Appendix A Terminology

Table A.1 and Fig.A.1 below summarize the power-relevant terminology used in the main manuscript. A brief discussion follows.

Table A.1: Power-related terminology.

Category	Term	Description
Data dimensionality	Univariate data	Scalar data
	Multiivariate data	Vector data
Measurement domain dimensionality	0D data	Univariate or multivariate data; the type of data analyzed by most commercial statistical software
	1D data	Univariate or multivariate data which vary continuously over a continuous one-dimensional (1D) domain, usually space or time
Data model components	Signal	Expected mean deviation from a datum (Fig.A.1). Units: same as observation.
	Noise	Residuals about a datum (Fig.A.1). Units: same as observation.
	Effect	Noise-normalized signal (Fig.A.1). Unitless.
Hypothesis testing	Null hypothesis (H0)	A testable statement of equality (e.g. Force change = 0)
	Alternative hypothesis (H1)	A non-testable statement of inequality (e.g. Force change > 0)
Probability	Type I error (α)	The probability of rejecting H0 when it is true
	Type II error (β)	The probability of failing to reject H0 when it is false
	Power (1 - β)	The probability of rejecting H0 given an alternative true effect
1D power types	Omnibus power	The probability of rejecting H0 at any point in a 1D continuum; i.e. in unconstrained 1D hypothesis testing
	Center of interest (COI) power	The probability of rejecting H0 within a given radius about a specific point in a 1D continuum; i.e. in regionally-constrained 1D hypothesis testing.
	Point of interest (POI) power	The probability of rejecting H0 at a specific point in a 1D continuum; i.e. in point-constrained 1D hypothesis testing. Equivalent to 0D power when a single continuum point is selected in an *a priori* manner for hypothesis testing.

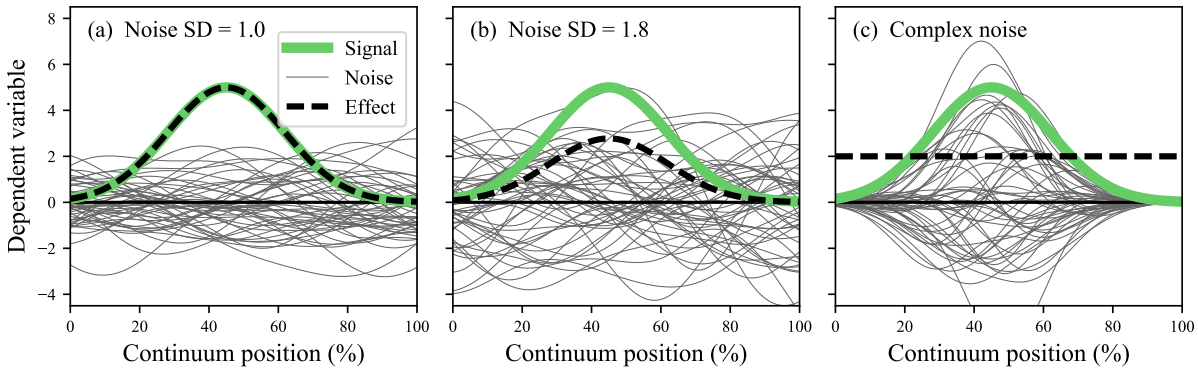

Figure A.1: Power-relevant terminology: "signal", "noise" and "effect". The goal of power analysis is to determine the probability of detecting a signal given the underlying noise. That probability is related most closely to the effect size, or signal-to-noise ratio. (a) An arbitrary signal and smooth Gaussian noise with a constant standard deviation (SD) of 1.0. (b) Same as (a) but with a constant SD of 1.8; since the noise is greater and also constant across the continuum the effect is uniformly compressed. (c) Same as (a) but with irregular, complex noise; in this particular case the noise amplitude scales with the signal so the effect is constant across the 1D continuum.

Discussion

Standard power theory and most commercial software packages deal exclusively with 0D data. Their relations to 1D data can be elusive because it is usually difficult to justifiably reduce a 1D observation to a specific 0D metric in an *a priori* manner (Pataky et al., 2013). Moreover, power-relevant terminology is not readily translatable to 1D data. For 0D data the 'effect' is simply the signal-to-noise ratio, but for 1D data the relation amongst signal, noise and effect can be more complex because both signal and noise magnitudes can change across the 1D domain (Fig.A.1), and also because noise can be signal-dependent, implying that a constant effect size implies neither constant signal nor constant noise. Furthermore, adjacent values in time are often highly correlated due to the viscoelastic nature of biological tissues, implying that 0D approaches, which neglect this temporal correlation, are generally not valid for smooth 1D data analysis.

There are three separate types of power that exist in 1D power analysis: point-of interest (POI), center-of-interest (COI) and omnibus (Figs.3,6, main manuscript) (Pataky, 2017). The POI power continuum shows the probability of rejecting the null hypothesis at each continuum point. The COI continuum shows power increases associated with extending the hypothesis testing scope to adjacent continuum nodes. The omnibus power represents the power of rejecting H0 anywhere in the continuum. By definition, POI power <= COI power <= omnibus power. COI powers are equivalent to POI and omnibus powers when the COI radii are zero and 100%, respectively.