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**Authors' reply:** We thank Professors Craddock and Owen for the insightful comments on the possible molecular genetic basis of the relation between epilepsy and psychosis. In most clinical studies of psychosis in patients with epilepsy, individual psychotic vulnerabilities are rarely concerned compared with epilepsy-related factors. However, several large studies have recently demonstrated genetic vulnerabilities to psychosis even in patients with epilepsy.[1,2] Our recent work[3] also demonstrated various factors (i.e. genetic, organic, and epilepsy-related) associated with the development of interictal psychosis in patients with epilepsy.

Psychoses in patients with any central nervous system (CNS) adversity, not only epilepsy but also other brain disorders, can be diagnosed as organic psychosis. The international criteria for mental disorders, either the ICD–10 or the DSM–IV, recognise the traditional dichotomy, i.e. functional and organic psychosis. However, since such CNS adversities are not invariably associated with the development of psychotic states, other additional conditions are required to generate psychotic symptoms. It is known that psychoses after brain injury occur more frequently in people with a family loading of psychoses.[4] Thus, individual (possibly constitutional) vulnerability to psychosis can be considered as a contributing factor to the development of organic psychosis and its severity.

As for classification systems for mental disorders, many limitations of the Kraepelinian dichotomy between schizophrenia and affective disorders have been discussed.[5] Likewise, there appear to be limitations to the dichotomous view of organic and non-organic. The concept of organic psychosis has been useful to classify and treat patients, but it appears too simplistic to explain complex pathogenesis in such patients. It may be time to reconceptualise psychoses in patients with or without diagnosable brain disorders.

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## Heterogeneity of coordinate-based meta-analyses of neuroimaging data: an example from studies in OCD

Two automated, coordinate-based meta-analyses of voxel-based morphometry (VBM) studies comparing individuals with obsessive–compulsive disorder (OCD) and healthy controls have been recently published, respectively, in the *British Journal of Psychiatry*[1] and *Neuropsychopharmacology*.[2] Surprisingly, their results are less concordant than one would have expected. We believe this is largely due to methodological differences across the studies.

In coordinate-based meta-analysis, three-dimensional brain maps are built based on the reported coordinates of voxels of peak statistical difference between groups, with higher values being assigned to voxels closer to these coordinates. The full-width at half maximum (FWHM) value of a Gaussian kernel determines the width of spatial distribution,[1,3,4] thus critically influencing the results. Radua & Mataix-Cols[1] used a 25 mm FWHM kernel, whereas Rotge *et al*[2] set this parameter at 12 mm. Such distinction may explain two differences between their results. First, only Radua & Mataix-Cols reported grey matter increases in the right superior parietal cortex and precuneus, although both studies took exactly the same parietal cortical coordinates ($n = 4$) from the individual VBM investigations. However, these parietal coordinates were not in close proximity to each other, possibly reflecting the spatial uncertainty of OCD-related abnormalities in this area. Since the width of the distribution of voxel values reflects the spatial uncertainty of significant findings,[3] the greater FWHM kernel used by Radua & Mataix-Cols possibly afforded greater sensitivity to detect parietal clusters of grey matter difference. Second, although both studies detected striatal foci of increased grey matter, Rotge *et al*'s findings were confined to the putamen, whereas in the study by Radua & Mataix-Cols these foci spread also to the globus pallidus and caudate nucleus. The greater FWHM value used by Radua & Mataix-Cols probably explains the lower spatial resolution of the striatal foci in their meta-analysis.

Moreover, Rotge *et al* used the activation likelihood estimation method,[4] in which coordinates regarding increased and decreased grey matter are separately computed in independent maps. Conversely, Radua & Mataix-Cols used the signed differential mapping method,[1] in which coordinates for findings of either increased or decreased grey matter are reconstructed in the same map, thus influencing each other. Since VBM studies of OCD have identified foci of both increased and decreased grey matter in the orbitofrontal cortex, this may explain why Radua & Mataix-Cols did not reproduce Rotge *et al*'s finding of grey matter increase in this region of critical relevance to the pathophysiology of OCD.[5]

An additional source of discrepancy relates to the criteria for coordinate selection. Rotge *et al* included all coordinates reported in the selected studies, regardless of statistical thresholds and correction for multiple comparisons. Conversely, Radua & Mataix-Cols employed stricter criteria, thus leading to the inclusion of fewer coordinates (as detailed in their article).[1]

In conclusion, these papers are an example of how methodological differences may critically influence the results of coordinate-based meta-analyses. Therefore, when performing such investigations, one should clearly justify the criteria used for coordinate selection and the choice of other methodological parameters. Future studies using such novel techniques should focus on how to foster greater methodological comparability and reproducibility of results.

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**Authors' reply:** As pointed out by Ferreira & Busatto, one parameter critically influencing the results of a coordinate-based meta-analysis is the FWHM of the kernel. The optimal FWHM has been found to depend on the meta-analytic method.[1] In signed differential mapping (SDM), a 25 mm FWHM shows a good compromise between sensitivity and control of false positives.[2] This FWHM may account for different sources of spatial error such as registration mismatch, the size of original clusters or the location of the peak coordinates within the clusters. Much smaller FWHMs are common in activation/anatomical likelihood estimation (ALE), usually 10–15 mm.[3] However, the use of these small FWHMs has not been clearly justified and it might lead to a dramatic reduction in sensitivity. Salimi-Khorshidi *et al*[1] found that the sensitivity of the ALE method with a standard deviation of 5 mm (corresponding to 10–15 mm FWHM) was approximately 50% of the sensitivity achieved with a standard deviation of 15 mm (corresponding to 35 mm FWHM).

Other limitations of ALE may be more serious[2,4] and have motivated the development of other methods such as SDM.[2] For example, coordinates of increased and decreased activation (or, in this case, grey matter volume) are computed separately. This means that when calculating the meta-analytic increase in a voxel, the (negative) values of those studies reporting decreases in the same voxel are artificially replaced by zeros, leading to an inflation of the meta-analytic increase. Similarly, when computing the meta-analytic decrease, the (positive) values of those studies reporting increases in the same voxel are artificially replaced by zeros, leading to an inflation of the meta-analytic decrease. Therefore, brain regions with higher variability are more likely to be detected as significant in the meta-analysis, to the extent that some brain regions may appear to have both increases and decreases at the same time (e.g. see Menzies *et al*[5]). This is both mathematically and physiologically implausible. Another advantage of SDM is the strict inclusion of coordinates that are statistically significant at the whole-brain level and using the same threshold throughout the brain.[2] This is of utmost importance given that it is not uncommon in neuroimaging studies that some regions (e.g. *a priori* regions of interest) are more liberally thresholded than the rest of the brain, thus potentially leading to false positives.

Unfortunately, psychiatric neuroimaging is plagued with methodological problems such as small sample sizes and overly liberal statistical methods, often making findings hard to replicate. Meta-analytical methods have the potential to overcome some of these limitations by helping researchers 'see the forest before the trees'. However, if the methods or its parameters are not chosen rigorously, meta-analyses may suffer from the same problems that motivated their development in the first place.

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## Correction

Association between extreme autistic traits and intellectual disability: insights from a general population twin study. *BJP*, **195**, 531–536. Table 1 (p. 534): the figures in parentheses are upper and lower boundaries (+/–) of the 95% confidence intervals, calculated using corrected standard errors (not s.d. values, as originally reported). The online version of this table has been corrected post-publication in accordance with this correction.

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