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American Scientists' Willingness to Use Different Communication Tactics

John C. Besley[1], Todd P. Newman[2], Anthony Dudo[3], and Leigh Anne Tiffany[1]

Abstract

The careful choice of tactics—such as specific messages, styles, channels, or sources—is how strategic science communicators ensure that the time and money going into communication results in intended changes to chosen audiences' beliefs, feelings, and frames, as well as associated behaviors. Using a sample of scientists from American research universities ($N = 516$), we assess scientists' willingness to use 11 different communication tactics and the relationship between these tactics and potential predictors. We find that scientists are open to a range of communication tactics. Practical and theoretical implications for science communication are discussed.

Keywords

training, scientists, strategic communication, survey, ordinary least squares regression

[1]Michigan State University, East Lansing, MI, USA
[2]University of Wisconsin, Madison, WI, USA
[3]University of Texas, Austin, TX, USA

Corresponding Author:
John C. Besley, Department of Advertising and Public Relations, Michigan State University, 378 Communication Arts and Sciences, East Lansing, MI 48824, USA.
Email: jbesley@msu.edu

Introduction

The careful choice of communication tactics is how strategic science communicators try to ensure that the time and other resources going into communication results in intended changes to chosen audiences' beliefs, feelings, and frames, as well as associated behaviors. Smart tactical choices can also help ensure that communicators have the opportunity to change their own beliefs, feelings, frames, and behaviors (e.g., providing opportunities for dialogue and listening) (Bucchi & Neresini, 2008; Grunig & Grunig, 1992). Indeed, strategic communicators have long advocated for communication planning processes that include early identification of audience-specific behavioral goals and use such goals to identify communication objectives and tactics that evidence-based theory suggests should result in desired behavior change (Borchelt & Nielsen, 2014; Hon, 1998). Communicators' tactical choices are where much of the action happens in science communication. It is at this point where communicators can choose how to behave (i.e., room setup, scheduling, time for listening, etc.), what to say or write (i.e., message design, etc.), the style of that communication (i.e., hopeful, funny, aggressive, etc.), the channel for the communication (i.e., face-to-face, online, etc.), and the source of the communication (i.e., a recognized expert, local leader, a neighbor or peer, etc.). Indeed, much of the available science communication training and advice appears to focus on this tactical level (Besley et al., 2016; Miller et al., 2009).

The current research note therefore explores how a probability-based sample of United States based scientists at America's most prominent research universities think about 11 different communication tactics. These universities represent the 62 members of the Association of American Universities (AAU), a Washington, D.C.–based membership organization for the most research-intensive U.S. universities. It seeks to extend an earlier study focused on a nonprobability-based sample of Canadian scientists that focused on just six tactics and was published outside the communication literature (Besley et al., 2019). This report is presented as a research note because it relies on an established body of theory that has been discussed in depth elsewhere (Besley, Dudo, & Yuan, 2018; Besley et al., 2019; Besley et al., 2020). However, the data and focus on tactics remain uncommon and thus worthy of additional research. We also believe such research may be of use to practitioners because we specifically focus on identifying ways to get scientists to consider prioritizing specific tactics. Getting scientists to prioritize specific tactics that research suggests may be useful is one potential way to improve the quality of science communication practice.

Literature Review and Hypotheses

Strategic Science Communication as Planned Behavior

The current study is based on the idea of treating Strategic Science Communication as Planned Behavior (SSCPB). This flexible and emerging approach to studying science communicators' behavior treats communicators' choices about tactics, objectives, and goals as intended behaviors. It thus argues that we can understand—and try to reshape—these communication choices by drawing on the existing behavior change literature (Besley et al., 2019). The SSCPB approach particularly highlights the limited set of explanatory variables included in the Integrated Behavioral Model—a contemporary extension of the well-known Theory of Planned Behavior and other behavior change theories (Montano & Kasprzyk, 2015)—as key drivers of communication behaviors. Predictor variables in the Integrated Behavioral Model include target behavior–specific evaluative beliefs (i.e., attitudes, often in the form of risk or benefit beliefs), normative beliefs, and self-efficacy beliefs. Together, these three types of variables are hypothesized to represent the core drivers of behavioral intent (or willingness), and intent has been shown to provide a good predictor of actual behavior (Fishbein & Ajzen, 2010).

Previous attempts to use and develop the SSCPB have looked at the degree to which scientists' evaluative beliefs, normative beliefs, and self-efficacy beliefs are associated with overall willingness to take part in public engagement activities (Besley, Dudo, Yuan, & Lawrence, 2018), as well as their willingness to consider prioritizing specific communication objectives, especially objectives related to trust building (Besley, Dudo, & Yuan, 2018; Dudo & Besley, 2016). As noted, however, only one study has looked at willingness to consider specific communication tactics (Besley et al., 2019).

A central premise of the current study is that a better understanding of how scientists think about different communication tactics could help the science communication community get scientists to make evidence-based communication decisions. For example, if evidence suggests that getting scientists to speak informally helps scientists connect with a given audience (i.e., the first tactic listed in Table 1), we might conceptualize "speaking informally" as a desired behavior. In turn, this would suggest using the Integrated Behavioral Model to understand willingness to enact the behavior of informal speaking. Our hypothesis would thus become that scientists' willingness to speak informally with a specific audience can be understood as a function of whether a scientist believes this tactic is ethical and potentially beneficial (i.e., attitudes as evaluative beliefs, as well as response efficacy in the case of perceived

Table 1. Tactic Description Provided to Respondents.

General relational tactics

1. . . . *to speak in a way that helps CONNECT with an audience*. This might mean speaking in a more or less formal way than the scientist might normally communicate.
2. . . . *to try to FRAME a topic in ways that resonate with one's audience.* This might mean purposefully talking about the issue in terms of health impacts for one group, its national security impacts for another group, and its environmental impacts for a third group.
3. . . . *to tell first-person STORIES in a way that helps connect with an audience.* This might mean spending less time talking about scientific findings to have more time for providing a clear, compelling narrative about why you study your topic, your research choices, the challenges you faced, and how you overcame them.[a]

Trust-related tactics

4. . . . *to make sure that nonscientists feel like they are being LISTENed to by the scientific community.* This might mean spending less time talking about scientific findings to have more time for discussion, questions, and comments.[a]
5. . . . *to talk about the role that a desire to HELP their community or society plays in shaping their research.* This might mean spending less time talking about scientific findings to have time to talk about why you chose a science career or what you hope to achieve through your science.[a]
6. . . . *to publicly question the CREDIBILITY of those who disagree with a scientific consensus*. This might mean describing such people as deniers, liars, antiscience, or otherwise criticizing their motives or knowledge.[a]

Emotion-related tactics

7. . . . *to try to get people angry about a science topic.* This might mean spending less time talking about your research and focusing some time on highlighting cases where societal actors have been irresponsible, negligent, or purposefully dishonest. [ANGER]
8. . . . *to talk about science in terms of HOPE.* This might mean talking about the forward-looking, optimistic aspects of your science.

Organizational tactics

9. . . . *to have PROFESSIONAL communicators help create a high-quality presentation.* This might mean devoting resources and time to working with a designer to help create visually attractive slides and a professional writer to craft a compelling script.
10. . . . *to commit to spending about 10% of their project BUDGET to support communication efforts.* This would mean having less funding for other aspects of the research project.
11. . . . *to try to organize a group of scientists to work together to send decision-makers a common message*. This might mean organizing a letter writing or social media campaign where a group of scientists are asked to send similar messages or organizing a public event where the messages are shared with the media or other citizens.[a] [COORDINATING]

Note. All statements were prefaced by the following "One choice that scientists can make to achieve some communication objectives is . . ."

[a]Indicates item was used in previous study (Besley et al., 2019). Respondents were asked questions about four tactics, including one of 1, 2, or 4, two of 3 and 5 through 7, and one from 9 through 11. Also, the first block of tactics was asked prior to the second block and the second block was asked prior to the third block. Respondents did not see the all-capitalized words as capitalized; there are included only to highlight connections between text and tables.

benefits); something their colleagues would approve of and consider for themselves (i.e., beliefs about descriptive and injunctive norms); and something they have the ability themselves to enact (i.e., self-efficacy). In this regard, we

can use surveys to learn how to better advise trainers by knowing the degree to which beliefs from the Integrated Behavioral Model are associated with willingness to use a tactic (i.e., behavioral intent), as well as where there is room to change beliefs (Hawkins et al., 2008). For example, there is little point in trying to get scientists to feel more self-efficacious in their ability to speak informally if (a) self-efficacy is not associated with willingness to speak informally and (b) scientists already believe they are highly competent when it comes to informal speaking (i.e., they have high self-efficacy).

The past research on communication tactics suggested that the most consistent statistical predictors of scientists' willingness to choose a communication tactic were a sense that the tactic would be effective (i.e., response efficacy or positive attitude) as well as the degree to which the respondents said they believed they had the ability to use the tactic (i.e., self-efficacy) (Besley et al., 2019). In contrast, normative beliefs and ethicality beliefs about specific tactics were somewhat less consistently correlated with tactical willingness. This suggests, for example, that people who want to get scientists to consider adopting an informal communication style—a communication choice that often takes preparation and other types of effort—might focus their pitch to potential communicators by emphasizing the likely benefits of using an informal communication style, as well as finding ways to ensure informal communication seem feasible to the potential communicator. Past research similarly pointed toward the likely value of communicating benefits and self-efficacy—but not normative beliefs—to foster both overall willingness to engage and prioritization of specific communication objectives (for a review, see Bennett et al., 2019). This emphasis on the importance of ensuring that scientists perceive external benefits and self-efficacy—rather than norms—conflicts with arguments that scientists likely avoid certain communication behaviors because of concerns about negative peer reactions (Johnson et al., 2013; Martinez-Conde, 2016).

Research using the SSCPB approach has also found that few other variables are consistent predictors of willingness to make communication choices. Demographic characteristics, field, amount of communication training, and media use have not shown themselves to be consistent or substantive predictors of either overall willingness to engage (Besley, Dudo, Yuan, & Lawrence, 2018) or specific communication objectives (Besley, Dudo, & Yuan, 2018; Bennett et al., 2019). The one additional variable that was somewhat useful in predicting willingness to consider specific communication tactics was overall willingness to take part in public engagement activities. Scientists willing to engage appeared to be more willing to try a range of tactics, suggesting perhaps general willingness to try new things or a desire to have an impact in whatever way might work.

For the current research note, we do not present results of models that use demographics as initial correlational analysis suggests that, as with past research, doing so would provide no additional benefits. Such models were explored in initial model development but dropped for parsimony because they provided little insight. The following hypotheses and research questions are tested in a multivariate context:

> Controlling for other variables, willingness to choose specific tactics will be positively correlated with . . .
> *Hypothesis 1:* . . . overall willingness to take part in public engagement activities.
> *Hypothesis 2:* . . . perceived ethicality of the specific tactic.
> *Hypothesis 3:* . . . perceived benefit (i.e., response efficacy) of the specific tactic.
> *Hypothesis 4:* . . . scientists' perceived self-efficacy for the specific tactic.
> *Hypothesis 5:* . . . scientists' degree of prior consideration of the tactic.

Finally, the inconsistent history of normative beliefs in statistically predicting communication choices means that we address such beliefs with a research question:

> *Research Question 1:* To what degree are normative beliefs associated with specific communication tactics?

The Tactics Tested

Assessing support for these hypotheses required us to select a set of tactics around which to collect data. As noted and discussed further below, we selected 11 different tactics based on our own experience in science communication research and practice, as well as interviews of trainers (Besley et al., 2016; Dudo et al., 2021) and others involved in the practice of science communication (Dudo et al., 2020; Yuan et al., 2019). The full wording of questions presented to survey participants is provided in Table 1. To our knowledge, there is no broad typology or list of tactics available to researchers, and our contention is that if the SSCPB approach works for these 11 tactics, then this would reinforce the previous work and provide additional support for the SSCPB approach. The types of tactics might be grouped into four main types. Each is also the subject of its own research that we note briefly here. Capitalized words are used in the body text and tables to ensure it is clear what tactics are being discussed at any given time.

First, we included three broad messaging tactics that might be broadly useful for fostering positive beliefs about the communicator, including choosing to speak in more or less formal ways to better CONNECT with different audiences (Thon & Jucks, 2017), to FRAME issues in ways meant to resonate with specific audiences (Myers et al., 2012), and telling compelling STORIES meant to provide insight into a speakers' motivation and journey (Olson, 2015). The storytelling tactic was the only tactic included in the study that we sought to extend, but it is one that is often discussed by trainers (Dudo et al., 2021). Also, it is noteworthy that all three tactics could be tailored to (try to) affect multiple potential communication objectives (e.g., clear speaking could affect audiences' ability to process, as well as beliefs about communicator competence and caring).

The second set of tactics used here were described to study participants in a way that specifically connected the tactics to one of three different trust-related objectives addressed in previous research (Besley, Dudo, & Yuan, 2018) and the literature on the dimensionality of trustworthiness beliefs (Besley et al., 2021; Hendriks et al., 2015). These include a tactic focused on being perceived as a good LISTENer, a tactic focused on highlighting researcher benevolence through discussion of their prosocial motives [HELP], and a negative tactic focused on attacking the integrity of opponents [CREDIBILITY]. All three tactics were replicated from the previous study. These types of tactics are not typically mentioned by trainers (Dudo et al., 2021), but the idea of trust building seems central to many contemporary discussions of science communication (Fiske & Dupree, 2014).

The third set of tactics addressed here focus on two objectives associated with discrete positive and negative emotions, including both HOPE and ANGER. Affecting science communication participants' positive emotions is sometimes discussed as an objective of science communication (Nabi et al., 2018; Yeo et al., 2020) and promulgating the idea of "science is hope" is the focus of a prominent American groups' efforts to communicate science (Wooley, 2018). Anger was chosen as the negative emotion inasmuch as it seems like a likely outcome when scientists use aggressive tactics to attack their opponents (e.g., Yuan et al., 2018). Neither of these tactics was included in the previous study.

Finally, the fourth set of tactics focuses on organizational factors that reflect the types of choices that scientists could make to be effective. These include obtaining support from PROFESSIONAL communicators on the development of communication products as well as BUDGETing for such support. Also included is a tactic from the replicated study focused on collaborating to send a common message [COORDINATING]. These types of

tactics are not the types of issues that typically get studied in science communication research but seem like the types of organizational steps that may be needed to improve communication quality. The dearth of such activities was a key conclusion of recent interview studies of science communication trainers (Dudo et al., 2021).

The consideration of 11 different tactics also means that the study essentially includes 11 different tests of the hypotheses described above. We therefore treat the question of whether the SSCPB variables consistently predict tactical willingness across different tactics as a second research question that we address in a largely qualitative manner.

Research Question 2: To what degree do tactic-specific evaluative beliefs, normative beliefs, and self-efficacy beliefs predict different types of tactic-specific willingness?

Method

Implementation

Scientists were recruited to participate through email and completed the surveys online through the Qualtrics survey platform. The survey began with questions about past public engagement, engagement willingness, and engagement goals and objectives. They were then randomly assigned to receive a description of 4 of the 11 different tactics included in the study (Table 1) and presented with six statements about each tactic. Specifically, we asked respondents to use a 7-point Likert-type scale to respond to the statements (*strongly disagree* [1] to *strongly agree* [7]). The statements included the following:

- "This choice would be ethical" (Hypothesis 2, attitude/evaluative belief).
- "My colleagues would approve of someone who makes this choice" (Research Question 1, injunctive norm).
- "My colleagues would themselves make this choice" (Research Question 1, descriptive norm).[1]
- "Making this choice would make a difference" (Hypothesis 3, response efficacy/benefit).
- "I have the ability to make this choice, if I wanted to" (Hypothesis 4, self-efficacy/behavioral control).
- "Prior to this survey, I had thought a lot about this choice" (Hypothesis 5).

The criterion variable was

- "I would be willing to make this choice."

Sample

The sample was based on a randomized sample of scientists from the 62 universities in the AAU in 2018. In 2018, the AAU consisted of the most prominent North American public ($N = 40$) and private ($N = 22$) research universities. The number of institutions in the AAU is fairly consistent, over time. To build the sample, research assistants were provided with eight randomly selected departments per university based on the U.S. National Science Foundation list of STEM (science, technology, engineering, and mathematics) fields. The research assistants manually searched online for email addresses of faculty and research staff from these departments, resulting in 14,374 email addresses. From this sample, we grouped these data on three criteria—university type (public or private), discipline, and rank—to ensure that our sample accounted for each relative weight. The sample included 6,935 email addresses, of which 71 emails returned as undeliverable. We sent five emails between September 2018 and October 2018 and had a completion rate of 8% ($n = 516$). Average time to complete was about 20 minutes.

Analysis

Below, we provide descriptive statistics with 95% confidence intervals for the mean to allow for a discussion of qualitative differences between the various measures. Visual inspection of the relationships between the predictor variables and the outcome variables suggested that simple Pearson correlation and ordinary least squares (OLS) regression would be appropriate for testing the relationships between the various predictors and outcome variables. Unstandardized regression coefficients are provided along with 95% confidence intervals.

Results

Mean Comparisons

The scientists surveyed were quite willing to consider most of the tactics they were asked about (Table 2). They were especially likely to consider tactics related to how they speak and structure their message (e.g., FRAME). In both

Table 2. Descriptive Statistics for All Variables in Regression Models.

	Speak to CONNECT (n = 167)			FRAME to resonate (n = 211)			STORIES to connect (n = 174)		
General Relational Tactics	*M*	*SD*	95% CI	*M*	*SD*	95% CI	*M*	*SD*	95% CI
Tactical Willingness	5.86	1.25	[5.67, 6.05]	5.73	1.32	[5.55, 5.91]	5.24	1.50	[5.02, 5.46]
Engagement Willingness	5.39	1.11	[5.22, 5.56]	5.37	1.24	[5.20, 5.53]	5.47	1.17	[5.30, 5.65]
Ethicality Beliefs	5.88	1.25	[5.69, 6.07]	5.66	1.40	[5.47, 5.85]	5.55	1.27	[5.36, 5.74]
Normative Beliefs	4.99	1.25	[4.80, 5.17]	5.41	1.21	[5.24, 5.57]	4.36	1.22	[4.17, 4.54]
Response Efficacy Beliefs	5.62	1.14	[5.44, 5.79]	5.79	1.13	[5.64, 5.94]	5.01	1.33	[4.81, 5.21]
Self-Efficacy Beliefs	5.67	1.33	[5.47, 5.87]	5.82	1.23	[5.65, 5.99]	5.51	1.37	[5.31, 5.71]
Prior Thought	4.69	1.79	[4.42, 4.96]	4.80	1.92	[4.54, 5.06]	4.07	1.91	[3.79, 4.36]
	Ensure feel LISTENed to (n = 154)			Communicate desire to HELP (n = 184)			Question opponent CREDIBILITY (n = 169)		
Trust-Related Tactics	*M*	*SD*	95% CI	*M*	*SD*	95% CI	*M*	*SD*	95% CI
Tactical Willingness	5.29	1.32	[5.08, 5.49]	5.21	1.53	[4.99, 5.43]	4.01	1.86	[3.73, 4.29]
Engagement Willingness	5.40	1.20	[5.21, 5.59]	5.46	1.09	[5.30, 5.61]	5.44	1.13	[5.27, 5.61]
Ethicality Beliefs	5.47	1.24	[5.27, 5.66]	5.72	1.27	[5.53, 5.90]	4.68	1.77	[4.41, 4.95]
Normative Beliefs	4.22	1.21	[4.03, 4.41]	4.85	1.28	[4.66, 5.03]	4.42	1.39	[4.21, 4.63]
Response Efficacy Beliefs	5.03	1.23	[4.83, 5.22]	4.96	1.34	[4.76, 5.15]	4.08	1.61	[3.84, 4.33]
Self-Efficacy Beliefs	5.38	1.17	[5.19, 5.56]	5.48	1.34	[5.29, 5.68]	5.30	1.31	[5.10, 5.49]
Prior Thought	3.78	1.87	[3.48, 4.07]	4.23	1.77	[3.98, 4.49]	4.02	1.83	[3.74, 4.29]

(continued)

Table 2. (continued)

Emotion-Related Tactics	Evoke HOPE (n = 211)			Evoke ANGER (n = 196)		
	M	*SD*	95% CI	*M*	*SD*	95% CI
Tactical Willingness	5.23	1.41	[5.04, 5.42]	2.74	1.73	[2.50, 2.98]
Engagement Willingness	5.41	1.18	[5.25, 5.57]	5.45	1.17	[5.29, 5.61]
Ethicality Beliefs	5.42	1.31	[5.24, 5.60]	3.57	1.70	[3.33, 3.81]
Normative Beliefs	4.90	1.18	[4.74, 5.06]	3.18	1.27	[3.00, 3.36]
Response Efficacy Beliefs	4.96	1.22	[4.79, 5.12]	3.54	1.64	[3.31, 3.77]
Self-Efficacy Beliefs	5.54	1.22	[5.38, 5.70]	4.66	1.66	[4.43, 4.89]
Prior Thought	3.89	1.91	[3.63, 4.15]	3.03	1.85	[2.77, 3.29]

Organizational Tactics	COORDINATING messaging (n = 154)			PROFESSIONAL presentation help (n = 162)			Devote 10% of BUDGET to communication (n = 177)		
	M	*SD*	95% CI	*M*	*SD*	95% CI	*M*	*SD*	95% CI
Tactical Willingness	5.01	1.54	[4.76, 5.25]	4.92	1.79	[4.64, 5.20]	3.82	1.74	[3.56, 4.08]
Engagement Willingness	5.48	1.11	[5.30, 5.65]	5.43	1.16	[5.25, 5.61]	5.40	1.20	[5.22, 5.57]
Ethicality Beliefs	5.79	1.24	[5.59, 5.98]	5.43	1.43	[5.21, 5.65]	4.62	1.62	[4.38, 4.86]
Normative Beliefs	4.98	1.27	[4.78, 5.18]	4.47	1.43	[4.28, 4.69]	3.28	1.47	[3.06, 3.49]
Response Efficacy Beliefs	4.94	1.37	[4.72, 5.15]	5.14	1.44	[4.91, 5.36]	4.66	1.39	[4.46, 4.87]
Self-Efficacy Beliefs	5.25	1.41	[5.03, 5.48]	4.36	1.73	[4.09, 4.62]	3.75	1.85	[3.47, 4.02]
Prior Thought	4.38	1.68	[4.12, 4.65]	3.93	1.89	[3.64, 4.22]	3.33	1.82	[3.06, 3.60]

Note. All variables measured using 7-point Likert-type (*strongly disagree* to *strongly agree*) scales. Capitalized words are used in the body when the variable is mentioned. CI = confidence interval.

cases, the mean was close to 6 on the 7-point scale provided. Scientists were also quite likely to indicate they would be willing to try to use trust-focused objectives. These included ensuring audiences' felt LISTENed to ($M = 5.23$, $SD = 1.32$), recognized scientists' desire to HELP ($M = 5.21$, $SD = 1.53$), to tell STORIES to help connect with audiences ($M = 5.24$, $SD = 1.50$), and try to evoke HOPE ($M = 5.23$, $SD = 1.41$). Willingness to perform all four tactics was all about a half point lower than the top-scored tactics, but still quite high relative to the midpoint of the scale. Using PROFESSIONAL help ($M = 4.92$, $SD = 1.79$) and COORDINATING messaging ($M = 5.01$, $SD = 1.54$) were also quite high relative to the scale midpoint, but about three-quarters of a point lower than the top-rated tactics. This might suggest that most scientists were at least somewhat willing to consider these tactics. In contrast, AAU scientists were about evenly split when it came to trying to attack the CREDIBILITY of opponents ($M = 4.01$, $SD = 1.86$) or devote a tenth of their project BUDGET toward public engagement activities ($M = 3.82$, $SD = 1.74$). Evoking ANGER was the only tactic for which there was consistent opposition ($M = 2.74$, $SD = 1.73$).

Beyond willingness to use the tactics, similar patterns are apparent in Table 2. For most of the integrated behavioral model variables, perceptions about speaking informally to CONNECT and to FRAME to resonate score relatively high, while views about attacking opponents' CREDIBILITY, devoting 10% of the BUDGET communication, and trying to evoke ANGER score relatively low. The ANGER-focused scores, in this regard, are especially low. One interesting break in this pattern occurs for the BUDGETing tactic, where respondents seemed to indicate that they thought this choice would make a difference (i.e., response efficacy) but did not seem to believe they had the ability to make this choice. Indeed, the mean score for self-efficacy for the BUDGETing tactic was at about the scale midpoint. Also noteworthy is the generally low agreement with the statements focused on prior thinking about the various tactics. Most of these means are near the midpoint of the scale or lower, suggesting somewhat limited thinking by scientists about these specific tactics.

In general, unlike the replicated study (Besley et al., 2019), overall engagement willingness was not a substantial predictor of tactical willingness (Table 3). Hypothesis 1 was thus only marginally supported. However, ethicality beliefs (Hypothesis 2) and response efficacy beliefs (Hypothesis 3) were consistent predictors of tactical willingness. As shown in Table 3, ethicality beliefs typically accounted for about a third of a point in tactical willingness in most of the models, and about half a point in the model for evoking ANGER as a tactic. The one model where ethicality was not significant was the one for ensuring LISTENing. Response efficacy beliefs were also

Table 3. Unstandardized Regression Coefficients and Correlations for Willingness to Use Communication Tactics.

	Speak to CONNECT (n = 167)					FRAME to resonate (n = 211)					STORIES to connect (n = 174)				
	B	*LL*	*UL*	*p*	*r*	B	*LL*	*UL*	*p*	*r*	B	*LL*	*UL*	*p*	*r*
(Constant)	−1.06	−1.94	−0.18	.02		−0.40	−1.05	0.25	.22		−0.23	−1.22	0.75	.64	
Engagement Willingness	0.23	0.12	0.34	.00	.41	0.08	−0.01	0.16	.07	.37	−0.02	−0.16	0.12	.73	.25
Ethicality Beliefs	0.26	0.15	0.36	.00	.53	0.30	0.21	0.39	.00	.68	0.29	0.15	0.43	.00	.53
Normative Beliefs	0.09	−0.01	0.19	.08	.27	0.03	−0.07	0.13	.55	.44	−0.10	−0.25	0.04	.16	.28
Response Efficacy Beliefs	0.38	0.26	0.50	.00	.63	0.33	0.21	0.46	.00	.70	0.41	0.27	0.56	.00	.61
Self-Efficacy Beliefs	0.18	0.08	0.29	.00	.55	0.20	0.10	0.31	.00	.64	0.31	0.18	0.44	.00	.54
Prior Thought	0.11	0.04	0.19	.00	.46	0.16	0.09	0.22	.00	.58	0.16	0.07	0.25	.00	.43
Adjusted-R^2	.62					.70					.55				

	Communicate desire to HELP (n = 184)					Ensure feel LISTENed to (n = 154)					Question opponent CREDIBILITY (n = 169)				
	B	*LL*	*UL*	*p*	*r*	B	*LL*	*UL*	*p*	*r*	B	*LL*	*UL*	*p*	*r*
(Constant)	−0.92	−1.79	−0.04	.04		−0.15	−1.06	0.76	.74		−0.72	−1.78	0.34	.18	
Engagement Willingness	−0.01	−0.15	0.12	.83	.27	0.10	−0.01	0.22	.09	.25	−0.04	−0.19	0.11	.59	.01^{ns}
Ethicality Beliefs	0.37	0.23	0.50	.00	.67	0.10	−0.02	0.23	.11	.45	0.47	0.35	0.59	.00	.72
Normative Beliefs	0.11	−0.02	0.24	.10	.48	0.19	0.06^{ns}	0.32	.00	.47	0.29	0.13	0.45	.00	.59
Response Efficacy Beliefs	0.35	0.20	0.50	.00	.69	0.53	0.39	0.67	.00	.72	0.27	0.13	0.41	.00	.64
Self-Efficacy Beliefs	0.23	0.09	0.36	.00	.61	0.09	−0.05	0.23	.21	.50	−0.05	−0.20	0.10	.51	.34
Prior Thought	0.15	0.05	0.24	.00	.47	0.09	0.01	0.18	.03	.49	0.16	0.06	0.27	.00	.45
Adjusted-R^2	.64					.60					.65				

(continued)

Table 3. (continued)

	Evoke HOPE (n = 211)					Evoke ANGER (n = 196)									
	B	*LL*	*UL*	*p*	*r*	B	*LL*	*UL*	*p*	*r*	B	*LL*	*UL*	*p*	*r*
(Constant)	−0.67	−1.43	0.09	.08		−0.81	−1.70	0.08	.07						
Engagement Willingness	0.00	−0.10	0.10	.99	.16	0.01	−0.12	0.15	.86	.06^{ns}					
Ethicality Beliefs	0.34	0.23	0.45	.00	.68	0.56	0.45	0.68	.00	.71					
Normative Beliefs	0.12	0.00	0.24	.05	.51	0.12	−0.02	0.27	.09	.45					
Response Efficacy Beliefs	0.32	0.20	0.45	.00	.68	0.22	0.10	0.33	.00	.54					
Self-Efficacy Beliefs	0.27	0.15	0.39	.00	.62	−0.06	−0.16	0.04	.25	.21					
Prior Thought	0.10	0.03	0.17	.00	.45	0.20	0.11	0.29	.00	.34					
Adjusted-R^2	.65					.59									

	COORDINATING messaging (n = 154)					PROFESSIONAL presentation help (n = 162)					Devote 10% of BUDGET to communication (n = 177)				
Variable	B	*LL*	*UL*	*p*	*r*	B	*LL*	*UL*	*p*	*r*	B	*LL*	*UL*	*p*	*r*
(Constant)	−1.72	−2.96	−0.48	.01		−1.20	−2.22	−0.18	.02		−1.80	−2.70	−0.90	.00	
Engagement Willingness	0.15	−0.01	0.32	.07	.24	−0.02	−0.17	0.13	.83	.15	0.17	0.04	0.30	.01	.18
Ethicality Beliefs	0.35	0.20	0.51	.00	.50	0.27	0.14	0.41	.00	.56	0.32	0.19	0.44	.00	.63
Normative Beliefs	0.22	0.06	0.38	.01	.45	0.18	0.03	0.32	.02	.55	0.24	0.10	0.38	.00	.59
Response Efficacy Beliefs	0.29	0.15	0.43	.00	.46	0.60	0.45	0.75	.00	.74	0.27	0.13	0.41	.00	.58
Self-Efficacy Beliefs	0.06	−0.08	0.21	.40	.40	0.07	−0.04	0.18	.21	.35	0.16	0.05	0.28	.01	.60
Prior Thought	0.22	0.11	0.34	.00	.46	0.13	0.03	0.24	.02	.50	0.17	0.07	0.27	.00	.48
Adjusted-R^2	.49					.64					.63				

Note. *LL* = lower limit of 95% confidence interval; *UL*= upper limit of 95% confidence interval. All Pearson correlation coefficients are significant at $p < .05$ (two-tailed) unless noted (*ns*). All *p* values are two-tailed.

substantive predictors for all 11 models, accounting for about a third of a point in the outcome measure in many of the models, and about half a point in the models for tactics associated with ensuring LISTENing and seeking PROFESSIONAL presentation help. Prior consideration of the tactics (Hypothesis 5) was the only other variable consistently associated with tactical willingness, but a one-point change in this variable typically accounted for less than a fifth-of-a-point change in tactic willingness. Self-efficacy beliefs were sometimes a significant predictor (i.e., 8 of 11 models) but seemed to vary substantially in their relationship with tactical willingness. It was not a significant predictor in the models for evoking ANGER or attacking opponents' CREDIBILITY, as well as ensuring audiences perceived that they were being LISTENed to by scientists. Normative beliefs (Research Question 1) were significant predictors in less than half the models (i.e., 5 of 11), but three of these models were the ones focused on organizational issues.

Correlation statistics are also included in Table 3. These were almost always significant—and often quite substantive—highlighting that various types of beliefs about these tactics are entwined. The underlying pattern, however, appears similar to what the multivariate models show.

Limitations

The current research is not, however, without limitations. As noted, we addressed only a subset of potential communication tactics, and we also only use single-item measures to assess the key constructs. We think doing so is justifiable because the underlying concepts seem fairly clear, and because we are able to assess our ideas in 11 different contexts. Inasmuch as we obtain similar results across the models, critics who would like to have seen us ask about different tactics might be asked to explain why they think we would have received a different pattern of results with a different list of tactics or a different approach. A related issue is that while we randomly assigned respondents to see four different tactics, the order of the tactics was not entirely random (see Table 1 notes). Consistent with the replicated study, we also did not include a measure of previous science communication training in our model. Including this measure may have small influence on our model, as previous research suggests that the more prior training a scientist receives, the higher they are likely to rate self-efficacy beliefs (Copple et al., 2020).

One other type of variable we did not include in this project was questions about whether scientists believed they might expect personal benefits or harms from using a tactic. There is an argument that perceived incentives—or lack thereof—can affect overall engagement willingness (Alperin et al.,

2019; Rose et al., 2020) and scientists' willingness to prioritize specific tactics might be similarly incentive driven. Future research could consider this question, as well as related questions about the impact of perceived personal benefits or harms from pursuing specific communication objectives or behavioral goals. Our expectation is that beliefs about personal benefits would be highly correlated with ethicality and normative beliefs, inasmuch as we would hypothesize that a science communicator might fear professional risks from violating ethical or normative expectations and benefits from behaving ethically and exceeding normative expectations.

Discussion

The overall results suggest that scientists are quite open to a range of communication tactics that might assist the scientific community in achieving a range of different objectives. This willingness includes potentially simple changes to communication speech style, as well as more challenging changes to the structure and content of communication. It further includes trying to affect people's emotions and working with partners. This willingness is not absolute, however. The researchers surveyed were generally not willing to use negative tactics, such as attacking opponents or stirring up ANGER. There was also a substantial split on the idea of devoting 10% of project BUDGETs to communication activity.

The practical outcome of the current work is to highlight the potential value of having people like communication trainers and advisors ensure that potential science communicators see the potential benefits and ethicality of any tactics they want to recommend. In contrast, the current results would suggest that communicating normative information may not make much difference in scientists' willingness to use specific tactics. These findings are consistent with the previous study that the current research note sought to extend and replicate (Besley et al., 2019), as well other work on overall engagement willingness and willingness to consider specific communication objectives (Bennett et al., 2019).

Together, this work also speaks to the idea of studying choices about communication using the SSCPB approach and provides data about the relative strength of Integrated Behavioral Model variables in predicating communication behavior. The results continue to indicate to us that, in the absence of alternative approach, it continues to make sense to treat communication choices about tactics, objectives, and goals as behaviors amenable to study using behavior change models

Such work is also, however, speculative. We still need research—especially field research—that shows that we can change science communicators' evaluative, normative, and self-efficacy beliefs about communication choices

and that such changes will result in changes to their communication choices. This seems like a necessary next step. The underlying variables are well established in the behavior change literature as key drivers of behavior (Fishbein & Ajzen, 2010; Montano & Kasprzyk, 2015), but the science community should still consider testing these ideas in their specific context.

One challenge to such efforts may be that researchers already seem quite open to some of the potential tactics (e.g., getting people to speak informally to CONNECT, or tell STORIES) such that there may not be much room for movement. The average scores for these variables are already close to 6 on a 7-point scale. That being said, there appears to be more room for potential movement on objectives related to trust and emotion, as well as collaboration. It may be that there is similar room for movement on other tactics that someone might want science communicators to consider.

A related challenge is that it is not clear to us that scientists or groups of scientists have typically thought carefully about what overall behavioral goals they want to achieve when they communicate. A lack of shared understanding about the behaviors (including pseudo-behaviors such as support or acceptance) scientific groups want to change means there is little opportunity to have substantive discussions about potential behavior change strategies. And a lack of strategy makes it challenging to have conversations about what communication objectives and associated tactics should be used. It therefore seems critical to find ways to assist and encourage scientists to identify their audience-specific goals based on their research area so that it is possible to move forward with developing and implementing strategies based on an evidence-based understanding of potential paths from tactics to communication objectives to behavioral goals (Besley et al., 2020). The irony is that what may be needed is additional assistance from strategic communication professionals (Besley et al., 2020; Davies & Horst, 2016), but as is suggested in the current study, the choice to devote resources to hiring professional assistance also represents a tactical choice that the scientific community may need to find ways to foster.

A related important question is better understanding the degree to which getting scientists involved in strategic discussions might change how they view specific tactics and objectives. It seems reasonable to helping scientists identify and prioritize a specific goal might help those scientists see the value of using specific tactics to achieve goal-related objectives. For example, scientists who decide that they want to make sure that regional policy makers consider their evidence when making decisions might, in turn, come to see the value of prioritizing the objective of building trusting relationships with these policy makers. This recognition of the need to build trustworthiness beliefs might, in turn, lead to a greater willingness to support the use of tactics aimed facilitating relationship building.

Furthermore, while the idea of treating communication choices as behaviors remains novel within the science communication literature, there is likely insight from related fields of strategic communication (e.g., organizational and corporate communication) (Hallahan et al., 2007), as well as the broader world of strategy (Freedman, 2013), that could help the science communication community better understand how to advance a more strategic version of science communication. We have attempted to draw on this literature where we have knowledge of relevant material, but there almost certainly remains substantial opportunity to bring insight into science communication theory and practice.

Authors' Note

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ORCID iDs

John C. Besley https://orcid.org/0000-0002-8778-4973
Todd P. Newman https://orcid.org/0000-0001-9767-958X
Anthony Dudo https://orcid.org/0000-0003-3586-758X
Leigh Anne Tiffany https://orcid.org/0000-0002-7998-3948

Note

1. In this regard, the two norms questions were fairly highly correlated, and it therefore made sense to combine them into a single variable (r = .62-.83 across the various tactics, $p > .001$) to avoid problems with collinearity.

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Author Biographies

John C. Besley is the Ellis N. Brandt Chair in Public Relations at Michigan State University. He studies how views about decision processes affect perceptions of science and technology with potential health or environmental impacts. This work emphasizes the need to look at both citizens' perceptions of decision makers and decision makers' perceptions of the public.

Todd P. Newman is an assistant professor in the Department of Life Sciences Communication at the University of Wisconsin-Madison. Newman's research focuses on the role of strategic communication within the context of science, technology, and the environment. This includes recent work examining the role of communication training in supporting scientists' communication and engagement goals, including developing innovative methods for evaluation. Newman is the editor of *Theory and Best Practices in Science Communication Training* (Routledge, 2019), which covers the growing body of research in this emerging field.

Anthony Dudo is an associate professor in the Stan Richards School of Advertising & Public Relations at the University of Texas at Austin. His research focuses on sci-

entists' public engagement activities, media representations of science and environmental issues, and the contributions of informational and entertainment media to public perceptions of science.

Leigh Anne Tiffany is a doctoral student and research assistant at Michigan State University, jointly appointed in the Department of Advertising and Public Relations, the School of Journalism, and the Environmental Science and Policy Program (ESPP). She is also an ESPP Doctoral Recruiting Fellow and a Sustainable Michigan Endowed Project Scholar. Her research looks at the intersection of scientists, journalists, and public relations practitioners in the context of miscommunicated science through news media channels.