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Science for Others or the Self? Presumed Motives for Science Shape Public Trust in Science

Tessa M. Benson-Greenwald^{1*}, Alejandro Trujillo², Andrew D. White¹, and Amanda B. Diekman¹

Affiliations:

¹Indiana University, Bloomington, IN, USA

² Miami University, Oxford, OH, USA

*Corresponding Author: Tessa Benson-Greenwald, tmbenson@iu.edu, Psychology Building, 1101 E 10th Street, Bloomington, IN 47405

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Abstract

Science can improve life around the world, but public trust in science is at risk. Understanding presumed motives of scientists and science can inform the social psychological underpinnings of public trust in science. Across five independent datasets, perceiving the motives of science and scientists as prosocial promoted public trust in science. In Studies 1 and 2, perceptions that science was more prosocially oriented was associated with greater trust in science. Studies 3 and 4a-b employed experimental methods to establish that perceiving other-oriented motives, versus self-oriented motives, enhanced public trust in science. Respondents recommend greater funding allocations for science subdomains described as prosocially-oriented vs. power-oriented. Emphasizing the prosocial aspects of science can build stronger foundations of public trust in science.

Key Words: Trust in Science, Goal Affordances, Communion, Agency, Motivation/Goals

Science for Others or the Self? Presumed Motives for Science Shape Public Trust in Science

Science can improve life around the world, but realizing this potential requires the trust of the public – of citizens, lawmakers, teachers, business leaders, and others. This trust is threatened by the spread of misinformation (Brossard & Scheufele, 2013), but crises such as the COVID-19 pandemic can correspond to increases in public trust in science (3M, 2021). Such fluctuations of public trust in science can be better understood through understanding their psychological foundations. We posit that understanding presumed motives of scientists and science can inform the social psychological underpinnings of public trust in science. Specifically, do perceivers see science as providing opportunities to fulfill prosocial motives, and do these beliefs influence public trust?

Presumed motives matter because trust does not solely rely on the merits of science (Rutjens, Heine, et al., 2018). More science knowledge does not lead inevitably to positivity toward science (Allum et al., 2008); more knowledge can increase polarized attitudes if perceivers interpret that knowledge through their own preconceptions (Kahan et al., 2012). The scientific process itself can set the stage for distrust because of conflicting evidence and strong debates. Contemporary skepticism has led scientific leadership to call for “a new American affinity for science” by highlighting how science serves the public good (Korte, 2019, para. 4). Understanding the perceived *motivational culture* of science – that is, what goals scientists value and the goals afforded by scientific careers– can illuminate the psychological foundations of public trust.

Stereotypes of Scientists and Science Roles as Lacking Communality

In considering the foundations of trust in science, we focus on perceptions of agency and communality attributed to scientists and seen as afforded by scientist roles. This perspective reflects the social role principle that attributes of individuals or groups are inferred from the observation of people within particular social roles (Eagly & Koenig, 2021). In particular, beliefs about science, technology, engineering, and math (STEM) roles reflect expectations that STEM roles do not afford working

collaboratively with others or for prosocial purpose: STEM careers are seen as affording fewer *communal* opportunities than other fields (Diekman et al., 2020).

The perception of science as lacking this communal orientation is important because communion, along with agency, comprise two core dimensions of perceptions of social judgment (Abele & Wojciszke, 2014): Communion reflects an orientation toward others, whereas agency reflects an orientation toward the self (Bakan, 1966). The communal and agentic value dimensions, sometimes referred to as meta-motives, reflect abstract purposes guiding goal pursuit (Schwartz & Bilsky, 1987; Trapnell & Paulhus, 2012). These two dimensions of agency and communion emerge repeatedly as foundations of understanding the self and others (Fiske et al., 2007; Folberg et al., 2019; Judd et al., 2005; Trapnell & Paulhus, 2012).

Inferences about communal motives in science may be particularly important in understanding trust in science because stereotypes of science and scientists reflect low levels of communality. STEM careers are perceived as affording fewer opportunities to work with and help others, even among STEM majors (Diekman et al., 2011) or pre-service K12 science teachers (Fuesting et al., 2021). Scientists are stereotyped as competent but not warm (Fiske & Dupree, 2014) and are viewed as less communal and more agentic than the average woman or man (Carli et al., 2016). In all, the perceived motivational culture of science is characterized by low communality compared to agency.

Yet these beliefs are not monolithic or immalleable. For example, when individuals personally experience science or math as including collaboration or altruism, they perceive that STEM fields afford more communal opportunities (Brown et al., 2018). Contextual cues can heighten communal beliefs about science – whether through direct information about the collaborative or altruistic work of scientists (Brown, Smith, et al., 2015; Diekman et al., 2011) or through considering the purpose rather than the process of science (Steinberg & Diekman, 2018). Here, we seek to understand whether

perceptions of communal culture in STEM can elucidate the psychological foundations of public trust in science.

Dimensions of Interpersonal Perception as Foundations for Trust in Science

Institutional Trust and Interpersonal Trust

The literature on the foundations of interpersonal trust offers insight into public trust in science. Interpersonal trust means holding positive expectations of outcomes with another person (Holmes & Rempel, 1989). Quickly determining whether to trust another person in ambiguous conditions benefits human evolution because trust is fundamental to cooperation and social connections (Oosterhof & Todorov, 2008). In close relationships, trust develops through using past behaviors to predict future behaviors (predictability), inferring a partner's qualities (dependability), and setting aside doubts despite emotional risks (i.e., faith; Rempel et al., 1985).

Similar to interpersonal trust, institutional trust means holding positive expectations of outcomes related to belonging to or interacting with an institution, and thus there is some overlap in the psychological foundations of interpersonal trust and institutional trust (Kramer & Tyler, 1996; Shockley-Zalabak et al., 2000; Zaheer et al., 1998). Some differences are clear: Institutions are comprised of many members rather than a single partner, and individuals may not directly interact with organization members. Whereas interpersonal trust derives from an interaction partner, institutional trust may derive *both* from interactions *and* observing other institutional actions, such as its policies and structures (Murphy & Reeves, 2019). These observations can provide information along the same dimensions that define interpersonal trust (Rempel et al., 1985): Predictability might take the shape of positive expectations for interactions and organizational actions (e.g., will a fair process be followed?). Dependability might focus on inferring the motives of the institution and its members (what are the traits or motives of institutional actors?). Faith may be expressed in willingness to follow an institution's policies or recommendations, despite doubts.

Prior research about public trust in science aligns most closely with the faith or predictability components: Trust in science is frequently conceptualized as positive expectations about the actions of scientists (predictability), even in the presence of uncertainty (faith) (e.g., Luhmann, 1979; Nisbet et al., 2015; Rutjens, Heine, et al., 2018). Less research has examined trust in science as related to the dependability dimension: What character inferences might shape trust in science? In this research, we examine whether inferences about motivations perceived in science affect public trust.

Inferences of Communal and Agentic Motives Underlie Trust

In interpersonal judgments, communal inferences are central. Judgments of others weigh communion more than agency (Abele & Wojciszke, 2014) and communal information is processed preferentially (Abele & Bruckmüller, 2011). Indeed, confiding in others particularly relates to perceiving potential confidantes as highly communal (Wojciszke et al., 2009). Further, interpersonal distrust relates to perceiving both low levels of communion and high levels of agency (Radkiewicz et al., 2013). Extrapolating from this research, public trust in science may be enhanced when the public views communality as a central motivation for science – that is, perceiving scientists and scientific institutions as acting for the prosocial good. Conversely, public trust in science may be diminished when the public views agency as a central motivation for science – that is, perceiving scientists and scientific institutions as acting for their own gain.

In examining the impact of communal and agentic inferences for institutional trust, a key consideration is the varying expressions of communion and agency that can be folded into the “Big Two” umbrella constructs. Depending on the relevant context, specific aspects of the meta-motives may be especially impactful. Components of agency include power/dominance (Folberg et al., 2019; Trapnell & Paulhus, 2012), independence/autonomy (Eagly et al., 2019; Folberg et al., 2019), and competence (Eagly et al., 2019; Trapnell & Paulhus, 2012). Components of communion include altruism (Brown,

Smith, et al., 2015; Brown, Thoman, et al., 2015), collaboration (Fuesting et al., 2017), harmony, and equality (Trapnell & Paulhus, 2012).

Further, agency and communion are often observed as orthogonal constructs, but at times high levels of one dimension accompany low levels of another. Within the domain of interpersonal interaction, the interpersonal circumplex (Wiggins, 1979) examines behaviors that might arise given varying levels of agency and communion. High agency has different consequences in interpersonal interaction when paired with high versus low communion (Locke, 2000). Although research from a Big Two perspective often finds positive or no correlation between agency and communion, focusing on subcomponents of agency can yield a different pattern: Agency as dominance can be associated with low communion (particularly when dominance is high; Diekmann, 2007; Imhoff & Koch, 2017). In the current research, we posit that communal motives particularly matter for trust in science. In turn, agentic motives may affect trust in science more when inferences of agency also implicate inferences of communion (for example, seeking power over others rather than seeking competence or independence). Moreover, trust in science may be especially low when science is perceived as pursuing power at the expense of others, consistent with the Agency/Separation blend of the interpersonal circumplex (Locke, 2000).

In all, we expect that perceptions of communal and agentic motives will influence trust in science, but research has yet to identify communal motivational culture of science as associated with trust in science. Prior evidence provides some support along these lines: Perceiving scientists as valuing knowledge advancement over morality contributes to viewing scientists as potentially dangerous (Rutjens, Heine, et al., 2018). In medicine, nutrition, and the environment, the public trusts scientific researchers less than they trust practitioners whose work more closely affects the public (Pew Research Center, 2019). Similarly, scientists who conduct research in the public sector, compared to the private sector, are perceived as being motivated by benevolent values and having research that is accessible by

the public; these perceptions in turn predict trust in science (Critchley, 2008). This evidence lays the groundwork for the current research: Understanding the impact of perceived motives in science can provide insight into enhancing trust.

Current Research

We tested the hypothesis that perceiving a more communal motivational culture in science would promote public trust in science. We employed correlational and experimental methods across five independent datasets: Studies 1 and 2 examined correlations between perceived motives in science and trust in science. Studies 3 and 4a-b employed experimental methods to establish that communal motives enhance public trust in science compared to agentic motives.

Additional analyses tested for moderation by political ideology and participant gender because prior research shows lower trust in science among conservatives and women (Gauchat, 2012; Rutjens, Sutton, et al., 2018). These analyses appear in supplemental materials because of inconsistent power to detect higher-order interactions. All data are available at

https://osf.io/k2tfa/?view_only=af4f426473934c22a7bd654b95022fd8.

Study 1

Study 1 examined the relationship between prosocial perceptions of science and trust in science in the General Social Survey (GSS), a nationally representative dataset drawn from interview surveys conducted by the National Opinion Research Center (Smith et al., 2016). The GSS provides a unique opportunity to investigate these associations in a large, nationally representative sample with a range of demographic predictors.

Method

Participants. The sample for analyses included 478 participants (227 female; 251 male) who answered items of interest¹ in the 2012 GSS (see Measures below). The GSS is a nationally-

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¹ Results were similar when N varied across analyses.

representative survey that tracks sociological and attitudinal patterns in the U.S. Data are collected biennially via face-to-face interviews and telephone from approximately 1,700 respondents. Each independent sample draws from noninstitutionalized English-speaking persons at least 18 years old (Smith et al., 2016). The 2012 GSS utilized multiple ballots with certain sections only appearing on some versions (Smith et al., 2019). A subsample of 485 participants responded to the science-related questions of interest.

The sample (Age: $M = 48.48$, $SD = 17.02$) included 359 participants identifying as White, 64 as Black, and 55 as other. The median reported income was \$25,000 or over. The sample was distributed across party affiliations (110 Republican, 182 Independent, 172 Democrat, 11 other). Most participants reported completing at least high school (75 did not complete high school, 225 high school diploma, 38 junior college, 92 bachelor's degree, and 48 graduate degree).

Measures.

Developing measures of perceived prosociality of science and trust in science progressed in two steps. In step one, we selected all items from all available years in the GSS that asked about science or scientists, removing items that assessed science knowledge, exposure, or education. To obtain a sufficiently large pool of items, we excluded items only appearing in years with fewer than 5 total science opinion items. This process resulted in a pool of 9 items² collected in the 2012 survey.

In step two, these items were entered into a Maximum Likelihood factor analysis with an oblique rotation (Promax) to allow for correlation between the factors (John & Benet-Martínez, 2000). This analysis revealed two factors with eigenvalues greater than 1 that accounted for 43.99% of the total variance.³ We retained items if they loaded .30 or higher and only onto one factor. The first factor

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² The GSS items were SCIENTGO, SCIENTHE, SCIENTBE, SCIENTMO, SCIENTAL, NEXTGEN, ADVFRONT, NATSCI, SCIBNFTS.

³ Because use of eigenvalues for factor extraction has been criticized (e.g., Turner, 1998), we also examined other indices to determine the factor structure of these items (see Supplement).

focused on perceived qualities of scientists (prosociality of scientists), and the second factor focused on perceptions of science as a field worthy of trust. The measures were moderately positively correlated with each other, $r(475) = .35, p < .001$.

Perceived Prosociality of Scientists. Participants rated their agreement with three items on scales from 1 (*Strongly disagree*) to 4 (*Strongly agree*). Additional responses coded as missing values included *don't know* and *no answer*. Items were *Scientists work for the good of humanity*, *Scientists help solve problems*, and *Scientists want to make life better for the average person*.⁴ Items were averaged ($\alpha=0.71$).

Trust in science. Participants rated agreement with two items on scales from 1 (*Strongly disagree*) to 4 (*Strongly agree*). Additional responses coded as missing values included *don't know* and *no answer*. Items were *Because of science there will be more opportunities for the next generation* and *Even if it brings no immediate benefits, scientific research that advances the frontiers of knowledge is necessary and should be supported by the federal government*.⁵ Items were averaged, $r_s(462) = 0.32, p < .001$.⁶

Results

Does perceived prosociality of scientists predict trust in science? We conducted a stepwise regression in which we regressed trust in science on perceived prosociality of scientists and demographic variables (see Table 1).⁷ Demographic variables were entered in Model 1, and perceived prosociality was entered in Model 2. As hypothesized, prosocial perceptions of scientists uniquely and

⁴ GSS items were SCIENTGO, SCIENTHE, and SCIENTBE.

⁵ GSS items were ADVFRONT and NEXTGEN.

⁶ With two-item scales, Cronbach's alpha can underestimate reliability (Eisinga et al., 2013) and the Spearman-Brown coefficient is recommended.

⁷ Without demographic controls, perceived prosociality of science positively predicts trust in, $b = 0.47, SE = 0.06, p < .001$.

positively predicted trust in science, above and beyond the demographic predictors. When people see scientists as serving prosocial goals, they tend to trust science more.

Table 1. Predictors of Trust in Science

	Trust in Science	
	Model 1	Model 2
Perceived Prosociality of Scientists	—	0.36 (0.26)***
Gender	0.11 (0.10)†	0.11 (0.11) †
Political Ideology	0.08 (0.23)***	0.06 (0.18)**
Education	0.01 (0.03)	0.02 (0.05)
Income	-0.01 (-0.05)	-0.01 (-0.04)
R²	.06	.12
Model df	4,273	5,272
Model F	4.34**	7.58***
R²Δ		.06
df Δ		1,272
F Δ		19.37***

NOTE: Table presents both unstandardized and standardized regression coefficients, standardized coefficients are inside the parentheses. Gender was effect coded (women = -1, men = +1). Political ideology ranged from 1 (*Extremely conservative*) to 7 (*Extremely liberal*). Education ranged from 0 (*Less than high school*) to 4 (*Graduate*). Income ranged from 0 (*Less than \$1000*) to 12 (*25000 or more*). ** $p < .01$, * $p < .05$, † $p < .10$.

Discussion

In a nationally representative sample, perceived prosociality of scientists predicted greater trust in science. Indeed, prosocial perceptions of scientists accounted for variance above and beyond demographic predictors, including political ideology. This initial study demonstrates a robust association between perceived prosociality of scientists and trust in science in a large, nationally representative

sample. However, an inherent limitation to the GSS is that analyses are constrained to items included in the survey. In Study 2, we turn to primary research that employs conceptually and empirically distinct measures of the motivational culture of science and trust.

Study 2

This study examined how perceived opportunities for communal or agentic goal pursuit in scientific careers relate to trust in science. Study 1 examined the perceived motivational culture of science through examining beliefs about scientists' prosocial motives; Study 2 shifts from focusing on the inferred motives of scientists to focusing on motivational opportunities within the scientist role (i.e., communal or agentic affordances; Steinberg & Diekmann, 2018).

Method

Participants. We recruited 367 US citizens using Amazon's Mechanical Turk (MTurk) online marketplace; respondents were compensated \$0.50. Potential participants were recruited at two time points⁸ and excluded from participating twice. Fifty-three respondents were removed for failing attention checks.⁹ The remaining 314 participants (148 women; 166 men) comprised the sample for analyses (Age: $M = 33.34$, $SD = 18.71$). The sample included 190 participants identifying as White/European American, 23 as Black/African American, 22 as Asian/Asian American, 13 as Hispanic/Latinx, 8 as multiracial, 58 as other/did not report. Political identification included 123 Democrats, 72 Independents, 59 Republicans, 60 other/no affiliation.

Sensitivity analyses¹⁰ showed sufficient power (0.80; $\alpha = .05$) to detect small-to-medium sized regression coefficients in all analyses ($f^2 = 0.05$ for models with one to four predictors; Faul et al., 2007, 2009).

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⁸ Recruitment time point produced no main effects or interactions. All analyses are available from the authors.

⁹ Results are the same when those excluded for inattention are included in analyses. Attention checks used in Studies 2-4a-b are reported in Supplement.

¹⁰ All sensitivity analyses were conducted using G*Power 3.1.9.7.

Procedure. Participants completed all measures in the order described below as part of a larger battery of surveys. Finally, they answered demographic questions.

Measures.

Science affordances. Participants rated how much science careers offer communal and agentic opportunities (Table 2). The science affordances measure (Steinberg & Diekman, 2018) was created by adapting base measures of communion and agency (e.g., Folberg et al., 2019; Diekman et al., 2010), which contain similar content to other measures (see Trapnell & Paulhus, 2012).¹¹ The base measures of communion and agency have demonstrated structural validity (Folberg et al., 2019) and convergent validity with the Bem Sex Role Inventory (Bem, 1974) and the Interpersonal Adjective Scale (Wiggins, 1979), a circumplex measure of interpersonal behavior (Trapnell & Paulhus, 2012).

The base communion or agency items were adapted in these affordances items to ask about perceived opportunities to pursue agentic or communal goals within a scientific career. Participants rated the presence of each opportunity on a scale from 1 (*Not at all*) to 7 (*Very much*). Items were averaged to form indices of communal affordances and agentic affordances.

Table 2. Communal and Agentic Affordances of Science

Science Affordances	
<i>How much do you think a career as a scientist includes...</i>	
Communal ($\alpha=0.84$)	Agentic ($\alpha=0.73$)
Providing direct help to others	Demonstrating skill or competence
Helping society	Enacting power over other people
Improving the lives of others through direct contact	Gaining power in society
Generally improving the lives of others through scientific innovation	Attaining power within their field

¹¹ Mixed support for a two-factor solution for agentic affordances emerged in an exploratory factor analysis (stronger in Study 2 than in Study 3). The content of these factors aligned with prior literature, with one factor focusing on dominance affordances and the other on competence affordances. However, the reliabilities for these subdimensions are too low to interpret with confidence, and thus we report the overall agentic affordance scale.

Working face-to-face with others	Working alone
Participating in a broader scientific community	Striving for success
Directly mentoring others	Competing with others
Serving as a role model in the community	Financial rewards

Note. Measure from Steinberg & Diekmann (2018)

Trust in science. Participants rated their agreement with 15 items on scale from 1 (*Strongly Disagree*) to 7 (*Strongly agree*). Items were drawn from the GSS and supplemented with face-valid items written by the authors (see Table 3). Items were entered into a Maximum Likelihood factor analysis with an oblique rotation (Promax) to allow for correlation between the factors (John & Benet-Martínez, 2000). All items loaded onto 1 factor with an eigenvalue of 6.67 that accounted for 44.42% of total variance. Items were averaged ($\alpha=0.90$).¹²

Table 3. Trust in Science Measure

Trust in Science
Because of science and technology, there will be more opportunities for the next generation.*
Government funding for basic science pays off.*
Science and technology are making our lives healthier, easier, and more comfortable.**
Overall, modern science does more harm than good.**
Modern science will solve our environmental problems with little change to our way of life.
Climate scientists can be trusted to give full and accurate information on causes of climate change.
Scientists should have a major role in policy decisions.
Climate scientists should have a major role in policy decisions.
Because scientific findings change from day to day, science can never truly be trusted.
Scientists have a political agenda which skews their results.

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¹² Similar results emerge with omission of climate science items.

Climate scientists are unsure whether global warming is actually happening.

Scientific findings seem to be made up.

Government funding should be spent on things other than science.

Scientists should have no role in politics.

Disputes among scientists make me question scientific findings.

Note: All items were used in Studies 2 and 3. *Items from 2012 GSS items used in Study 1; ** GSS items drawn from other years.

Results

Perceived communal and agentic affordances in science. Consistent with broader STEM stereotypes, a one-way repeated measures ANOVA revealed perceptions that science provided fewer communal opportunities ($M = 4.85$, $SD = 0.96$) than agentic opportunities ($M = 5.00$, $SD = 0.82$), $F(1,304) = 6.05$, $p = .01$, $\eta^2_p = 0.02$.

Do communal and agentic affordances predict trust in science? We regressed trust in science on communal and agentic affordances, controlling for participant gender and political orientation.¹³ Communal opportunities positively predicted trust in science, $b = 0.32$, $SE = 0.05$, $\beta = 0.32$, $p < .001$, whereas agentic opportunities negatively predicted trust, $b = -0.23$, $SE = 0.06$, $\beta = -0.20$, $p < .001$ (Figure 1).^{14,15} Thus, whether the public construes science as motivated by communal or agentic goals distinguished trust from mistrust.

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¹³ Income and education were not collected from the full sample and thus not available as controls.

¹⁴ Without controls, trust in science is positively predicted by communal affordances ($b = 0.39$, $SE = 0.06$, $\beta = 0.39$, $p < .001$) and negatively predicted by agentic affordances ($b = -0.31$, $SE = 0.07$, $\beta = -0.31$, $p < .001$).

¹⁵ Exploratory analyses with subcomponents of agentic affordances align with prior theory: Trust in science is negatively predicted by perceived power opportunities ($b = -0.27$, $SE = 0.04$, $\beta = -0.32$, $p < .001$) and positively predicted by perceived competence opportunities ($b = 0.24$, $SE = 0.06$, $\beta = 0.21$, $p < .001$). Crucially, perceived communal affordances strongly predict trust ($b = 0.31$, $SE = 0.05$, $\beta = 0.31$, $p < .001$) uniquely from these distinct forms of agentic affordances.

Figure 1. Beliefs about Motivational Culture Predict Trust in Science: Study 2

Note: Communal affordances (solid) positively relate to trust in science. Agentic affordances (dashed) negatively relate to trust in science. *Not at All*, *Moderate*, and *Very Much* correspond to raw scale scores of 1, 4, and 7. Graph presents predicted values, however, participants reported perceiving communal and agentic affordances throughout the entire range of the scale.

Discussion

Beliefs about science as affording communal or agentic goals aligned differently with trust in science. Communal perceptions uniquely positively predicted trust, whereas agentic perceptions uniquely negatively predicted trust. Given the robust alignment of prosocial perceptions with trust in science, we next turned to experimental methods to test the hypothesis that scientists' communally-oriented behavior can heighten trust in science.

Study 3

Study 3 employed experimental methods that framed science as communal (vs. agentic) to influence communal perceptions of science and explore consequences for trust in science. To do this, we manipulated motivational culture by describing the activities and motives of a particular scientist.

Notably, this operationalization of communal motivational culture primarily emphasizes performing science with other people (collaborative subcomponent of communion) along with prosocial purpose. The operationalization of agentic motivational culture primarily emphasizes working alone (independent subcomponent of agency) along with power or status seeking. These manipulations seek to differentiate between communal and agentic motivational frames by integrating different subcomponents within each of the meta-motives. For simplicity, we refer to these as collaborative or independent but we acknowledge the presence of other aspects.

Additionally, we tested whether the effect of perceived motivational culture of science is an artifact of evaluative differences: Is it simply the case that perceivers positively evaluate communally-oriented roles and this positivity predicts trust? Such heightened positivity toward communality parallels the “women are wonderful” effect in gender stereotypes (Eagly & Mladinic, 1989). To test whether trust effects emerge beyond positivity toward the role, we directly measured positivity about the scientist’s role description. In sum, Study 3 examines whether perceived goal opportunities uniquely underlie trust in science.

Method

Participants. We recruited 193 US citizens from MTurk who were compensated with \$0.50. Thirteen respondents were removed for failing attention checks.¹⁶ The remaining 180 participants (89 men, 89 women, 2 did not report) comprised the sample for analyses (Age: $M = 37.57$, $SD = 12.67$). The sample included 131 participants identifying as White/European American, 22 as Black/African American, 13 as Asian/Asian-American, 6 as Hispanic/Latinx, 2 as multi-racial, and 6 not specified.

Sensitivity analyses showed sufficient power (0.80; $\alpha = .05$) to detect small effects. A 2×2 mixed model ANOVA could detect within-between interactions with an effect size of $f^2 = 0.09$ or larger.

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¹⁶ Results are the same when those excluded for inattention are included in analyses. Exclusion did not vary systematically across conditions, $\chi^2(1, N=193) = 1.90, p = .17$.

Regression coefficients for models with one to four predictors could detect an effect size of $f^2 = 0.04$ or larger.

Procedure. Participants read about the typical day of a scientist whose daily activities and motives were framed as either collaborative or independent (adapted from Diekmann et al., 2011). The essential tasks (e.g., data analysis, presentations) were constant across condition but varied in involving work with others versus alone. For example, the collaborative framing included the task “I go to the lab after about an hour to work with others on checking samples left overnight,” whereas the independent framing included the task “I go to the lab after about an hour to check on samples left overnight.” See supplement for full text. Participants then completed measures described below and answered demographic questions.

Measures.

Science affordances. Measures of communal opportunities ($\alpha=0.89$) and agentic opportunities ($\alpha=0.77$) were identical to Study 2.

Trust in science. Participants completed the Study 2 *trust in science* measure ($\alpha=0.88$), as well as an existing measure of *trust in the scientific community* (Nisbet et al., 2015). These 5 items included *I am suspicious of the scientific community*, *I have very little confidence in the scientific community*, *Information from the scientific community is trustworthy*, *I trust the scientific community to do what is right*, and *The scientific community often does not tell the public the truth*. Participants rated items on scales from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Items were averaged together ($\alpha=0.87$). Reflecting convergent validity, this measure correlated highly with the trust in science measure; $r(177) = 0.86, p < .001$.

Positivity. Participants evaluated the scientist’s day by responding to the item, “On average, it sounds like this scientist has a good day,” on a scale from 1 (*Strongly disagree*) to 7 (*Strongly agree*).

Results

Neither participant gender nor political ideology moderated effects, all $ps > .19$ (see supplement).

Does framing of the scientist role affect affordance beliefs? Affordance ratings were submitted to a 2 (scientist role: collaborative, independent) $\times$ 2 (perceived affordances: communal, agentic) mixed model ANOVA, with perceived affordances as a within-subjects factor. As designed, affordances varied with the role framing (see Figure 2). The tendency to perceive higher communal than agentic affordances, $F(1,178) = 36.00$, $p < .001$, $\eta^2_p = 0.17$, $f^2 = 0.45$, appeared only in the collaborative role, as reflected in the predicted Scientist Role $\times$ Affordances interaction, $F(1,178) = 61.99$, $p < .001$, $\eta^2_p = 0.26$, $f^2 = 0.59$. In the collaborative scientist role, people perceived more communal than agentic affordances, $t(90) = 9.25$, $p < .001$. In the independent scientist role, people perceived similar levels of communal and agentic affordances, $t(88) = -1.42$, $p = .16$.

Figure 2. Perceived Affordances by Scientist Role (Study 3)

Note. Error bars represent ± 1 SE. *** $p < .001$

Does framing of the scientist role affect trust in science? Independent samples t-tests examined whether the scientist role framing affected trust in science and trust in the scientific

community. The direct effect of the scientist role framing was nonsignificant for both trust in science [$t(177) = -1.48, p = .14, d = 0.22, f^2 = 0.11$] and trust in the scientific community [$t(178) = -1.67, p = .10, d = 0.25, f^2 = 0.13$]. The collaborative role produced descriptively greater trust than the independent role on both measures (*trust in science*: $M_{collab} = 5.12, SD = 0.95$ vs. $M_{ind} = 4.90, SD = 1.06$; *trust in the scientific community*: $M_{collab} = 5.34, SD = 1.21$; $M_{ind} = 5.01, SD = 1.40$).

What role perceptions predict trust? Given that role framing influenced perceived affordances, we examined what specific affordances were associated with trust, and whether these were distinct from overall positivity. In a parallel path model, we compared the indirect effects of perceived communal affordances, agentic affordances, and positivity. Even though the direct effect of role framing on trust was not significant, indirect effect analyses are informative: In some cases, an independent variable exerts a stronger influence on a mediator than the dependent variable, leading to significant indirect effects in the absence of significant direct effects (Rucker et al., 2011).

As shown in Figure 3, we tested indirect paths in a parallel model with (1) scientist role as the predictor variable, (2) communal affordances, agentic affordances, and positivity as mediators, and (3) trust in science as the outcome variable. The model used Hayes PROCESS macro model 4 and 10,000 bootstrapped samples. The collaborative science role predicted greater trust through higher communal affordances and lower agentic affordances. As predicted, the indirect effect of positivity was not significant (Indirect Effect: 0.03, 95% CI = [-0.02, 0.14]). This pattern replicated in the model examining trust in the scientific community (see Figure 4b).

Figure 3a-b. Indirect effects of perceived affordances and positivity on trust (Study 3).

a) Trust in Science

b) Trust in Scientific Community

Note. The figure presents unstandardized and standardized beta coefficients (in parentheses). * $p < .05$,

** $p < .01$, *** $p < .001$, † $p < .10$.

Discussion

The content of science roles relates to greater trust in science through perceived communal and agentic affordances, and these pathways cannot be reduced to positivity. Collaborative (versus independent) science was perceived as offering more communal opportunities and fewer agentic opportunities which, in turn, predicted greater trust in science across two different measures.

The lack of a direct effect of role activities on trust in science is puzzling; however, this null effect may reflect that an individual scientist's activities do not generalize to the overall culture of science. The observed indirect pattern suggests that to the extent that individual scientists' activities and motives shape broader perceptions of communal and agentic goals opportunities in science, these broader motivational perceptions are associated with trust in science. Moreover, these indirect effects of perceived opportunities on trust in science remained robust when controlling for global impressions of positivity toward the role. In Studies 4a-b, we shift to an experimental manipulation that focuses on science at a broader level rather than an individual lab.

Studies 4a and 4b

Studies 4a-b replicated and extended the findings thus far in key ways. As noted above, we adopted an experimental manipulation of scientific culture that portrayed entire subdisciplines of science, rather than individual labs. The new manipulation also provided a conceptual replication by changing the operationalization of the specific motivational dimensions. In Studies 4a-b, we operationalized communion as focusing on benefitting others and the world, and we operationalized agency as focusing on attaining power and status. This design allows us to investigate the effects of more polarized views of communion and agency, consistent with the Agency/Separation blend in the interpersonal circumplex (Locke, 2000).

We further investigated the consequences of the motives-to-trust effect by examining the impact of perceiving different motivational cultures of science on funding recommendations for that

science. These preferences for monetary resource allocation serve as a proxy for support and prioritization of scientific domains. We hypothesized that participants would recommend spending taxpayer dollars on sciences perceived as benefiting society. Further, the manipulation of subdisciplines of science, and public funding measure, focus participants on publicly-funded scientists, who tend to be trusted more than privately-funded scientists (Critchley, 2008).

Method

Participants. All participants were US citizens recruited using Amazon's MTURK online marketplace and compensated with \$0.50. In Study 4a, 15 out of 138 initial respondents were removed for failing attention checks and/or a culture check (TurkPrime, 2018).¹⁷ The remaining 123 participants (64 men, 59 women) comprised the sample for analyses (Age: $M = 38.63$, $SD = 12.84$). The sample included 90 participants identifying as White/European American, 16 as Black/African American, 7 as Asian/Asian-American, 6 as Hispanic/Latinx, and 4 as multiracial. The sample was distributed across party affiliations (47 Democrat, 33 Independent, 37 Republican, 6 other/no affiliation).

In Study 4b, 23 out of 287 initial respondents were removed for failing data quality checks (TurkPrime, 2018).¹⁸ The remaining 264 participants (113 men, 147 women, 4 did not report) comprised the sample for analyses (Age: $M = 38.72$, $SD = 12.16$). The sample included 195 participants identifying as White/European American, 22 as Black/African American, 13 Asian/Asian American, 17 Hispanic/Latinx, 11 as multi-racial, 6 as Other/did not report. The sample was distributed across party affiliations (117 Democrats, 74 Independents, 53 Republicans, 20 other/no affiliation). Most of the sample reported at least some college education (20 high school diploma, 77 some college, 121 college degree, 42 graduate/professional degree, 4 other/missing).

Because both studies used the same manipulations and measures, we combined the data from both samples for these analyses to improve power ($n=387$). Sensitivity analyses showed sufficient power

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¹⁷ Results are the same when those excluded for inattention and/or failed culture checks are included in analyses.

(0.80; $\alpha = .05$) to detect small effects in the combined sample. Repeated measures 2×2 ANOVAs could detect an effect size of at least $f^2 = 0.06$. Regression coefficients for models with up to four predictors could detect an effect size of $f^2 = 0.03$.

Procedure. Participants read an ostensible news report describing two groups of scientists (chemical engineers and physicists). The prosocially-focused group was described as valuing working toward a better society and serving as a role model in the community, whereas the power-focused group was described as valuing attaining power and status within their field and in society.

For example, participants who read about prosocial physicists read the following:

*The results conclusively show that the majority of **physicists** indicate that their number one goal is to work toward a better society and serve as a role model in the community, whereas chemical engineers indicate that their number one goal is attain power and status within their field and in society. This research proves it. The domain of science determines their aims: physicists want to help the world, chemical engineers want to rise to the top of it.*

Other versions varied nuisance variables on between-subjects bases, including which science branch was described as prosocial vs. power seeking, and which science branch was presented first. All stimuli are included in supplemental materials (Table S2).

Participants then provided ratings of each subdomain and answered demographic questions.

Measures. Respondents completed measures in the order described below.

Affordances. Participants rated how much careers in chemical engineering and physics afford communal and agentic goals (adapted from Diekmann et al., 2010). Participants responded to several items beginning with the statement, “How much do you think a career as a chemical engineer (physicist) involves...” Participants considered 3 communal affordances (*serving the community, helping society,*

*generally improving the lives of others; $\alpha \geq 0.92$) intermixed with 3 agentic affordances (*gaining power in society, gaining status within their field, demonstrating competence; $\alpha \geq 0.61-0.70$* ¹⁸).*

Trust in science. Participants rated support for using each scientific subdomain's research in public policy on an abbreviated trust measure ($n=5$; adapted from items in Table 3). Items for chemical engineering included: *Overall, chemical engineers do more harm than good; Chemical engineers should have a major role in policy decisions; Government funding for research in chemical engineering pays off; Chemical engineers have a political agenda that skews their results; Chemical engineers should have no role in politics* ($\alpha \geq 0.77$). Identical items for physics replaced "chemical engineers" with "physicists" ($\alpha \geq 0.74$). Respondents rated agreement from 1 (*Strongly disagree*) to 7 (*Strongly agree*).

Positivity. Participants rated their positivity toward chemical engineers and physicists by responding to the item "What is your general opinion of chemical engineers (physicists)?" Participants provided ratings on scales from 1 (*Extremely negative*) to 7 (*Extremely positive*).

Funding recommendation. Study 4b included a funding allocation measure (adapted from Rutjens, Sutton, et al., 2018). Participants were presented with a pie chart with the accompanying directions: "Below you can view the "Spending Allocation Pie" for the NSF (National Science Foundation) in 2017.... It is up to you to indicate changes to the spending pie, by rearranging the order of the areas. Which spending areas should be prioritized in 2019?" Participants rank ordered the six spending areas, including the target disciplines. The measure of funding priority converted rankings of the prosocially-focused science and the power-focused science to an ordinal scale ranging from 1 to 6, with a ranking of 1 reflecting highest priority.

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¹⁸ Although some alphas for agentic affordances are low, similar patterns emerged when items were examined separately. We retained the index for simplicity of reporting.

Results

The design included nuisance variables of order and the scientist group described as prosocial; both were manipulated on a between-subjects basis. These variables did not moderate any analyses, and were omitted from analyses presented here. Neither participant gender nor political ideology moderated effects, all $ps > .16$ (see supplement for analyses).

Does motivation focus affect perceived opportunities? A 2 (scientist motivation: prosocial, power) $\times$ 2 (goal affordance: communal, agentic) repeated measures ANOVA was conducted to establish that the scientist motivation manipulation shifted perceived affordances (Figure 4). The predicted Motivation $\times$ Goal Affordance interaction emerged [$F(1,386) = 248.95, p < .001, \eta^2_p = 0.39, f^2 = 0.80$]. When scientists' motivation was prosocial, participants perceived more communal affordances than agentic affordances. When scientists' motivation was power-seeking, participants perceived more agentic affordances than communal affordances. These interactions subsumed main effects of motivation framing [$F(1,386) = 37.03, p < .001, \eta^2_p = 0.09, f^2 = 0.31$] and affordance type [$F(1,386) = 35.60, p < .001, \eta^2_p = 0.08, f^2 = 0.29$].

Figure 4. Perceived Affordances by Scientist Motivation (Studies 4a-b)

Note. Error bars represent ± 1 SE. *** $p < .001$

Does motivational focus affect trust in science? A paired-samples t-test examined whether scientists' motivation affected trust in science (see Figure 5 for effects presented by study). Participants reported more trust in science when the scientists were described as prosocially-motivated than power-motivated, $t(386) = 9.43$, $p < .001$, $d = 0.48$, 95% CI = [0.37, 0.58], $f^2 = 0.96$.

Figure 5. Scientist Motivational Focus Affects Trust (Studies 4a-b)

Note. Prosocially-motivated scientists elicited greater trust than power-motivated scientists. Error bars represent +/- 1 SE. *** $p < .001$

Do perceived affordances mediate the motivation-to-trust effect? The previous analyses established that experimentally manipulating scientist motivation affected both perceived goal affordances and trust in science. Yet, the question remains as to whether trust in science is predicted by higher communal affordances, lower agentic affordances, or both, as well as whether these effects are reducible to positivity. We tested a parallel mediation model with communal affordances, agentic affordances, and positivity as mediators of the motive-to-trust effect, using Montoya's (2017) MEMORE plugin for SPSS and 10,000 bootstrapped samples (Figure 6). Perceived communal affordances

significantly mediated the relationship between motivation and trust above and beyond the indirect effect of positivity.

Figure 6. Perceived communal affordances mediate the motivation-to-trust relationship: Studies 4a-b combined.

Note. The figures present unstandardized beta coefficients. * $p < .05$, ** $p < .01$, *** $p < .001$, † $p < .10$.

Does motivation affect funding priorities? We analyzed rankings of funding priority using a non-parametric Friedman test of differences among repeated measures (Howell, 2009). The prosocially-motivated science received higher funding priority than the power-motivated science [Figure 7; average rank 1.27 vs. 1.73; $\chi^2(1, N=251) = 52.69$, $p < .001$]. Participants ranked the prosocially-oriented science highest for funding twice as frequently as the power-oriented science (28.3% vs 11.2%).

Figure 7. Funding priority rankings for scientific subdomains described as motivated by prosociality or power

Discussion

Portrayals of the motivational culture of science affected trust in science. Specifically, science subdomains described as prosocially motivated (vs. power-seeking) were perceived as providing greater communal opportunities and, in turn, trusted more. Similar to Study 3, the beneficial effect of communal affordances for trust remained above and beyond positivity – suggesting that these effects cannot merely be reduced to valence.

Consistent with prior research, effects on trust were larger in this study that pitted a power-seeking motive against a prosocial motive (compared to independence vs. collaboration). The power-seeking motive can elicit stronger distrust because it implicates perceptions of communal as well as agentic opportunities. Indeed, the science subdomain described as power-seeking was rated as providing *both* more agentic opportunities and fewer communal opportunities than the prosocially

motivated subdomain. This polarization of perceived communion and agency is consistent with the Agency/Separation blend that has particular impact for interpersonal behavior (Locke, 2000). Further, this finding aligns with previous research showing that the perceived immorality of scientists can threaten trust (Rutjens & Heine, 2016).

Finally, Study 4b demonstrates a potential downstream consequence of greater public trust in science. In short, the perceived motives of science mattered for perceptions of funding priority. The same scientific domain, when framed as prosocially-oriented, deserves more dollars in the public's eye.

Internal Meta-Analysis

Perceiving science as prosocially motivated relates to public trust, as demonstrated here in five datasets ranging in methods, measures, and samples. An internal meta-analysis aggregating across datasets (Goh et al., 2016) provided more precise estimates of effect size. As shown in Table 4, trust in science related positively to perceived communal beliefs about science ($N = 1359$, $r = .36$, 95% CI = [0.31, 0.41], $Z = 13.79$, $p < .001$) but negatively to agentic beliefs ($N = 881$, $r = -.28$, 95% CI = [-0.34, -0.22], $Z = -8.52$, $p < .001$). These meta-analytic correlations differed significantly, $Z = 15.34$, $p < .001$.

Table 4. Internal meta-analysis of relationships between affordances and trust in science

	<i>N</i>	Communal	Agentic
Study 1	478	.35	
Study 2	314	.29	-.14
Study 3	180	.23	-.26
Study 4a	123	.40	-.37
Study 4b	264	.51	-.41
Overall		.36	-.28

Note: All effect sizes are provided in *r*.

To summarize the experimental effect of role framing manipulations used in Study 3 and Studies 4a-b, we conducted an internal meta-analysis (Table 5). Although the effect is smaller and nonsignificant in Study 3, the hypothesized effect emerges when aggregated across studies ($N = 567$, $r = .23$, 95% CI = [0.15, 0.30], $Z = 5.45$, $p < .001$). Framing the scientist role as communally- vs. agentically-motivated fostered greater trust in science.

Table 5. Internal meta-analysis of experimental effects on trust in science

	<i>N</i>	Trust in Science
Study 3	180	.11
Study 4a	123	.21
Study 4b	264	.31
Overall	567	.23

Note: All effect sizes are provided in *r*.

General Discussion

Inferences about the motives pursued in science can inform the understanding of when and why the public trusts science: People trusted science more when the scientific culture emphasized communality than agency. Further, perceptions of motivational culture mattered above and beyond positivity: Even though communally-oriented science elicits positive impressions, these positive impressions cannot account for effects on trust.

The current findings indicate that insights about the interpersonal foundations of trust in perceived communality (e.g., Radkiewicz et al., 2013; Wojciszke et al., 2009) can be leveraged to understand trust accorded to societal institutions. Cues to prosociality in science may be particularly important because of the potential for conspiracy theories to heighten contemporary distrust in scientists (Rutjens, Heine, et al., 2018). Yet, we anticipate that foundations of public trust in a variety of societal institutions, not just science, are similarly rooted in the perceived motivational culture of those institutions.

Across studies, results more consistently demonstrate that perceived communal motivational culture heightens trust in science than that perceived agentic motivational culture depresses trust in science. To some extent, we can trace this variation to the different forms of agentic motivational culture that were emphasized across studies. Effects on trust appear to be stronger when scientists are described as seeking power, perhaps because this power seeking can implicate inferences about communal motives (consistent with the Agency/Separation blend in interpersonal values, Locke, 2000). Relations of trust with perceived agentic affordances were also less consistent than relations of trust with communal affordances, again consistent with research in the interpersonal domain that places inferences of communality at the center of interpersonal trust.

Practically, these data suggest that emphasizing scientists' prosocial motives and collaborative activities can enhance public trust. Consistent with this idea is the finding that public approval of Congress aligns with the amount of prosocial language in legislative addresses (Frimer et al., 2015). Prosocial communication especially matters because scientific progress involves uncertainty that can be exploited for political gain (Bolsen & Druckman, 2015) and polarize attitudes toward science (Druckman, 2017). Emphasizing science as a public good might enhance trust where it is most depleted, such as among those higher in religious orthodoxy and conservatism (Clobert & Saroglou, 2015; Gauchat, 2012; Rutjens, Sutton, et al., 2018). Though political ideology did not moderate experimental effects of motives on trust (Studies 3, 4a-b $ps > .16$; see supplement), highlighting prosocial and humanitarian aims of science holds potential to heighten trust where it is low. We note that the motives-to-trust relationship emerges across the political spectrum, and that a worthwhile endeavor would be to understand whether conservatives and liberals differentially weigh specific aspects of prosociality in alignment with varying moral foundations (Graham et al., 2009).

Limitations and Future Directions

The convergence and divergence between interpersonal trust and institutional trust is worthy of future study. The approach in this paper was to build predictions about institutional trust on the more established literature on interpersonal trust. Yet, trust in individuals and trust in an organization are conceptually and empirically distinct (Zaheer et al., 1998). To date, little research directly compares how institutional and interpersonal trust operate similarly or distinctly. For example, the dispersal of cooperative behavior across an institution might be particularly important in shaping institutional trust. If institutional trust is more affected by information dispersed among an institution, this process could account for the larger effect size observed in Study 4 (where motives of scientist groups were portrayed) than Study 3 (where motives of an individual scientist were portrayed). Although investigating the quantitative and qualitative differences in interpersonal and institutional trust is beyond the scope of this work, it provides ample opportunity for future research.

Another question is how this knowledge can be leveraged to so that scientific insights and processes can more effectively solve societal problems. Over the time of the COVID-19 pandemic, public trust in science has increased (3M, 2020); the motivational cultures perspective would hypothesize that this increased trust relates to the greater visibility of the prosocial impact of science due to the rapid development of vaccines and treatments. On the other end of the spectrum, perceptions of scientists as lacking prosociality may contribute to resistance to vaccination or other public health measures. To amplify the potential benefits of prosocial aspects of science, future research might investigate the impact of science communicators and the contexts in which they are most needed and most effective. Because many people lack firsthand knowledge of scientific culture, exemplars (e.g., Dr. Fauci) play an important role in shaping perceptions of the motives of science and scientists which, in turn, shapes trust in science.

Particularly important is to understand how highlighting the communal motives of science and scientists can garner the trust of communities where distrust is especially heightened. Distrust can be

well-deserved; what can institutions do to earn public trust? A case in point was the disparate impact of COVID-19 on Black communities (Khatana & Groeneveld, 2020). Given the disproportionate impact of the virus, Black communities stood to especially benefit from vaccination. However, reluctance toward vaccination was higher among Black Americans than other racial groups (Hamel et al., 2020), which is not surprising given the history of anti-Black racism in science (e.g., Tuskegee, Henrietta Lacks; Rajagopalan et al., 2017; Skloot, 2010).¹⁹ Given this history, it is not adequate to signal that science benefits society at large because those benefits may be only available for some (i.e., White Americans). Providing direct information about the benefits of science for specific communities may be more effective in fostering trust in science.

Finally, the relationship between perceived motivational culture and trust in science is likely bidirectional. As demonstrated here, perceiving prosocial motives can elicit trust. Yet trusting science might lead people to interact more with scientists, to learn scientific information, and to enter scientific settings. This approach motivation may yield opportunities to see scientists more prosocially. Although these studies focused on effects of perceived motives on institutional trust, this research can provide a foundation for other work to understand how institutional trust in turn contributes to exposure to communal aspects of science.

Conclusion

Because science operates at the edge of the known, the scientific enterprise will always be challenging. Yet contemporary scientists face the additional challenge of greater skepticism toward science itself, exacerbated by the spread of (mis)information (Brossard & Scheufele, 2013). Crises like the COVID-19 outbreak show the danger societies face without trust in scientific knowledge.

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¹⁹ The Tuskegee Syphilis Study was conducted by the United States Public Health Service between 1932 and 1972 in the Tuskegee area of Alabama (Rajagopalan et al., 2017). Black men who had contracted syphilis were tracked for cardiovascular and mental health changes over time without their knowledge or consent. In the Henrietta Lacks case, cancer cells were taken from Henrietta Lacks without her knowledge or consent. These cells, known as HeLa cells, have become widely used in studying the effects of treatments on cancer cell growth (Skloot, 2010).

Understanding how the public views the motives underlying science offers a lens for delineating the psychological underpinnings of public distrust, and a specific strategy for building trust. Excellent science relies on collaborative processes for purposes that serve the greater good; clarifying these communal practices and purpose to the public can build stronger foundations of public trust in science.

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