Appendix A. Full width at half maximum (FWHM)

The FWHM parameter can be used to describe the smoothness of experimentally observed 1D residuals (Fig.1d, main manuscript). Most generally, the FWHM describes the shape of a Gaussian kernel (Fig.A1), which is typically defined as:

$$g(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} \tag{A.1}$$

Here μ and σ are its mean and standard deviation, respectively. Gaussian kernels can alternatively be expressed in terms of the FWHM (Fig.A2) through the following identity:

$$\text{FWHM} = 2\sigma\sqrt{2\log 2} \approx 2.4\sigma \tag{A.2}$$

The FWHM is somewhat more-intuitive than σ for describing 1D field smoothness because it is linked directly to kernel height: the kernel loses half of its maximum height over a distance of 0.5 FHWM units (Fig.A2). More specifically, the FWHM represents the width of a Gaussian kernel which, when convolved with uncorrelated Gaussian data (Appendix B), yields 1D Gaussian trajectories with the same smoothness as the observed 1D residuals.

Random field theory (RFT) (Adler & Taylor, 2007; Friston et al. 2007) regards experimentally observed 1D residuals as 1D random fields, and uses the estimated FWHM value to describe the probabilistic behavior of an infinite number of identically smooth fields. Thus, once one knows or estimates the FWHM, one can use RFT to calculate the maximum 1D differences / effect that random 1D fields would produce in arbitrary experiments.

While σ could be used in place of the FWHM to describe field smoothness, the main manuscript uses the FWHM parameter preferentially over σ because: (i) σ is typically used to represent population standard deviation, and (ii) the literature convention is to use FWHM (Friston et al. 2007).

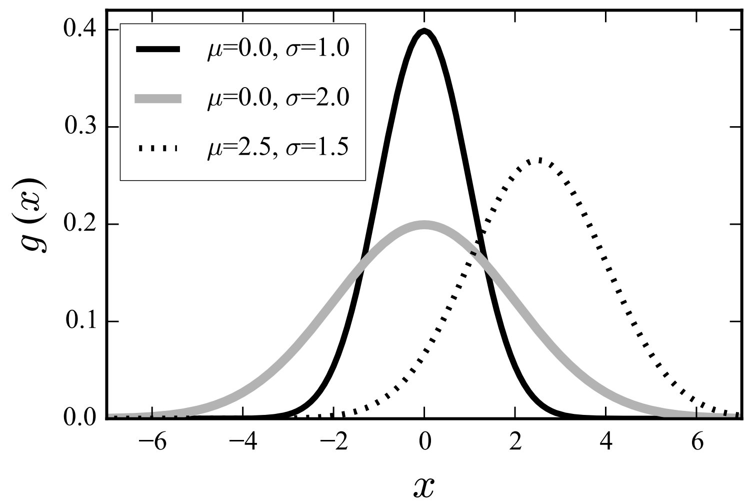

Figure A1: Gaussian kernels.

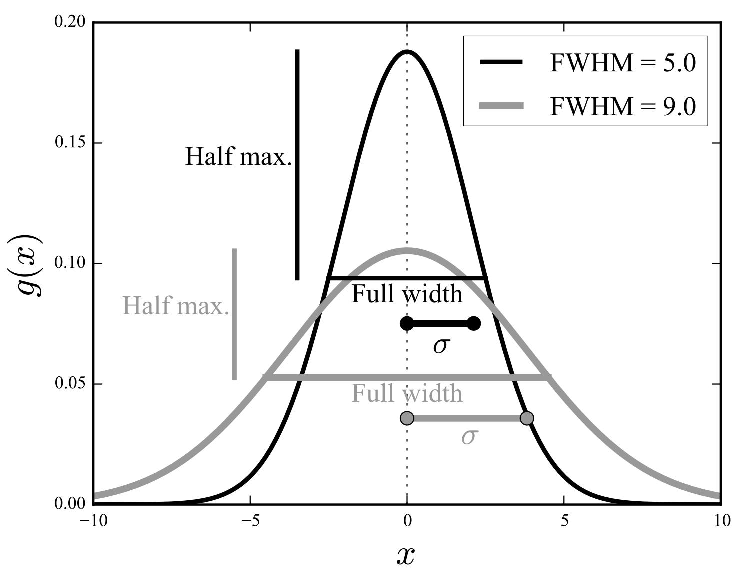

Figure A2: Breadth parameters for Gaussian kernels: σ and FWHM.