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neuroscience

**PERSPECTIVE**

# **Erroneous analyses of interactions in neuroscience: a problem of significance**

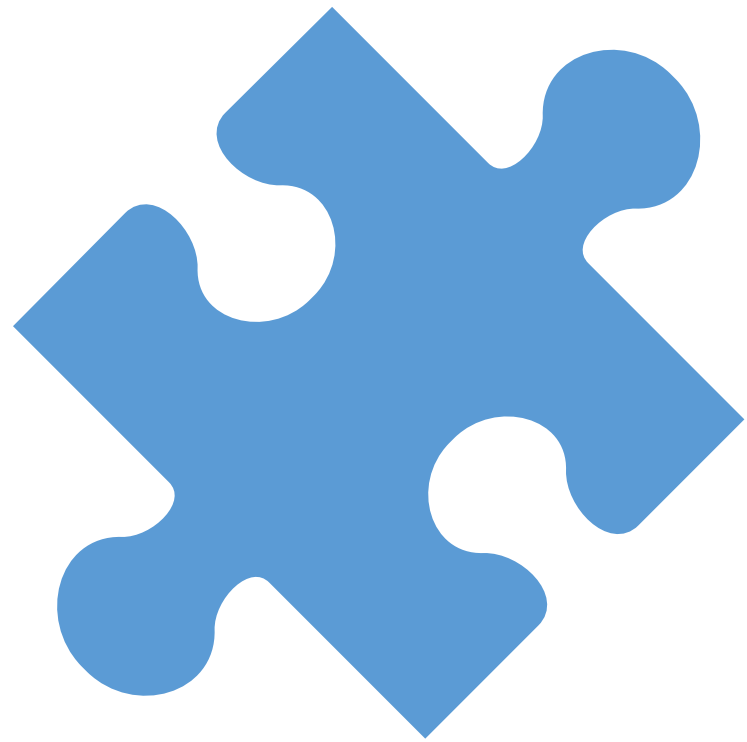
Sander Nieuwenhuis<sup>1,2</sup>, Birte U Forstmann<sup>3</sup> & Eric-Jan Wagenmakers<sup>3</sup>

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Lunchtime Data Club, Nottingham, UK

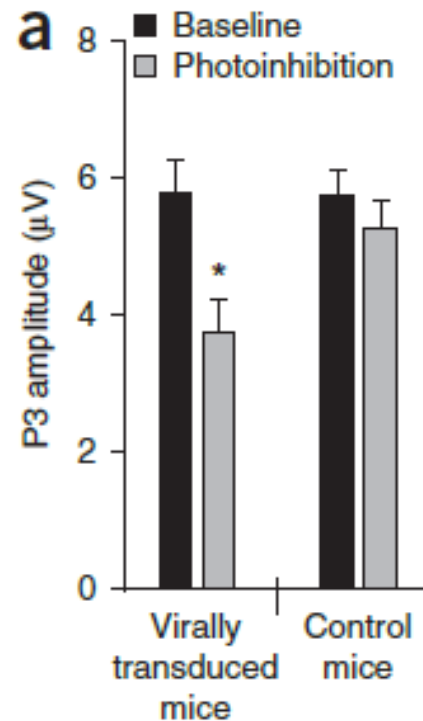
08/02/2023



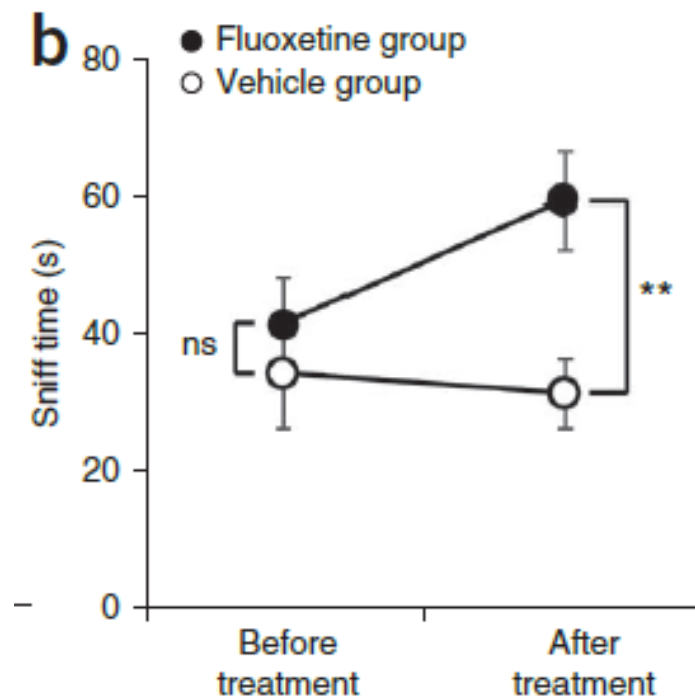
Pop Quiz!!

Optogenetic photoinhibition of the locus coeruleus decreased the amplitude of the target-evoked P3 potential in virally transduced animals ( $P = 0.012$ ), but not in control animals ( $P = 0.3$ ).

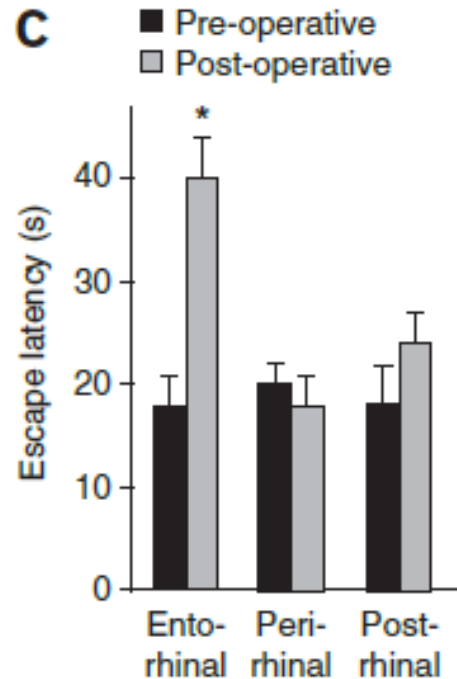
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Acute fluoxetine treatment increased social approach behaviour (as indexed by sniff time) in our mouse model of depression ( $P < 0.01$ )



Escape latency in the Morris water maze was affected by lesions of the entorhinal cortex ( $P < 0.05$ ), but was spared by lesions of the perirhinal and postrhinal cortices (both  $P$  values  $> 0.1$ ), pointing to a specific role for the enthorinal cortex in spatial memory.



- The difference between “significant” and “not significant” is not itself statistically significant (Gelman & Stern Am. Stat. 2006)
- Surely, God loves the 0.06 nearly as much as the 0.05 (Rosnow & Rosenthal Am. Psychol. 1989)

at the brink of significance ( $p=0.06$ )  
at the cusp of significance ( $p=0.06$ )  
at the edge of significance ( $p=0.055$ )  
at the limit of significance ( $p=0.054$ )  
at the limits of significance ( $p=0.053$ )  
at the margin of significance ( $p=0.056$ )  
at the margin of statistical significance ( $p<0.07$ )  
at the verge of significance ( $p=0.058$ )  
at the very edge of significance ( $p=0.053$ )  
barely below the level of significance ( $p=0.06$ )  
barely escaped statistical significance ( $p=0.07$ )  
barely escapes being statistically significant at the 5% risk level ( $0.1>p>0.05$ )  
barely failed to attain statistical significance ( $p=0.067$ )  
barely fails to attain statistical significance at conventional levels ( $p<0.10$ )  
barely insignificant ( $p=0.075$ )  
barely missed statistical significance ( $p=0.051$ )  
barely missed the commonly acceptable significance level ( $p<0.053$ )

<https://mchankins.wordpress.com/2013/04/21/still-not-significant-2/>

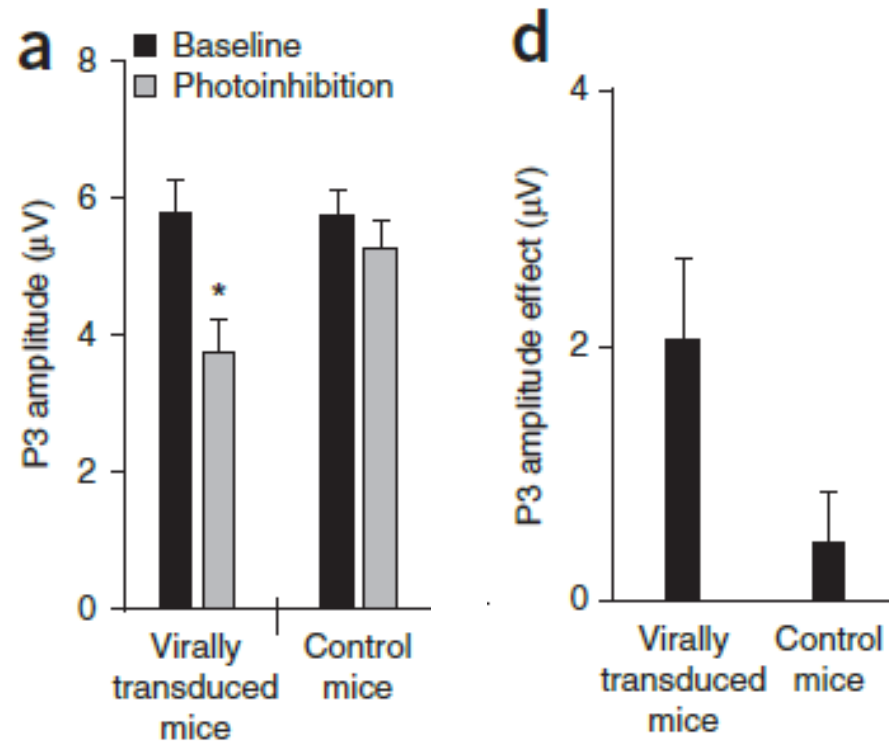


**Table 1 Outcome of the main literature analysis**

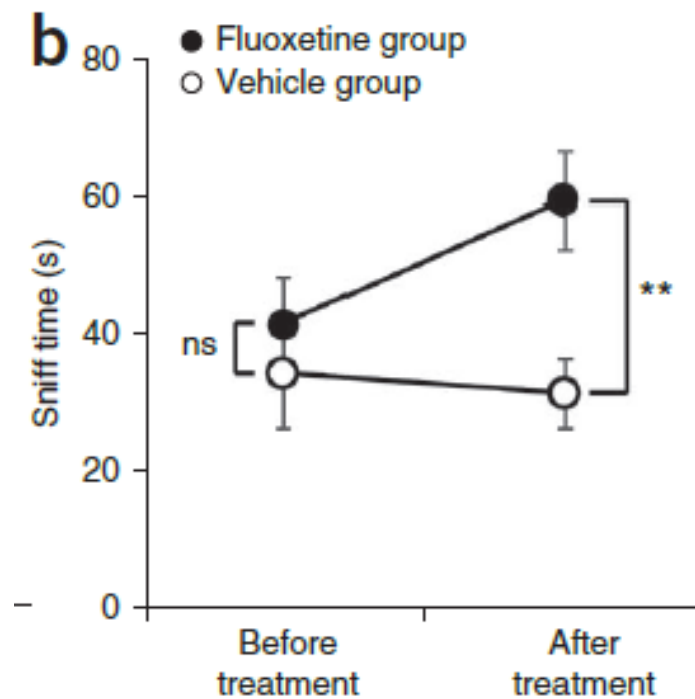
	<i>Nature</i>	<i>Science</i>	<i>Nature Neuroscience</i>	<i>Neuron</i>	<i>Journal of Neuroscience</i>	Summed
Total reviewed	34	45	117	106	211	513
Correct count	3	9	17	13	36	78
Error count	7	11	16	15	30	79

For this analysis, we included every article of which the abstract referred to behavior, cognitive function or brain imaging.

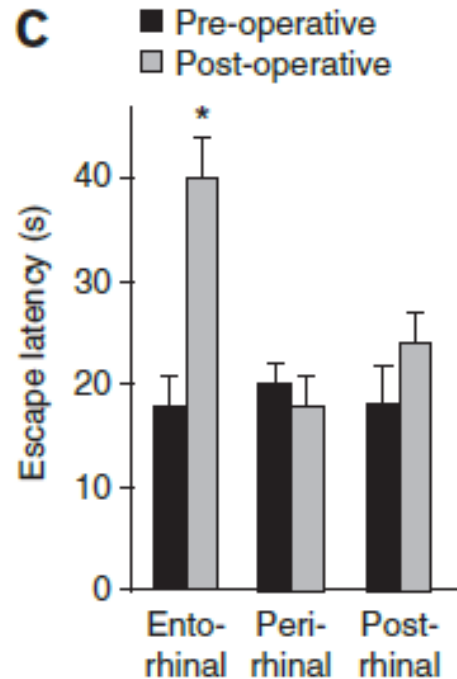
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# Other issues

1. Interpreting p values (rejecting  $H_0$  or accepting  $H_1$ )
2. Beyond p values – Reporting effect sizes and other approaches
3. Correcting for multiple comparisons
4. Choosing the right ANOVA
5. Power analysis
6. Rank vs. parametric tests
7. Dealing with correlated variables
8. Nested models and model comparisons
- ...



SCIENCE FORUM

# **Ten common statistical mistakes to watch out for when writing or reviewing a manuscript**

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