Chapter 1
The Big Picture

Abstract The purpose of this book is to share some results and the data from four studies in which we used experimental procedures to manipulate key features of deliberative public engagement to study the impacts in the context of deliberations about nanotechnology. In this chapter, we discuss the purpose of this book, which is to advance science of public engagement, and the overarching question motivating our research: What public engagement methods work for what purposes and why? We also briefly review existing prior work related to our overarching goal and question and introduce the contents of the rest of the book.

Keywords Science of public engagement · Deliberative engagement · Science and technology studies · Nanotechnology · Big data

1.1 Introduction

Some of us remember the time before widespread Internet access, when instead of watching YouTube or Facebooking, we watched a preset schedule of Saturday morning cartoons. One such cartoon, *The Jetsons*, featured a futuristic family that lived a seemingly amazing life—populated by then-imaginary inventions such as video phones, housecleaning robots, and flying cars.[1] Now, of course, video phones are old news and have exceeded Jetson-inspired expectations: instead of mounting them on the wall, you can carry them in your pocket. Robots increasingly Roomba our carpets, Robomow our lawns, and have begun to patrol our

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[1] http://www.smithsonianmag.com/history/50-years-of-the-jetsons-why-the-show-still-matters-43459669/

shopping malls.[2] And, as a final step toward the Jetsonian life, news outlets recently have been abuzz with commentary about the development of flying cars.[3]

At the same time as new technological developments bring futuristic dreams to life and widen imaginable opportunities, they also often result in unanticipated new problems. George Jetson had to grapple with pizza for breakfast when his food dispenser malfunctioned and with a robot co-worker that was trying to steal his job. Today, there is increasing interest in "robot-proof" jobs. Meanwhile, cyberbullying, sexting, and social isolation are examples of problems attributed to widespread smartphone use. Texting and driving has resulted in a troubling new reason for car crashes, encouraging authorities to consider the potential use of "textalyzer" technology to detect when drivers are illegally texting just before a crash.[4] Others worry about the dramatic increase in data collected on everyday citizens, the potential rise of a pervasive surveillance society, use of big data to manipulate people, and the unknown effects of nanoparticles that can easily cross the blood-brain barrier.

Given the potential for negative—or at least controversial—effects of new technologies upon the societies in which various publics must live, what could be more democratic than promoting public involvement in decisions about those new technologies? Unless, of course, it turns out that public involvement, which can sometimes be costly, is ineffective, unnecessary, or actually makes things worse. Some have suggested this may be the case (e.g., Sunstein, 2000, 2002), but, for better or worse, public engagement with and about new technologies is happening all around us. Our interest in studying such public engagement—the topic of this book—is to learn how to design it for the better.

The research described in this book was funded by the National Science Foundation (NSF)[5] and aimed to begin to fill current gaps in the research on public engagement by applying certain social, psychological, and behavioral theories and experimental procedures. As we describe in Chap. 2, our project included five studies, four of which we present in this book.[6] The four studies described here involved more than 1000 college students as participants, and all four studies focused on the same topic and context. Thus the studies resulted in a wealth of quantitative and qualitative data collected at multiple time points and provide a unique opportunity to see which results replicate across studies.

Our work was motivated by a desire to better understand how, when, and why public engagement might work to achieve different purposes. It also reflects a largely untapped role that social scientists might play in the area of responsible

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[2] http://www.npr.org/2017/04/26/525675196/robot-security-guards-coming-to-shopping-malls

[3] http://www.npr.org/sections/alltechconsidered/2017/04/25/525540611/flying-cars-are-still-coming-should-we-believe-the-hype

[4] http://www.npr.org/sections/alltechconsidered/2017/04/27/525729013/textalyzer-aims-to-curb-distracted-driving-but-what-about-privacy

[5] Research and data dissemination is funded by NSF #0965465 and #1623805. Any opinions, findings, and conclusions are those of the authors and do not necessarily reflect the views of the National Science Foundation (NSF).

[6] Study 1 data, our pilot data, was prioritized last for release and is currently not included in the full release of data. Researchers wishing to use our data are welcome to do so as long as they cite it appropriately.

research and innovation (Macnaghten, Kearnes, & Wynne, 2005). Prior scholars have noted that social scientists are needed to help in the design phase of the technology (Doubleday, 2007; Evans & Kotchetkova, 2009). By facilitating public engagement, social scientists can help technologists revise their work so that it not only "works" in a technical sense but also in social sense, so that it doesn't, for example, suffer the polarized fate of genetically modified foods in Europe (Gaskell, Bauer, Durant, & Allum, 1999; Marris, 2015; Webler & Tuler, 2010).

However, our view is that social scientists are also needed to take the lead in theorizing, researching, and advancing the *science of public engagement*. The field could use some bona fide "public engagement psychologists," as well as "public engagement political scientists" and "public engagement communication" researchers. Work in education might provide a model for the new field or set of fields we envision. Understanding and promoting positive educational outcomes are not the goal of a single field. Rather, diverse scholars are involved in advancing education-relevant goals, including those who study educational psychology, educational policy, and educational administration. There is a need for similarly diverse groups of scholars to work from different angles to focus specifically upon how to promote engagement-related outcomes in and across specific contexts.

In our studies we worked from a psychological perspective to begin to envision and demonstrate what a science of public engagement might look like. The aims of this book are to tell the story of our experience; share our measures, methods, and data; describe some of our findings; and ultimately (hopefully) provoke and inspire more studies advancing the science of public engagement. We hope our story will embolden and facilitate additional attempts to apply rigorous experimental procedures to public engagement contexts and that our overviewed studies provide exemplars for future efforts. By providing links to our detailed methods, materials, and measures and reams of quantitative and qualitative data, we hope to foster additional analyses and findings and maybe also to provide materials useful for training others who aspire to be public engagement scientists. Indeed, our rich data likely have further insights to reveal to researchers with a variety of interests. The data also reveal, in sometimes humbling ways, the struggles we encountered in conducting our experiments. We hope lessons from our struggles can enhance future studies of public engagement strategies used in different contexts and for varied purposes.

In light of these aims, we use the rest of this chapter to provide a brief overview of the existing public engagement literature and gaps that motivated our research. We also discuss some social and psychological theories potentially applicable to the development of science of public engagement, and provide an overview of the rest of the book.

1.2 Motivating Questions and Gaps

Public engagement is claimed to have numerous benefits (Fiorino, 1990). Proponents claim it is "the right thing to do" (Petts, 2008) and that it will result in better and more publicly acceptable policies. Those policies, they say, will take into account more viewpoints, while the engagement activities simultaneously improve citizenship

capacities (Selin et al., 2016) and social capital (Webler, Kastenholz, & Renn, 1995). Imagine, if you will, George Jetson getting to have a say about the design of his robot co-workers. George might suggest a precautionary "no-job-stealing" algorithm be installed before the robot begins working. As a result of George's engagement, not only does policy and technology development improve, but George himself learns about a new technology and its pros and cons, as well as learning about and gaining appreciation of others' views and honing skills needed to express his own views—ultimately improving our democracy, one George at a time.

Other more skeptical writers provide contrary claims that public engagement might actually have harmful effects. What if George Jetson and his human colleagues fail to imagine important effects of new technologies? How useful is their input then? What if the engagement incites polarization and conflict among participants instead of fomenting forward-moving consensus (Kahan, 2012; Schkade, Sunstein, & Hastie, 2007; Sunstein, 2002)? George and his bottom-line-focused boss may have very different ideas about how the robot co-worker should be developed. Some writers also argue engagement may hand the powerful even more power (Benhabib, 2002; Hickerson & Gastil, 2008) or cause citizens to disengage rather than engage (Hibbing & Theiss-Morse, 2002). After all, if George finds inventors and regulators catering to his boss's concerns rather than his, what reason does he have to engage in the future?

Despite the negative possibilities, a number of democracies seem to agree that the public should be engaged around technology and policy decisions. In the latter part of the twentieth century, the Netherlands began developing and using a procedure called constructive technology assessment (CTA) as a means to include more stakeholder perspectives and ensure that social values were taken into account earlier in technology development (Rip & Robinson, 2013; Wilsdon & Willis, 2004). More recently, in the USA, public participation was touted as a key feature of the Obama Administration's Open Government Initiative. Now, as Internet giants and other organizations increasingly make online experimentation and other research a part of their everyday operations, international guidelines have been released, encouraging public deliberation aimed at defining the appropriate ethical boundaries for such big data social research.[7]

Calls and support for public engagement have become so widespread that some have claimed we are, for better or worse, in an "age of engagement" (Delgado, Kjølberg, & Wickson, 2011). Certainly we are in an age of *calls* for public engagement, which suggests that public engagement, and what it really achieves, should be given more attention. What measurable good and/or harm does public engagement do? How, when, and why does it do so? Unfortunately, despite all the enthusiasm for public engagement, as well as some pointed doubts and criticisms, the empirical research on public engagement is still in its infancy. Especially few are the number of controlled experiments that might elucidate microprocesses and psychological factors that operate during public engagements and perhaps shed light on conflicting outcomes from prior work.

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[7] http://www.oecd-ilibrary.org/science-and-technology/research-ethics-and-new-forms-of-data-for-social-and-economic-research_5jln7vnpxs32-en

As described elsewhere (PytlikZillig & Tomkins, 2011), we began our exploration of public engagement by considering the evidence base for some of the claims made about the benefits of public engagement. Very quickly, we realized that results from studies of public engagement were highly variable. Thorough academic reviews of such variable outcomes are provided by others (Delli Carpini, Cook, & Jacobs, 2004; Mendelberg, 2002; Ryfe, 2005), and we do not repeat them here. However it is useful to consider an illustrative example, such as the outcomes of engagements around planning for potential influenza pandemics.

The mention of the word "pandemic" probably fills some people's heads with visions of Ebola and SARS and others with the words "it won't happen to me." Both responses are or perhaps should be frightening. In this context, Garrett, Vawter, Prehn, DeBruin, and Gervais (2009, p. 18) "strongly urge government officials and policymakers to facilitate robust public engagement on key issues in pandemic ethics," arguing that "[i]nformed public perspectives can help improve pandemic policies, promote trust and enhance cooperation."

Yet, an evaluation of six pandemic engagement projects conducted in the USA was much more cautious in its conclusions about the effectiveness of such engagements (Public Policy Center, 2010). On the positive side, the report noted the engagement events did appear to result in overall changes in opinions about the types of social values that should be weighed during a pandemic. This suggests that the effort to engage and inform people had some effect, resulting in changes in attitudes due to the engagement activities. Yet, on the negative side, *agreement* on the values underlying people's opinions did not increase. Further, relating to the hoped-for "informed public perspectives," the report noted that participant knowledge did generally increase, but also that, "given the relatively low post process scores across states, we cannot conclude that participants were well informed" as they gave their input (pp. 12–13). Results relating to the promotion of institutional trust were also mixed. Some of the evaluated projects showed increases in trust in some institutions, others showed decreases in trust in some institutions, and still others showed mixed or no changes in trust.

Such varied results, which are common across studies of public engagement, give hope that public engagement *can* have positive effects but also underscore that positive impacts are not certain. Different outcomes can, will, and do occur under different conditions; but there is little clarity regarding which conditions, features, or contexts are responsible for the differences. This leads to a recognized problem in the public engagement literature: the lack of clarity around "how to enable effective involvement (i.e., which mechanism to use, and how) in any particular situation," (Rowe & Frewer, 2005, p. 252) or, phrased another way, "*which* forms, features, and conditions of public engagement are optimal for *what* purposes and *why*" (PytlikZillig & Tomkins, 2011, p. 198). We were interested in such questions because they not only have implications for theory development, they also are essential for providing practitioners with direction for designing "effective" public engagement in different situations. Thus, in the next sections, we break down our overarching question into its component parts (what works, for what purposes, and why) and describe the state of the prior research pertaining to each.

1.2.1 What Works? Delineating Important Public Engagement Types and Variables

Answering the question of "*what* works" requires defining what public engagement is or is not, as well as identifying different dimensions or types of engagement. Although some narrower definitions have been offered (Litva et al., 2002), currently, just about any interaction with the public that is even tangentially policy-related seems to count as public engagement. Public engagement includes activities ranging from idea marketing and museum exhibits, to focus groups and national surveys, to community-based participatory research, to citizen juries and deliberations (Rowe & Frewer, 2005).

Attempts to define and organize the myriad of public engagement activities have included placing them on a "ladder" to reflect the amount of power they afford public, ranging from total citizen control to public manipulation (Arnstein, 1969; see also Pretty, 1995). Other suggested distinctions include purpose of the engagement (Glass, 1979; Rosener, 1975), structure of activities (Glass, 1979), public acceptability (Nelkin & Pollak, 1979), types of participants (Cornwall, 2008; Fung, 2006), and direction of information flow to and/or from the public (Rowe & Frewer, 2005). Some have also noted that variation occurs both between *and within* different types of public engagement. For example, Carman et al. (2013) focused only on "deliberative" engagement mechanisms and noted that these can vary in their recruitment methods, number of participants, use of face-to-face versus online modes of interaction, use of different resources such as educational materials and accessible experts, and length and number of sessions.

Despite the considerable work done to organize and name all the variations, it's still not really clear what factors, dimensions, or characteristics of public engagement are most worthwhile to study. Almost two decades ago, Chess and Purcell (1999) noted that "typologies" of engagement mechanisms do not seem to consistently correspond to different outcomes—casting doubt on how useful it is to simply compare different broad "types" of engagement (e.g., surveys vs. deliberations vs. focus groups). Later, Rowe and Frewer (2005) advised that researchers should prioritize the study of design variables most likely, from a theoretical and empirical standpoint, to impact the *effectiveness* of the engagement activity. Of course, theorizing about effectiveness also requires defining what counts as success (or as positive outcomes) when it comes to public engagement, a topic which we turn to next.

1.2.2 For What Purposes? Assessing Engagement Effectiveness and Success

The public engagement literature has also given quite a bit of attention to defining and organizing criteria and measures for the success of public engagements. Some of these criteria come from the arguments for or against public engagement, which then have

been arranged in categories of success criteria. For example, Webler et al. (1995) proposed two categories: fairness and competency criteria. *Fairness* of an engagement activity is judged by how acceptable the activity is to the public, its inclusiveness of affected stakeholders as participants, the extent to which processes are equitable and transparent, and so on. *Competency* of an engagement refers to how well and efficiently it achieves its purposes, whether those purposes are to educate and inform, to gather the full range of viewpoints on an issue, to build trust, or something else.

Rowe and colleagues (Rowe & Frewer, 2000; Rowe, Horlick-Jones, Walls, Poortinga, & Pidgeon, 2008) somewhat similarly categorized criteria for judging the success of public participation activities into acceptance criteria or process criteria. *Acceptance* criteria include whether the participants are representative of the affected public and whether the event occurs early in decision-making, in a transparent and unbiased manner. *Process* criteria include having well-defined tasks, highly accessible and appropriately thorough and unbiased resources, appropriately structured decision-making processes, and cost-effective methods.

In an attempt to align common effectiveness criteria with workflow processes associated with designing and implementing public engagements, PytlikZillig and Tomkins (2011) suggested that categories of *information criteria* (e.g., is the information balanced, complete, accurate) and *representation criteria* (e.g., are all relevant stakeholders included) are associated with preparing for the engagement, *process* and *acceptance criteria* (e.g., are the appropriate processes implemented effectively and found to be acceptable by participants) are associated with implementing the engagement, and *outcome criteria* (e.g., did the engagement achieve its goals) are associated with the purposes and hope-for functions of the engagement.

While these classes of criteria provide useful overviews of everything about an engagement that might be judged and evaluated, there are at least a couple[8] of problems with using the criteria classes to advance theory and research. Most important to the work we present in this book, the classes are too broad to readily lend themselves to the application and testing of specific theories. Each class of criteria contains varied constructs, and each construct may need its own theoretical and empirical account. Very few evaluative frameworks have focused on tying specific engagement mechanisms to specific outcomes (but see Beierle, 1998's evaluation framework based on social goals). Research and theory might be advanced more quickly if effectiveness components were identified and organized in a manner that allowed for the application of specific theories to specific processes and outcomes and contexts.

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[8] Due to our study design and space constraints, we will not be able to deal much with a second perhaps even more significant problem than discussed here, which is that most all of the outcome criteria are focused solely on the publics who are engaged and not on the experts or policymakers who also may be engaged or may have contracted the engagement. As researchers and practitioners increasingly seek out alternatives to "deficit models" of engagement, it is becoming more important to attend, not only to how publics are impacted by engagements but how policymakers', policies', and technologists' understandings, trust, and so on are also impacted (Eaton, Burnham, Hinrichs, & Selfa, 2017).

1.2.3   In What Contexts and Why? From Comparison to Causation

The importance of context for public engagement has been extolled in the political science and STS (science, technology, and society) literatures (Delgado et al., 2011; Delli Carpini et al., 2004). In some ways, however, context seems to be a scapegoat for "inconsistent results." That is, the argument goes like this: Context must matter, because studies that analyze, compare, and even pit one type of engagement against another, in various contexts, find inconsistent results. Indeed, some studies, mostly conducted in health policy contexts, have compared deliberation, education-only, and measurement-only control groups or survey, interview, or discussion procedures. These studies often find greater change in knowledge and/or attitudes when deliberative methods are used instead of other methods (Abelson et al., 2003; Barabas, 2004; Carman et al., 2014; De Vries et al., 2010; Kim et al., 2011). However, other studies, such as Denver, Hands, and Jones's (1995) study of deliberative poll participants in the UK, find no change in knowledge or attitudes, and yet others suggest deliberation may facilitate the biased strengthening of pre-existing attitudes (Kahan, 2012; Sunstein, 2002). Even within our single program of research, which used highly similar methods, measures, and participants, we found inconsistent results from one study to another, as we describe in later chapters.

For the most part, it is still unclear whether the differences in results that come from diverse studies in the field are due to process differences such as variation in the operationalization of "deliberation" or whether studies are truly illustrating effects due to the context in which the processes are used or whether the effects are simply unstable and difficult to consistently achieve. Regardless, let's assume context does matter: "context" still doesn't provide a very informative explanation for different results. Findings that effects vary across studies and contexts beg for an answer to the question: Why? And "why" questions in turn beg for analyses of "how" and the use of methods that can test causal processes.

Experimental studies of public engagement that use random assignment and control groups, especially those that connect features-processes-outcomes, are increasing but still relatively rare (Carman et al., 2013; Friess & Eilders, 2015). Such studies can, however, be very fruitful and enlightening. For example, relating to the knowledge increases commonly found during engagements, a deliberative experiment by Muhlberger and Weber (2006) found that knowledge gains were more likely due to reading the materials, with no additional knowledge gains attributable to the deliberative discussion. In a later study, Esterling, Neblo, and Lazer (2011) used experimental methods to compare deliberative discussion that included online discussion with one's political representatives, with an information-only group, or a true control group (receiving no information). In contrast to the Muhlberger and Weber study, their methods found deliberative discussion participants gained more knowledge than either the control or information-only groups. But they also showed the increased knowledge was likely due to seeking out policy-relevant information outside of the experiment. This suggests their participants were motivated to appear

informed about the issues in front of their representatives. Furthermore, it provides a potential explanation for why the findings may have differed from the Muhlberger and Weber study, based on time allowed for exploration of information outside the context of the engagement activities.

Studies that connect features-processes-outcomes can help clarify why similar but different designs have varied effects and be used to build theories that help to predict and explain when public engagement will be effective for different purposes. As we detail in Chap. 2, the framework we used to guide our methods also aspired to make features-processes-outcomes connections while at the same time examining moderators of such connections which might inform theory development.

1.3 Advancing the Theoretical and Empirical Bases of a Science of Public Engagement

1.3.1 The Current State of Theory

In the above review, we have identified a number of frameworks and exemplar studies but virtually no overarching "theories" of public engagement. This is, in part, due to the already discussed problems the field has faced when it comes to conceptualizing the "what" and "for what purposes" of public engagement. As Rowe and Frewer (2005) noted, "Given the sheer number of mechanisms available for engaging the public and also the confusion as to what each does and does not entail, and how each differs from the others, it is unsurprising that no significant theory has emerged as to what mechanism to use in what circumstance to enable effective engagement" (pp. 259–260). It is easy to extend Rowe and Frewer's observation about public engagement mechanisms (see also Chess & Purcell, 1999) to public engagement outcomes: Given the diverse outcomes public engagement is expected to achieve, it is not surprising that no single theory has emerged to cover all of them.

This is not to say that public engagement research is atheoretical or that theories are not applied within public engagement research. In some ways, the problem is that there are many, many—perhaps too many—theories, and these theories are not yet well-organized in a manner that optimally serves the advancement of a science of public engagement. Theories applied to public engagement range from the relatively encompassing perspective of deliberative democracy (see Gutmann & Thompson, 2004, for a review) to more narrow and specific theories such as Barabas' (2004) theory of opinion updating during deliberative discussions. The theory of affective intelligence (Marcus, Neuman, & MacKuen, 2000) also has been proposed and used to explain when individuals will engage versus disengage and how they will interact with political information under different conditions, including when they will engage in an open-minded versus defensive manner (MacKuen, Wolak, Keele, & Marcus, 2010). More broadly, agency theory (Muhlberger, 2005; Muhlberger & PytlikZillig, 2016) has been proposed as an overarching framework

that might guide research on public engagement, taking into account both individual and group level, rational and nonrational, and psychological and sociological forces on public attitudes and beliefs. However, perhaps due to a lack of coordination across the specific areas and domains in which public engagement takes place, for the most part, current theories have not been integrated into more broadly useful theories that advance science of public engagement per se. Such theories also have not been integrated with other social psychological and cognitive theories in a manner that could help to advance those existing theories, or, in the case of the highly integrative agency theory, they have not been widely applied.

1.3.2 Moving Forward

How might we move forward to develop more useful and integrative theories of public engagement that more effectively advance a science of public engagement? In our prior work (PytlikZillig & Tomkins, 2011), we have suggested that it would be useful to (1) analyze public engagements by inventorying their commonly varied features and hoped for outcomes; (2) broadly consider a variety of existing theories from a wide number of fields ranging from psychology to political science, to communication, and more; (3) narrow our focus and use experimental methods to carefully and systematically vary a subset of engagement features that (a) are purported as most important to achieving public engagement outcomes and (b) have strong connections to other existing theories; and (4), across multiple studies, systematically measure the impacts of those experimentally varied features on both the outcomes and potential explanatory mediators while also exploring potential moderators of the effects. This is the approach we therefore applied in the present work.

1.4 Focus and Overview of the Rest of this Book

Earlier in this chapter, we provided an overview of the many features of public engagement and the many outcomes public engagements are expected to achieve. Of course no single research program could examine all such features and outcomes. For our studies, we narrowed our focus to deliberative public engagements primarily because of the interests of our team members, each of whom had research and/or practical experience in contexts using deliberative methods.

Deliberation has been broadly defined as a type of thinking where people take in and weigh diverse information to form and justify their opinions (Gerber, Bächtiger, Fiket, Steenbergen, & Steiner, 2014; Gundersen, 1995; Lindeman, 2002). Democratic deliberative theory (Bohman, 2000; Chambers, 2003; Coleman & Gotze, 2001; Fishkin & Luskin, 2005; Gastil & Levine, 2005; Habermas, 1990) likewise purports that voters should first be thinkers and discussants who weigh the reasons for their choices. Thus, deliberative engagements are designed around the

idea that the best decisions are ones that are critically evaluated and well-reasoned, and deliberative engagement stresses the need to consider diverse perspectives and weigh evidence in terms of its quality and relevance.

Beyond the cognitive definition of deliberation, others have suggested additional criteria before an activity can be called "deliberative engagement." For example, it is common to require the social criterion of discussion with others or formal processes for creating rationales such as "problem analysis, criteria specification, and evaluation" (Gastil, 2000, p. 22). Thompson (2008) argues that deliberation requires the social criterion of some disagreement and decision criteria involving a collective decision that will bind all group members (see also Parker, 2003). Even so, Thompson notes that non-binding discussion, such as that occurs in many deliberative polls (Fishkin & Luskin, 2005), may be seen as relevant preparation for democratic decisions, and studies of such processes therefore have relevance to understanding the effectiveness of deliberative methods.

Our research did not aim to compare "deliberation" to "non-deliberation," so much as it aimed to focus on specific features of deliberative engagement and their effects, alone or in combination. For this purpose, it is less important that we define deliberation exactly than it is that we identify some of the features that arguably are part of deliberation, which can then be operationalized and subjected to experimental manipulation. To facilitate effective deliberation, it is commonly argued that deliberative engagements need to include features such as *discussion*, high-quality *information*, participants who engage in *critical thinking* during exposure to *diverse opinions*, and with the help of effective *facilitation* (Bohman, 2000; Chambers, 2003; Coleman & Gotze, 2001; Fishkin & Luskin, 2005; Gastil & Levine, 2005; Habermas, 1990). We thus focused on varying these features in our studies. Meanwhile, some of the most commonly lauded and hoped-for outcomes of deliberative engagements include *informed (knowledgeable) opinions*, *attitude changes*, increased *trust in institutions*, and *acceptance of resulting policies.* These variables thus became some of our primary outcome variables. In Chap. 2 we describe how we operationalized such variables in our manipulations and measures, along with providing links to our materials and detailed method reports.

In Chaps. 3, 4, and 5, we provide examples of analyses focused on testing theories and exploring potentially important mediators and moderators that might advance various theories. The variables we focused upon are relevant to a wide number of theories from other fields that could be (but have yet to be) usefully tested in the context of public engagement—furthering both public engagement theory and the original theories. Such theories suggest a number of mechanisms or mediators by which features of engagement might impact outcomes. For example, theories and research from educational psychology are very relevant to public engagement learning outcomes. Yet certain constructs commonly examined in educational contexts, like individual differences in *intrinsic and extrinsic motivation* (McGregor & Elliott, 2002; Midgley, 2014; Pintrich, 2004) or use of different modes or types of *cognitive engagement* (Chin & Brown, 2000; Dinsmore & Alexander, 2012), still are not commonly examined in the context of public engagement. Furthermore, despite the emphasis of most public engagement activities on

"informed opinions," little research has focused on what is meant by "informed." Informedness indicated by *subjective knowledge* often has a relatively low correlation with *objective knowledge* (Carlson, Vincent, Hardesty, & Bearden, 2008), and little theoretical (or empirical) guidance exists regarding whether engagement practitioners should focus on one versus the other.

In Chap. 3, we explicitly examine different types of cognitive-affective engagement as potential mediators of the effects of our experimental conditions upon changes in knowledge. We examine both how our conditions impacted these various types of engagement, as well as how different forms of engagement related to gains in subjective and objective knowledge. Our findings suggest self-reports of careful and conscientious engagement are especially important if the goal is to increase objective or subjective knowledge and that this conscientious engagement can be encouraged during deliberations via the instructions given to the participants.

Chapter 4 focuses on attitude formation and change and potential moderators of the effects of different engagement features on attitude outcomes. Like knowledge, attitudes toward the topics of the public engagement are commonly examined during public engagement evaluations. Typically such studies focus on whether individual attitudes change their attitudes or come to exhibit certain features like certainty or coherence (Gastil & Dillard, 1999). In addition, some studies examine attitudes at the group level, to determine the conditions under which attitudes held by a group of individuals show overall mean change, or come to consensus, exhibit polarization (Schkade et al., 2007), or move toward single-peakedness (Farrar et al., 2010). The literature on attitude formation and change is voluminous and includes reference to theories such as the theory of cognitive dissonance (Festinger, 1957), theories of motivated cognition (Kunda, 1990), the elaboration likelihood model and the meta-cognitive model (Petty & Brinol, 2010), and so on. These theories, although too often not explicitly mentioned, are relevant to prior studies of attitudes during public engagement, including prior experimental studies (e.g., see Baccaro, Bächtiger, & Deville, 2016). In Chap. 4, we discuss the application of such theories and explore whether our experimental conditions relate to attitude changes at the individual and group levels and to the observed variation in participant attitudes. By also examining moderators of some of our effects, we move toward determining the reliability of the relationships between our experimental manipulations and attitude outcomes.

In Chap. 5, we explore whether certain variables may operate via mediation and moderation processes simultaneously. We do this while discussing an undertheorized and underinvestigated outcome: policy acceptance. Drawing from existing theories related to policy acceptance and support, procedural fairness, and legitimacy, we propose that certain engagement features or processes and perceptions of engagement processes may simultaneously impact mediating and moderating variables which, at times, may work against one another to hide main effects of the experimental condition. Using correlation and multiple regression analyses, we demonstrate that, despite the lack of main effects of our experimental conditions upon policy acceptance, our experimentally varied features of deliberative engagement are impacting mediators and moderators in ways that have implications for advancing theory and practice.

Finally, in Chap. 6, we summarize some of the key lessons that we learned from our efforts on these studies over the years. In our studies, we attempted to reach beyond evaluations of public engagement, to focus upon theory development, by creating methods, materials, and measures that draw broadly from a number of diverse and relevant theoretical perspectives. We discuss how successful these efforts were and some of the drawbacks and benefits of our approach. Hopefully, our frank assessments will spark continued conversations regarding other ways in which the development of theories of public engagement might take place and how empirical research on public engagement might be expanded in the future.

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