



Ethology adopts the STRANGE framework for animal behaviour research, to improve reporting standards

Following a consultation process, the editors of *Ethology* have decided to adopt the STRANGE framework for animal behaviour research (Webster & Rutz, 2020). It seems fitting that the world's oldest behavioural biology journal (founded in 1937) should become the first to implement these new guidelines, making an important contribution to ongoing efforts to improve reporting standards and reproducibility in the field.

The STRANGE framework was designed to help scientists identify, mitigate and report sampling biases in animal behaviour research and allied fields (Webster & Rutz, 2020). The acronym STRANGE stands for: Social background; Trappability and self-selection; Rearing history; Acclimation and habituation; Natural changes in responsiveness; Genetic make-up; and Experience. STRANGE draws attention to the fact that, in many laboratory and field studies, samples of test subjects may be unwittingly biased with regard to one or several of these seven factors, with implications for the generalisability and reproducibility of findings. Our original article provided a point-by-point discussion of STRANGE, an extensive collection of examples, clarification of important conceptual issues, and detailed guidance for researchers and journals (Webster & Rutz, 2020). Readers are encouraged to consult this information, but for the purposes of this editorial, a brief introduction to the framework's basic rationale and practical implications shall suffice.

Problems arise whenever samples of animal subjects are not representative of the wider populations for which researchers seek to draw inferences. STRANGE provides a framework for assessing if this concern applies to a given study, and (if it does) offers guidance on how to ensure that papers reporting the work include sufficient detail to enable robust evaluation and replication. For illustrative purposes, let us take the letter "T" in STRANGE, which stands for "Trappability and self-selection." It is well known that in many study systems, only subjects of a particular "personality" type may enter traps or participate voluntarily in experimental trials (for examples and references, see Webster & Rutz, 2020). This means that a study may have to rely on data from a non-random subsample of subjects, which is problematic if the researchers' aim was to chart the behaviour of the wider population. Another common problem is that subjects may only exhibit certain behaviours because of their rearing history or participation in earlier experiments (factors "R" and "E," respectively)—again, this may significantly limit the generalisability of a study's findings.

While the STRANGE framework can be used productively for improving the design of new studies at the planning stage (this is

the "design" step in the "3D approach" proposed by Webster & Rutz, 2020), we will focus here on its second purpose, which is to support the publication of completed research. So, what does STRANGE mean in practice for researchers preparing manuscripts for submission to *Ethology*? For any manuscript reporting research on animal subjects—whether conducted in the laboratory or in the field, whether experimental or observational in nature—the journal will from now on ask authors to follow two simple steps (these are the "declare" and "discuss" steps outlined by Webster & Rutz, 2020; for further details, please consult the journal's updated author guidelines: <https://onlinelibrary.wiley.com/page/journal/14390310/homepage/forauthors.html#policies>).

First, authors should provide relevant attribute information (e.g. origin, sex, age, personality type, housing conditions, past opportunities for individual and social learning, and experimental history) both for the subjects that contributed data to the study and for those that had to be excluded (as a guide, see the sample questions provided in Table S1 in Webster & Rutz, 2020). This should follow the well-established ARRIVE guidelines (Percie du Sert, Ahluwalia, et al., 2020; Percie du Sert, Hurst, et al., 2020), with a few additions (Webster & Rutz, 2020), and can employ whatever format seems most helpful. In many cases, some additional text in the methods section, a supplementary table, or a citation of an earlier publication or online resource will be sufficient. Second, authors should add two brief statements to the main text of their article. In the methods section, they should evaluate—based on the information provided—the "STRANGEness" of their sample of animal subjects, including a discussion of potential sampling biases and of any steps that were taken to mitigate biases (such as using different trap designs or adjusting testing protocols, to facilitate more inclusive sampling). Additionally, in the discussion section, authors should explain how potential biases may limit the generalisability of the reported findings. This is where the results should be linked explicitly to the test sample, to ensure that all claims are fully supported and do not over-reach. Usually, only a handful of sentences will be required to achieve the necessary degree of transparency. Where certain factors do not apply, or authors have insufficient information to judge if they apply, this should simply be stated.

We wish to clarify a few important points. First, we are fully aware that researchers are overstretched, so having to deal with yet another reporting requirement may seem daunting at first. The good news is that the STRANGE recommendations were designed to be deliberately "light touch"—they ask for very little extra work during

manuscript preparation and may actually save time over the course of the review and revision process, as editors and referees often request clarifications about the very issues that are covered by the framework. Second, we believe it is important not to be overly prescriptive about how authors should provide additional information. In fact, the STRANGE recommendations do not include compulsory checklists, but instead empower researchers to judge for themselves which information needs declaring and discussing for their particular studies (*Ethology* is considering whether to collate key information in a “reporting summary”). There is also flexibility with regard to presentation: for example, in some cases, a combined statement may be more effective than two separate statements in the methods and discussion sections—three recent papers nicely illustrate this approach (Cely Ortiz & Tibbetts, in press; Ghazanfar et al., 2020; Marshall et al., 2020). And, finally, providing a transparent account of potential limitations will not be held against authors during peer review. Editors know that there are no “perfect” studies and that all animal behaviour research involves compromises. In fact, there are often compelling ethical, scientific or practical reasons for studying biased samples of subjects (Webster & Rutz, 2020). STRANGE is pragmatic in this regard and does not intend to penalise authors—it simply advocates transparent reporting of potential limitations. So, as long as the work falls within *Ethology*'s remit, is deemed to be of sufficient interest and is technically sound (i.e. there are no serious methodological flaws), the declarations will simply serve the purpose of honing a study's claims (to ensure that they do not overextend) and of providing readers with sufficient information to evaluate and replicate the work.

We hope that prospective authors will not consider these new requirements as a tedious box-ticking exercise. The STRANGE framework tries to make a useful contribution by inviting researchers to briefly pause during manuscript preparation, to evaluate potential sampling biases and formulate precise claims. Discussions with many colleagues over the years, and an enthusiastic response to our comment article that introduced STRANGE, indicate that the community is ready to embrace this opportunity to further improve reporting standards. Lots of people have stories to tell about particularly “cooperative” or “shy” subjects in captive populations, the difficulty of trapping some individuals in wild populations, or the effects of past experimental experience or testing protocols on behavioural performance. The STRANGE framework provides a means of formally articulating these concerns in research articles (Webster & Rutz, 2020), and is supported by other recent calls to evaluate more carefully how study outcomes are affected by subjects' attributes (Whittaker & Hickman, 2020) and the composition of test samples (Voelkl et al., 2020). A detailed discussion of how STRANGE aims to improve reproducibility in animal behaviour research will be presented elsewhere. Incidentally, we believe that *Ethology* would be an excellent outlet for any articles that examine the core issues spotlighted by STRANGE, both via systematic review of published literature or empirical investigation.

The STRANGE framework was inspired by efforts to address sampling biases in human experimental psychology where studies

routinely use participants from non-representative WEIRD (Western; Educated; Industrialized; Rich; Democratic) societies to draw general inferences about human psychology (Henrich et al., 2010). While more work remains to be done, the WEIRD concept succeeded in highlighting this important issue, initiating productive discourse, identifying a path for improving research practice and generating new research opportunities (Apicella et al., 2020; Rad et al., 2018). STRANGE has the potential to serve a similar purpose for research on non-human animals. We are excited that *Ethology* has committed to supporting these efforts, and are aware of other “early adopters,” including both specialist and broad-interest journals. It is inspiring to see how the animal behaviour research community is restlessly striving to improve research transparency and reproducibility.

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DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Christian Rutz 
Mike M. Webster 

Centre for Biological Diversity, School of Biology, University of St Andrews, St Andrews, UK

Correspondence

Christian Rutz, Centre for Biological Diversity, School of Biology, University of St Andrews, St Andrews, UK.
Email: christian.rutz@st-andrews.ac.uk

ORCID

Christian Rutz  <https://orcid.org/0000-0001-5187-7417>

Mike M. Webster  <https://orcid.org/0000-0001-9597-6871>

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