Happiness Scale (Lyubomirsky and Lepper, 1999). We used mean happiness values across all available scores.

Neuroimaging data:

Measured surface areas of the parietal cortex included 4 regions: cuneus, precuneus, inferior parietal lobe and superior parietal lobe that were estimated using FreeSurfer 5.1 (fig. 1) from MRI scans collected in 3 different MRI studies. (van 't Ent D. et al., 2007) (den Braber A. et al., 2010)(de Geus et al., 2007).

Data Analysis :

We ran mixed models, in SPSS (v.21) based on maximum likelihood estimation. The dependent variable was the normalized mean subjective happiness score and included as fixed effects were: sex, age at MRI, total intracranial volume (ICV), MRI study, and the perspective brain measure. As the data were derived from family members (twins), we added genetic relatedness as a random effect to the models. The corrected alpha level was 0.05/16=0.0031.



Adapted from http://mindboggle.info/data.

Fig. 1: measured parietal cortex areas

Measure	Mean	SD	Range	
Age at MRI	30.1	11.0	11.0	57.0
Mean age of happiness assessment	28.3	10.0	14.5	56.4
Mean happiness score	22.2	4.4	6.0	28.0

Fig. 2: Demographics

Relations between subjective happiness and parietal lobe structure

The linear mixed model results (fig. 3) revealed no associations between subjective happiness scores and cortical thickness for any of the evaluated parietal lobe structures.

Significant associations with measures of parietal surface area were also absent, although the results did point to a tendency for (positive) relations of subjective happiness with surface areas of left (R^2=.014) and right (R^2=.013) inferior parietal regions.

Parietal Brain Region	Hemisphere	Cortical thickness		Cortical Surface area	
		F	Sig.	F	Sig.
Cuneus	L	0.006	0.937	0.001	0.975
	R	0.098	0.755	0.511	0.475
Precuneus	L	0.811	0.368	0.529	0.468
	R	1.714	0.191	0.019	0.890
Inferior parietal	L	0.391	0.533	2.840	0.093
	R	0.087	0.769	4.069	0.044
Superior parietal	L	1.167	0.281	0.287	0.593
	R	1.142	0.286	0.016	0.900

Fig. 3: Mixed model results

Results

Demographics

Demographic data of the participants are shown in fig. 2. Age at MRI and mean age of happiness assessment were highly correlated (R^2=.91, $p < 0.001$), with the MRI scans derived 2 years later, on average. Mean happiness scores showed no associations with age at MRI or happiness assessment. All of the analyzed parietal cortex measures as well as total ICV showed significant negative correlations ($p < 0.001$) with both age measures.

Conclusions

In our substantial dataset, including 341 subjects, we did not find significant correlations between happiness scores and parietal cortex thickness or surface area.

In earlier work, associations between happiness scores and brain regions were commonly assessed from functional activation data (Habel et al., 2005) or, anatomically, using Voxel Based Morphometry (VBM) (Sato et al., 2015).

The present results suggest that associations with brain activation differences or structural brain differences at the resolution level of individual voxels, as observed using VBM, are not supported by structural brain differences at the resolution level of cortical patches as derived from MRI segmentations.

References:

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