The battle for reproducibility over storytelling

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This issue of *Cortex* plays host to a lively debate about the reliability of cognitive neuroscience research. Across seven Discussion Forum pieces, scientists representing a range of backgrounds and career levels reflect on whether the “reproducibility crisis” – or “credibility revolution” (Vazire, 2018; Munafò et al., 2017) – that has achieved such prominence in psychology has extended into cognitive neuroscience. If so, they ask, what is the underlying cause and how can we solve it?

Huber, Potter and Huszar (2019) set the scene by describing their experience of attempting to replicate a high-profile experiment, and after finding that the original results could not be reproduced, having their manuscript rejected by the same journal that published the original claims – in this case, *Nature Neuroscience*. Although their replication was eventually published (in *Cortex*; Potter et al., 2018), Huber et al. suggest that our discipline has lagged behind neighbouring fields in valuing replication, and that despite pockets of innovation, we have in general failed to participate in psychology’s credibility revolution. They conclude by suggesting two concrete reforms: first that cognitive neuroscience journals should raise initial standards for publication, including increased checking of reliability (through replication and study preregistration), and second, that we should develop more efficient means for correcting the literature in light of future replication attempts.

Six sets of authors then respond to Huber et al.’s arguments. In the first reply, Schwarzkopf (2019) questions whether requiring studies to be replicated prior to publication could in fact worsen publication bias by determining which studies are published based on their results. Instead, Schwarzkopf argues that we should label unverified claims as “pending replication” and raise the profile of work that is transparently exploratory. At the same time he believes that deeper cultural reforms are necessary, warning that “nothing will change unless we change” by favouring quality over storytelling on grant panels, job committees, and editorial boards.

In a second reply, Wall (2019) argues that increasing the reliability of cognitive neuroscience will require more than merely altering our evaluation standards, calling for increased scrutiny of the reliability of our experimental tools in the first place. Using functional magnetic resonance imaging as an example, he shows that the reliability of various experimental tasks and paradigms is rarely examined and a likely barrier for participation in the reform movement. Without knowing the reliability of

these techniques and then standardizing our approaches accordingly, the overall reliability of cognitive neuroscience will hit a glass ceiling, regardless of whatever other rules or incentives are in place.

In a third reply, Hobson (2019) maintains that an additional key ingredient for promoting reliability is a shift away from combative peer review, which Huber et al. identify as an unhelpful element of their experience at *Nature Neuroscience*. Where replication studies are reviewed by the original authors, Hobson suggests that such review is most productive when results-blind (as in Registered Reports) and as part of an adversarial collaboration in which competing hypotheses are tested simultaneously by opposing teams. This approach, she suggests, would not only move the field forward together but would focus attention on generating precise and falsifiable theory.

To what extent are these reforms sensitive to the pressures faced by early-career researchers (ECRs), the primary workforce within cognitive neuroscience? In a fourth reply, Maizey and Tzavella (2019) warn that any reforms of cognitive neuroscience that do not account for needs of the ECR community are destined to fail. They suggest that the pressure to pursue novel research is greatest among ECRs, and so “replication and extension” may provide a preferred route over replication alone. At the same time they support Huber et al.’s proposal for linking replications with original studies because doing so will afford them greater prominence in the literature, and thus provide greater incentive for engagement by ECRs. Together with a host of initiatives to encourage ECRs to pursue collaborations and adopt open research methods, Maizey and Tzavella conclude that initiatives to promote replication and reproducibility can succeed, if delivered carefully.

In a fifth reply, Inzlicht (2019) reflects on the journey that cognitive neuroscience is now starting to take – one that psychology, and social psychology in particular, has already begun. “What the neuroscience establishment does next...is critical”, he counsels. Neuroscience, like psychology, must learn that admitting errors and thereby prioritising quality over reputation is crucial for reform. Calls for scientists to rise above their fallible human nature can sometimes feel empty, even naïve, but Inzlicht’s appeal is strengthened by his own track record. In 2018, he and his team published a Registered Report in *Cortex* that attempted to replicate one of his own

previous experiments (Elkins-Brown et al., 2018). Upon failing to reproduce their own results they concluded that “[t]hese findings are consistent with the view that our original study may have been a false positive”, taking that rarely trodden path of casting doubt on their *own* previous claims. Inzlicht thus walks the walk in championing reproducibility over reputation, and from his example we learn that self-criticism offers the opportunity for cognitive neuroscientists to build a new and different kind of reputation.

Finally, Arguello – a former editor at *Nature Neuroscience* – provides a critical market perspective on the challenges not only facing cognitive neuroscience but science in general (Arguello, 2019). Drawing an analogy to the news media, Arguello offers an unflinching assessment of publishers, noting that although they “tout the value of replications and pay lip service to other reformative practices, their policies in this regard are often vague and non-committal”. He welcomes the “short-term fixes” proposed by Huber et al, but concludes that the elevation of scientific quality to its rightful place will require something far more radical – that the scientific community wrestles the entire process from the grip of publishers, and in doing so decouples how we evaluate, publish and curate knowledge.

What should these comments lead us to conclude? Readers will be aware that *Cortex* is a strong advocate for open cognitive neuroscience and neuropsychology, being the first journal in basic science to offer Registered Reports (Chambers, 2013) and Exploratory Reports (McIntosh, 2017), and then in 2018 launching the Transparency and Openness and Promotion (TOP) guidelines and Badges for Open Practices (Chambers, 2018a). The contributions to this Forum, however, remind us that normalising reproducible research practices within cognitive neuroscience remains a formidable challenge. We cannot afford to be complacent.

To this end, in 2019 we will be introducing two additional reforms. First, we will be joining *Royal Society Open Science* in adopting an Accountable Replications policy (Chambers, 2018b) in which we will guarantee to publish any methodologically sound replication any previous study published within *Cortex*. Second, we will be creating a brand new article type, tentatively called *Verification Reports*, as a track for authors seeking to test the analytic reproducibility and robustness of previous conclusions using the same data from the original article. While these are relatively small steps,

they take us closer to creating a more reliable and impactful knowledge base, and we will share more details about them in due course.

Collectively the articles in this Forum show that the cognitive neuroscience community cannot afford to remain silent in discussions about reproducibility. With the recent establishment of the UK Reproducibility Network, which is supported by a wide range of UK funders, publishers and regulators (Munafò, 2018), the next 5-10 years are going to witness an unprecedented period of structural reform, including a combination of mandates and incentives that will elevate reliability up the scientific and political agenda. If storytelling in science matters then it is the story of our future scientific culture that matters the most. These chapters are being written as we speak and it is crucial that cognitive neuroscience takes a seat at the table.

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