Reflexivity in Quantitative Research: A Rationale and Beginner's Guide

Michelle K. Jamieson[1,2], Gisela H. Govaart[3,4,5], and Madeleine Pownall[6]

1. Edinburgh Napier University, School of Health and Social Care
2. University of Glasgow, School of Social and Political Sciences
3. Department of Neuropsychology, Max Planck Institute for Human Cognitive and Brain Sciences, Stephanstraβe 1a, 04103 Leipzig, Germany
4. Charité – Universitätsmedizin Berlin, Einstein Center for Neurosciences Berlin, 10117, Berlin, Germany
5. Humboldt-Universität zu Berlin, Faculty of Philosophy, Berlin School of Mind and Brain, Luisenstraße 56, 10117 Berlin, Germany
6. University of Leeds, School of Psychology, UK

Correspondence concerning this article should be sent to Dr Madeleine Pownall, School of Psychology, University of Leeds, 4 Lifton Place, Leeds, LS2 9JT, UK. Email: M.V.Pownall@leeds.ac.uk. Tel: (+44)113 343 2927

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Michelle K. Jamieson: Conceptualization, Methodology, Validation, Resources, Writing - Original Draft, Writing - Review & Editing, Visualization, Project administration. **Madeleine Pownall:** Writing - Original Draft, Writing - Review & Editing, Project administration. **Gisela H. Govaart:** Writing - Original Draft, Writing - Review and Editing.

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Changes to the new version of this pre-print include:

1. More nuanced discussion about how and why some researchers may not feel able or comfortable to share details of positionality
2. Clarification of 'open science' as a term
3. Addition of a case study example to. work through the reflexivity prompts

Abstract:

Reflexivity is the act of examining one's own assumption, belief, and judgement systems, and thinking carefully and critically about how this influences the research process. The practice of reflexivity confronts and questions who we are as researchers and how this guides our work. It is central in debates on objectivity, subjectivity, and the very foundations of social science research and generated knowledge. Incorporating reflexivity in the research process is traditionally recognized as one of the most notable differences between qualitative and quantitative methodologies. Qualitative research centres and celebrates the participants' personal and unique lived experience. Therefore, qualitative researchers are readily encouraged to consider how their own unique positionalities inform the research process and this forms an important part of training within this paradigm. Quantitative methodologies in social and personality psychology, and more generally, on the other hand, have remained seemingly detached from this level of reflexivity and general reflective practice. In this commentary, we, three quantitative researchers who have grappled with the compatibility of reflexivity within our own research, argue that reflexivity has much to offer quantitative methodologists. The act of reflexivity prompts researchers to acknowledge and centre their own positionalities, encourages a more thoughtful engagement with every step of the research process, and thus, as we argue, contributes to the ongoing reappraisal of openness and transparency in psychology. In this paper, we make the case for integrating reflexivity across all research approaches, before providing a 'beginner's guide' for quantitative researchers wishing to engage reflexively with their own work, providing concrete recommendations, worked examples, and reflexive prompts.

Key words: reflexivity, quantitative research, methodology, open science, positionality

Reflexivity in Quantitative Research: A Rationale and Beginner's Guide

Reflexivity is the process of engaging in self-reflection about who we are as researchers, how our subjectivities and biases guide and inform the research process, and how our worldview is shaped by the research we do and vice versa (Wilkinson, 1988). If positionality refers to what we know and believe, then reflexivity is about what we do with this knowledge. Reflexivity is a form of critical thinking that prompts us to consider the 'whys' and 'hows' of research, critically questioning the utility, ethics, and value of what, whom, and how we study (Willig, 2013). As Lazard and McAvoy (2020, p. 167) explain, the reflexive process is ultimately based around the question "*what is the research process and how am I influencing it?*". This questioning forms part of an ongoing process that prompts the researcher to continually shift and (re)construct their understanding (Barrett et al., 2020), as part of a process of 'disciplined self-reflection' (Wilkinson, 1988). Crucially, reflexivity does differ from 'reflection', although the two have been conceptualised as existing on a continuum (Shaw, 2010). Reflexivity refers to the conscious, active acknowledgement of one's own belief, biase, and judgement systems *before, during, and after* the actual research process. In contrast, reflection is often done retrospectively and typically leads to insights about details that were 'missed' in the original research process. Reflexivity, therefore, has a greater potential to guide the research process, across all research epistemologies and methodologies. Reflexivity is historically a hallmark of qualitative research because of its critical nature (Lazard & McAvoy, 2020) and offers much insight to qualitative research, which has been noted extensively throughout the literature. Due to its thoughtful and reflective nature, reflexivity is a cornerstone of successful and insightful qualitative work (Olukotun et al., 2021) and can be particularly useful for social and personality psychologists. For example, Wiggington (in Lafrance & Wiggington, 2019, p. 541) discusses the "light-bulb moment" they had when they became aware of how their own position as researcher was

affecting the questions they asked of their participants, noting how this influenced and shaped their assumptions. Moreover, reflexivity can help researchers to navigate the ethics and emotional labour (or lack of) in their research (Guillemin & Gillam, 2004; McGowan, 2020).

Reflexivity has been an integral part of the qualitative research tradition for decades (Lazard & McAvoy, 2020; Olukotun et al., 2021). However, a small (but growing) body of literature has also considered how reflexivity may be a useful tool for *quantitative* research. For example, Ryan and Golden (2006) argue that the reflexive lens is an important one for all data collection in sociology, noting in particular how reflexivity can lead to important insights into the emotional cost of researching sensitive topics. This means that reflexivity is also particularly useful for social and personality psychologists, who typically deal with sensitive, political, or complex issues. They also suggest that keeping reflexive journals throughout quantitative research can provide a useful opportunity to add a depth of understanding to the data analysis. Similarly, in a midwifery context, Kingdon (2005) stressed that reflexivity may be relevant to all research approaches. Kingdon (2005) specifically focused on how reflexivity may identify, and thus mitigate, potential researcher biases which may impact clinical care. However, despite these early commentaries, the vast majority of quantitative research has remained seemingly ignorant to this facet of the research process (although see Steltenphol et al., 2021 for a notable exception). Recently, the introduction of Conflicts of Interest (CoI) statements has sparked a relevant discussion in quantitative research. CoIs have long been defined in quantitative research as predominantly financial; only recently, discussions have arisen about what other possible, less defined, CoIs might arise, and how to report those (Chivers, 2019). In response to this, the question of how reflexivity may benefit quantitative research has also gained renewed momentum (e.g., Steltenpohl, 2020). Throughout this commentary, we demonstrate how reflexivity can, and indeed *should*, be embedded in all stages of quantitative research, from the

early stages of project conceptualisation to research design, to the final point of drawing conclusions from data.

The first major challenge in making the case for embedding reflexivity into quantitative research is relinquishing the perception of quantitative data as the 'gold standard' of objectivity, and more 'scientifically sound', than qualitative data. As Stainton-Rogers (2019) suggests, perhaps the time has now come for quantitative scientists, particularly in the context of social psychology, to "face up to and confront the limitations and distortions imposed by psychologists clinging to scientific method" (p. 5). Acknowledging that the 'scientific method' does, indeed, carry distortions, biases, and limitations, may give way to a more open-minded approach to research. Indeed, qualitative research *is* typically more equipped to deal with the study of sensitive areas which may evoke a heightened concern for researcher and participant ethics of care and emotional labour (or 'emotional work'; see Dickson-Swift et al., 2009), which makes it especially suitable for reflexivity. Quantitative research, in contrast, is more concerned with providing a summary of 'patterns', including behaviours, responses, and attitudes; for example, survey methodologies that gather large-scale data sets providing insights into patterns and commonalities of experience.

However, this epistemological approach does not make quantitative research inherently more objective, robust, reliable or scientific than other approaches. As Farran (1990) argues, statistics, or quantitative methods, are at risk of being perpetually "divorced from the context of their construction and thus lose the meanings they had for the people involved" (p.101). Moreover, quantitative science often deals with topics that are thematically all *but* objective, especially in the social sciences. For example, research on gender differences in the brain can lead to neurosexism (e.g., Eliot, 2019) and research on sex and gender can be used to instigate and justify discrimination against transgender people (English, 2021; Sun, 2019). We argue that

these topics are distinctly subjective and impacted by the researchers' own political, ideological, and personal agendas. For example, Moss et al (2019) note how social psychological fieldwork in conflict settings have practical and ethical considerations, which are heightened when researchers are 'outsiders' to the local context of the research (see also Uluğ et al., 2021). Therefore, how these topics are approached should be handled not only with care, but also with active deliberation through reflexive practice. This tension is further complicated by growing ideological claims that 'identity politics' are becoming overly embedded in psychological research, in a way that threatens research integrity. Moreover, the notion that quantitative approaches are inherently objective also relies on the idea that data are objective. Yet, data are all but objective, which becomes apparent with the rise of 'big data' and machine learning, perpetuating inequalities and harming minority groups (Birhane, 2021; Birhane & Grayson, 2018). It is, therefore, necessary to question the assumptions that are contained in the datasets themselves, noting how these relate to injustice and power asymmetries (; Birhane, 2021; Jamieson, 2020). Thus, researchers' own positionality, subjectivities, and biases in the research process cannot only be a concern specific to qualitative methodologies.

Furthermore, now is an appropriate time to challenge the veneers of objectivity in psychological science, given how the Open Science movement has impacted the social sciences in recent years, calling into question the objectivity of data analysis processes in quantitative data. Note that 'open science' has also been referred to as open scholarship or open research; however, we have elected to use the term that is most commonly used in the literature, particularly in early discussions about scientific rigour. Open science started as a response to the 'credibility crisis' or 'replication crisis' that exists in much experimental and quantitative based work. In the last decade, many different voices have joined the open science movement (e.g., Ledgerwood et al., 2022), making it difficult to address the movement as one group.

Curiously, whilst the early and most dominant voices in the 'Open Science' movement set their sights firmly on improving data transparency and the rigour of analysis plans, an appreciation of researchers' positionality has, to date, been exempt from this conversation (however, see for an exception Steltenpohl et al., 2021). What is more, the fact that the Open Science movement proposes relatively accessible solutions to mitigate researchers' biases might even create a false sense of (performative) objectivity. It gives the impression that if researchers simply follow the rules proposed by the dominant advocates for the Open Science movement, this will lead to perfectly objective research. This view that purely by eliminating researchers' subjective biases one can discover the truth does not originate from the open science movement. It is firmly grounded in rationalist thinking, influenced by for example Cartesianism and Newtonianism (Birhane, 2021). As described by Birhane (2021), this tradition hosts a fertile ground for dichotomous thinking, for example in subject vs. object. However, we argue that even if data are quantitative and numerical, the ways in which they are analysed and, to a greater extent, the inferences made from this analysis, will vary depending on who the researcher is. Therefore, this false sense of objectivity maintained by the Open Science movement has the potential of standing in the way of a truly reflexive approach. Even though we are extremely empathetic to the goals of the Open Science movement, and are active contributors to the community, we argue that quantitative analysis should go one step further. That is, we should work to combine a transparent approach to analysis with a reflexive approach, to truly appreciate the subjective and biased nature of all data interpretation in the social sciences.

We argue that engaging in reflexivity, either formally (i.e., in reflexivity or positionality statements) or informally (i.e., in thinking reflexively throughout the research process), can alleviate some questionable research practices. For example, we argue that reflexivity can bring biases and unchecked assumptions 'to the surface', which may reduce practices that can impact

the credibility and verifiability of research, such as selective outcome reporting and hypothesising after results are known (HARKing; Kerr, 1998) without proper statistical correction. Indeed, as Open Science advocates have stressed, there are a multitude of decisions that analysts of quantitative data must make in the data analysis process, which all can sway the final outcome. Acknowledging this 'garden of forking paths' goes some way in dismantling the notion that analysis of quantitative data is entirely objective and free from researcher bias (Gelman & Loken, 2013). However, we take this analogy one step further, arguing that every step of the research process, from setting out a research question, to choosing a sample, to collecting data, to interpreting their meaning, offers a new 'fork in the path' that researchers must contend with. Therefore, there is value in promoting an up-front approach to researcher positionality, biases, and agendas.

Embedding Reflexivity Throughout the Research Process: A Beginner's Guide

In order to demonstrate *how* reflexivity can be embedded into all aspects of the research process, we now provide a 'beginner's guide' to engaging with reflexivity. These recommendations are centred predominantly around what researchers can do to embed reflexivity into all kinds of research, not only in social and personality psychology, but any discipline concerned with people and data. It is worth acknowledging here that, as with all researcher-based recommendations, these suggestions often require other stakeholder's engagement to be achieved in practice. Therefore, we provide recommendations for quantitative researchers but also caveat this by appreciating how investment from funders, journals, editors, and other stakeholders (e.g., see Evans et al., 2022) may contribute to facilitating these suggestions in practice. However, if the above prevents the inclusion of reflexive work, we still strongly recommend its adoption, and carrying it out for your individual purpose or private

practice. Therefore, the following guide may be best seen as a useful entry-level *starting point* for researchers interested in adopting a more reflexive approach to their work.

1. Reflexivity in Research Questions and Design

A common method for developing and answering quantitative research questions is by identifying a gap in the existing literature and designing a study to address this gap. There are useful guiding principles that help researchers to identify a useful research question (e.g., when conducting a replication study; Isager et al., 2021). However, while these are useful starting points, we argue that this process may benefit from embedding reflexive engagement from the very start of the research journey. For example, it may be useful to embed an *explicit* consideration of why we research a particular topic and not another? Why one population and not another? Out of all possible gaps in the literature and all the possible research questions we could have asked, why this one in particular? Why is this interesting? And, perhaps most importantly, why are *we* best placed - or not - to research and involve this population group, and answer these questions? As Magnusson and Marecek (2012, p. 90) note, "knowledge is *'interested'*: that is, there is a reason why a particular question is of interest". We argue that at the early stage of the research process, bias exists, whether it is hidden under a veneer of objectivity or not. Integrating reflexivity at this stage would include broad questions like 'what is the research process' and 'how am I influencing it?' and 'why am I the one to answer these questions over someone else?'. This is a method of personal insight, characterised by a persistent questioning of assumptions through a personal dialogue (Lazard & McAvoy, 2020), which has been used in psychotherapy, psychology, the broader social sciences, and other areas that involve qualitative aspects to teach critical inquiry and self-knowledge (e.g., Piro & Anderson, 2015), and can be integrated in quantitative research methods. At the time of research conception, design, and forming the research questions, this would take the form of internal dialogue as well

as conversations with participants, colleagues and others, including those who may take different perspectives to that which frames the research. This helps the field move away from voyeuristic research that does not further marginalise or Other (Jull et al., 2018). It can also inspire co-produced research, in which the people that are affected by the research ("knowledge users" e.g., experts by lived experience or policy makers), are part of the research process (Graham et al., 2019), or "insider" research, in which the researcher themselves has lived experience of the topic. For example, having personal experience of living with a mental health condition being studied in the research project. This can apply to any part of the research cycle, from formulating research questions to analysing data or implementing research output (Filipe et al., 2017). This level of thoughtful engagement could also be applied to participant recruitment processes, to ensure that recruitment materials do not perpetuate harmful stereotypes or use problematic language.

Moreover, part of the reflexive process should be an ongoing critical engagement with the voices that are heard in the literature review that sets the tone for the theoretical framework and inspires the research questions. Importantly, a reflexive approach to a literature review should attend to one's own biases and assumptions as a researcher and be prepared to critically evaluate the *source* of chosen evidence. That is, which researchers are being cited, which researchers are thought to be credible? This is a complex issue that can be best tackled through thoughtful engagement with the literature review citation process. For example, research demonstrates that men are overrepresented compared to women in citations (Fulvio et al., 2021), and that White authors are overrepresented compared to ethnic minorities (Bertolero et al., 2020). There is value, therefore, in researchers attending to this throughout this process in the research, in attempts to diversify the evidence that is used in psychological research. However, of course, there is also a need for researchers to select the best and most appropriate available

evidence, which may always mean citing underrepresented scholars. Reflexivity may thus aid a more thoughtful appreciation of these complex issues, by drawing researchers' attention to who, what, and how they select and then cite as supporting evidence.

How?

In practice, embedding reflexivity into the early parts of the research practice can be achieved by confronting biases transparently and openly; a simple example is including a reflexive statement in a study pre-registration. In doing so, this practice may prompt researchers to articulate their positionality early in the process, thus allowing space for an acknowledgement of how this may then guide future decisions in the research. This may be particularly useful when working in collaborative teams with multiple researchers. As 'Team Science' becomes more mainstream in social and personality science (see Moshontz et al., 2018), reflexive statements up-front may provide a logistical answer to the ideological challenge that working with multiple researchers addressing one question may present. If the opportunity for these early conversations has passed, a further way to reflect on how researcher's positionality influences research questions and research designs, and to mitigate bias, is to add a diversity or positionality statement to academic papers, which serve to centralise and confront the presence of bias in psychological research (e.g., Ledgerwood et al., 2021), but should be considered the very least in starting with reflexive practice.

For example, in a recent paper lead by one of the authors of this commentary (Pownall et al., 2021), authors joining the writing team each wrote a positionality statement on the topic at hand and used this to frame the approach to writing. These individual articulations of positionality were then condensed and shaped, leading to a final consensus on positionality which was included in the final paper to orientate readers to the viewpoint of the collective

writing team. Therefore, with this in mind, we argue that being up-front about viewpoints, biases, agendas, and lenses may lead to a richer, more contextualised final product.

There is no 'one size fits all' for positionality or reflexivity statements, and authors should feel able to share as much (or as little) of themselves as they feel safe and comfortable with. There are legitimate reasons why a researcher may not feel comfortable articulating their position in a positionality or reflexivity statement. For example, positionality statements may be thought to have the capacity to 'out' authors, which may be problematic for anonymous peer review. Similarly, given how research demonstrates that researcher demographics, including gender, influences perceptions of research quality (e.g., Moss-Racusin et al., 2012), explicitly drawing the reader's attention to the researcher's demographics may negatively impact perceptions of the work itself, which may be a barrier to engaging with this process. Similarly, early-career or precariously employed academics may not have the 'academic capital' that allows them to advocate for embedding and acknowledging reflexivity (see Kathawalla et al., 2021), particularly if they are working in the quantitative social psychological paradigm. Therefore, these recommendations should not be applied prescriptively and should instead be flexible. Another possible concern could be potential dishonesty about researcher biases (i.e., authors selectively choosing what aspects of their assumptions/position to share). Therefore, as reflexivity continues to gain momentum in research, positionality statements should be standardised to prevent selective reporting.

As a starting point for quantitative researchers inspired by this commentary, some good examples of explicit positionality statements in recent (qualitative) research include Siegel et al. (2021), who detail grappling with being both 'insider and outsider' in their study of father's experiences of discussing body image with their daughters, Moffitt et al. (2021), who articulate their ongoing reflexivity in the context of grappling with 'colour blindness' in a study of white

racial identity, and all research and statements produced by Recovery in the Bin, a lived experience lead critical theorist and activist collective (2022). These examples provide a useful starting 'language' for researchers starting to engage reflexively in their work.

2. Reflexivity in Data Collection

The data collection stage may benefit from embedding reflexivity, for all research epistemologies. At this stage, researchers can think through the theoretical, epistemological, and political positions that are shaping the research, at a time when these considerations may be actionable and tangible. Del Busso (2007) describes how methods become interwoven with broader theoretical issues and power dynamics, especially within data collection. They used interviews to explore young women's embodied experiences. Their reflexive journey during this collection flagged how those participants, who positioned themselves as "tomboys," problematized Del Busso's own heterosexualized feminine embodiment. Reflexive engagement, particularly around their aim to use interviews to create an empowering experience for her participants, opened up directions of reading the research encounter which subsequently impacted data analysis. Del Busso's reflexivity explicitly states how particular experiences during the research process, and particularly data collection, highlight assumptions made about participants, topics and methods (see also Medico & Santiago Delefosse., 2014). It also demonstrates how reflexivity can be used to generate insights which subsequently shape interpretations made and knowledge produced, and subsequent analysis. This is taken further in Rosenberg and Tilley's work (2021) which examines the phenomenon of 'insider/outsider' research and the experience of being a transwoman researching the lives of other transwomen, with the resulting reflexivity leading to a new model of interviewing and co-production. While this approach is a common feature of high-quality and robust qualitative data collection (Lazard & McAvoy, 2020), we argue that engaging in reflexivity throughout the data collection stage of

quantitative research can also provide rich insights. Reflexivity in quantitative data collection could provide space for checking unconscious bias that might influence the performance of participants, while also encouraging transparency of researcher positionality that may influence the data collection process, in spite of the widely held belief that quantitative methods are the inherently objective stance that yields 'gold standard' results (Walker et al., 2013).

How?

In the context of quantitative data collection, there is scope to embed reflexivity in less explicit ways. For example, again, preregistration of sample size, characteristics of said sample, and recruitment strategies may be a useful starting point to embedding transparency into the process. However, preregistration does not constitute reflexivity by itself. This can be useful in a number of ways. As an illustrative example, imagine the following scenario: a team of researchers are conducting a study examining whether there is evidence of gender bias in perceptions of academics. The researchers themselves have experienced negative gender biases and thus are all of the personal and professional opinion that such biases 'exist' and are hoping to locate these biases in their empirical investigations. The decisions made during the data collection process can largely sway this research question; that is, the research team could circulate their surveys in spaces which contain potential participants who are inherently aligned with this viewpoint. The researchers could also make decisions that increase the chances of 'finding' their expected result (see our data analysis section for a wider discussion of such confirmation biases), by how they frame the research study to participants (e.g., see Harper, 2020). While this may not in of itself be problematic, existence of such practices provide a ripe opportunity for serious reflexive engagement. Recall that the cornerstone of reflexivity is the question "what is the research process *and how am I influencing it*?" (Lazard & McAvoy, 2020), which can provide a useful question to guide the data collection process. If the researchers in our

example engage meaningfully and actively with this question, this may lead to differences in how they choose to negotiate data collection decisions (Jamieson, 2020). Further, if these researchers had preregistered their decisions, this may protect them from accusations of biased sampling. Indeed, preregistration of methodological and analytical decisions can be useful in two distinct ways. They can a) serve to alleviate the temptation of researchers making ideologically self-serving research decisions, b) they can bring these viewpoints up-front and centre, providing future consumers of this research with the appropriate context.

3. Reflexivity in Data Analysis and Interpretation

Perhaps the most obvious place to embed reflexivity into research is the data analysis and interpretation phase of the research process. In order to begin to embed reflexivity into the process of analysing quantitative data, we first need to dismantle the myth that numerical data is objective and textual data is subjective (Jamieson, 2020). The ongoing discussion and the adoption of Open Science practices have indeed made researchers more aware of biases that impact the objectivity of numerical data. For example, there has been much discussion about 'confirmation biases' (i.e., preferring or seeking out information that confirms, rather than challenges, your worldview) in the context of interpreting data. Lehner et al. (2008), for example, show that we generally give more weight to evidence that supports a preferred hypothesis, and give less weight to evidence that disconfirms it. Indeed, for social psychology to be 'self-correcting', it is important that researchers acknowledge their own perceptions of the research questions, goals, and hypotheses themselves (see McDiarmid et al., 2021). Interestingly, however, the biases that are addressed by the Open Science movement are mainly "universal" biases, that is, biases that are supposedly similar for all humans. We argue that next to biases like the confirmation bias, that are vital to address in social psychology, we also need to reflect on

researchers' individual biases, that is, the way in which our personal stories impact the way in which we analyse and interpret our data.

How?

Reflexivity can be embedded at the data analysis stage in many ways. In an ideal world, the quantitative community would entirely dismiss the notion that data about human beings collected, analysed, and interpreted by other human beings can ever be fully objective. This is a point of epistemological and ontological contention, but we believe it is time to confront this issue. Until this lofty goal is reached, however, there are ways to embed reflexive engagement with data analysis when dealing with quantitative data. If all the steps are followed, researchers will arrive at the data analysis stage with a well-articulated understanding of their own positionality and agenda for the research at hand. They will be well-versed in acknowledging and confronting their biases and will be prepared to either a) transparently centre these viewpoints within the research itself or b) include safeguards to build in more objectivity into the research process. For either of these approaches, one particularly entry-level way to engage reflexively in data analysis is to keep detailed journal-style notes during the data analysis process. Indeed, this is another example where the quantitative world has much to learn from our qualitative peers. In qualitative research, for example, keeping detailed, thoughtful, reflexive field notes is gold-standard practice (see Phillippi & Lauderdale, 2018). Field notes provide a useful space for 'critical reflection' throughout the research process, which can be used as an analytical tool. In Phillippi and Lauderdale's (2018) discussion about best practice in field notes, they explain how "qualitative research acknowledges the role of the researcher as an instrument within the research, shaping the results" (p. 386), and use this as rationale for note-keeping. Note keeping may be a useful practices throughout the entire research process and may be facilitated through digital, computational notebooks, which can then be shared transparently on platforms such as

ResearchEquals (https://www.researchequals.com/), which gives all uploaded aspects of research a DOI. We argue that this process has much to inform quantitative analysis also. For example, take the previous example of embedding reflexivity in a study of gender bias. An excerpt of such (fictional) field notes could be structured as follows:

> ***Field notes.*** *[date]: Data analysis of gender bias project. Gender*Career stage ANOVA. Decision made to exclude participants who did not answer all questions. This makes interaction significant. Not excluding = not significant. Variables originally picked not only due to research questions, but also due to personal (researcher B's lived experience) experience* (see Appendix A for detailed notes on experience*). Discussed with the research team, in light of the positionality statement, and came to a consensus. All in agreement. See supplementary information for the analysis without exclusions.*

This log of decisions could then be made openly available with the data, code, and paper, which would add a concrete level of transparency to the published research. In this sense, the process of compiling field notes may be aligned with pre-registration, in which researcher's openly share their hypotheses, research questions, and analysis plan prior to data collection and/or access. However, field notes differ from pre-registration, because they do not necessarily *need* to include specific analytical or methodological details. Further, field notes do not allow another researcher to check or verify the planned process with the final analysis, because they are not designed to facilitate verification, but are rather designed to improve transparency and document processes. Therefore, it would be beneficial for field notes to be accompanied by a pre-registration, as and where this is appropriate. This ultimately improves the transparency of the research, while also remaining attentive to researcher's own decisions. A log journal similar to this is easily built in open science platforms such as GitHub and Open Science Framework (see Appendix A for a reproducible example).

4. Reflexivity in Conclusions and Framing

Reflexivity can also be a useful research tool to consider throughout the very final stages of the research process. In short, we argue that the ways that data are interpreted, conclusions drawn, and the 'framing' of analysis all largely reflect the researcher's biases and lived experiences. We argue for a wider consideration of how the evidence that we use to contextualise and frame our research findings also largely reflect our own biases and assumptions. For example, in a discussion about the role of political ideology, Harper (2020) argues that ideological biases drive citation practice. That is, a study reporting gender bias in academic hiring was cited more than ten times than a more recent, higher-powered paper that finds no evidence of gender bias (see Honeycutt & Jussim, 2020). This raises important questions for our discipline. To respond to this, we argue that instead of grappling with this bias in a way that attempts to minimise or deny it, researchers would benefit from *acknowledging* it and *centring* it in the research process.

How?

Positionality statements, again, provide a useful framework for acknowledging biases and researcher viewpoints. At this stage of the research process, there may also be scope to embed reflexivity into the research peer review process, ideally, a dedicated 'section' expanding on that. As an extreme example of researchers 'laying bare' the research process, the Red Team Challenge (see Coles et al., 2020) offered researchers a financially motivated opportunity of a team scouring their materials, data, and code of a submission-ready manuscript, in attempt to catch errors and improve the robustness of the research. Similarly, the 'Critique of Research Ideas Collective' aims to embed collegiality into this practice, by establishing a diverse and interdisciplinary group that critiques proposed research ideas. A more palatable offer may be a reflexive engagement with *who* researchers elect to review their manuscripts at the journal

submission stage. Again, acknowledgement of biases, conflicting interests, and competing agendas may well be at play during this stage, and this could be 'spotted' via reflexive engagement with the research process.

Broader Reflexive Engagement

This discussion has centred around practical steps that researchers may engage with to embed reflexivity into their work. We appreciate, however, that there are much wider, more epistemological, ontological questions surrounding data usage, ethical considerations, and research frameworks that should also be acknowledged. In this sense, our discussion so far has resolved around how to embed reflexivity into research projects, assuming this research itself has been thoughtfully approached. Table 1 provides some example prompts that researchers may wish to engage in. We encourage researchers to keep these reflexivity prompts in mind when navigating the research process. These prompts do not, of course, signify a complete and thorough adoption of a wholly reflexive approach to research, but they do start the process of thinking about quantitative research reflexively. Relatedly, we also suggest that the binary between quantitative and qualitative methodologies may be harmful, or at least counterproductive, because it erroneously draws the distinction of objective vs. subjective research, and positions reflexivity and reflection as a tool necessary for qualitative research only. Therefore, we welcome more acknowledgement of how the tools deemed appropriate only for qualitative (or, indeed, quantitative) research may be mutually beneficial and informative. Appendix B also provides some concrete guided reflexive practice in the form of writing exercises that can be used time and time again.

As an example, imagine that a social psychologist is interested in understanding the impact of sleeping duration on participants' weight. This is ostensibly an 'objective' research question, in that both the independent and dependent variables are quantifiable and seemingly

rely on objective, numerical measurement. However, it is worth questioning *how* and *why* this research question is considered interesting and meaningful. This researcher could use the following prompts to thoughtfully and critically unpack their approach to this research, in a way that highlights the biases, assumptions, and potential harm that is present in this study. This researcher might, for example, critically question why 'weight' is the chosen variable of interest. Could this work harm the participant group? Beyond traditional ethics, is this an ethically designed and run study? Could this, in any way, be thought of as causing harm? What does the researcher seek to gain for the results, depending on how they turn out? This is an example of a research study that may, on the surface, be considered objective, bias-free, and 'scientific'. However, reflexive engagement may prompt a more nuanced appreciation of whose interests this research is (not) serving, which may lead to more compassionate, rigorous, and meaningful conclusions.

Table 1. Prompt questions for embedding reflexivity in all stages of the research process. Note that these prompts may be engaged with on an individual level (i.e., by individual researchers) but can also be beneficial to work through as a research team, and sharing as much or as little as any member of the team would feel comfortable with, given the diversity of experiences that members of a collaboration will bring. Making space for honest, structured conversations around positionality within a research team may lead to useful insights.

Stage of research	**Broader reflexivity prompts**

Research question and design	● Why do I want to research this group? ● To what extent am I "within" the participant group that I am researching? Am I an "insider" or "outsider" researcher? ● Could I (or my work) harm this group? ● What can I give to this group? Who is represented within the research team? ● Should I be the one to research this group, or am I taking space away from someone else?
Data collection	● Am I intruding on this group? How can I make this as non-coercive as possible? ● How can I make this research accessible to the population? ● Do participants understand what their data will be used for? ● Have I thought beyond traditional ethics? Am I acting ethically? ● Could my collection methods cause harm?
Data analysis and interpretation	● Am I aware that people have given me this data and that they may not know me (e.g., survey, health, admin data)? ● Who are these people behind the data? ● If I am using existing datasets, are there any silent assumptions in this dataset? ● Could my analysis of the dataset reproduce existing inequalities?
Conclusions and framing	● How does my use of evidence reflect my biases (or the biases of the research team) as researchers and as individuals with their own life, wants, emotions, needs? ● What do I gain from this research? What does the population I have studied gain? ● Is there a disconnect between the two questions above? If so, consider the first few questions in this table again.

Conclusion and Moving Forward

In this critical commentary, we have provided a rationale for quantitative researchers to adopt a similar level of thoughtful reflexivity that is present in qualitative methodologies. We

appreciate that some of this discussion is epistemologically grounded. For example, in much of our discussion we have generally offered two routes: 1) researcher bias is acknowledged, centred, and *celebrated* in quantitative work, 2) researcher bias is deemed to be problematic and is instead confronted and challenged. Both of these approaches are, we argue, more useful than the assumption that such biases do not exist. However, they do represent two very different epistemological approaches, for which there is space both in social and personality psychology. The hard-line positivists in our field may prefer the latter of these approaches and relish any opportunity to reduce bias in quantitative research. While this is acceptable and welcomed, we would like to end this commentary by encouraging researchers to undertake the messy task of centring, rather than fighting, our biases as quantitative researchers. Similarly, it is important to note that a lot of our suggestions require stakeholder buy-in: We do not aim to put the entire burden of improving reflexivity in quantitative research on the shoulders of individuals, especially early career or precariously employed, researchers. Top-down support is necessary. For example, trainers should integrate reflexivity across methodologies and disciplines, journal editors and reviewers should appreciate the value of reflexivity, editorial guidelines should encourage or facilitate positionality statements as the very least expected in a reflexive journey, and funders should acknowledge reflexivity as a tool to promote research rigour, including in grant proposals.

Finally, we caution that these recommendations should not be considered superficial 'add ons' to the research process. Indeed, we have some concerns with some existing tools to reform science, because some may simply allow researchers the opportunity to falsely signal or *perform* 'bias checking' in a superficial way. In sum, embedding reflexivity into all research can not only improve the credibility and rigour of research (Del Busso & Leonardsen, 2019; Rosenberg &

Tilley, 2021) but also fundamentally acknowledge that biases and subjectivities *do*, in fact, (still) exist.

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