

What meta- science is missing: Perspectives on the replication crisis, science, and controversies behind direct and conceptual replications

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Abstract

The sequence of replication failures in a number of scientific disciplines gave emergence to the idea that there is a replication crisis. Social psychology has the lowest reproducibility rates within psychological science. Some scientists question the credibility of knowledge in social psychology by promoting the importance of identical replications, namely direct replications. Other scientists support that identical replication is not adequate in social psychology, pursuing the importance of conceptual replications. This dichotomy seems to exist due mainly to two opposing ontological conceptions. The one views psychological objects as static and constant effects, observed under controlled conditions. The other views them as complex, fragile and dynamic, requiring multiple methods to understand them. Hence, instead of generalizing the idea of a crisis, it is essential to understand how those controversies exist and what can science learn from them. This study is pilot, qualitative and descriptive, investigating how social psychologists perceive the different forms of replication and the reasoning behind their beliefs. With thematic analysis, this study investigated 94 responses by social psychologists who work as researchers in the Netherlands. Most responses supported conceptual replications as more applicable in social psychology than direct replications. They reasoned that conceptual replications consider the context- sensitivity, dynamism, and complexity that constructs in social psychology obtain. Furthermore, they explained that using multiple methodologies to understand psychological constructs can embrace theory development, validity and generalizability of findings. Lastly, participants advocated that direct replications deplete the information needed to understand psychological objects because of the singularity they hold upon their conditions.

What meta- science is missing: Perspectives on the replication crisis , science, and controversies behind direct and conceptual replications

Replication of research is a scientific attempt that aims to examine the reproducibility of earlier findings (Vachon et al., 2020; Guttinger, 2020). Recent high profile replication failures in psychology, molecular genetics and medicine (Hagger et al., 2015) gave emergence to what the scientific community refers to as the replication crisis (Fraser et al., 2020; Fanelli, 2018).

Within psychology, out of the 100 studies that the “Reproducibility Project: Psychology” (RPP) (Open Science Collaboration, 2015) attempted to identically replicate, only 39% were successfully reproduced (Guttinger, 2020). Among psychological sciences, social psychology has reported the lowest reproducibility rate, namely, 23% (Open Science Collaboration, 2015). Although scientists who advocate reform, identified as reformers, declare replication necessary for scientific reliability and credibility (Ioannides, 2012), different perspectives exist on the value and meaning of replication (Morawski, 2021; Guttingler, 2020).

An issue that is rarely acknowledged is the lack of an ontological consensus and understanding between researchers (Morawski, 2021). What is replication and the form of replication that scientists should adhere to is an ongoing discussion with tense debates (Guttinger, 2020). The tension exists because the practices that reformers purpose, are not perceived as applicable in social psychology by everyone (Crandall & Sherman, 2016). Instead of standardizing how replication should take place in all disciplines of psychology, it is important to acknowledge the different perspectives that exist and learn from them. In order to understand those claims, this paper aims to explore the perspectives of social psychologists, who are affected by the crisis on the different forms of replication. Raising awareness within the scientific community about these perceptions can help in regulating research in an adequate manner specifically for social psychology.

The two kinds of Replication and Controversies Behind.

Direct and Conceptual replications. Scientists identified a diversity of forms of replications (Barba 2018; Fiddler & Wilcox, 2018; Plesser, 2018). Two types of those have received the most prominent attention, namely, direct and conceptual. A direct replication attempts to reproduce an original study by using identical materials, population, dependent variables, and manipulations (Crandall & Sherman, 2016; Schmidt, 2009; Makel et al., 2012). It seeks to test the reliability of the original effect. Its success depends on whether it will produce the same data pattern as the original study. A conceptual replication attempts to reproduce an original phenomenon by using different operationalizations, populations, variables and study designs (Guttinger, 2020). A conceptual replication attempts to examine the theory or the hypothesis underlying the original study (Nosek & the Open Science Collaboration, 2012). It is usually associated with assessing the generalizability of an effect, as it uses a variety of contexts to examine a phenomenon (Schmidt, 2009). Subsequently, conceptual replications may assess the boundary conditions in which an underlying theory can hold true (Nosek & the Open Science Collaboration, 2012). The type of replication chosen by scientists reflect their views on the nature of psychological phenomena. There are two main ontological perspectives held by scientists (Morawski,2021). One assumes that psychological objects are stable and static, whereas the other views them as dynamic and complex.

Advocating psychological objects as stable and static. Many reformers hold Popper's position, hypothesizing that science can reproduce reliable and stable phenomena across time from one experiment to another (Morawski,2021). It can be argued that these tendencies are based on the fundamental hypothesis of uniformity of nature, which reinforces the application of direct replications (Schmidt, 2009). That is because direct replications reproduce phenomena under unchangeable conditions. Hence, based on the conception that objects are singular, reformers devote themselves to the belief that direct replications are a necessity to understand reality (Wiggins & Christopherson, 2019; Morawski,2021). As such, the singularity in conditions that direct replications provide, explains why they can be argued to be

most applicable in fields that investigate stable constructs of interest. Moreover, reformers support that replications should be so well prescribed, that any scientist than the original could reproduce them (Zwaan et al., 2018). As Ioannides (2012b) argues replications conducted by the original researchers are insufficient to provide valid experimental reliability, because the motivation and subsequent confirmation biases by the original scientists, can be detrimental to the independence of the results.

The suggestion that effects should exist independently of the scientists is explained by the application of auxiliary assumption. As cited in Lakatos (1970), Popper argued that researchers do not make predictions from their theory only, but from the theory and auxiliary assumptions in combination (Duhem, 1954; Quine, 1980). The particular demonstrations originate from the idea that “if a theory is true, and a set of auxiliary assumptions is true, an observation should occur” (Earp & Trafimow, 2015, pp. 6). Hence, auxiliary assumptions are supposed to enable scientists to define potential elements in the chain of assumptions that cause a failure to reproduce a phenomenon (Earp, & Trafimow, 2015). For example, in certain fields of science such as physics, scientists obtain a common consensus of the operationalizations they use when they study phenomena since the conditions that can enable a replication to take place are clearly prescribed. On the contrary, several scholars have indicated that scientists of the original experiment should be allowed to participate in replication (Schnall, 2014). The certain statement seems reasonable, based on literature examining the concept of “tacit knowledge”. Polanyi, as cited in Penders et. al. (2019), explains tacit knowledge as humans’ capacity to perform a certain task without being able to articulate the way they do (Penders et al., 2019). Therefore, it can be hypothesized that different scientists might not view replication work similarly, especially in a very fragile, context-dependent social psychology.

Criticisms by reformers on conceptual replications have long been held, (Rosenthal, 1979). The primary problem with conceptual replication that they criticize is its susceptibility to publication bias (Wiggins & Chrisopherson, 2019). It is argued that it can be relatively difficult

for a replicating researcher to fail a conceptual replication (Earp & Trafimow, 2015). A failed attempt to find a similar effect can be explained by differences concerning methodology instead of the fragility of the original results. Consequently, conceptual replications, with the absence of “direct” replications, have been claimed to unlikely change the beliefs regarding the original effect. The argument that supports that conceptual replications are susceptible to publication bias received a recent empirical basis. Novel demonstrations showed that “conceptual” replications reproduce studies faster than direct replications (Open Science Collaboration, 2015). Consequently, calls for “direct” replications resulting from specific recent observations are growing.

Advocating psychological objects as complex and dynamic. Some scientists, choose to challenge the connotations of the reformers, suspecting phenomena as contextsensitive, complex and dynamic (Morawski,2021). The particular claims support that psychological objects require a variety of investigations to understand them deeply (Crandall & Sherman, 2016). Based on these ontological conceptions, scientists often support conceptual replications (Morawski,2021). Historically, psychology favored conceptual replications (Stroebe & Strack, 2014; Wiggins, & Chrisopherson, 2019). Conceptual replications are assumed to contribute to theory development because they test an idea across different operationalisations and examining which circumstances hold that idea true (Crandall & Sherman, 2016). Furthermore, scholars suggest that conceptual replications may assess the generalizability of an effect. As a contemporary example in social psychology, a study hypothesized that reducing individuals’ motivation to produce cognitive processes can lead to conservatism (Eidelman et al., 2012). The authors examined the hypothesis through four separate conceptual replications. In each replication, there was a different task for the participants. The tasks were supposed to lead participants to basic and simple modes of thought. Successfully, participants endorsed conservatism in all of the different conditions. Thus, the same theoretical idea was evaluated four times by using diverse methods. In brief, it is supported that conceptual replication can

establish an empirical contribution through which operationalization does not matter (Crandall & Sherman, 2016). Instead, the generalizability of the phenomenon across different dynamic systems, does matter.

The idea of a crisis is based on large- scale direct replication failures (Frasel et al., 2020), and many scientists criticize the reformers' suggestions, claiming that their restrictive methods are not enough to understand social phenomena (Fabricar & Wegener, 2016; Reis & Lee, 2016). Besides, social psychology has displayed instances in which direct replications led to consistent error (Crandall, & Sherman, 2016). For example, the landmark paper by Brehm (1956) on cognitive dissonance was replicated multiple times across different decades. However, it has been proven that the many direct replications of this study were reproducing a significant mistake initially induced by the original researchers (Chen & Risen, 2010). Consequently, it can be suggested that direct replications may take a narrow perspective towards the original experiment that may result in invalid conclusions about phenomena. In other words, the narrow focus of direct replications may perpetuate possible biases of original researchers without questioning the credibility of the operationalization of the results.

The current study. To sum up, there is a lack of common ontological consensus between scientists regarding psychological objects. It seems that the tendency to normalize psychological constructs as stable and static, advocated by reformers, is positioning the field of social psychology in a vulnerable position within discussions about the replication crisis. In addition, the growing discussions and debates appear to revolve around the two types of replications, namely “conceptual” and “direct”. Hence, this paper investigates how the dichotomy in perspectives hypothesized in the literature exists. That is to say; it highlights the importance of investigating how social psychologists may view replication differently from how reformers talk about it in the literature. This paper aims to investigate the particular research questions: How do social psychologists perceive “direct” and “conceptual” replications? Secondly, what is the reasoning behind their beliefs? Through its qualitative and descriptive

nature, this pilot study used thematic analysis to truly understand the meaning of the reasoning behind the perspectives of social psychologists. Accordingly, any pre-existing theoretical interest will not guide the analysis with the inductive approach. That is because since the study is pilot, the data will be used for future research proposes at the University of Groningen.

Methods

Ethical Considerations

Prior to sample collection, the project was approved by the BSS-Psychology Ethics Committee at the University of Groningen. The code for approval is PSY-2122-S-0016. Participation was voluntary and could be ended at any time during the survey. Participants also provided informed consent prior to data collection. Email addresses required for survey dissemination were available publicly. Data was processed anonymously. We did not collect personal data such as name or email address during the survey or metadata such as IP addresses; therefore, a participant's answers could not be linked back to them.

Researcher Description

I am currently a student at the University of Groningen. I identify with increasing the reproducibility of the phenomena within social psychology. For this to happen, I consider important the acknowledgement by the scientific community of the fragility that exists in constructs of psychological constructs. Every human is a unique entity, and in order to be understood, I support the implementation of more conceptual replications with a focus to individual differences and dynamic interactions between those differences and complex environments. I believe that psychological science needs improved overarching theories, that take into account the unique processes of the individual, alongside with their interferences with their corresponding contexts.

Participants

Our target population consists of social psychologists. Since the main aim of our pilot study was to receive and integrate the feedback on our survey before future distribution, we aimed for a relatively small minimum sample size. We deemed a response rate of 10% as realistic and in turn contacted 246 psychologists. Using a convenience sample, we approached researchers from University of Groningen (UG) (102), VU Amsterdam (27), University of Amsterdam (47), Tilburg University (34), Radboud University (RU) (36) by extracting email addresses from their department websites. The universities mentioned supra were selected because they clearly separated social psychology from other departments. The selection sequence began with the present researchers' own university (UG) since we expected the highest response rate from them, and thereafter continued with the rest universities. Out of 246 invited social psychologists, 94 participated (approximately 38%). 23 of the participants did not complete the whole survey. Non-social psychologists were excluded from the analysis, as the purpose of this study was to explore explicitly the perspectives of social psychologists on the two types of replication. Partial responses by the participants were still considered as valuable in both descriptive and qualitative analysis. The majority of the participants were working in the Netherlands when filling the survey. Five participants were working individually remotely in China, Israel, Indonesia and Poland correspondently. Lastly, the participants had an average of 6 years of experience in research.

Procedure

We sent a Qualtrics link and the informed consent form out to our target population via email. This email included information on why the participants were being contacted, namely that we were looking for social psychologists to share their perceptions and opinions on the crisis debate, the reform movement and their methodological proposals. Respondents were also informed that the data set will not be published openly, that it will be used for several bachelor theses, and that data analysis may result in publication in a scientific journal. The survey ran for

three weeks. We sent out two reminders to answer the survey, sent at one and two weeks after our initial invitation. The invitation email, the two reminder emails and the informed consent form can be found in Appendix A.

Limitations of the sampling procedure

As we worked with a convenience sample, certain types of responses may be under- or overrepresented. Moreover, it is quite likely that researchers who participated in our study are different from those who chose not to fill out the survey. One possibility is that those with stronger opinions regarding the practices proposed by reformers are more likely to answer. In addition, polarized opinions might have been exacerbated by a heated public Twitter debate on the reform movement and psychology that occurred days prior to survey distribution (Brown, 2021). The debate was about the credibility of a published paper in the *British Journal of Social Psychology*, supporting that self-objectification can reduce females' awareness of their body, hence decreasing their ability to feel the cold (Felig, et al., 2021). The possibility of bias is taken into account in the discussion of the results. Another limitation of this procedure is that it is not known whether the participants have been actively publishing in social psychology in the last years. It is possible that university web pages could be outdated and not account for individuals who have pursued other fields of interest. However, we accounted for these limitations by asking for the participants' broad field of expertise and by checking their familiarity with the replication crisis and reformer's propositions.

Survey Description

The survey used in the current study was based on existing, unpublished qualitative work produced in former bachelor and master theses (Futjes, 2021; Hershler, 2021; Nicolai, 2021; Pool, 2021; Sales, 2021; Schmidt, 2021; Schwarzbach, 2021). This qualitative work used thematic analysis to investigate psychologists' perspectives on the replication crisis and open science practices. Survey designs used in studies which assessed the role of replication in ecology

(Fraser et al., 2020) and psychology (Agnoli et al., 2021), while also theoretical work regarding different perceptions on views on epistemology and ontology between scientists (Derksen, 2019; Flis, 2019; Morawski, 2019). assisted items' development. Lastly, the items in the survey are novel, self-generated for the purposes of this study, and cannot be found in existing validated surveys or established inventories.

The survey consists of four core sections and it was anticipated that it would take 15 minutes for participants to complete it. Firstly, the participants were asked about their epistemological and ontological views regarding (psychological) science. The second section, most important for my research question, broadly investigated the participants' views on (1) the purposes of new replication studies (generalizability, falsification, and/or confirmation of established results), (2) the importance of conducting direct and conceptual replication, and (3) the extent to which direct and conceptual replication are indicative of research quality, with all three aspects in relation to their field(s) of expertise. Then, with an open-ended question, we asked why participants believed that either direct or conceptual replication, when successful, is or is not indicative of research quality. Further optional open-ended questions asked if there were other important quality indicators outside replication in their field, and gave respondents the opportunity to provide broad thoughts on replication or the replication items. The third block of questions gathered information on open science concepts, practices and applications. Lastly, critical reflections on the reform movement and obstacles to implement proposed reforms were asked to be evaluated by participants. The complete survey can be found in Appendix B.

Quantitative Data. Closed Questions. Eight quantitative items will be used in order to conduct a descriptive data analysis regarding my first research question; Q24 (generalization), Q25(falsification), Q26 (confirmation), Q27 (contribution of original researchers in replications), Q28 (importance of direct replications), Q29 (importance of conceptual replications), Q30 (research quality and direct replications), Q31 (research quality and conceptual replications). Visual analogue scales from 1- 100 scores are used for these items. The

particular questions can be viewed in Appendix A, in Block 6. For each item, the median, and the Interquartile Range will be calculated. Concerning the visualization of the summary of the data, for each item, I will display a box plot illustrating the median, the spread, and Interquartile Range (IQR) with the data points shown (using a jitter function). These analyses will be conducted by means of the open-source statistical software programme R (R Development Team, 2018). The exact lines of code used for analysis will be included in the Appendix.

Qualitative Data: Thematic Analysis

Open Questions.

In cooperation with two other students, the conduction of the thematic analysis was guided by Braun & Clarke (2006), consisting of six phases; 1) familiarization with the data, 2) code generation, 3) searching for themes, 4) reviewing themes, 5) defining and naming themes, and 6) writing the report. The analysis was inductive, meaning that the coding and was driven by the data, without involving any theoretical interest or the items of the survey influencing the process. Hence, we reported explicitly a description of what participants answered

First, we familiarized ourselves with all open question responses to the survey. All contributors (Kate Evgeniou, Colm O’Fuarthain, and Robert van Ark) individually highlighted important responses about replication and generated a non-exhaustive list of initial codes, without attaching it to specific text extracts. We compared the initial codes from each collaborator, checking for differences and similarities through a collective codebook. Similar codes were combined to form one code. Codes that were unique to a collaborator were also included. Thereafter, definitions were created for all codes. The preliminary codebook consisted of 25 codes. Then, the particular codes were applied to the text data. Codes were only applied if a consensus was met by all collaborators that the code fit that specific data extract. Although TA is subjective by nature, we refrained from interpreting the text beyond what was explicitly said or in a way that would suit our research interests. During the coding process, eight new codes were added to

describe relevant data that existing codes did not yet describe. Thereafter, the collaborators examined the codebook once more. Four codes that were not assigned to any pieces of data were removed from the codebook.

We then began the theme generation process. Here, all collaborators first independently sorted similar codes into themes (i.e. groups of codes) and thought of initial theme names. We compared our independent themes, and engaged in discussions over the appropriate final grouping and naming. The process of grouping and naming was done recursively. Simultaneously with these discussions, codes were again assessed on their distinctness and relevance. Thus, four more codes were removed and changed, and the relevant text extracts were reassigned. Hence, we identified six themes from 25 codes. The final codebook containing definitions and exemplars can be found in Appendix D. These are displayed and discussed in the *Results*.

Results

Quantitative results

Replication.

Figure 1

Boxplots for the seven relevant quantitative survey items (with jitter function; outliers are indicated by red dots)

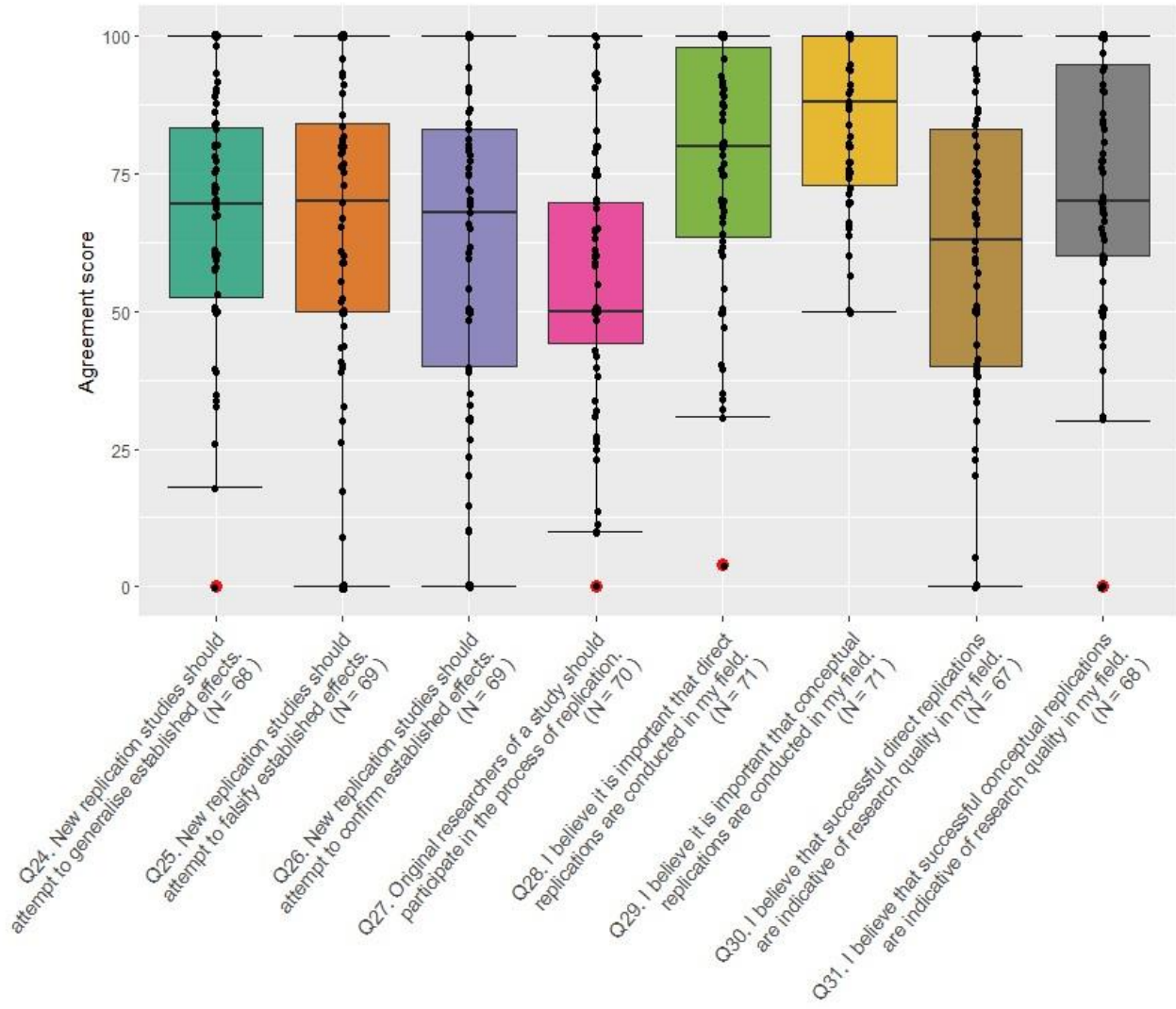


Figure 1 shows the responses on the items asking about the value and aims of replication.

Generalizability, falsification, and confirmation. The median agreement score on the statements that new studies should attempt to generalize (Mdn = 69.5, $N = 68$), falsify (Mdn = 70, $N = 69$), and confirm (Mdn = 68, $N = 69$) established effects were highly similar. The spread of agreement among respondents was less similar across the three items (generalizability: IQR 30.8 [52.5, 83.3]; falsification: IQR 34 [50, 84]; confirmation: IQR 43 [40, 83]).

Original researchers participating in the process of replication. The median agreement score regarding the extent to which participants agree on the participation of original researchers in the process of replication is $Mdn = 50.0$ ($N = 70$). Interestingly, the spread of agreement among social psychologists was the smallest ($IQR_{Q27}: 25.5 [44.3, 69.8]$) compared to the spread of agreement of the rest of the items.

Importance of direct and conceptual replication. There was high agreement that the conduction of direct replication ($Mdn = 80$, $N = 71$) and of conceptual replication ($Mdn = 88$, $N = 71$) is important in social psychology. Besides the higher level of importance accredited to conceptual replication, and the spread of agreement among participants was smaller for conceptual replication ($IQR: 27 [73, 100]$) than for direct replication ($IQR: 34.5 [63.5, 98]$). The lowest agreement score concerning the importance of conceptual replication was 50. regarding the importance of direct replication, the lowest indicated agreement was at 4.

Successful replication as an indication of research quality. Respondents generally indicated lower agreement for successful direct and conceptual replication being indicative of research quality. The median for successful direct replication being indicative of research quality ($Mdn = 63$, $N = 67$) was lower than that of conceptual replication ($Mdn = 70$, $N = 68$). The spread of agreement among participants was found to be smaller for conceptual replication ($IQR: 34.8 [60, 94.8]$) than for direct replication ($IQR: 43 [40, 83]$). Moreover, for both direct and conceptual replication spread estimates increased for successful replication being indicative of research quality in contrast to their importance in being conducted.

Thematic Analysis

Using thematic analysis, 25 codes were identified in the text, resulting in eight themes (see Table 1). Each theme consisted of three to five codes. The complete codebook containing all codes and examples for all codes can be found in Appendix D.

Table 1

Identified Themes with Pertaining Codes (number of examples that the code has in the data is between brackets)

Themes	Assigned Codes
Process and Conclusions of Replication	<i>Successful single replication is not conclusive (7)</i> <i>Replication is a learning and quality process (4)</i> <i>Incentives and bias for failed replications (2)</i> <i>Replication should not have purposes (1)</i>
Direct Replication: Functionality and Drawbacks	<i>Direct replication for reliability (9)</i> <i>Direct replication is uninformative (5)</i> <i>Direct replication reinforces original bias/mistakes (3)</i> <i>Direct replication for robustness (3)</i> <i>Direct replication indicative of quality of methodology (3)</i> <i>Direct replication not applicable in social psychology (2)</i>
Conceptual replication: functionality	<i>Conceptual replication for generalizability (12)</i> <i>Conceptual replication for theory development (7)</i> <i>Conceptual replication for validity (4)</i> <i>Conceptual replication and context-sensitivity (3)</i> <i>Conceptual replication overcomes methodological limitations and bias (3)</i> <i>Conceptual replication for theory boundary conditions (4)</i>
Broad judgements regarding both replication types	<i>Conceptual over direct replication (13)</i> <i>Both replication types are uninformative (3)</i> <i>Both replication types are similarly important (2)</i> <i>Direct over conceptual replication (2)</i> <i>Nature of study determines which type of replication (1)</i>
Epistemology & Ontology	<i>Social psychology and context-sensitivity (10)</i> <i>Objectivity and truth as foundations for science (7)</i> <i>Research is subjective by nature (6)</i> <i>Universal and stable effects exist in science (2)</i>

Processes and Conclusions of Replication

Overall, a number of participants view any form of replication as an essential quality in research that can be used to learn and advance the knowledge on phenomena beyond the information that only single studies can provide for them. Nevertheless, the success or failure of a single form of replication is not enough to define the quality of a study, as suggested. For example, a participant stated, "It's not the results of the replication that matters. What matters

is that we do them and learn from them". Nevertheless, some participants argued that the scientific community's incentives may consciously or subconsciously influence a researcher's efforts to replicate a study. Specifically, a participant claimed, "The underlying problem is that failed replications are seen as more newsworthy than successful replications, so that replicators can have more impact if their replication attempts fail. This is a big problem that the field needs to engage with much more actively."

Direct Replication: Functionality and Drawbacks

Respondents associated direct replications with enhancing the reliability and robustness within social psychology, while also with standardization of research policies in the discipline. They explained that if the original conditions reproduce an effect, the confidence and stability in its evidence and research methodology amplify. For example, a participant expressed, "*It makes sense to me that if we use the same population, study design, and analysis (direct replication), we should get somewhat similar results. If not, it may indicate that the results were not reliable (due to low power, bad implementation, p-hacking, etc.)*". In brief, the particular pattern of arguments implicated that direct replications are beneficial when controlling confounding variables that might influence the understanding of an effect.

Nevertheless, negative connotations implied that direct replications deplete the information needed to understand an effect in social psychology truly. For example, one respondent remarked, "*I think direct replication is not indicative of research quality in my field as results are deeply dependant on situational, cultural, and -perhaps more importantly- periodical conditions where research is conducted*". Moreover, responses claimed that direct replications could eliminate the improvement of the quality of research since they tend to reproduce the same mistakes and biases that original researchers did by using identical initial methodologies to study a phenomenon.

Conceptual Replication : Functionality

Participants explicitly associated conceptual replications with the validity of research in social psychology. They exhibited that because conceptual replications aim to study an original effect in a different manner, the original limitations, restrictions and biases are eliminated in the process, and hence, conceptual replications ensure methodological and theoretical improvements through generalizability of findings. For example, a participant noted: *"it is necessary to test the same logic in different contexts (e.g. stereotypes usually have to be studied in the culture they belong to."* Lastly, participants stated that conceptual replications serve in the understanding of the boundaries that hold theories in social psychology, stating that *".. for an effect to be meaningful it should be present in more than one study. Conceptual replications are thus important as they indicate in what context something is and is not present, which we can build on theoretically".*

Broad judgements regarding both replication types

Controversies on which of the two types of replication represent is more essential in social psychology were observed. On the one hand, some participants suggested that neither type of replication, direct or conceptual provide meaning by proposing that *"Successful replications, whether direct or conceptual, can be meaningless if the original phenomenon/effect is not of theoretical value. This is often the case in social psychology. In other words, replication can not be a sufficient criterion of research quality.* Besides, some responses advocated that there is functionality in both replications. They reasoned that depending on the nature of the study and the purpose of the replication, the different forms can be applied accordingly. As an example, a participant declared: *"... direct replication would be the first step, to ensure the reliability of the effect, followed by conceptual replication for validity".* Lastly, the high imbalance in support of the two types of replication is essential to consider, as there were strong tendencies to support the utility of conceptual replications (13) more than direct replications (2) in social psychology. A participant stated: *"I perceive especially conceptual replication as an indicator of good*

research quality as this accounts for variations in different studies rather than trying to gain an exact copy of a previously conducted study whereas external factors (e.g., media on the topic) and contextual factors may have an influence that should be considered.". Another participant explained: "*Many of the topics studied in social psychology naturally change over time, and the background of the researcher can influence the kinds of research questions that they ask and the way the research is designed.*", implicating the instability of the constructs of interest in social psychology, and the influence of researchers having upon their investigation. In contrast, a minority of participants favoured direct replications by declaring that: "*Conceptual replications infuse a lot more interpretation and degrees of freedom in the discussion (what counts as a conceptual replication?) and this are of limited, yet also not zero, use.*"

Epistemology & Ontology

A participant inferred that there are stable phenomena in science while also admitting their complexity in understanding them. For example, the participant claimed, "*I think there are phenomena in reality that have stable characteristics, but that can never be described in any words. Multiple theories are needed to approach the quality and complexity of these real phenomena. The phenomena themselves will never be described in their essence but they can be described and predicted with the clumsy tools we call theories.*" Lastly, there was a recognition of the lack of consensus between scientists about the approach towards the phenomena they study. To illustrate, a participant expressed that "*The item on truth does depend on what people attribute to the "truth". To me, the truth can change over time and can depend on a given context or situation. As such different things can both be the truth at the same time. In that sense I do not consider the truth to be an unfixed, static, sacred unit. Even more "hard" scientific findings can be relative. For example, the law of gravity depends on where in the universe you apply it.*"

Discussion

The particular paper aimed to explore how do social psychologists perceive direct and conceptual replications and secondly, what is the reasoning behind these views. In brief, participants suggested direct replications as useful to establish the reliability, robustness and stability of research policies in social psychology. Furthermore, conceptual replications were associated with advancing generalizability, theory development and validity of findings in social psychology. Notably, most participants supported that conceptual replication are more applicable than direct replications in social psychology. The singularity in direct replications was suggested to deplete the understanding of constructs in social psychology. Overall, participants view replication as necessary for facilitating learning pathways to understand specific phenomena. However, participants declared that the success of a single, any form of replication, is not enough to be conclusive. If the original phenomenon does not provide a theoretical value, some participants suggested that both types of replication, either direct or conceptual, can be meaningless. Besides, a participant claimed that depending on the nature study and the purpose of the research, both types of replication could serve functionality.

Regarding the link between direct replication and reliability, in line with Ioannides (2012b), Simons (2014) argues that direct replication conducted by other than the original laboratories is the only condition to assess reliability. Based on this statement, a direct replication should isolate an effect from the sampling error and find an average across multiple kinds of error through different laboratories (Simons, 2014). This view may explain participants' suggestions that direct replications promote stability in research methodologies. The original materials, the procedures, and the methodology are what a direct replication aims to reproduce (Nosek & Errington, 2017). Seemingly, the constructs that scientists refer to should be under observation within laboratories under controlled conditions. However, the stability that direct replications hold to their methodologies seems to explain participants' arguments that direct replications are not applicable in social psychology.

Most responses indicated that conceptual replications are more applicable in social psychology than direct replications. They reasoned that conceptual replications consider the context-sensitivity that psychological constructs have. In line with this argument, prior research explains that factors either cultural, historical, periodical or even unknown to the researchers may keep a phenomenon from being identically replicated (Zwaan et al., 2018; Cesario, 2014). However, reformers respond that if scientists devote themselves to the rationale of context-sensitivity, they avoid the accumulation of knowledge in a specific field (Zwaan et al., 2018). They suggest that research is supposed to illustrate predictions of phenomena, and the incapability to display the circumstances that predict is not progressive to science (Lakatos, 1970). They propose that if researchers cannot reproduce a theory under the original conditions and add more auxiliary assumptions to enable the replication, then the initial theory is problematic (Meehl, 1990b). It seems that for reformers, an object can be real only if it is stable (Morawski, 2021). On the contrary, as a participant argued, there might be objects with stable characteristics; however, understanding them is complex. It might require multiple methods, theories and procedures to capture those features (Morawski, 2019).

Reformers promote a theoretical loyalty to the original materials, stating those can be valid predictors of phenomena (Nosek & Errington, 2017). However, participants argued that this approach to replication can narrow the understanding of psychological phenomena. In line with this argument, prior research suggests that psychological objects can be influenced by external elements and the dynamic conceptualizations that individuals associate with those contexts (Strack & Strober, 2018). Based on these suggestions, static prescriptions of replication procedures may deplete the necessary information that is needed to understand the mechanisms that cause an effect (Stroebe & Strack, 2014). Some researchers elaborated this argument with the concept of "situated conceptualization" (Barsalou, 2016, p.9). Based on situated conceptualization, individuals obtain cognitive representations in their long term memory of their surrounding environments through their senses. Nevertheless, these cognitive

representations can be unique according to the individual and hardly ever controlled due to their fragile and changing nature (Strack & Stroebe, 2018). Consequently, some scientists suggested that small-sized studies with a qualitative focus on individual differences and the environment's effects on them might be more beneficial than large-sized direct replications (Smith & Little, 2018). Accordingly, these suggestions seem to pay attention to the individual as an entity, validating and embracing its uniqueness and complexity.

Participants consistently supported conceptual replications as a contribution to theoretical development. In agreement with this responses, scientists suggested that conceptual replications can replicate overarching theories of phenomena beyond the limits of their operationalization (Crandall, & Sherman, 2016; Strack & Strober, 2018). They view how a phenomenon manifests in different contexts, populations, methodologies and take that into account theoretically. Subsequently, conceptual replications have been declared to embrace the generalizability of findings in social psychology and the ecological validity of social psychology (Crandall, & Sherman, 2016; Salmon, 2020). Scientists suggested that conceptual replications can be a pathway of understanding psychological objects in everyday life, ensuring that certain phenomena do not occur only in laboratories under conditions that researchers only created, but instead, in the real complex world (Salmon, 2020). Overall, it seems that social psychologists may have a different approach to developing theories from reformers. Social scientists, seek overarching theories that account for the individual differences and the interchangeable influences that the context and individuals' situated conceptualizations provide.

In brief, the idea that psychological objects should be reappraised within the scientific community is growing, with scientists discussing constructs' fragility and context sensitivity (Morawski, 2019). Bayesian statistics have connected the idea of a replication crisis in social psychology to the default conception coming from null hypothesis significance testing, that effects should be static, with precise identifiable properties (Gelman, 2015). Bayesian statistics emphasize on the role of interaction, small- sized samples, the individuality of participants, and

the unknown. They advocate that as soon as researchers acknowledge the context-dependency of objects, and embrace this uncertainty, they can begin investigating how their variation exists, though implying unique effects for unique individuals, under unique contexts (Dehejia, 2015). It seems that the exploration of how scientists view direct and conceptual replication, reveals that psychological objects are perceived by scientists based on the preference of methodology they have. However, democracy in science seems not to work (Morawski, 2019). Democracy in science seems to led a particular conception of scientists, namely, scientists who support reform to govern the research policies. Instead, embracing scientists' individualism, expertise, and tacit knowledge seems to be the component that scientific community has been missing within discussions of the crisis (Bench et al., 2017)

Limitations and Implications

It is essential to discuss how some limitations of this study might influenced its results, and how can future research take this into account. First, there are two limitations regarding the timing of the study. Scientists who participated in this study had approximately 6 years of experience in research. The talk of a crisis has received larger velocity over the past century, as a result of the sequence of large – scaled replication failures (Open Science Collaboration, 2015). Therefore, it can be assumed that because of the exposure of scientists to the recent debates, polarization of arguments could be amplified, and hence, it could explain why some scientists considered only conceptual replications as applicable in social psychology and not direct. In addition, participants had approximately 6 years of experience. Hence, it could be beneficial if future research could build on how scientists with longer years of experience perceive replication, across different contexts of time. Furthermore, participants were chosen based on convenience sampling. However, scientific suggestions claim that how scientists choose to talk about replication, objects, and methodologies is shaped by the system of knowledge they work in (Morawski, 2019). Therefore, the epistemological conceptions that the system of universities in

the Netherlands hold, might influence researchers' views. Precisely since the study is pilot, the survey items needed to be evaluated initially through a small, convenience sample, before being used for larger distributions. Accordingly, perhaps it can be seen as a limitation that within the survey we first asked participants about their epistemological views and then how they reflect on replication. That could activate certain views of scientists that probably they would not think of without reflecting on their epistemological values first. One of the most important implications of this research is that future research should investigate more the importance of expertise and tacit knowledge, in replication but also in science in general. There is only one empirical study on this topic, which showed that expertise improved the process of replication (Bench, et. al, 2017). Moreover, the phenomenon of "situated conceptualization" is relatively new in research. The investigation of the variation within and across individuals regarding how they conceptually relate to their surrounding environments can obtain important implications for how scientists should view psychological objects.

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Appendix A

Invitation E-mail , reminder emails and the Informed Consent

Invitation Email.

Dear [title+ name],

We are contacting you, because we are doing a pilot study for a large-scale study about perceptions of the replication/credibility crisis and the ‘reform movement’. In this context, social psychology is a field that is often *talked about*, but in our opinion, not *talked to* enough. We are curious how you, as a social psychologist, have experienced the crisis debate, the reform movement and the proposed changes. The results of this survey will facilitate a critical evaluation of the aims and accomplishments of the reform movement. Because this is a pilot survey, we are especially interested in your feedback about our questions (content, wording, etc.).

We kindly invite you to take part in the survey via this link:

https://rug.eu.qualtrics.com/jfe/form/SV_8quywigev6mhQa2 Participation will take

approximately 15 minutes. Your contribution would be greatly appreciated!

In the attachment of this email, you can find more information about the study. Feel free to reply to this email if you have questions or concerns. If you would like to be kept up to date about this research and its results, please send us an e-mail at perceptions.of.reform@rug.nl.

Kind regards,

Robert van Ark, Maria Bompa, Kaiti Evgeniou, Colm Ó Fuartháin, Rafael Funke and Larissa Hoß

Research team:

Joyce Hoek, MSc

Nina Schwarzbach, MSc

Sarahanne Field, MSc

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Dr. Rink Hoekstra

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Faculty of Behavioural and Social Sciences, Rijksuniversiteit Groningen, the Netherlands

First Reminder Email

Dear [title+ name],

A week ago we contacted you because of our survey about “perceptions of the reform movement”, and we highly appreciate your participation. In case you did already fill out the survey: thank you very much! Please disregard this email. Unfortunately, we cannot remove you from our mailing list, since participation is anonymous.

In case you have not filled out the survey, we would kindly like to remind you that participation in our survey is still possible.

You can participate in the survey using the following link:

https://rug.eu.qualtrics.com/jfe/form/SV_8quywigev6mhQa2

In response to previously raised concerns:

- We invited 250 people to this pilot survey. Therefore, it would be difficult to trace back your identity on the basis of demographic data we ask for.
- If you'd like to give more detailed feedback verbally or via email, please do not hesitate to contact us.
- Some said that the survey takes longer than 15 minutes. Please take into consideration that it might take up to 30 minutes depending on how detailed your answers are.

Thank you in advance,

Robert van Ark, Maria Bompa, Kaiti Evgeniou, Colm Ó Fuartháin, Rafael Funke and Larissa Hoß

Research team:

Joyce Hoek, MSc

Nina Schwarzbach, MSc

Sarahanne Field, MSc

Merle Pittelkow, MSc

Dr. Rink Hoekstra

Prof. dr. Don van Ravenzwaaij

Faculty of Behavioral and Social Sciences, Rijksuniversiteit Groningen, the Netherlands

Second Reminder Email

Dear [title+ name],

We would like to remind you one last time about our survey about “perceptions of the reform movement”. You still have time to fill it out until December 8th, after which the survey will close. Your participation is still highly appreciated!

In case you did already fill out the survey: thank you very much! Please disregard this email. Unfortunately, we cannot remove you from our mailing list, since participation is anonymous.

You can participate in the survey using the following link:

https://rug.eu.qualtrics.com/jfe/form/SV_8quywigev6mhQa2

In response to previously raised concerns:

- We invited 250 people to this pilot survey. Therefore, it would be difficult to trace back your identity on the basis of demographic data we ask for. In addition, we’ve decided not to publish the data of this pilot survey on OSF or any other open data platform.
- If you’d like to give more detailed feedback verbally or via email, please do not hesitate to contact us.
- Some said that the survey takes longer than 15 minutes. Please take into consideration that it might take up to 30 minutes depending on how detailed your answers are.

Thank you in advance,

Robert van Ark, Maria Bompa, Kaiti Evgeniou, Colm Ó Fuartháin, Rafael Funke and Larissa Hoß

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INFORMED CONSENT

“PERSPECTIVES OF THE REPLICATION CRISIS, SCIENCE AND THE REFORM MOVEMENT”

Welcome and thank you very much for participating in our survey. For more information about this pilot study, please refer to the study information form in the email or contact us at:

perceptions.of.reform@rug.nl

Please read the information below and indicate whether you agree with it before continuing with this survey. You have the right to take a screenshot of this information.

- I have read the information about the research. I have had the opportunity to ask questions about it.
- I understand what the research is about, what is being asked of me, which consequences participation can have, how my data will be handled, and what my rights as a participant are.
- I understand that participation in the research is voluntary. I myself choose to participate. I can stop participating at any moment. If I stop, I do not need to explain why. Stopping will have no negative consequences for me.

I consent to participating in this study

Appendix B

Complete Survey

Start of Block 0: Informed Consent

Welcome and thank you very much for participating in our survey. For more information about this pilot study, please refer to the [Study information form](#) or contact us at: perceptions.of.reform@rug.nl. The study will take approximately 15 minutes, contains 11 sections and is best completed on a computer. Please read the information below and indicate whether you agree with it before continuing with this survey. You have the right to take a screenshot of this information. I have read the information about the research. I have had the opportunity to ask questions about it. I understand what the research is about, what is being asked of me, which consequences participation can have, how my data will be handled, and what my rights as a participant are. I understand that participation in the research is voluntary. I myself choose to participate. I can stop participating at any moment. If I stop, I do not need to explain why. Stopping will have no negative consequences for me. I consent to participating

in this study: Yes, I consent to participation.

No, I do not consent to participation.

End of Block 0: Informed Consent

Start of Block 1: Demographics

First, we'd like to ask you for some demographic data.

Q1. In what country are you currently working?

▼ Afghanistan ... Zimbabwe

Q2. What is your broad field of expertise?

- Social psychology
- Developmental psychology
- Industrial and organizational psychology/ work psychology
- Environmental psychology
- Experimental psychology
- Personality psychology
- Clinical (neuro) psychology
- Cognitive psychology
- Quantitative psychology
- Biological psychology
- Political psychology
- Other, namely: _____

Q3. What is your current job position?

- (Undergrad) student
 - Research Assistant
 - Junior researcher
 - PhD student
 - Postdoc
 - Assistant professor/UD
 - Associate Professor/UHD
 - Full professor
 - Other, namely: _____
-

Q4. How long have you been working in academia? (years)

End of Block 1: Demographics

Start of Block 2: Terms

To have a consistent and shared understanding throughout the survey, we would like to clarify what the terms mean to us. Throughout the survey, you can always go back to these definitions using a pop-up button found at the bottom.

Direct replication: The attempt to conduct a study in a manner as close to the original as possible (the same population, methodology, and statistical analyses).

Conceptual replication: The attempt to test the same theoretical process or effect as an existing study, or understand boundary conditions of given phenomena, but that uses methods that vary in some way from the previous study.

Successful replication: When the replication study yields results which are sufficiently similar to the original study in terms of the strength of the effect and whether the effect goes in the same direction as the original. 'Sufficiently similar' varies, and is usually defined by the replicating author.

Open science: Open science aims to make science more transparent. Open science practices include among others: preregistration, registered reports, open data, open peer review, and open access publishing.

Metascience: The study of research itself, often with the aim of improving its practice. Metaresearchers study the scientific community and its actors, their methods and reporting, reproducibility, evaluation, behavior, and incentives.

Reform movement: There are many different words describing groups of people that are promoting change in science, including 'meta-science movement', 'open science movement' or 'reformer movement'. In the following we summarize people sharing concern with regards to improving science through either meta-scientific or transparent/open science practices as the 'reform movement'.

Q5. Optional: Do you have feedback on these definitions?

From now onwards, we will refer mostly to the reform movement. You can always go back to the definitions if you are unsure about the terms used in the survey.

End of Block 2: Terms


Start of Block 3: Reform movement

The next questions will be about how the aims of the reform movement resonate with you and your research practices.

Q6. Please indicate the extent to which you...

Not at all

Completely

...identify with the reform movement	
--------------------------------------	--

Q7.

Do you agree with this statement: "I am part of the reform movement."?

Yes

No Don't

know

Q8. Optional: Do you have any thoughts with regard to your identification with the reform movement you'd like to add here?

Q9. Optional: Do you have feedback on the questions about identification with the reform movement?







End of Block 3: Reform movement

Start of Block 4: Epistemology/Ontology

We would like to know more about how you think about science and knowledge in general. Please indicate how the following statements relate to your research.

Please indicate how the following statements relate to your research:

	Not at all	Completely
Q10. "For every phenomenon that I study, there are multiple valuable truths."		
Q11. "In my field of research, scientists can ultimately get to/reach the truth."		
Q12. "In my field of research, results depend on the perception of the researcher."		
Q13. "Science should be organized in such a way as to reduce scientists' biases."		

Q14. "In my field of research, the effects are dependent on the time period in which these studies took place rather than universal."	
Q15. "In my field of research, the effects are dependent on the culture where the study took place rather than universal."	
Q16. "In my field of research, the effects are dependent on the experimental setup rather than universal."	
Q17. "It is possible to specify all the boundary conditions that enable a theory to hold true."	
Q18. "Conducting a scientific study requires constant adaptation of the methods used."	
Q19. "The expertise of an individual scientist is important to study a phenomenon."	

Q20. Optional: Do you have any thoughts you'd like to add here?

Q21. Optional: Do you have feedback on the questions about science and knowledge in general?

End of Block 4: Epistemology/Ontology

Start of Block 5: Research Quality

The current survey includes some questions about the quality of research. First, we would like to know what you think of the current state of research quality in your field.

Please indicate the extent to which you agree with the following statement:

Not at all

Completely

Q22. "I think that research quality in my field is something that needs to be improved."



Q23. Optional: Can you elaborate?

End of Block 5: Research Quality

Start of Block 6: Replication

The next couple of questions will be about replication.

Please indicate the extent to which you agree with the following statement:






Not at all

Completely

Not applicable

Q24. "New replication studies should attempt to **generalise** established effects."





Q25. "New replication studies should attempt to falsify established effects."	
Q26. "New replication studies should attempt to confirm established effects."	
Q27. "Original researchers of a study should participate in the process of replication."	
Q28. "I believe it is important that direct replications are conducted in my field."	
Q29. "I believe it is important that conceptual replications are conducted in my field."	

We would now like to ask some questions about replication and research quality.

Please indicate the extent to which you agree with the following statement:

Not at all Completely Not applicable

Q30. "I believe that successful direct replications are indicative of research quality in my field."	
Q31. "I believe that successful conceptual replications are indicative of research quality in my field."	

Can you elaborate on your previous two answers?

Q32. Why do you think that successful replication is, or is not, indicative of research quality in your field of research? Please indicate what type of replication you are talking about (i.e., direct, conceptual or any other form)?

Q33. Optional: Which quality indicators other than replication do you think are important in your field of research?

Q34. Optional: Do you have any thoughts you'd like to add here?

Q35. Optional: Do you have feedback on the questions about replication?

End of Block 6: Replication



Start of Block 7: Open Science Ideas

The next couple of questions are about your ideas of open science in general.

Please indicate the extent to which you agree to the following statements:

Not at all

Completely

Q36. I think that science in general should be transparent and open if possible.	
Q37. Generally, I think that the more transparent and open the research process is, the higher its quality and reliability.	

Q38. Optional: Do you have any thoughts you'd like to add here?

Q39. Optional: Do you have feedback on the questions about open science ideas?

End of Block 7: Open Science Ideas



Start of Block 8: Open Science Practices

The next couple of questions are about your thoughts on the practical application of open science.

Q40. Please give an estimate on how many hours of (informal) training on open science practices you have received.

Please indicate the extent to which you agree with the following statements:

Very Little Very Much Not applicable

Q41. "I feel like I have received sufficient (informal) training on how to practice open science."	
Q42. "My working environment/colleagues encourage me to use open science methods to conduct my research."	

Q43. Which of the following practices are you currently using in your research?

	Never	Rarely	Sometimes	Mostly	Always	I don't know what this means	Not applicable
Preregistration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Registered reports	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open access publishing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open materials (code, metadata)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open peer review	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q44. Optional: Alternatively, which other open science practice are you currently using in your research?


	Never	Rarely	Sometimes	Mostly	Always
Other practice:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q45. Which of the following practices would you like to use (more) in your future research?

- Preregistration
- Registered reports
- Open access publishing
- Open data
- Open materials (code, metadata)

Please indicate the extent to which you agree with the following statement:


Not at all Completely Not applicable

Q49. "I feel like the reform movement addresses the most pressing issues regarding scientific quality in my field."	
---	--

Q50. Optional: Please explain why (not)?

Please indicate the extent to which you agree with the following statement:

Not at all Completely Not applicable

Q51. "The proposed solutions solve the problems in my field sufficiently."	
--	--

Q52. Optional: Please motivate your answer.

Q53. The reform movement prioritizes some solutions over others. Please rank how **you think** the reform movement prioritizes the following issues (1=most priority, 16=least priority):

- Preregistration/registered reports
- Data/code sharing
- Research methods other than inferential (qualitative, descriptive, exploratory)
- Improving statistics (bayesian statistics vs NHST etc)
- Theory or construct development
- Bigger sample sizes
- Slow science
- Managing competitive culture in academia
- More collaboration
- More direct replication
- More conceptual replication
- Increasing diversity within universities
- Increasing the importance of societal impact
- More freedom to pursue your scientific interests
- More job security
- Nuanced reporting of results

Q54. Are you sure you finalised the ranking?

- Yes, I am
 - No, I am not
-

Q55. Optional: What problems with regard to the quality of research in your field is the movement missing?

Q56. Optional: Do you have feedback on the questions about the priorities of the reform movement?

End of Block 9: Critique

Start of Block 10: Important Issues To Be Addressed

Q57. In order to improve **research quality** in your field, multiple solutions are suggested. Please rank how important **you think** they are to improve research quality in your field (1=most important, 16=least important).

- _____ More focus on preregistration/registered reports
- _____ More focus on data/code sharing
- _____ More focus on research methods other than inferential (qualitative, descriptive, exploratory)
- _____ More focus on improving statistics (Bayesian statistics and/or NHST etc.)
- _____ More focus on theory or construct development
- _____ More focus on bigger sample sizes
- _____ More focus on slow science
- _____ More focus on managing competitive culture in academia
- _____ More focus more collaboration

- _____ More focus on direct replication
 - _____ More focus on conceptual replication
 - _____ Increasing diversity within universities
 - _____ Increasing the importance of societal impact
 - _____ More freedom to pursue your scientific interests
 - _____ More job security
 - _____ More focus on nuanced reporting of results
-

Q58. Are you sure you finalised the ranking?

- Yes, I am
 - No, I am not
-









Q59. Optional: Did we forget something?

Q60. Optional: Do you have feedback on the questions about the important issues to be addressed?

End of Block 10: Important Issues To Be Addressed

Start of Block 11: Obstacles to Implementation

Researchers also report various obstacles to reforming science. How much do you agree with the following statements?

	Not at all	Completely	Not applicable
Q61. "Open science does not sufficiently take into account privacy issues for studies with sensitive data."			
Q62. "Open sciences practices are too timeconsuming."			
Q63. "At this moment, open science practices are not rewarded or incentivised enough."			
Q64. "Practicing open science gives me a competitive advantage over other scientists."			
Q65. "Practicing open science gives me a competitive disadvantage over other scientists."			
Q66. "The critique about my field of research from the reform movement makes me feel like I have to prove my innocence."			
Q67. "The tone of the members of the reform movement should be more nuanced."			
Q68. "I am less likely to engage with the propped reform practices because I feel the reform movement is prejudiced toward my field of research."			

Q69. Optional: Do you want to elaborate on any of your answers with regard to obstacles for reform?

Q70. Optional: What other obstacles for changing the practices of your field do you see?

End of Block 11: Obstacles to Implementation

Start of Block 12: Feedback

You've now reached the end of the survey.

Q71. Would you like to give more specific feedback on the survey?

Q72. I have honestly answered the questions above.

Yes No

Q73. I paid attention filling in this survey.

Yes

No

Please press → to submit your answers. You cannot change your answers anymore after submitting.

End of Block 12: Feedback

Appendix C

R code used for quantitative analyses

```
#install.packages("ggplot2")
#install.packages("tidyverse")
#install.packages("hrbrthemes")
#install.packages("viridis")
#install.packages("reshape2")
#install.packages("grid")
#install.packages("gridExtra")

library(ggplot2)
library(tidyverse)
library(hrbrthemes)
library(viridis)
library(reshape2) library(grid)
library(gridExtra)

## Setting working directory and preparing data for analysis setwd("D:/R")
mydata = read.csv("DATAREALREAL.csv", header = TRUE) mydata2 =
mydata[,c("fieldofexpertise", "Q99_1", "Q99_5", "Q99_6", "Q99_9",
"Q99_7", "Q99_8", "Q110_1", "Q110_5", "Q123", "Q124")]
mydata2 = dplyr::filter(mydata2, grepl('24', fieldofexpertise)) # exclude non-social
psychologists mydata2 = dplyr::filter(mydata2, Q123 == "1" | Q123 == "" & Q124 ==
"1" | Q124 == "")
```

```

#Excluding possible dishonest responding and lack of attention mydata2
= mydata2[,c("Q99_1", "Q99_5", "Q99_6", "Q99_9",
"Q99_7", "Q99_8", "Q110_1", "Q110_5")] # removing column of field of expertise
colnames(mydata2) <- c('Q24','Q25','Q26','Q27','Q28','Q29','Q30','Q31') mydata2
= as.data.frame(sapply(mydata2,as.numeric))

## Calculating medians, IQR, quartiles, and a minimum value

# Medians d_Medians = apply(mydata2,2,median,
na.rm = TRUE)

# IQRs, along with Q1 and Q3 d_IQRs =
apply(mydata2,2,IQR, na.rm = TRUE) all_quartiles =
apply(mydata2,2, quantile, na.rm = TRUE)
Quartiles_1 = all_quartiles[2,]
Quartiles_3 = all_quartiles[4,]

# Minimum value complete_mydata2_min =
mydata2[complete.cases(mydata2),6]
min(complete_mydata2_min)

## Boxplot chart

mydata2_m = melt(mydata2) #Change data structure for function ggplot mylabels =
c("Q24. New replication studies should \n attempt to generalise established

```

effects.",

"Q25. New replication studies should \n attempt to falsify established effects.",

"Q26. New replication studies should \n attempt to confirm established effects.",

"Q27. Original researchers of a study should \n participate in the process of replication.",

"Q28. I believe it is important that direct \n replications are conducted in my field.",

"Q29. I believe it is important that conceptual \n replications are conducted in my field.",

"Q30. I believe that successful direct replications \n are indicative of research quality in my field.",

"Q31. I believe that successful conceptual replications \n are indicative of research quality in my field.") item_obs = c(sum(mydata2\$Q24 > -1, na.rm = TRUE),

sum(mydata2\$Q25 > -1, na.rm = TRUE), sum(mydata2\$Q26 > -1, na.rm =

TRUE), sum(mydata2\$Q27 > -1, na.rm = TRUE), sum(mydata2\$Q28 > -

1, na.rm = TRUE), sum(mydata2\$Q29 > -1, na.rm = TRUE),

sum(mydata2\$Q30 > -1, na.rm = TRUE),

sum(mydata2\$Q31 > -1, na.rm = TRUE)) mylabels = paste(mylabels,

"\n (N =", item_obs, ")") # Adding the number of observations to the labels

boxplots ggplot(mydata2_m, aes(x = variable, y = value, fill = variable)) +

geom_boxplot(alpha = 0.8, varwidth = TRUE, outlier.colour="red", outlier.fill="red",

outlier.size=3) + stat_boxplot(geom = 'errorbar') + geom_jitter(width = 0.01) +

```

theme(legend.position = "none", plot.margin = unit(c(0.5,0.5,0.5,2),"cm"),
axis.text.x = element_text(angle = 50, hjust = 1, size = 10.5)) +
scale_fill_brewer(palette="Dark2") + scale_x_discrete(labels = mylabels) +
xlab("") + ylab("Agreement score")

# How many years have participants been in academia yearsinacademia =
(as.data.frame(sapply(demogr$workinacademiayears,as.numeric))) # Putting the Data
as numerical median_yearsinacademia = apply(yearsinacademia, 2, median, na.rm =
TRUE) all_quartiles_yearsinacademia = apply(yearsinacademia, 2, quantile, na.rm =
TRUE)
Quartiles_1_yearsinacademia = all_quartiles_yearsinacademia[2,]
Quartiles_3_yearsinacademia = all_quartiles_yearsinacademia[4,]

```

Appendix D

Codebook including definitions and example quotes

Table 1

Codebook, Definitions and Exemplars

Codebook	Definition	Exemplars
Both replication types are uninformative	To code when a response indicates that both replication types, even if successful, do not provide any information or meaning.	<i>“Successful replications, whether direct or conceptual, can be meaningless if the original phenomenon/effect is not of theoretical value.”</i>

Both replication types are similarly important	To code when a response indicates that both replications types are similarly important.	<i>“I’d say direct replication would be the first step, to ensure the reliability of the effect, followed by conceptual replication for validity.”</i>
Direct over conceptual replication	To code when a response indicates that direct replication is distinctly more important than conceptual replication.	<i>“Direct replication rate should be diagnostic of the robustness of findings published in a field. Conceptual replications are limited by the (typically) unclear correspondence in validity of measurements across studies purporting to test the same hypothesis.”</i>
	code when a response	<i>“Conceptual replications do the same [as direct replication] AND are To</i>

Conceptual over direct replication	indicates that conceptual replication is distinctly more important than direct replication	<i>indicative of whether the result is something generalizable and not specific to the exact methods used in the original experiment.”</i>
Direct replication is uninformative	Direct replication does not provide any new information and cannot prove anything, so it yields uninformative results	<i>“There are a lot of factors which might influence a direct replication to not be successful (...) a failed direct replication does not tell us all that much about the effect.”</i>
Direct replication for reliability	Successful direct replication studies can say something about the reliability (a measure) of our results	<i>“Id say direct replication would be the first step, to ensure the reliability of the effect, followed by conceptual replication for validity.”</i>

Direct replication for robustness	<p>Successful direct replication studies can say something about the robustness (a characteristic) of our field and our theories.</p>	<p><i>“Direct replication rate should be diagnostic of the robustness of findings published in a field.”</i></p>
Direct replication not applicable in Social Psychology	<p>Due to the context-sensitivity of the social sciences, the conditions between two different studies will always be different even if the methods are followed as closely as possible. Thus, direct replication cannot say anything about research quality of our results, and can be considered not applicable in the field.</p>	<p><i>“... there are cases when direct replication is difficult because of changed context or meaning...”</i></p>
Direct replication indicative of quality of methodology measures and methodology we use in social psychology	<p>Successful direct replication studies can say something about the quality of the methodology we use in social psychology</p>	<p><i>“Direct replications also have their value and can indicate the stability of the work and the quality of research protocols (can someone replicate the</i></p>

Direct replication reinforces of the original researcher also original bias/mistakes end up in the new replication	<p>As direct replication aims to follow the original study in as close a manner as possible, what ends up happening is that the mistakes and biases of the original researcher also end up in the new replication study, eliminating the possibility of improving the quality of our research.</p>	<p><i>“Using the same materials/populations as before, as in direct replications, only further reinforces/empowers the potential biases involved in the original research.”</i></p>
Conceptual replication for generalizability	<p>Conceptual replication increases the generalizability (for example, contexts, different populations, and different operationalizations)</p>	<p><i>“Conceptual replication is more important for generalizability than direct ones because it gives a sense that the way we study things</i></p>
	<p><i>work).”</i></p>	
	<p>of phenomenon that have been studied</p>	<p><i>can be applied to other contexts or samples or methods.”</i></p>

<p>Conceptual replication for validity</p>	<p>Conceptual replication for (construct) validity, in the sense that conceptual replication that measuring phenomena in different manners increases our confidence that we are effectively capturing the phenomenon we purport to.</p>	<p><i>“... the conceptual replication would be successful to prove the concept is valid.”</i></p>
<p>Conceptual replication for theory boundary conditions</p>	<p>The success or failure of conceptual replication studies can say inform us on the boundaries of our theories</p>	<p><i>“... conceptual replications can add important information on boundary conditions and extensions.”</i></p>
<p>Conceptual replication for theory development</p>	<p>Conceptual replication can be a more effective form of replication for building theories, which is considered a desired facet for science in social psychology</p>	<p><i>“For an effect to be meaningful it should be present in more than one study. Conceptual replications are thus important as they indicate in what context something is and is not present, which we can build on theoretically.”</i></p>

Conceptual replication and context-sensitivity	Conceptual replication is more appropriate for social psychology due to the context sensitive nature of the field	<i>“Especially conceptual replications are important as social psychological theories can be quite time, culture and context dependent.”</i>
Social psychology and context-sensitivity	The idea that social psychology as a field deals with context-sensitivity in terms of phenomena and dynamic systems	<i>“Basically a complexity perspective confronts you with the possibility of fundamental uncertainty. Replication might be only possible in more stable situations of complex systems, and hence is not a good concept to study more turbulent stages in social systems.”</i>
Conceptual replication overcomes methodological limitations and bias	By testing in different manner than the original study, conceptual replication overcomes methodological limitations and bias in original studies.	<i>Conceptual replications can overcome the methodological limitations or unique methodological features of the previous studies.</i>

Nature of study determines
which type of replication

Nature of study determines
which type of replication

I think it depends heavily on the nature of the study. If we're talking about decision making processes, observing behavior in experiments, etc., direct replications have value. If we're talking about field experiments, conceptual replication might be more fruitful, as of, for example, cultural differences.

“...a successful or unsuccessful replication may not necessarily mean that a phenomenon is not true, but reveal more nuances to our understanding of what we

Successful single replication
is not conclusive

The success/failure of a **single** replication (both direct and conceptual) study should not tell us anything about the quality of the study

study.”

Replication should not have purposes

Replication is a learning and quality process

replication has goals, such as find out if the outcome of a single study is or is not reproducible, it limits the productive output of this enterprise and creates bad incentives for the execution of replication studies.

“I believe replicators (or scientists in general) should not have such goals. The goal should be to establish whether a particular effect replicates, and the replicator should be open to all possible outcomes.”

Subjectivity (Epistemological sense)

This code defines the idea that an ideal of an objective

Here is the idea that when

researcher and science is not realistic, and that subjectivity will always be contained within science and our findings.

“It's not the results of the replication that matters. What matters is that we do them and learn from them.”

This code defines the idea that an ideal of an objective researcher and science is not realistic, and that subjectivity will always be contained within science and our findings.

“There's always going to be a tension between objectivity and subjectivity.”

Objectivity and Truth

The idea that in science objectivity and (single) truth are valuable cornerstones to hold

“Replication is important, because if we cannot make any replicable observations, there it is very unlikely that any of our explanations captures parts of the truth.”

Universal and Stable Effects

The idea that there exists objects and effects in psychological science that are stable and universal

“I think there are phenomena in reality that have stable characteristics but that can never be described in any words.”

Original researchers as replicators; motivation bias

The idea that if the original researchers are part of the replications, they can influence the results based on their motivations

“If a work can be replicated by other scientists then this helps confirm the strength of the effect and that it was not due in some way to the motivations of the original researchers.”