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Registered Reports: Realigning incentives in scientific publishing

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Recent years have witnessed growing concerns that despite a proud legacy of discovery, the reproducibility of scientific research is being undermined by lesser goals. Within the life and social sciences, there is now clear evidence for a prevalence of publication bias within journals (Faneli, 2010), selective reporting of desirable statistical outcomes (John et al., 2012; Simmons et al., 2011; Ware and Munafò, 2015), hindsight bias in which researchers present a hypothesis derived from data as *a priori* (John et al., 2012; Kerr, 1998), lack of data sharing (Wicherts et al., 2011; Wicherts et al., 2006), failure to consider statistical power (Bezeau and Graves 2001; Button et al., 2013; Cohen, 1962), and near absence of direct replication (Makel et al., 2012). These practices have proliferated within an incentive structure that places the immediate career needs of individual scientists in opposition to the longer-term objectives of science (Nosek et al., 2012).

In 2013, *Cortex* launched the Registered Reports initiative in an effort to realign these incentives (Chambers, 2013). In contrast to conventional publications, Registered Reports focus the power of peer review on the quality and rigour of experimental design, rather than assessing which manuscripts to publish based on whether results are deemed novel or groundbreaking. Registered Reports are thoroughly reviewed and revised before researchers collect data. Study proposals that are judged to be methodologically valid, detailed, replicable, and which address an important scientific question are then offered *in-principle acceptance*, in which the journal agrees to publish the results regardless of whether they confirm or disconfirm the experimental hypothesis. This mechanism prevents publication bias while also minimising, as much as possible, potential influences of selective reporting, *post hoc* hypothesising, and low statistical power. Most importantly, by making the outcomes of hypothesis tests *irrelevant* in reaching editorial decisions, Registered Reports minimise the incentive for authors to engage in questionable research practices in the first place.

At this stage, readers may be interested to know some practical details of the Registered Reports review process. The *Cortex* editorial sub-team generally triages submissions with 1 week, deciding either to reject manuscripts outright, to invite a revision to meet the necessary standards for further consideration, or to send the manuscript immediately for Stage 1 in-depth review. Not including the time taken for authors to implement revisions, Stage 1 has taken approximately 8-10 weeks to

move from initial review to in-principle acceptance (including, so far, 1-3 rounds of review). Once authors have completed their study, Stage 2 review has so far required approximately 4 weeks for a final editorial decision.

The current issue sees the first fruits of this labour: a Registered Report by Jona Sassenhagen and Ina Bornkessel-Schlesewsky from the University of Marburg and the University of South Australia (Sassenhagen and Bornkessel-Schlesewsky, in press). Sassenhagen and Bornkessel-Schlesewsky pre-registered an experiment that tested whether the P600, an electrophysiological waveform associated with language processing, is in fact an instance of the P3, a waveform associated with attentional reorienting. Their results are consistent with this hypothesis – these waveforms, considered distinct by some previous studies, may in fact reflect the same underlying neural process. Readers will note that the format of the article looks very much like a standard research report – under the *Cortex* model, the approved protocol is held in reserve and only published at the end of the process once integrated with the findings and discussion.

As we recognise this important moment for *Cortex*, we also take the opportunity to reiterate our view that Registered Reports should not be seen as a one-shot cure for reproducibility problems in science. The applicability of Registered Reports to different sub-fields within neuropsychology and cognitive neuroscience remains to be established; for instance, studies that rely exclusively on exploration rather than deductive hypothesis testing may not be compatible. Registered Reports present no threat to exploratory science – in cases where studies include a mixture of both hypothesis testing and exploratory analyses, authors are welcome to report the outcomes of the unregistered analyses, as Sassenhagen and Bornkessel-Schlesewsky do in the current issue. Pre-registration simply allows readers to distinguish the outcomes based on *a priori* hypothesis testing from *post hoc* exploration.

Over the coming months, *Cortex* readers will see more Registered Reports appearing as increasing numbers of submissions move through the pipeline toward completion. At this time we extend our thanks to many critical friends who have helped us improve the Registered Reports mechanism, both before the launch and

along the way. We also especially thank the reviewers and authors who are making Registered Reports possible. With the continuing support of the scientific community, we believe this format opens the door to a new kind of science, a new incentive structure, and, in our view, a more sustainable and reproducible knowledge base.

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