Trusting the Scientific Community:

The Development and Validation of an Instrument to Measure Trust in Science

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Trust in the scientific enterprise — in science as an institution — is arguably important to individuals' and societies' well-being. Although some measures of public trust in science exist, the recipients of that trust are often ambiguous between trusting individual scientists and the scientific community at large. We argue that more precision would be beneficial — specifically, targeting public trust of the scientific community at large — and describe the development and validation of such an instrument: the Scientific Community Trust Index (SCTI). We show the results of initial field testing to establish instrument reliability and validity. We then demonstrate certain advantages of the SCTI against other measures of trust and deference, and present correlations between the SCTI and participant scores in two trust-in-science scenarios. Our results suggest that the SCTI is a useful and compact tool for measuring public trust in the scientific community.

1. Introduction: Trusting Science

Science, as an institution, deserves our epistemic respect. This statement requires nuancing and defense, of course. But as a general claim, we submit that it is clearly true. And yet, we see much evidence that considerable numbers of people are willing to reject the scientific consensus on a number of important matters — including the risks of climate change and hydraulic fracking, the safety of GMOs and vaccines, and so on (Funk and Rainie 2015; Leiserowitz *et al.* 2016). Many factors could be cited as explanations for this fact — such as the concerted efforts of denialists (Brulle 2014; McCright and Dunlap 2011; Carr and Rubenstein 2009), motivated cognition (Kahan *et al.* 2011; Kahan *et al.* 2012), poor scientific literacy (Lombrozo *et al.* 2008; Miller 1983, 2004; Bodmer 1985) and flawed communication models (Lewenstein and Brossard 2006; Jasanoff 2014) — but an element common to many (if not all) of them is the question of the public's *trust of science*.

What precisely does it *mean* to trust science? Two initial matters need clarification. First, who are the recipients of trust? For example, consider an individual trusting agent — a member of the scientific laity, who has no scientific training (beyond what they learned in secondary school and have read casually since). Call him Jones. When we say that Jones trusts science, do we mean that Jones trusts individual scientists — any (or most) individuals who are scientists? Or do we mean that Jones trusts scientists when they speak *ex cathedra* of the collective work of the scientific enterprise? Or do we mean something somewhat different still: that Jones trusts the consensus messages of the scientific community? In fact, we can mean any of these things and more besides. "Trust of Science"

can thus tend to be ambiguous. The second matter is somewhat more philosophically complex: what does it mean to *trust* any of these sources? How might we distinguish between this relation and related concepts like *epistemic deference* or *recognition of authority*?

While we will have a bit to say about the second matter in §2, our focus will be on the first: the recipients of trust. Our main goal in this work was the development of a measure that could be used to gauge a certain social conception of trust of science in survey-based research. While there are other measures of trust-of-science in the literature (Nadelson *et al.* 2015), we observe in them the ambiguity of recipients mentioned above. We should add immediately that in some cases this ambiguity will be harmless — and perhaps better described as a kind of *generality*. However, in other cases we believe that a more precise targeting of individuals' trust in *the scientific community* (or of *scientific consensus*) is more fruitful. We offer a brief justification of this claim in §3 and in our concluding remarks (§6). In §4, we describe the measure (what we call the Scientific Community Trust Index or "SCTI") and its development and validation; §5 describes an experiment that employs this measure and reflects positively on its validity.

2. Approaches to Trust

2.1. Trust in Testimony

Trust is arguably key to our epistemic lives, for a great deal of what we know is based on the testimony of others (Hardwig 1985; Coady 1992; Lipton 1998; Lackey 2008). However, it is a highly non-trivial project to characterize epistemic trust or the role it plays in mediating our reception of testimony. We cannot hope to survey the relevant disputes here, much less argue for a particular stance on this issue. But here is a starting point that may serve as a general orientation to these issues: to trust someone (we shall henceforth use 'trust' only in an epistemic sense) is to be disposed to receive their testimony and incorporate it into our stock of beliefs; in many cases this also results in knowledge. According to many, trust is often granted rather easily. Some even suggest that it is often accorded to others *a priori*, notwithstanding evident grounds for withholding it (Burge 1993; Coady 1992; cf. Fricker 1994). For example, consider a common case of asking directions: Jones gets off the train and asks a passer-by how to get to the Sears Tower; he is told (truthfully) and thereby comes to know where the Sears Tower is (Lackey 2004). Jones trusts the passer-by to be an *honest* and *competent* (or *reliable*) source of information (Lipton 1998) not because of Jones's extensive experience and history with this passer-by, but because it seems to Jones a reasonable *ex ante* stance to take.

Note that it would probably *not* be correct to claim that Jones's disposition to trust the testimony of the passer-by amounts to a very general inclination to believe anything that the passer-

by has to say. Indeed, it may not even be correct to say that prior to Jones asking his question that he treats the passer-by as trustworthy. This is because Jones may simply have no firm beliefs about the passer-by's competence to speak on this question; perhaps the passer-by is also a tourist in Chicago and has no idea where the Sears Tower is. Equally, if the passer-by replies that the Sears Tower is about two hundred miles east, in Cleveland, or that it can only be found by the pure of heart, Jones will presumably withhold any disposition to trust her. Trust, at least in this *ex ante* form, is and ought to be tentative and defeasible.

In cases where we have established a source as trustworthy, our disposition to assimilate their testimony into our stock of beliefs will likewise often be partial and guided by certain content/plausibility filters. This is for the simple reason that individuals' competence and honesty can both be limited in scope. I may well accord the restaurant sommelier a great deal of trust on whether 2012 was a good year for Oregon Pinot Noir without inclining to accord her with much trust on whether 1,000 mg of naproxen sodium is a safe dose. Likewise with the passer-by: our requests for others' testimony reflect our initial guess or belief about the scope of their trustworthiness.

Now it might turn out that the sommelier *is* qualified to offer advice on safe doses of non-steroidal anti-inflammatory drugs in general, having worked previously as a pharmacist. She might in fact *be* trustworthy to speak on this question. A failure to recognize her as a source of testimony on that topic does not reflect on whether she in fact *is* trustworthy — only on our disposition to trust her in this instance. Similar remarks apply to the honest side of the coin. Testifiers can be honest without being recognized as such. The relevant sense of 'honesty' may need to be taken in a wide sense to exclude non-cognitively transparent cases of "dishonesty" — e.g., when someone has an unconscious systematic bias against sharing certain information completely and accurately; Elizabeth Anderson treats this as a third parameter of evaluation that she calls 'epistemic responsibility' (2011, 146).

Dispositions to trust or not trust particular agents on particular occasions concerning certain matters are subject to normative — including moral — evaluation. Suppose in the restaurant case that Jones fails to accord our sommelier any trust about wine because she is a woman (perhaps as a non-conscious expression of some implicit bias). This is a paradigm case of what Miranda Fricker calls "testimonial injustice" (Fricker 2007): by failing to appropriate recognize the sommelier's trustworthiness on this subject Jones has done an injustice to her. Even when moral condemnation is inappropriate, failure to trust trustworthy sources can be subject to normative–*epistemic* evaluation (Code 1987). This matter is complex, however. Our epistemic behavior occurs in the context of a network of beliefs and dispositions some for which we have at best partial responsibility. Agents who

are conditioned to distrust "elites" or ideological outgroups are, in a sense, behaving rationally when they distrust scientists (Kahan *et al.* 2011; Almassi 2012). Any epistemic critique thus should target the relevant components of this broader web of belief.

2.2. Deference and Assessments of Expertise

How is trust related to deference and assessment of expertise? Again, our discussion must be brief, but we submit that the conceptual core of trust is more general than either notions. First, as we have characterized it, following what we take to be the philosophical consensus, trust incorporates two key assessments of a potential source: (1) their competence/reliability and (2) their honesty. Expertise involves only the first. Now, one might think that identifying someone as an expert on a topic signals one's inclination to trust that person. But this can be explained on Gricean grounds of conversational implicature. For Jones to *assert* (or publicly acknowledge) that Smith is an expert on, say, pinot noir will often imply that Jones is willing to trust Smith on that subject. However, Jones can also cancel this implicature in a given instance by noting that Smith is herself a winemaker pushing her own product. Experts can fail to be honest.

Moreover, trustworthy people can fail to be experts. Reflection on the ordinary cases of testimony is sufficient to demonstrate this point. The passer-by is trustworthy and appropriately accorded trust when they tell Jones the location of the Sears Tower. We commonly trust others when they tell us their names. But it would be strange to characterize these as expressions of *expertise*. The people in question simply happen to know these things (if they indeed do) — and perhaps little else on the subject. Expertise, in contrast, seems to require a certain kind of depth and breadth of one's knowledge and understanding (Collins and Evans 2007; Goldman 2001).

The relationship between trust and deference is somewhat less clear, in part because the concepts seem to substantially overlap. Anderson *et al.* write that "While it may seem conceptually similar to institutional trust, deference to scientific authority differs because it is developed early in life and represents a stable worldview" (2012, 227). This may be correct as an empirical generalization, but we find the latter clause implausible as a characterization of the *concept* of deference. Brossard and Nisbet's earlier characterization of *deference to scientific authority* as "a key value predisposition" and "a long-term socialized trait that guides citizens' responses to a range of technical controversies" (2006, 28–30) seems more apt, but could also be criticized on the grounds that it is not a characterization of the concept of deference as much as a generalization about the way deference tends to be instantiated. It is also not entirely clear that epistemic deference typically involves attributing expertise, but we leave this question to one side.

We suggest that, in general, deference signals a more thoroughgoing disposition to accept one's testimony as true — perhaps at the expense of our own pre-existing beliefs (e.g., involving lower

plausibility thresholds for assimilating their testimony). This suggestion is broadly consistent with the gloss offered by Keren (2014) who writes that "deference to an epistemic authority involves not merely thinking that I may allow [a trusted speaker's] weighing of the evidence to replace my own, but that [in contrast with trust] it would be epistemically irresponsible for me not to treat her judgment in this way" (2601).

To illustrate the contrast, suppose that Jones firmly believes that acetaminophen is completely safe. His grounds for this belief are somewhat shallow but broadly rooted thanks to successful marketing campaigns, offhand statements of his family physician, behavior of his parents, and so on. There's a sense in which he'd bet his life on the safety of acetaminophen. Now imagine two parallel exchanges concerning this belief of Jones: one with his friend Miller and one with the aforementioned pharmacist-turned-sommelier Smith (with whom Jones has since become friends). Miller, while generally well-informed and trusted by Jones is not a pharmacist. So when Miller admonishes Jones that in certain common circumstances acetaminophen is in fact *not* safe in even moderately high doses, Jones is unwilling to accept his testimony and revise his belief ("Come on," he might say: "It's right there on the package: it's the safest!"). While Jones does not trust Miller's testimony on this, he may still treat it as reason to inquire further and come to his own conclusion on the basis of improved evidence.

In contrast, when Jones's pharmacist friend Smith admonishes him in exactly the same way as Miller did, Jones relinquishes his belief and defers to Smith's greater expertise without inquiring further ("She ought to know; I guess I was wrong"). He essentially allows Smith's weighing of the evidence replace his own, recognizing, as Keren puts it, that not doing so would be irresponsible.

Perhaps the concept of deference also suggests a generality or stability gestured at by Anderson *et al*. Whether it is also a value-reflective trait that is learned early in life seems to us an empirical question. We will take no stance on these issues except to suggest that while one's deferring to a source (an individual, some individuals, or an institution) will entail trusting that source; the reverse implication need not hold. Trust thus appears to be the more general notion; perhaps it is also the more "ordinary" notion — something that members of the general public are better able to grasp from their day-to-day epistemic experience. In any case, trust will henceforth be our focus.

3. Trusting the Scientific Community

Let us come to the matter of whom to trust in the context of science. Recent studies of the public's attitude toward scientists reveal some interesting complexity at the individual level. Fiske and Dupree note that "Scientists as communicators have earned audiences' respect, but not necessarily their trust" (2014, 13593). When judged among other professions, their research finds that scientists

are generally regarded as "high-competence" but "low-warmth". Fiske and Dupree's terminology of credibility and trustworthiness differs from ours but can be mapped in an obvious way onto our terminology of competence and honesty; they write:

> Being seen as competent but cold might not seem problematic until one recalls that communicator credibility requires not just status and expertise (competence) but also trustworthiness (warmth). People report envy towards groups in this space. These are mixed emotions that include both admiration and resentment. Science communicators arguably need to know about this possible type of response to them. (Fiske and Dupree 2014, 13595)

But even supposing that one took a more neutral view of the individuals who are scientists, it is far from obvious what our prima facie trust of them ought to be in general. Even in a context in which a given scientist is an acknowledged expert, should members of the laity trust them simply in virtue of their being experts? Scientists are people and people can lie, mislead, or succumb to cognitive biases — presumably more or less as easily as the rest of us.

Now it may often be appropriate to trust an apparent expert's testimony more or less as Jones trusts the passerby's testimony about the Sears Tower. But granting that such a practice exists (and is often, in context epistemically perfectly acceptable) should be distinguished from the asserting it as a general epistemic *policy*. Oreskes and Conway argue in their Epilogue to *Merchants of Doubt* that "we must trust our scientific experts on matters of science, because there isn't a workable alternative" (2010, 272). It depends on what one means by 'workable'; clearly suspending belief about what scientists say or only trusting their testimony on a case-by-case basis are possible alternatives (and compatible with granting that our epistemic lives are thoroughly imbricated with trust relations). Are these alternatives *unadvisable*? In some cases, very probably. Jones would presumably be a bit foolish not *not* accept the warning of his pharmacist friend Smith — or at least not to take them seriously as a matter for further investigation. But this does not clearly bear on the general policy. After all, individual experts often disagree with each other. Thus, just as we are unwilling to recommend as a general policy that people trust passers-by on matters on which they may well be experts — even as a prima facie, defeasible matter — we are unwilling to suggest, in general, that the laity ought to trust individuals who are scientists in virtue of their being scientists.

It is far more plausible, however, to interpret Oreskes and Conway's suggestion in communitarian terms: we ought to trust *the expert scientific community* — or relevant sub-communities — when they speak with one voice on an issue (Anderson 2011). Now, there is much that has been said and more that needs to be said about *why* scientific consensus should command our epistemic trust (and how to identify it). We cannot take on this project in the present context,

except to offer a parting suggestion in this section for why our epistemic policies might deserve to differ with respect to the scientific community at large. The key idea is that the honesty parameter in our trust evaluations gets a boost from several aspects of the scientific community's norms and practices. First, we have the norm of institutional skepticism (Merton 1942) that enjoins members of the community *not* to implicitly trust others' results until they can be subjected to scrutiny or replication. (One of the complexities in this context is that many of these practices serve as ideals that admit of limitations in scope and exceptions in practice; '*Nullius in verba*' may have been the motto of the Royal Society, but as Shapin (1994) shows, *plenty* was taken on others word (cf. Lipton 1998).) Second, we have the fact that scientists are often in competition with one another (Kitcher 1990; Strevens 2003). There are institutional incentives for showing other scientists to be wrong or for being a successful maverick. This, of course, is one side of what Thomas Kuhn referred to as "the essential tension" within science (Kuhn 1962; Kitcher 1992): science is both a cooperative and competitive enterprise. This latter aspect, we posit, is key to the epistemic significance of consensus. Assessments of both expertise and honesty are bolstered when individuals with some motivation to disagree with one another in fact agree (Odenbaugh 2012).

One could presumably cite other norms and practices that contribute to the scientific community's prima facie deserving of the laity's trust — e.g., practices for punishing or marginalizing bad actors — but we hope that our basic contention at least seems plausible. There is more reason for the laity to trust the consensus testimony of the scientific community than for the laity to trust individual scientists. If this is so, then researchers conducting empirical studies of the public's trust of science should investigate the most plausible relationships to the most plausible targets. Because we did not find an instrument that reliably did this, we set out to create one. We turn now to its development and validation.

4. Measure Development

We set out to create a measure of trust in science that focuses not merely on trust in the individual scientist, but rather on trust in the practices and consensus testimony of the scientific community. A secondary goal in creating this measure was to validate and field-test an instrument that performs as well or better than previously tested measures, but that has fewer questions (making it easier and more affordable to use in larger studies).

These two overarching goals left us with the specific tasks of (1) identifying aspects of the scientific enterprise and processes that plausibly ought to command our trust, (2) creating a domain-general set of items to assess trust in these aspects, (3) field-testing our instrument alongside an instrument for which validity and reliability have already been assessed, and (4) establishing the

reliability of our instrument as compared with this previous measure, as well as via its performance on two experimental scenarios (detailed in §5).

4.1. Related Measures

In order to further contextualize what is distinctive about our measure, it is worth considering a few of the alternatives. We briefly mentioned two measures of "Deference to Scientific Authority" above; they are as follows (measured on 5-point likert scales):

Brossard and Nisbet (2006)

1. Scientists know best what is good for the public.
2. It is important for scientists to get research done even if they displease people by doing it.
3. Scientists should do what they think is best, even if they have to persuade people that it is right.
4. Scientists should make the decisions about the type of scientific research on agricultural biotechnology.

Anderson, Scheufele, Brossard, Corley (2012)

1. Scientists know best what is good for the public.
2. Scientists should do what they think is best, even if they have to persuade people that it is right.

Note two features of the second set of items. First, the reference to 'scientists' is ambiguous between the scientific community (as a somehow univocal whole) and a population of individual people any of which might relied upon or deferred to. Second, the matters on which the public might defer to scientists are left quite broad — indeed, they are not limited to what we might normally think is within scientists' normal scope of expertise. Reference in the second item of Anderson *et al.* (2012) to scientists doing what they think best is also troublingly broad — particularly in democratic contexts (Kitcher 2001, 2011). It also strikes us as potentially confusing; if one grants that scientists should do what they think is best, what role does public attitude have left to play? (For whatever it is worth — being deeply anecdotal —, despite our general interest and enthusiasm for science and our broad trust in the scientific enterprise, we are ourselves rather ambivalent in our responses to these items.)

Nadelson *et al.* (2015)

This instrument contains 21 items that, as the authors put it, attempt to measure the multifaceted nature of trust, conceived as "trustworthiness" in ways compatible with our framework. Thus, it includes questions concerning the competence and epistemic responsibility of scientists, such as:

1. When scientists change their mind about a scientific idea it diminishes my trust in their work.
2. Scientists ignore evidence that contradicts their work.
13. When scientists form a hypothesis they are just guessing.

Also included are questions concerning their honesty, such as:

4. Scientists intentionally keep their work secret.
10. We should trust that scientists are being honest in their work.

Other questions concern generalities concerning subjects' attitudes towards scientists:

5. We can trust scientists to share their discoveries even if they don't like their findings.
9. We should trust the work of scientists.

As above, though these questions refer to 'scientists' in the plural, this is ambiguous between asking after one's beliefs and attitudes about *individual* scientists and asking about the *scientific community*.

4.2. The Scientific Community Trust Index: Items and Development

As noted above, the domain for which we aimed to create trust items was at the level of science as an enterprise or community, rather than at the level of the individual scientist. Thus, we explicitly mention the scientific community as the relevant source of information in several of the items and developed items that would probe a variety of dispositions to trust that source (or be relatively insensitive to testimony by that source).

To establish construct and content validity for our instrument, we first critically evaluated the wording and content of each of the items to ensure domain-generality and emphasis on trust at the community level of science. After internal review, we shared our items with external researchers. We deleted two items and adjusted the language of a few remaining items in light of their feedback. These steps were taken to ensure construct and content validity of our instrument items. We settled on the following six items, each scored on a five-point Likert scale of "strongly agree" to "strongly disagree" (brief thematic tags indicated in brackets; reverse-coded items starred):

Scientific Community Trust Index (SCTI)

1. When many scientists agree on something, it's worth listening to them. [*consensus-significance*]
2. I generally accept what the scientific community says is true. [*deference*]
3. If my personal opinion differed from what scientists agree is true, I would probably rethink my opinion. [*rethinking*]

4. Knowing what scientists think about an issue would not necessarily influence what I believe.* [*insensitivity*]
5. When politicians disagree with scientists about an issue, it's hard to know who to trust.* [*political-disagreement*]
6. Scientists ignore evidence that contradicts their work.* [*blinders*]

Item (6) duplicates Nadelson *et al.*'s second item. To further probe the validity of the SCTI, we deployed our instrument alongside the Nadelson *et al.* and Anderson *et al.*'s instruments as described below.

4.3. Scale Testing

Participants

The field test was conducted in two rounds with a data quality check between administrations. A total of 539 members of the American population participated in our survey (Round 1: n = 221; Round 2: n = 318). The respondents were employed through Amazon Mechanical Turk and were compensated $1.00 for their participation. Descriptive statistics included in the survey included *Age* (M = 37.89, SD = 12.89), *gender identity* (46.7% female) highest level of *education* (59.5% with a bachelor's degree or higher), *income level* (M = $50,000), and *race* (83.3% white). Participants were asked for their *political party identification* (40.6% Democrat) as well as their *political ideology* on a scale of 1 to 7 with 1 indicating "very conservative" and 7 indicating "very liberal" (M = 3.45, SD = 1.75).

Materials and Procedures

Participants completed an online survey (presented in Qualtrics survey software) that consisted of three different trust or deference measures: Nadelson et *al.*'s "Trust of Science and Scientists" instrument (21 items), Anderson *et al.*'s two-item "Deference to Science" instrument developed by Andersen et *al.*, and our SCTI (Anderson *et al.* 2012; Nadelson *et al.* 2015). The measures were presented in a random order, and the the questions within each scale were also randomized. Following the trust measures, participants were presented with one of two trust scenarios (further explained in §5), before moving on to the demographic questions.

Results

For the six items on our SCTI, the 539 participants had an overall average score of 23.36 (SD = 4.66) on a scale of 6 to 30. A reliability analysis of the results from the SCTI revealed a Cronbach's alpha of .84, indicating a good to very good level of reliability. The means and standard deviations of all six of our items were fairly consistent, and participants correctly perceived reverse coded items.

Item means, standard deviations, and corrected inter-item correlations are presented in Table 1. The corrected item correlations ranged between .54 and .70. Examination of these correlations indicates that all six items contribute positively to the reliability of our instrument, but no correlations are so high as to indicate item redundancy or over-correlation.

Table 1. Item means, Standard Deviations, and Inter-item Correlations for the Scientific Community Deference Index

Item	Mean	Standard Deviation	Inter-Item Correlation
SCTI_1: consensus	4.44	.825	.666
SCTI_2: deference	4.02	.977	.697
SCTI_3: rethinking	3.86	1.01	.592
SCTI_4: insensitivity	3.54	1.18	.544
SCTI_5: political-disagreement	3.81	1.23	.536
SCTI_6: blinders	3.70	1.12	.582

A one-way between subjects ANOVA comparing SCTI scores between *political parties* revealed a significant difference between groups $F(2,509) = 35.25$, $p = .000$. Post hoc analysis using Gabriel's procedure showed significant differences in scores between all three groups (all $ps = .000$). Republican SCTI scores are the lowest (M = 20.69, SD = 4.63), followed by Independents (M = 23.27, SD = 4.8), and Democrats (M = 24.96, SD = 3.91). Similarly, a significant negative correlation was found between SCTI score and conservative *political ideology* ($r = -.490$, $p = .000$). No difference was detected between genders ($t(531) = .237$, $p = .83$), and no correlation was seen between SCTI scores and education ($r = .049$, $p = .26$) or income ($r = .046$, $p = .29$).

4.4. Comparisons to Other Measures

SCTI scores correlated highly with Nadelson *et al.*'s measure of trust ($r = .83$, $p = .000$) and to a lesser degree (but still significantly) with Anderson *et al.*'s two-item measure of deference to scientific authority ($r = .54$, $p = .000$).

4.5. Discussion

This study has established the validity and reliability of the SCTI. The results of Cronbach's alpha reveal good internal reliability for the items of the SCTI, and the predicted correlations between

existing trust and deference measures support the construct validity of our instrument. Further, the negative correlation seen between conservative political ideology, and the significant differences in SCTI score between political parties are an interesting, but unsurprising, result. Previous studies of political ideology and trust in science find similar correlations, again confirming the construct validity of our instrument (Nadelson *et al.* 2015; Gauchat 2012).

5. The Measure in Action

In addition to testing our SCTI alongside the previously validated measures created by Nadelson *et al*. and Anderson et al., we developed two simple scenarios designed to further test the performance of our instrument — specifically to test the hypotheses that participants who scored well on the instrument would be able to successfully distinguish between trust of individual scientists and trust of the scientific community.

5.1. The Experiment

Materials and Procedures

The experiment was conducted as part of the previously described study (§4). Following the trust measures described above, participants were presented with one of the two scenarios and asked to answer the two associated questions, before moving on to the demographic questions. The scenarios and questions were parallel in structure. The first scenario describes an instance in which two researchers publishing conflicting results in a scientific journal ("Disagreement Scenario"). Participants were asked two questions (order randomized):

1. A week ago, one of the researchers mentioned above also published evidence in a respected journal that eating carrots noticeably lowers one's chance of contracting stomach cancer. Would you be inclined to trust this conclusion?
2. A week ago, the American Medical Association, a large group of doctors and medical researchers, after reviewing many scientific studies, published a statement that eating oatmeal was beneficial for one's cholesterol levels. Would you be inclined to trust this conclusion?

The second scenario describes a situation in which a published researcher is under investigation for scientific misconduct ("Misconduct Scenario"). Participants were asked a structurally analogous version question (1) above as well as question (2) verbatim. Responses to the questions were recorded on a 5-point likert scale indicating level of trust. Both scenarios and sets of questions can be found in the Appendix. Given the intuitive appropriateness of responding with a low level of trust on the "individual scientist" question (1) and a higher level of trust on the "community" question (2), we calculated a "*Trust Behavior*" score for each scenario, with scores for (1) reverse coded and added to

scores for (2), yielding a variable ranging from 2–10 for each scenario. Correlations between these two *Trust Behavior* scores — *Disagreement Trust Behavior* and *Misconduct Trust Behavior* Score — and the three different trust measures (our SCTI, Nadelson *et al.*'s instrument, and Anderson *et al.*'s deference measure) are examined below.

Results

SCTI scores correlated with both the *Disagreement Trust Behavior* score (r = .180, p = .003) and the *Misconduct Trust Behavior* Score (r = .172, p = .005). Nadelson *et al.*'s measure of trust in science also correlated highly with the *Disagreement Trust Behavior* score (r = .173, p = .005) and less significantly with the *Misconduct Trust Behavior Score* (r = .142, p = .022). Anderson *et al.*'s deference measure did not correlate with either the *Disagreement* (r = .091, p = .137) or the *Misconduct Trust Behavior* scores (r = -.063, p = .307).

5.2. Discussion

Our results indicate that participants who score highly on the SCTI are generally able to successfully distinguish between trusting an individual scientist and trusting the scientific community. A high score on Nadelson et al.'s measure also correlates with higher Trust Behavior scores, but in the case of the Misconduct Scenario, the correlation was not as strong. Interestingly, the deference to science measure created by Anderson et al. does not seem to predict participants' ability or inclination to distinguish between trusting individual scientists and trusting a community of scientists. The comparability of the SCTI to Nadelson et al.'s instrument in this experiment further justifies its validity and credibility to measure trust in the scientific community.

6. General Discussion and Conclusion

Public trust in the scientific community has long been of interest, but it is arguably more vital than ever given the current political and cultural climate of polarization and scientific distrust. This research has sought to test the validity and reliability of a new and relatively compact instrument for measuring trust in science. As explained previously, we believe that trust in the scientific community should be differentiated from trust in individual scientists. Our measure was designed to target the former inclination. Through multiple rounds of item revision and field testing with an embedded experiment, we find that the SCTI performs as well as a previously validated measure of trust, while being shorter in length and focusing more specifically on the scientific community.

One possible limitation to our research is the sample population. There are limitations to the generalizability of MTurk; however, it has been shown to be a reliable source of data, and are

considered to be more so than undergraduate students, which have been employed in previous trust in science research (Buhrmester *et al.* 2011; Paolacci and Chandler 2014). The size of our sample might also be a possible limitation, and larger tests of this instrument should be considered, but the sample size used here is comparable to those of similar studies (Drummond and Fischhoff 2015; Nadelson *et al.* 2015).

Additional experiments to investigate the performance of the SCTI in various trust scenarios beyond the preliminary ones conducted in this study would help to further separate the SCTI's ability to predict trust in the scientific community versus trust in individual scientists. Studies examining the relationship between trust measured by the SCTI and concern for or understanding of scientific issues that have become culturally or politically controversial, such as vaccine or GMO safety, would also present an interesting area of future research. It is our hope that others will use and continue to test the SCTI.

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Supplemental Information

Scenario 1: One-Off Disagreement

Please consider the following scenario and answer the two questions below:

A few months ago, a well-known medical researcher published a study in the *New England Journal of Medicine* that seemed to show that drinking 2–3 cups of coffee per day would reduce one's chance of liver disease by 20%. A few months later, however, another respected scientist published data in the same journal that showed that coffee had *no* significant effect on one's chance of liver disease.

1. A week ago, one of the researchers mentioned above also published evidence in a respected journal that eating carrots noticeably lowers one's chance of contracting stomach cancer.

   Would you be inclined to trust this conclusion? [not at all, probably doubt, not sure/neutral, probably accept, fully accept]

2. A week ago, the American Medical Association, a large group of doctors and medical researchers, after reviewing many scientific studies, published a statement that eating oatmeal was beneficial for one's cholesterol levels.

   Would you be inclined to trust this conclusion? [not at all, probably doubt, not sure/neutral, probably accept, fully accept]

Scenario 2: Misconduct

Please consider the following scenario and answer the two questions below:

A few months ago, a well-known medical researcher published a study in the *New England Journal of Medicine* that seemed to show that drinking 2–3 cups of coffee per day would reduce one's chance of liver disease by 20%. Upon closer inspection, however, it appeared that this researcher may have fabricated the data. The researcher is currently under investigation for misconduct.

1. A week ago, the researcher mentioned above also published evidence in a respected journal that eating carrots noticeably lowers a person's chance of contracting stomach cancer.

   Would you be inclined to trust this conclusion? [not at all, probably doubt, not sure/neutral, probably accept, fully accept]

2. A week ago, the American Medical Association, a large group of doctors and medical researchers, after reviewing many scientific studies, published a statement that eating oatmeal was beneficial for one's cholesterol levels.

   Would you be inclined to trust this conclusion? [not at all, probably doubt, not sure/neutral, probably accept, fully accept]