

# The p-value from a research-process perspective

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P-value testing is for scientists, not statisticians. That's what I'm going to argue for here anyway, since I keep seeing articles cropping up that seem to me to contain a lot of somewhat dubious or one-sided reasoning, and no real reference to what the p-value might actually be good for.

In science, we're looking for interesting regularities, for order: precisely such patterns that the null hypothesis will be unlikely to produce. Ideally, we want everyone in group A to score higher than anyone in group B. We want every increase in  $x$  to cause an increase in  $y$ . And so forth. After we find such data, we'll think about models for them.

I think that what p-values really provide is a measure for the quality of data. Saying that some attribute of the data would be easy to generate randomly is a way of saying the data are noisy, irregular, unordered. From a research-process perspective, the p-value is a natural and important warning signal: we're more interested in low- than high-p-value data, because we're more interested in regularity than in noise.

P-values by no means demand we don't use other statistical methods, if e.g. we want to compare models' likelihoods. In practice, furthermore, it's very commonly accepted that cut-offs shouldn't be taken too seriously. They can be wielded quite flexibly, e.g. in fMRI, where they can almost be reduced to a visualization aid. But since there's so much data around, a cut-off is just practical. We have to choose which results to focus on. The most ordered, and hence most likely to be reproducible data will always be most likely to survive such a decision process. Where the cut-off lies could just be left to evolve. If five percent seems to work, then OK; where it doesn't people will adapt, and we get alternatives like the false discovery rate.

Clearly, what people mustn't do is get confused about their statistics in, especially, medical trials. But surely this is a problem with statistics (or just maths, or just:) education, not the p-value itself.