15 Scientific Gullibility

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"Gullible" means easily deceived or cheated. In this chapter, we focus on the deception aspect of gullibility. What does gullibility have to do with social psychology? Scientific gullibility occurs when individuals, including scientists, are "too easily persuaded that some claim or conclusion is true, when, in fact, the evidence is inadequate to support that claim or conclusion." In this chapter, we review evidence of the sources and manifestations of scientific gullibility in (mostly) social psychology, and also identify some potential preventatives.

Before continuing, some clarifications are necessary. We have no insight into, and make no claims about, what any scientist "thinks" or "believes." What we can address, however, are statements that have appeared in scholarship. In this chapter, when a paper is written as if some claim is true, we take that to mean that it is "accepted," "believed," "assumed to be valid," and/or "that the scientist was persuaded that the claim was valid and justified." When we do this, we refer exclusively to written statements text, rather than to someone's "beliefs," about which we have no direct information. Issues of whether and why scientists might make claims in scientific scholarship that they do not truly believe are beyond the scope of this chapter, though they have been addressed elsewhere (e.g., Anomaly, 2017).

Furthermore, we distinguish scientific gullibility from being wrong. Scientists are human, and make mistakes. Even fundamental scientific methods and statistics incorporate uncertainty, so that, sometimes, a well-conducted study could produce a false result – evidence for a phenomenon, even though the phenomenon does not exist, or evidence against the existence of some phenomenon that does. Thus, scientific gullibility is more than being wrong; ~~because~~ error is baked into the nature of scientific exploration. We define *scientific gullibility* as being wrong, in regards to the strength and/or veracity of a scientific finding, when the reasons and/or evidence for knowing better were readily available. Thus, demonstrating scientific gullibility means showing that (1) scientists have often believed something that was untrue, and (2) there was ample basis for them to have known it was untrue.

Overview

Why should scientists be interested in better understanding their own gullibility? We think it is because most of us do not want to be gullible (see Cooper & Avery, Chapter 16 this volume). Although there may be a small number who care more about personal success, they are likely rare exceptions. Most researchers genuinely want to know the truth and want to produce true findings. They want to be able to critically understand the existing literature, rather than believe that false claims are true. A better understanding of scientific gullibility then, can (1) reduce the propensity to believe scientific claims that are not true; and (2) increase awareness of the logical, evidentiary, methodological, and statistical issues that can call attention to claims that warrant increased skeptical scrutiny. In this context, then, we suggest the following five flags of gullibility as a starting point, we also welcome suggestions for additional symptoms of gullibility:

> *Criteria 1.* Generalization of claims that are based on data obtained from small, potentially unrepresentative samples.
>
> *Criteria 2.* Causal inference(s) drawn from correlational data.
>
> *Criteria 3.* Scholarship offering opposing evidence, an opposing argument, or a critical evaluation of the claim being presented as fact is overlooked (e.g., not cited).
>
> *Criteria 4.* Claims, and possibly generalized conclusions, are made without citing empirical evidence supporting them.
>
> *Criteria 5.* Overlooking (e.g., not citing and/or engaging with) obvious and well-established (in the existing scientific literature) alternative explanations.

We first review basic methodological and interpretive standards involved in scientific inference. Next, we review evidence regarding the psychology of gullibility. In general, and in science, why do people often believe things that are untrue when they should have known better? A series of cases are then reviewed, where there was, and may still be, belief in erroneous conclusions, and where the evidence revealing how and why those conclusions are erroneous is sufficiently apparent. We conclude the chapter with recommendations for reducing scientific gullibility, including possible reforms to the academic incentive structure.

Methods, Statistics, and Their Interpretation

It may seem obvious to state that, in science, claims and conclusions require evidence. But, as we shall show below, even this most basic standard has been violated by some social psychological scholarship, as some canonical claims rest on almost no evidence at all. Assuming some sort of empirical evidence does exist, its mere existence does not automatically support any particular conclusion, even if the article reporting the conclusion says it does. Basic and widely accepted methodological standards in social psychology include obtaining representative samples of people, preferably from many places all over the world, if one wishes to generalize findings; that large samples are needed to minimize uncertainty in parameter estimates; and that causal inference requires experimentation.

Standards for Data Collection

High power can usually be obtained with a large sample or through use of within subject designs. Although high-powered designs do not guarantee high quality, low-powered designs typically produce results with such high levels of uncertainty (as indicated by wide confidence intervals surrounding point estimates) that it is difficult to conclude the findings mean very much (Fraley & Vazire, 2014). Causal inferences are least problematic when hypotheses are tested with experiments, though experimentation alone does not guarantee correct causal inferences. Statistical uncertainties, methodological imperfections, and the potential that untested alternative explanations remain all constitute threats to the validity of experimentally based causal inferences. Additionally, researchers can sometimes influence the behavior of their subjects (Jussim, 2012; Jussim, Crawford, Anglin, Stevens, & Duarte, 2016), and random assignment to condition and experimenter blindness are two well-established ways of reducing this potential influence.

Standards for Data Interpretation

We use the term “fact” as elucidated by Stephen Jay Gould (1981): “In science, ‘fact’ can only mean ‘confirmed to such a degree that it would be perverse to withhold provisional assent.’” We agree and add this corollary: Anything *not* so well established that it would *not* be perverse to withhold provisional assent is *not* an established scientific fact. When there are conflicting findings and perspectives in a literature, it is not perverse to believe otherwise, rendering it premature for scientists to present some claim as an established fact.

The presentation of confirmatory evidence is not sufficient to establish the veracity of a claim, even if the confirmatory evidence cited is relevant and sound (Roberts & Pashler, 2000). In other words, the conclusion may still not be justified, as evidence inconsistent with the conclusion that is on at least as sound a footing may exist. The presence of such evidence should prevent the conclusion from being presented as an established fact. Even in the absence of conflicting evidence, claims based on a limited body of research (e.g., a small number of studies with small samples; a single study) require further investigation before they can be considered established. Furthermore, the validity of some conclusion hinges not merely on the consistency of the data with that conclusion, but with the ability to eliminate alternative explanations for the same data (Roberts & Pashler, 2000).

Finally, it behooves social psychologists (and social scientists in general) to acknowledge there is a multiverse of potential ways to construct each unique data set for analysis (Steegen, Tuerlinckx, Gelman, Vanpaemel, 2016). Within this multiverse, researchers may have to make many decisions about how to proceed, and thus the published findings typically represent one of many ways to analyze the data. Acknowledging this may limit social psychologists' vulnerability to drawing conclusions of questionable veracity (see Miller & Chapman, 2001; Nunes et al., 2017; Roberts & Pashler, 2000).

The Psychology of Scientific Gullibility

What are the sources of scientific gullibility? Although there may be many, in this chapter, we focus on four: motivated reasoning, excess scientism, status biases, and status quo biases.

Motivated Reasoning

A number of factors sometimes lead scientists to reach conclusions that have questionable validity. How can individuals who are trained to be objective, methodical, and precise make such errors? One way is through motivated reasoning (MacCoun, 1998), which occurs when the desire to reach a particular conclusion, rather than an accurate conclusion, influences the processing of evidence (Kahan, Jenkins-Smith, & Braman, 2011). People may be motivated to reach conclusions they would like to be true (*desirability bias*; Tappin, van der Leer, & McKay, 2017), conclusions they believe are true based on prior evidence and experience (*confirmation bias*; Nickerson, 1998), or a combination of the two.

Many theorists argue that motivated reasoning is driven by "hot," affective processes: information produces an intuitive response, which then guides cognitive processing of the information. When information supports preferred conclusions, people experience positive affect and easily accept the evidence (Klaczynski, 2000; Munro & Ditto, 1997). When information supports an undesired (or belief-inconsistent) conclusion, however, people experience negative affect and critique, ignore, or reject the evidence on irrelevant grounds (Klaczynski, 2000; Munro & Ditto, 1997). These processes – particularly confirmation biases – can also be driven by "cold," logical cognitive strategies (Fischhoff & Beyth-Marom, 1983; Koehler, 1993). Beliefs form from prior evidence and experience, and thus it may be rational to subject new evidence that deviates from prior knowledge to greater scrutiny.

Moreover, although the desire to reach a particular conclusion can bias information processing, when accuracy motivations are strong, people may process evidence systematically in order to draw accurate conclusions based on the quality of the evidence, regardless of their prior or desired beliefs (Anglin, 2016; Klaczynski, 2000). People are motivated to reach conclusions that are compatible with their beliefs and preferences, but they are also motivated to be accurate (Hart et al., 2009), and can only arrive at desired conclusions if they are justifiable (Haidt, 2001).

What strategies allow people to justify their desired conclusions? They seek out evidence supporting a favored conclusion while ignoring evidence challenging that view (*positive* or *confirmatory information seeking and hypothesis testing*; Klayman & Ha, 1987), evaluate evidence more favorably (e.g., as more accurate, reliable, and convincing) when it supports versus challenges a desired conclusion (*biased evaluation*), deduce the relevance or meaning of evidence based on its consistency with desired conclusions (*biased interpretation*), assign greater weight to evidence supporting desired conclusions (*selective weighting*), and selectively retrieve supportive (but not conflicting) evidence from memory (*biased recall*).

Scientists are not immune to these biases (Jussim, Crawford, Anglin, Stevens, et al., 2016; Lilienfeld, 2010). In fact, research suggests that individuals with greater knowledge and expertise on a topic may be susceptible to motivated reasoning (Ditto et al., in press). At each stage of the research process, researchers' beliefs and motives can influence their research decisions. Collectively, the beliefs and motives of researchers – particularly political beliefs – may form significant blind spots or vulnerabilities, increasing the risk that certain questions aren't asked or investigated, that data are misinterpreted, or that conclusions of a convenient, exaggerated, or distorted nature are generated (Duarte et al., 2015; Jussim, 2012; Tetlock, 1994).

We have previously elaborated on political confirmation biases and how they may influence each stage of the research process (Stevens, Jussim, Anglin, & Honeycutt, 2018). Whether explicitly realized by researchers or not, these biases can exert their influence in a variety of ways. For instance, when generating hypotheses, researchers may, unintentionally, selectively expose themselves to research supporting a desired narrative or conclusion, neglecting to account for alternative perspectives or conflicting evidence. During data collection researchers can fall prey to experimenter or expectancy effects (Jussim, 2012; (Jussim, Crawford, Anglin, Stevens, et al., 2016), and when analyzing and interpreting results there are a number of researcher degrees of freedom available that can produce inaccurate, but desired conclusions (Simonsohn, Nelson, & Simmons, 2014; Wicherts et al., 2016).

Glorification of p < .05: "It Was Published, Therefore It Is a Fact"

Scientism refers to exaggerated faith in the products of science (Haack, 2012; Pigliucci, 2018). One particular manifestation of scientism is reification of a conclusion based on its having been published in a peer-reviewed journal. These arguments are plausibly interpretable as drawing an equivalence between "peer-reviewed publication" and "so well established that it would be perverse to believe otherwise" (for examples, see, e.g., Fiske, 2016; Jost et al., 2009). They are sometimes accompanied with suggestions that those who criticize such work are either malicious or incompetent (Fiske, 2016; Jost et al., 2009; Sabeti, 2018), and thus reflect this sort of scientism. Especially because ability to cite even several peer-reviewed publications in support of some conclusion does not make the conclusion true, this is particularly problematic (see, e.g., Flore & Wicherts, 2014; Jussim, 2012; (Jussim, Crawford, Anglin, Stevens et al., 2016; Simonsohn et al., 2014).

One of the most important gatekeepers for an article entering a peer-reviewed journal is a statistically significant result, or $p < .05$ (Simmons, Nelson, & Simonsohn, 2011). The undue reification of "peer reviewed" as "fact" itself implies a reification of $p < .05$, to the extent that $p < .05$ is a necessary finding to get some empirical work published (Nuijten, Hartgerink, van Assen, Epskamp, & Wicherts, 2016). Here is a list of conclusions that are *not* justified by $p < .05$:

1 The researcher's conclusion is an established fact.
2 The main findings are reliable or reproducible.
3 The difference or relationship observed is real, valid, or bona fide.
4 The difference or relationship observed cannot be attributed to chance.

In fact, the only thing $p < .05$ *might* establish, as typically used, is that the observed result, or one more extreme, has less than a 5% chance of occurring, if the null is true. Even that conclusion is contingent on both the underlying assumptions not being too severely violated, and on the researcher not employing questionable research practices to reach $p < .05$ (Simmons et al., 2011).

It gets worse from there. P-values between .01 and .05 are improbable if the effect under study is truly nonzero (Simonsohn et al., 2014). When a series of studies produces a predominance of p-values testing the key hypotheses in this range, it is possible that the pattern of results obtained (despite reaching $p < .05$) is more improbable than are the obtained results under the null for each study. Consider a three-experiment sequence where one degree of freedom F-tests of the main hypothesis, with error degrees of freedom of 52, 50, and 63, have values of 5.34, 4.18, and 4.78, respectively, and correspond to effect sizes ranging from d = .55 to .64. The corresponding p-values are .025, .046, and .033, respectively. If we assume an average underlying effect size of d = .60, the probability of getting three values between .01 and .05 is itself .014 (this probability can be easily obtained from the website http://rpsychologist.com/d3/pdist).

In other words, the likelihood of getting this pattern of results, with a true effect size of d = .60, is even more improbable than are obtaining those results under the null. This is not some concocted hypothetical. It is exactly the results reported in one of the most influential papers in all of social psychology, the first paper to produce evidence that stereotype threat undermines women's math performance; a paper that, according to Google Scholar, has been cited over 3,000 times (Spencer, Steele, & Quinn, 1999).

There are two bottom lines here. Treating conclusions as facts because they appear in peer-reviewed journals is not justified. Treating findings as "real" or "credible" simply because they obtained $p < .05$ is not justified. Some claims in some peer-reviewed articles are justified and some statistical findings do provide strong evidence in support of some claim. Excess scientism occurs, however, when the quality of the evidence, and the strength of the conclusions reached on the basis of that evidence, are not critically evaluated, and, instead, the mere fact of publication and $p < .05$ are presented as or presumed to be a basis for believing some claim is true.

Status Quo and Status Biases

Status Quo Biases

Laypeople are prone to metacognitive myopia (see Fielder, Chapter 7 this volume), and are often biased toward maintaining the current scientific consensus on a topic (Samuelson & Zeckhauser, 1988). Moreover, people often hold a false belief in small numbers, erroneously believing that a sample is representative of the population and that a study is more likely to replicate than the laws of chance would predict (Tversky & Kahneman, 1971). Seminal studies may thus be perceived as holding an exaggerated level of truth.

Does metacognitive myopia impact social psychologists? There are good reasons to think it does. When a paper, or finding, achieves canonical status it may be widely accepted by social psychologists as "truth." It can be quite difficult to change the canon once some finding has been published and integrated into common discourse in the field ((Jussim, Crawford, Anglin, Stevens, et al., 2016). This is so even when stronger contradictory evidence emerges (Jussim, 2012). Papers that challenge accepted or preferred conclusions in the literature may be held to a higher threshold for publication. For example, replication studies regularly report samples much larger than the original study (see Table 15.1), suggesting they have been held to a higher methodological and evidentiary standard.

Table 15.1 Social psychology bias for the status quo?

Publication	*Narrative*	*Key Aspects of Methods*	*Citations*	
			Total	*Since 1996*
Darley and Gross (1983)	Stereotypes lead to their own confirmation; stereotype bias in the presence but not absence of individuating information	People judge targets with vs. without relevant individuating information. Single experiment. N = 59–68, depending on analysis	1,355	1,154
Baron, Albright, and Malloy (1995)	Failed replication of Darley and Gross (1983). Positive results in opposite direction: stereotype bias in the absence of individuating information; individuating information eliminated stereotype bias	Close replication (and extension) of Darley and Gross (1983). Two experiments. Total N = 161.	75	72
			Total	*Since 2017*
Spencer et al. (1999)	Stereotype threat for women and math; apprehension of being judged by the negative stereotype leads to poorer math performance	Three experiments. Total N = 177.	3,023	294
Finnigan and Corker (2016)	Failed replication of the stereotype threat effect in Chalabaev, Major, Sarrazin, and Curry (2012), modeled closely on Spencer et al. (1999). No significant main effect or interaction effect for threat or performance avoidance goals	Pre-registered. Close replication of Chalabaev et al. (2012), and extension from Spencer et al. (1999). Single experiment. Total N = 590	9	9
			Total	*Since 2013*
Bargh, Chen, and Burrows (1996)	Automatic effects of stereotypes on behavior	Two experiments. Total N = 60	4,387	1,570
Doyen, Klein, Pichon, and Cleeremans (2012)	Failed replication of Bargh et al. (1996). No effects of stereotypes on behavior except when experimenters were not blind to condition	Two close replication and extension experiments. Total N = 170	404	386
			Total	*Since 1984*
Snyder and Swan (1978)	People seek to confirm their interpersonal expectations	Four experiments. Total N = 198. People chose among confirmatory or disconfirmatory leading questions (no option was provided for asking diagnostic questions)	1,152	1,060
Trope and Bassok (1983)	People rarely seek to confirm their interpersonal expectations. Instead, they seek diagnostic information	Three experiments. Conceptual replication. Total N = 342. People could seek information varying in the extent to which it was diagnostic vs. confirmatory	166	161

Note: Citation counts were obtained from Google Scholar (January 28, 2017).

This may, in part, result from repeated citations of the "canonical" finding, as mere repetition can increase the subjective truth of a message (see e.g., Myers, Chapter 5 this volume; Unkelbach & Koch, Chapter 3 this volume). This repetition-truth could be particularly potent in cases where the "canonical" finding is consistent with a preferred narrative in the field. Indeed, there may be a number of zombie theories remaining in psychology despite substantial and sustained criticism (e.g., Meehl, 1990), as even when an article is retracted, scientists continue to cite it (Greitemeyer, 2014). When the original authors acknowledge that new evidence invalidates their previous conclusions, people are less likely to continue to believe the overturned findings (Eriksson & Simpson, 2013). However, researchers do not always declare they were wrong, even in the face of evidence to the contrary.

Status Biases

One of the great arguments for the privileged status of science is universalism (Merton, 1942/1973); scientific claims are supposed to be evaluated on the basis of the quality of the evidence rather than the status of the person making the claim. The latter can be referred to as a status bias and it may play a role in influencing scientists' perceptions and interpretations of research. Sometimes referred to as an eminence obsession (Vazire, 2017), or the "Matthew Effect" (Merton, 1968), the principle underlying status bias is that the "rich get richer." Having a PhD from a prestigious university, currently being employed by a prestigious university, and/or having an abundance of grant money, awards, publications, and citations, are used as a heuristic for evaluating work. That is, the work of scientists fitting into one or more of these categories frequently may get a pass, and be evaluated less critically (Vazire, 2017).

Empirically, status biases have been demonstrated in a variety of academic contexts. Peer reviewers for a prominent clinical orthopedic journal were more likely to accept, and evaluated more positively, papers from prestigious authors in their field than identical papers evaluated under double-blind conditions (Okike, Hug, Kocher, & Leopold, 2016). In the field of computer science research, conference paper submissions from famous authors, top universities, and top companies were accepted at a significantly greater rate by single-blind reviewers than those who were double-blind (Tomkins, Zhang, & Heavlin, 2017). Peters and Ceci (1982) demonstrated a similar effect on publishing in psychology journals, reinforcing the self-fulfilling nature of institutional-level stereotypes.

Evidence of Scientific Gullibility

Thus far we have defined scientific gullibility, articulated standards for distinguishing scientific gullibility from simply being wrong, reviewed basic standards of evidence, and reviewed the evidence regarding potential social psychological factors that lead judgments to depart from evidence. But is there any evidence of actual scientific gullibility in social psychology? One might assume that scientific gullibility occurs rarely among social psychologists. We are in no position to reach conclusions about how often any of these forms of gullibility manifest, because that would require performing some sort of systematic and representative sampling of claims in social psychology, which we have not done. Instead, in the next section, we take a different approach. We identify examples of prominent social psychological claims that not only turned out be wrong, but that were wrong because scientists made one or more of the mistakes we have identified. In each case, we identify the original claim, show why it is likely erroneous, and discuss the reasons this should have been known and acknowledged.

Conclusions Without Data: The Curious Case of Stereotype "Inaccuracy"

Scientific articles routinely declare stereotypes to be inaccurate either *without a single citation*, or by citing an article that declares stereotype inaccuracy without citing empirical evidence. We call this "the black hole at the bottom of declarations of stereotype inaccuracy" (Jussim, Crawford, Anglin, Chambers et al., 2016), and give some examples: "[S]tereotypes are maladaptive forms of categories because their content does not correspond to what is going on in the environment" (Bargh & Chartrand, 1999, p. 467). "To stereotype is to allow those pictures to dominate our thinking, leading us to assign identical characteristics to any person in a group, regardless of the actual variation among members of that group" (Aronson, 2008, p. 309). No evidence was provided to support either claim.

Even the American Psychological Association (APA), in its official pronouncements, has not avoided the inexorable pull of this conceptual black hole. APA first declares: "Stereotypes 'are not necessarily any more or less inaccurate, biased, or logically faulty than are any other kinds of cognitive generalizations,' and they need not inevitably lead to discriminatory conduct" (APA, 1991, p. 1064). They go on to declare: "The problem is that stereotypes about groups of people often are *overgeneralizations and are either inaccurate or do not apply to the individual group member in question* ([Heilman, 1983], note 11, at 271)" (emphasis in original).

The APA referenced Heilman (1983), which does *declare* stereotypes to be inaccurate. It also reviews evidence of bias and discrimination. But it neither provides nor reviews empirical evidence of stereotype inaccuracy. A similar pattern occurs when Ellemers (2018, p. 278) declares, "Thus, if there is a kernel of truth underlying gender stereotypes, it is a tiny kernel" without citing scholarship that assessed the accuracy of gender stereotypes.

These cases of claims without evidence regarding inaccuracy pervade the stereotype literature (see Jussim, 2012; Jussim, Crawford, Anglin, Chambers et al., 2016, for reviews). It may be that the claim is so common that most scientists simply presume there is evidence behind it – after all, why would so many scientists make such a claim, without evidence? (see Duarte et al., 2015; Jussim, 2012; Jussim, Crawford, Anglin, Chambers et al., 2016; Jussim, Crawford, Anglin, Stevens et al., 2016, for some possible answers). Given this state of affairs, it seems likely that when the next publication declares stereotypes to be inaccurate without citing any evidence, it, too, will be accepted.

Large Claims, Small Samples

Studies with very small samples rarely produce clear evidence for any conclusion; and, yet, some of the most famous and influential social psychological findings are based on such studies. Social priming is one example of this. One of the most influential findings in all of social psychology, priming elderly stereotypes causing people to walk more slowly (Bargh, Chen, & Burrows, 1996, with over 4,000 citations as of this writing), was based on two studies with sample sizes of 30 each. It should not be surprising that forensic analyses show that the findings of this and similar studies are extraordinarily unlikely to replicate (Schimmack, Heene, & Kesavan, 2017), and that this particular study has been subject to actual failures to replicate (Doyen, Klein, Pichon, & Cleeremans, 2012).

A more recent example involves power posing, the idea that expansive poses can improve one's life (Carney, Cuddy, & Yap, 2010). That is an extraordinarily confident claim for a study based on 42 people. It should not be surprising, therefore, that most of its claims simply do not hold up under scrutiny (Simmons & Simonsohn, 2017) or attempts at replication (Ranehill et al., 2015).

Failure to Eliminate Experimenter Effects

Experimenter effects occur when researchers evoke hypothesis-confirming behavior from their research participants, something that has been well known for over 50 years (e.g., Rosenthal & Fode, 1963). Nonetheless, research suggests that only about one-quarter of the articles in *Journal of Personality and Social Psychology* and *Psychological Science* that involved live interactions between experimenters and participants explicitly reported blinding those experimenters to the hypotheses or experimental conditions (Jussim, Crawford, Anglin, Stevens et al., 2016; Klein et al., 2012).

Although it is impossible to know the extent to which this has created illusory support for psychological hypotheses, it is not impossible for this state of affairs to lead to a high level of skepticism about findings in any published report that has not explicitly reported experimenter blindness. This analysis is not purely hypothetical. In a rare case of researchers correcting their own research, Lane et al. (2015) reported failures to replicate their earlier findings (Mikolajczak et al., 2010, same team). They noted that experimenters had not previously been blind to condition, which may have caused a phantom effect. Research has also demonstrated that some priming "effects" occurred *only* when experimenters were not blind to condition (Gilder & Heerey, 2018). Much, if not all, social psychological experimentation that involves interactions between experimenters and participants, and that fails to blind experimenters, warrants high levels of skepticism, pending successful (preferably pre-registered) replications that do blind experimenters to hypothesis and conditions. Based on content analysis of the social psychological literature (Jussim, Crawford, Anglin, Stevens et al., 2016; Klein et al., 2012), this may constitute a large portion of the social psychological experimental literature.

Inferring Causation from Correlation

Inferring causality from correlation happens with regularity in psychology (e.g., Nunes et al., 2017), and, as we show here, in work on intergroup relations. Gaps between demographic groups are routinely presumed to reflect discrimination, which, like any correlation (in this case, between group membership and some outcome, such as distribution into occupations, graduate admissions, income, etc.), might but does not necessarily explain the gap. For example, when men receive greater shares of some desirable outcome, sexism is often the go-to explanation (e.g., Ledgerwood, Haines, & Ratliff, 2015; van der Lee & Ellemers, 2015), even when alternative explanations are not even considered (Jussim, 2017b). Sometimes, it is the go-to explanation even when an alternative explanation (such as Simpson's paradox) better explains the discrepancy (e.g., Albers, 2015; Bickel, Hammel, & O'Connell, 1975).

Similarly, measures of implicit prejudice were once presented as powerful sources of discrimination (e.g., Banaji & Greenwald, 2013) based on "compelling narratives." The logic seemed to be something like (1) implicit prejudice is pervasive, (2) inequality is pervasive, (3) therefore, implicit prejudice probably explains much inequality. We call this a "phantom" correlation because the argument could be and was made in the absence of any direct empirical link between any measure of implicit prejudice and any real-world gap. Indeed, even the more modest goal of linking implicit prejudice to discrimination has proven difficult (Mitchell, 2018). It should not be surprising, therefore, to discover that evidence indicates that implicit measures predict discrimination weakly at best (e.g., Forscher et al., 2016).

Furthermore, evidence has been vindicating the view proposed by Arkes and Tetlock (2004) that implicit "bias" measures seem to reflect social realities more than they cause them (Payne, Vuletich, & Lundberg, 2017; Rubinstein, Jussim, & Stevens, 2018). Thus, although it may well be true that there is implicit bias, and it is clearly true that there is considerable inequality of all sorts between various demographic groups, whether the main causal direction is from bias to inequality, or from inequality to "bias" remains unclear. This seems like an example of scientific gullibility, not because the implicit bias causes inequality link is known to be "wrong," but because dubious and controversial evidence has been treated as the type of well-established "fact" appropriate for influencing policy and law (Mitchell, 2018).

Overlooking Contrary Scholarship

The "power of the situation" is one of those canonical, bedrock "findings" emblematic of social psychology. It is true that there is good evidence that, *sometimes* situations are quite powerful (Milgram, 1974). But the stronger claim that also appears to have widespread acceptance is that personality and individual differences have little to no effect once the impact of the situation is accounted for (see e.g., Jost & Kruglanski, 2002; Ross & Nisbett, 1991). The persistence of an emphasis on the power of the situation in a good deal of social psychological scholarship provides one example of overlooking scholarship that has produced contrary evidence (Funder, 2006, 2009).

There are many problems with this claim, but with respect to scientific gullibility the key one is that it is usually without actually comparing the "power of the situation" to evidence that bears on the "the power of individual differences." The typical effect size for a situational effect on behavior is about the same as the typical effect size for a personality characteristic – and both are rather large relative to other social psychological effects (Fleeson, 2004; Fleeson & Noftle, 2008; Funder, 2006, 2009). It is not "gullibility" for those to believe in the "power of the situation" simply based on ignorance of the individual differences data. It is gullibility to make such claims without identifying and review such evidence.

The Fundamental Publication Error: Correctives do not Necessarily Produce Correction

The fundamental publication error refers to the belief that just because some corrective to some scientific error has been published, that there has been scientific self-correction (Jussim, 2017a). A failure to self-correct can occur, even if a corrective has been published, by ignoring the correction, especially in outlets that are intended to reflect the canon. With most of the examples presented here, not only are the original claims maintained by violation of fundamental norms of scientific evidence, but ample corrections have been published. Nonetheless, the erroneous claims persist. Despite the fact that dozens of studies have empirically demonstrated the accuracy of gender and race stereotypes, claims that such stereotypes are inaccurate still appear in "authoritative" sources (e.g., Ellemers, 2018; see Jussim, Crawford, & Rubinstein, 2015 for a review). Similarly, the assumption that inequality reflects discrimination, without consideration of alternatives, is widespread (see, e.g., reviews by Hermanson, 2017; Stern, 2018; Winegard, Clark, & Hasty, 2018).

Table 15.1 shows how studies that have been subject to critiques and failed pre-registered replications continue to be cited far more frequently than either the critiques or the failed replications, even after those critiques and failures have appeared. Although blunt declarations that situations are more powerful than individual differences are no longer common in the social psychological literature, the emphasis on the power of the situation manifests as blank slatism and as a belief in "cosmic egalitarianism" – the idea that, but for situations, there would be no mean differences between any demographic groups on any socially important or valued characteristics (Pinker, 2002; Winegard et al., 2018). Thus, the examples presented here are not historical oddities; they reflect a state of scientific gullibility in social psychology.

Reducing Scientific Gullibility

Changing Methods and Practices

Some researchers are actively working on ways to reduce gullibility and increase valid interpretations of published findings, many of which are aimed at reforming the academic incentive structure. Simply put, within academia, publications represent credibility and currency. The more a researcher publishes, and the more those publications are cited by others in the field, the more their credibility as a researcher increases. This can then lead to more publications, promotions, and funding opportunities. Thus, publishing one's findings is essential, and one of the most prominent gatekeepers of publication is the p<.05 threshold. Yet, such a metric can promote questionable research practices (Simmons et al., 2011; Simonsohn et al., 2014). These findings may constitute an example of Goodhart's Law – that when a measure becomes a desirable target it ceases to become a good measure (Koehrsen, 2018) – at work among researchers.

One intervention aimed at reducing behaviors that artificially increase the prevalence of p-values just below 0.05 is preregistration. Preregistration requires a researcher to detail a study's hypotheses, methods, and proposed statistical analyses prior to collecting data (Nosek & Lakens, 2014). By pre-registering a study, researchers are not prevented from performing exploratory data analysis, but they are prevented from reporting exploratory findings as confirmatory (Gelman, 2013).

Because of growing recognition of the power of pre-registration to produce valid science, some journals have even begun embracing the registered report. A registered report is a proposal to conduct a study with clearly defined methods and statistical tests that is peer reviewed before data collection. Because a decision to publish is made not on the nature or statistical significance of the findings, but on the importance of the question and the quality of the methods, publication biases are reduced. Additionally, researchers and journals have started data-sharing repositories to encourage the sharing of non-published supporting material and raw data. Openly sharing methods and collected data allows increased oversight by the entire research community and promotes collaboration. Together, open research materials, preregistration, and registered reports all discourage scientific gullibility by shedding daylight on the research practices and findings, opening studies to skeptical evaluation by other scientists, and therefore, increasing clarity of findings and decreasing the influence of the types status and status quo biases discussed earlier.

Benefits of Intense Skepticism

Extraordinary claims should require extraordinary evidence. Thus, subjecting scientific claims to intense, organized skepticism and scrutiny is necessary to sift unsubstantiated claims from ones justified and well supported. Such organized skepticism is one of the core norms of science (Merton, 1942/1973). Indeed, people are better at identifying flaws in other people's evidence-gathering than their own (Mercier & Sperber, 2011), and a dissenting minority within a group can reduce conformity pressures on decision-making (Crano, 2012), producing deeper thought that can lead to higher-quality group decisions (Nemeth, Brown, & Rogers, 2011). Science is a collective enterprise, where the independent operations of many accumulate into a bigger picture. Making high-quality group decisions (e.g., regarding what constitutes the canonical findings) is therefore important, and one way to do so is to subject scientific research to intense skepticism and scrutiny by other members of the scientific community.

The Evolutionary Psychology of Gender Differences: A Case Study in the Benefits of Intense Skepticism

One area of research that has received an intense amount of skepticism, scrutiny, and criticism from social psychologists, is the idea of evolved gender differences in the psychological and behavioral characteristics of human males and females (Geher & Gambacorta, 2010; Pinker, 2002; von Hippel & Buss, 2018). One common criticism often leveled against evolutionary psychology is that it is a political effort led by conservatives, emphasizing biological determinism, to advance a political agenda that defends current social arrangements and inequalities (for a more elaborate discussion of these criticisms, see Pinker, 2002; Tybur & Navarrete, 2018).

The premise on which this is based – that evolutionary psychologists are primarily conservative – has been disconfirmed. Surveys of evolutionary psychologists reveal they are as liberal, if not more, than their colleagues (Tybur, Miller, & Gangestad, 2007; see von Hippel & Buss, 2018 for a review).

More importantly for our discussion of scientific gullibility is that evolutionary psychologists have been clear for decades that their approach emphasizes an interaction between genes and the sociocultural environment. For instance, in his landmark study on mate preferences, Buss (1989, p. 13, emphasis added) noted the following: "Currently unknown are the *cultural and ecological* causes of variation from country to country in (1) the magnitudes of obtained sex differences, and (2) the absolute levels of valuing reproductively relevant mate characteristics." It is quite difficult to detect even a whiff of biological determinism in that statement, as it implies a need to research the *cultural and ecological* causes of variation. This study has been cited over 4,000 times and was a featured paper in *Behavioral and Brain Sciences* that was accompanied by a number of responses. To continue to imply that evolutionary psychology emphasizes biological determinism suggests that the critics are either (a) unaware of one of the most important papers in evolutionary psychology; (b) are aware of it, but have not read it; or, (c) are aware of it, have read it, and have decided to still insist the approach emphasizes biological determinism.

Nevertheless, despite the (ongoing) controversy (see, e.g., Galinsky, 2017), the level of controversy and mutual skepticism (between advocates and opponents of evolutionary psychology explanations for gender differences) has helped advance social psychology's understanding of gender. Meta-analyses and large sample studies (N >10,000) from different theoretical perspectives have investigated gender differences within and across cultures (see Stevens & Haidt, 2017). A collaborative effort by researchers with different research backgrounds, and in some cases adversarial perspectives, concluded that there are important gender differences between males and females that influence cognition and behavior, *which result from a complex interaction of innate (i.e., biological) factors and the sociocultural environment* (Halpern et al., 2007).

Intense skepticism – of purely cultural explanations for sex differences and of purely biological ones – has been a boon to the scientific research seeking to understand those differences. A similar skepticism directed especially to the canonical claims in social psychology could be most productive – are they based on any evidence? Are they based on a handful of small N studies? Have there been any successful pre-registered replications? Have they explicitly considered, and ruled out, alternative explanations? All research, but especially foundational research, should be subject to this sort of skepticism, at least if we want to reduce scientific gullibility and increase scientific support for our field's major claims.

Strong Inference

Strong inference involves two main strategies that are synergistic, and that, when used together, offer considerable promise to limit scientific gullibility and produce rapid scientific advances (Platt, 1964; Washburn & Skitka, in press). The two strategies involve (1) seeking conditions that might disconfirm one's predictions and (2) comparing theories or hypotheses that make alternative or opposing predictions in some research context. Platt (1964, p. 350) also speculated on obstacles to the use of strong inference:

> The difficulty is that disproof is a hard doctrine. If you have a hypothesis and I have another hypothesis, evidently one of them must be eliminated. The scientist seems to have no choice but to be either soft-headed or disputatious. Perhaps this is why so many tend to resist the strong analytical approach – and why some great scientists are so disputatious.

Nonetheless, strong inference can reduce gullibility by making use of one of the few known antidotes to all sorts of biases: consider the opposite (Lord, Lepper, & Preston, 1984). If, for example, a field has a theoretical bias (see e.g., Funder, 1987; Jussim, 2012) or political biases (Duarte et al., 2015), then scientific literature may become filled with lots of evidence providing weak and biased tests seeming to confirm certain notions. Combine this with excessive scientism, and one has a recipe for gullibility on a grand scale, because few scientists will dive into the individual studies in sufficient depth to debunk them.

However, adoption of strong inference can and has limited such biases. Washburn and Skitka (in press) review several cases where strong inference was used to minimize political biases. For example, one can adopt what they call a "negative test strategy": hypothesize *the opposite* of what one prefers. If liberals generally prefer evidence of liberal superiority, a liberal social scientist could add in hypotheses about conservative superiority. Interestingly, when this was done with respect to prejudice, the long-standing claim that liberals were generally less prejudiced than conservatives was disconfirmed, replaced by the understanding that overall levels of prejudice are similar, but directed towards different groups (Brandt, Reyna, Chambers, Crawford, & Wetherell, 2014). Similarly, for example, Rubinstein et al. (2018) used strong inference to compare perspectives emphasizing the power of stereotypes versus individuating information to bias implicit and explicit person perception. Perspectives emphasizing the power of individuating information were supported, thereby limiting bias in favor of bias.

Credibility Categories

Recently, Pashler and De Ruiter (2017) proposed three credibility classes of research. Class 1, the most credible, is based on work that has been published, successfully replicated by several pre-registered studies, and in which publication biases, HARKing (Kerr, 1998), and p-hacking can all be ruled out as explanations for the effect. Work that meets this standard can be considered a scientific fact, in the Gouldian sense of being well established. Class 2 research is strongly suggestive but falls short of being a well-established "fact." It might include many published studies, but there are few, if any, pre-registered successful replications, and HARKing and p-hacking have not been ruled out. Class 3 evidence is that yielded by a small number of small sample studies, without pre-registered replications, and without checks against HARKing and p-hacking. Such studies are preliminary and should not be taken as providing strong evidence of anything, pending stronger tests and pre-registered successful replications.

Pashler and De Ruiter's (2017) system could have prevented social psychology from taking findings such as stereotype threat (Steele & Aronson, 1995), social priming (Bargh et al., 1996), and power posing (Carney et al., 2010) as "well established." Had the field not had a norm of excessive scientism, and, instead, treated these findings as suggestive, and warranting large-scale pre-registered replication attempts, much of the current "replication crisis" may have been avoided. To be fair, the value of pre-registration was not widely recognized until relatively recently, which may help explain why it was not used. But our main point remains intact; absent pre-registration, or large, high-powered replications, such work should have been considered preliminary and suggestive at best, especially considering the small sample sizes on which it was based.

Pashler and De Ruiter's (2017) system is an important contribution to understanding when past literature in social psychology provides a strong versus weak evidentiary basis for or against some theory, hypothesis, or phenomenon. Nonetheless, we also think it is less important that researchers use this exact system, than it is that they develop some *systematic* way of assigning credibility to research based on factors such as sample size, consideration of alternative explanations, pre-registration, open data, and materials, etc. In fact, the field's view of how to evaluate research credibility is still evolving, and Pashler and De Ruiter's system is not the final word; in fact, it is more like an initial attempt to systematize strength of past evidence. Whatever system one uses, we predict that a closer attention to the credibility of research, rather than a simple acceptance of something as fact just because it was published, will go a long way to reducing scientific gullibility.

Conclusion

Scientific gullibility is a major problem because it has contributed to the development of a dubious scientific "canon" – findings that are taken as so well established that they are part of the social psychological fundament, as evidenced by their endorsement by the American Psychological

Association, and their appearance in outlets that are supposed to reflect only the most well-established phenomena, such as handbook and annual review chapters. Gullibility begins with treating results from small sample size studies as well established "facts," a lack of transparency surrounding data analysis, failure to understand limitations of statistical analyses, underestimation of the power of publication biases, or an over-reliance on *p*<.05. Researchers also sometimes give undue credibility to papers that oversell findings, tell compelling narratives that aren't substantiated by the data, or report data that support desired conclusions with insufficient skepticism. Findings that have been roundly refuted or called into question in the empirical literature are often not extirpated from the canon.

In this chapter, we articulated and provided evidence for six scientific gullibility red flags that can and do appear in the research literature: (1) large claims being made from small and/or potentially unrepresentative samples, (2) many published reports of experiments do not state that experimenters were blind to hypotheses and conditions, (3) correlational data being used as evidence of causality, (4) ignoring scholarship articulating clear opposing evidence or arguments, (5) putting forth strong claims or conclusions that lack a foundation in empirical evidence, and (6) neglecting to consider plausible alternative explanations for findings. Although we are not claiming that the whole social psychological literature reflects gullibility, it is also true that little is currently of sufficient quality to fall into Pashler and de Ruiter's (2017) class 1 of "established fact." On the other hand, we see no evidence of consensus in the field to use their system. Absent some such system, however, it remains unclear which areas of social psychology have produced sound science and established facts, and which have been suggestive at best and entirely false at worst. Our hope is that by revealing these influences on, standards for recognizing, and ways to limit scientific gullibility, we have contributed something towards social psychology producing a canon that is based on valid and well-justified claims.

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