

PRACTICE BRIDGE

Undercurrents: Exploring the human dynamics of adaptation to sea-level rise

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Coastal communities, including those surrounding the Gulf of Maine, are facing considerable challenges in adapting to increased flood resulting from sea-level rise, and these challenges will remain well past 2050. Over the longer term (decades to centuries), many coastal communities will have to retreat inland away from the coast and toward something new. To date, there appears to be little consideration of how arts and humanities could be leveraged to encourage learning and experimentation to help communities adapt to our changing climate. In this article, we describe an interactive theater model that seeks to address the challenge of bridging scientific knowledge and community conversations on managed retreat and serve as an innovative tool to encourage more productive community conversations about adapting to rising sea levels. The interactive theater workshop consists of two components. The first is a set of short intertwining monologues by three characters (a municipal leader, a climate scientist, and a coastal property owner) who share their thoughts regarding the prospect of managed retreat. Each character provides a glimpse into the attitudes, values, motivations, and fears related to distinct and authentic perspectives on managed retreat. The monologues are followed by a professionally facilitated interactive session during which audience-participants are invited to probe characters' perspectives and even redirect and replay scenes in new ways to seek more constructive outcomes. The workshop is designed for all session participants to examine their own strengths and weaknesses when engaging others on this subject, to be more prepared to accommodate a range of emotional connections to the subject matter, and to anticipate social dynamics at play. The workshop has now been piloted at four different events. Initial feedback from post-workshop voluntary surveys suggest that the workshop is useful for improving the capacity of resilience professionals to encourage more productive conversations about difficult climate adaptation actions.

Keywords: Gulf of Maine, Sea-level rise, Managed retreat, Interactive theater**Problem statement**

Theatre is a safe place, to do unsafe things that need to be done.

—John Patrick Shanley

Coastal communities around the globe, including those surrounding the Gulf of Maine, face increasing risk of coastal flooding from the combined threats of sea-level

rise and storm surge (e.g., Hallegatte et al., 2013; Hauer et al., 2016). Global mean sea level has risen about 7 in. over the past century (Sweet et al., 2017; Horton et al., 2018), with the rate of sea-level rise doubling since 1993 (Cazenave et al., 2018; Nerem et al., 2018). Approximately two-thirds of global mean sea-level rise since 2005 has been attributed to melting glaciers and ice sheets and the shift in mass from the continents into the oceans (Leuliette and Nerem, 2016; Intergovernmental Panel on Climate Change, 2019).

Projections of sea-level rise in climate assessments from global to national to regional scales tend to focus on the time period out to 2050 or 2100 (e.g., Church et al., 2013; Sweet et al., 2017; Greenan et al., 2018; Wake et al., 2019; Fernandez et al., 2020). For example, global mean sea level is very likely to rise by about 1 ft by 2050 and in the range of 1–4 ft by 2100. However, global mean sea-level rise by 2100 could exceed 10 ft due to uncertainties associated with the rate at which the Greenland and West Antarctic ice sheets disintegrate (e.g., DeConto and Pollard, 2016; Kopp et al., 2017).

While there remains considerable uncertainty regarding the rates of sea-level rise after 2100, two things are

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very clear: Sea levels are going to continue to rise for centuries and the amount of sea-level rise will be measured in dozens of feet (e.g., Kopp et al., 2017; Rignot et al., 2019). This poses significant challenges for coastal communities as they consider actions to adapt to sea-level rise. Over the short term (years to decades), individuals and communities will likely focus on protecting and accommodating strategies that can buy communities time (e.g., seawalls, protecting and expanding natural resources such as coastal dune systems and salt marshes that provide protection from storm surge, raising homes on stilts). However, over the longer term (many decades to centuries), many—if not most—coastal communities will have little choice but to retreat inland away from the coast and toward something new.

The scientific rationale for managed retreat (the movement of infrastructure and people away from vulnerable floodplains) is well grounded. The gradual increase in the risk of coastal flooding due to rising seas is a slow-moving crisis. Advances in climate and ocean modeling are enhancing the accuracy of current and projected future coastal vulnerability, improving visualizations of the risks faced by coastal communities, and even helping to drive policy discussions. We do have time to act to address the flood risks associated with the long-term sea-level rise if we choose to.

How best to respond to the long-term physical reality of sea-level rise and its inevitable impact on coastal communities is complicated. These difficulties are due to not only complex climate science but, perhaps more so, to differences in values which cannot be resolved with more knowledge or education (McCright et al., 2016). Conventional community engagement approaches focused on biophysical analyses, often depicted in geographic information system maps and multiple different sea-level rise scenarios, help experts communicate risk, and yet, community conversations about climate change adaptation are still rare in smaller municipalities (Romsdahl et al., 2018). Managed retreat is an especially difficult topic for communities to discuss as it inherently involves loss, trade-offs, questions of equity and justice, and imperfect implementation mechanisms (Siders, 2019; Siders et al., 2019).

The communities surrounding the Gulf of Maine are predominantly composed of small- and medium-sized municipalities that often lack the technical, financial, and knowledge resources as well as the political will to evaluate and adopt adaptation-related policies (Hamin et al., 2014; Levesque et al., 2017). Because of these barriers, municipal officials in these towns are uncertain how to initiate discussions about climate change adaptation in general and managed retreat in particular. Local boundary organizations, which help connect scientific information to policy, often serve the role of supporting local deliberations and decision making (Tribbia and Moser, 2008; Graham and Mitchell, 2016). Relatively little is known about the most effective strategies for boundary organization efforts that will result in the degree of multifaceted stakeholder engagement needed to resolve conflicting values and perspectives over climate change (Kirchhoff et al.,

2013; Graham and Mitchell, 2016; Nordgren et al., 2016; Fiack and Kamieniecki, 2017).

Furthermore, research suggests that traditional communication tools that are designed to provide municipalities with information aimed at supporting adaptation planning, such as web-based knowledge portals, are ineffective in helping municipalities overcome barriers to adaptation planning (Mees et al., 2018). Recently, there is increased attention on facilitating social processes that encourage learning, flexibility, and experimentation as critical for addressing the complex, uncertain characteristics of climate change (Baird et al., 2014). However, even these more innovative boundary-spanning approaches rely on fairly established deliberative concepts and methods such as adaptive governance and focus groups, and there appears to be little consideration of how arts and humanities could be leveraged to encourage learning and experimentation by local decision makers and community members.

The arts are vehicles for establishing connections among people through collective imagination, and between people and their environment, and can act as a tool for dealing with the social-ecological complexity of issues like climate change (Lopez, 2015). Of all the fine and performing arts disciplines, theater can be thought of as the form that most resembles real life. Because theater is art, an artificial construct resembling life, it can be taken apart and closely examined for deeper insight and understanding. A specific subgenre of this art form has been referred to as “applied theater” since the 1990s. This is a large umbrella term for many theatrical models that utilize theater performance and/or theater pedagogy in a myriad of ways. An accepted unifying concept is that these are practices, usually led by professional theater makers, intended to be socially or personally beneficial to the participants (Nicholson, 2011).

Within the many structures that could be considered as applied theater, various forms of “interactive theater” have been developed for the purpose of individual or community development. The principal characteristic of interactive theater is that the audience has an active, as opposed to a passive, relationship to the action on the stage. This type of applied theater ranges from Jacob Moreno’s creation of psychodrama in the 1920s (an interactive theater model used as experiential therapy) to Augusto Boal’s Forum Theatre in the 1970s (a model used for communities to develop strategies to overcome political or societal oppression). With current practitioners and theorists such as Jeffrey Steiger (founder of the Center for Research on Learning and Teaching Players at the University of Michigan) and Michael Rohd (Center for Performance and Civic Practice) interactive theater is an ever-evolving field. The interactive dynamic, in particular, has been used to foster community dialogue and transform conflicts, merging the interpretive nature of the performing arts with concepts from traditional conflict resolution models (Hawkins and Georgakopolous, 2010). Interactive or applied theater has been used to explore social change issues such as HIV/AIDS, prisoner rehabilitation, and reconciliation efforts (McCammon, 2007) but does not appear to have been

explored as a tool for climate adaptation dialogue and decision making.

This article describes and discusses the use of interactive theater to explore the challenge of bridging scientific knowledge and community conversations on adaptation to sea-level rise and managed retreat in a safe and constructive environment.

Approach

Eight years ago, University of New Hampshire PowerPlay (UNH PowerPlay), a professional interactive theater company, was established at the University of New Hampshire. Beginning with programs that primarily focused on issues related to bias awareness and intervention as well as civil discourse, the company also worked on a project related to communication and climate science. The execution of this initial climate-related program provided a foundational understanding of how interactive theater could be used as a tool at the intersection of science and effective communication. Bringing what was learned from the collaborative process that brought theater artists and scientists together, as well as experimentation with facilitation techniques used in performance, a new program with a focus on the challenges of initiating constructive community conversation on managed retreat began in fall of 2018. The result was a new interactive theater model titled *Undercurrents: Using interactive theater to encourage more productive conversations about managed retreat* that serves as a tool for scientists, boundary spanners, technical assistance providers, and others to foster more productive community conversations about managed retreat. The collaborative team anticipated that *Undercurrents* could be both a professional development tool for technical experts preparing to work with communities as well as an engagement tool for boundary spanners to stimulate conversations in communities facing the possibility of retreat. Over time, that objective has evolved. What has not changed is a commitment to explore tools that bridge science and humanities to improve climate preparedness. The world of theater is the world of human behavior as revealed through the often complicated dynamics of relationships. The *Undercurrents* workshop capitalizes on this foundational aspect of theater.

As an interactive theater workshop, *Undercurrents'* presenters (professional actors with special training in improvisation) reveal the points of view of three characters—a climate scientist, a municipal leader, and a coastal property owner—in short intertwining monologues where they share their thoughts regarding the prospect of managed retreat.¹ Each character provides a glimpse into attitudes, values, motivations, and fears related to distinct and authentic perspectives on sea-level rise and managed retreat. The monologues are followed by a professionally

facilitated, 60- to 90-min interactive session during which audience-participants are invited to probe characters' perspectives and even redirect and replay scenes in new ways to seek more constructive outcomes. The workshop's characters are based on over 30 interviews conducted with coastal resilience stakeholders in 2018 and 2019 in coastal Massachusetts, New Hampshire, and Maine in the southern reaches of the Gulf of Maine. *Undercurrents* encourages participants to deeply examine the relationships among science experts, local decision makers, and those affected by decisions; relationships must be better understood if we are to deal with the difficult issues associated with sea-level rise and managed retreat in a strategic and socially just manner.

The *Undercurrents* workshop allows participants to confront these challenging situations in a safe and constructive environment. This creative approach provides a highly engaging method to invite audience members to observe social dynamics, as portrayed by professional actors, around a challenging topic, and then interact with the characters to dive more deeply into their thoughts, feelings, and reactions. *Undercurrents* is designed to improve the ability of scientists, planners, policy makers, and climate resilience professionals to better empathize with and assist communities facing an increasing risk of catastrophic coastal hazards. *Undercurrents* allows resilience professionals and technical experts to explore complex human dynamics around difficult or tense situations in a safe space so they can be more prepared for such real encounters in the future.

Through an extensive development period, transcripts from the interviews were condensed into three composite characters. Their text contained the most commonly held points of view that surfaced from the interviews. These shared perspectives included frustrations, hopes, concerns, degrees of urgency, and knowledge (as they related to the subject), among other important commonalities. Through a series of writing sessions with the PowerPlay creative team, and then development rehearsals with the PowerPlay actors, three monologues were created. These monologues were then further sharpened and refined and eventually interwoven to create a 15-min script (see Supplementary Documents). The objective of the script was to illustrate (based on what was revealed through the interview process) where critical components of communication were strong and clear, weak or confusing, or all together counterproductive. At its core, the script was designed to show how a poor understanding of the emotional connection to the subject matter, as well as the interpersonal relationships between the characters, played a role in their inability to understand and effectively communicate with each other.

The next developmental phase was the facilitation structure. Over the last 8 years, PowerPlay has refined an approach based on guiding the audience through three phases of interaction: observe, investigate, and experiment. For the *Undercurrents* format, the audience is first asked to observe the short play they are about to see and to specifically focus on what is revealed about the characters' perceptions of managed retreat as well as their perceptions of each other. The facilitator then moves the

1. The script of the monologues is provided in the Supplementary Material. A video of workshop at the June 2019 Columbia University conference "At What Point Manage Retreat" provides an example of the *Undercurrents* Workshop (<https://www.youtube.com/watch?v=JzUZ3TC65Q4&feature=youtu.be>).

Table 1. Details of *Undercurrents* workshops in 2019 and 2020. DOI: <https://doi.org/10.1525/elementa.2020.060.t1>

Event	Location	Date	Participants
New Hampshire Coastal Adaptation Workgroup	Newington, NH	January 2019	30
Maine New Hampshire Beaches Conference	Kittery, ME	June 2019	200
At What Point Managed Retreat?	Columbia University, NY	June 2019	120
National Oceanographic & Atmospheric Administration Social Coast Forum	Charleston, SC	February 2020	80

audience to the next phase, where they are given the opportunity to investigate, more deeply, the thoughts of the three characters. In this phase, audience members ask the characters questions. The actors have fully developed these characters with additional backstories. They use this additional character development to help them answer as truthfully and authentically as possible. Finally, the last phase, experimentation, is engaged. Using their deeper understanding and knowledge of the characters, the audience has the opportunity to create the basis of a scene among any of the characters. For example, the audience may want to see our scientist character make a specific point to our municipal leader character. The actors, playing as truthfully and authentically as possible, will spontaneously perform the new scene. The facilitator then guides the audience through an examination of the effectiveness of the communication between the characters using questions such as *What did you see and hear? What would you like to see one of these characters do differently?* The outcome of this collective evaluation leads to the audience actually coaching the actor/characters toward clearer communication, understanding, and ideally, a better outcome. The idea behind this entire approach is that through this evaluation and coaching method, the audience is gaining insight and practice in their own ability to effectively communicate in conversations surrounding managed retreat.

After the actors make their first attempt (that is commonly not sufficient), the audience can then actually coach the actor/characters toward clearer communication, understanding, and ideally, a better outcome. The facilitator then allows the audience to examine the result of their coaching and to discuss in what ways the communication was or was not strengthened. The facilitator often uses guiding questions such as *What did you see and hear? What would you like to see one of these characters do differently? What do you take away from this experience?*

The UNH PowerPlay team piloted *Undercurrents* at four separate events during 2019 and 2020, engaging over 400 participants (**Table 1** and **Figure 1**). The program, in all four presentations, appeared to engage and energize the audience. Responses to some of the facilitated questions included comments such as *there's no shared language, there's a lack of understanding of different values and practices, there are power dynamics at play, they each have a different sense of urgency, and I want the scientist to take an interest in the community over and above the research.* These revelations illustrate barriers at the interface of

science and decision making, which reflect interpersonal and communication challenges, realities that are pervasive but rarely scrutinized in the education and training of scientists and technical experts.

An important aspect of interactive theater as a tool is that although the initial scene script is consistent from session to session, each event can vary significantly based on the interactive portion where characters respond to comments and questions from the audience-participants. A skilled, interactive theater facilitator and actors are critical to bringing out the malleability of the program. By listening carefully to the audience questions and the actors' answers, the new/revised scenes can organically pivot toward the specific aspect the audience/community is most drawn to explore.

Another tool that was utilized to increase how the program can become even more customized on the spot is called "what if." At any point, a participant can alter a scene in a way that may be of particular relevance to that audience. For example, "what if this was happening at a public meeting and it was all being recorded?" Or "What if the town is refusing to fix the road to the home owner's house because it keeps getting washed out and it is projected to be under water in 10 years?" The audience may also choose to change an element of one of these encounters to examine how this might affect the interaction. For example, what if the scientist bumped into the local official in the grocery store, making this exchange happen in a socially public space? This interplay affects how the characters interact with each other and the audience, what aspects of their personalities or backgrounds emerge, and what new dynamics unfold as scenarios are improvised at the audience's request. No two sessions are ever exactly alike.

Outcomes

During the rollout phase of this workshop, the project team gathered feedback from audience-participants at the final three events through voluntary completion of a short online survey. All three events were professional conferences attended by scientists and engineers, state and federal agency personnel, technical assistance providers, outreach and university extension specialists, undergraduate and graduate students, nonprofit organization representatives, and community leaders. These events were chosen as rollout sites because the conference attendees were likely to be identifying and addressing climate risks with communities. The intent behind developing the



Figure 1. Image of *Undercurrents* facilitation session at the *At What Point Managed Retreat?* Conference at Columbia University in June 2019. The three actors are seated, and the session facilitator is standing and interacting with the audience. DOI: <https://doi.org/10.1525/elementa.2020.060.f1>

survey was to gather feedback about the workshop's effects on participants'

- awareness of different perspectives on retreat;
- views on the usefulness of the interactive theater workshop as a tool for encouraging conversation;
- capacity to engage in community conversations about retreat;
- approach to designing or conducting their climate adaptation-related work; and
- perception that (other) technical assistance providers in their region should attend an *Undercurrents* session.

This initial feedback was important for helping to tease out what the *Undercurrents* workshop is and is not accomplishing in relation to its intended objective—to improve the capacity of resilience professionals to encourage more productive conversations about difficult climate adaptation actions. The project team is using the feedback to align its expectations, modifications, use, and promotion of

Undercurrents more closely with what it is learning from these audiences and to determine areas for further study.

The first event in January 2019 was conducted as a developmental session intended for the PowerPlay team to gather extensive feedback from a local group of resilience professionals through presentation, discussion, and written feedback. The online survey response rates for the subsequent three events were 27%, 23%, 62%, respectively. The *Beaches* conference participants received two of the eventual five questions, the *At What Point?* conference attendees received four of the eventual five questions, and the *Social Coast* session participants received all five questions. While the survey results are intended primarily to inform the project team as we continue to work on *Undercurrents*, a few results are worth noting. There is near unanimous (94%) agreement from survey respondents at all three events that the workshop *demonstrates a useful tool for generating more productive conversations about managed retreat*. Other intriguing results from two of the three events include 71% agreement that *technical assistance providers working with communities on retreat in my region should participate in an Undercurrents session*. Finally, 74% of Social Coast participants agreed that *participating in Undercurrents affects the way I think*

about designing or conducting my work related to the topic of climate adaptation and/or retreat. Agreement that *Undercurrents* increased my capacity to engage in community conversations about retreat landed around 64% for two of the three events, a result that might reflect the fact that all audiences included many climate resilience professionals already immersed in some aspect of adapting to sea-level rise with communities.

Additional survey comments and direct feedback raise several additional points. For example, the utility of the tool for preparing resilience professionals for community engagement in ways that are distinct from conventional methods was called out. One participant wrote [*The workshop*] got us out of our “academic” headspace into direct community engagement and the messiness that this entails. Several participants identified the benefit of fresh and innovative modes for teaching and learning about science communication and community engagement: *Undercurrents* made explicit a lot of what I was already aware of—but in a way that was beneficial to reexamine and discuss. I think this kind of consciousness is extremely important to explore with different types of individuals. I thought this was a great learning opportunity and an effective way at approaching communication. I think the lessons learned could be applied to almost any topic, not just climate adaptation/retreat. Participants also noted the value of integrating the humanities into coastal resilience efforts: *I think work that engages the humanities is integral to our work!*

While the initial events and feedback have been extremely helpful for learning more about the potential and the limitations of *Undercurrents*, the project team is interested in pursuing a more rigorous assessment of the potential for interactive theater to play a role in improving how scientists and communities discuss and work together to address climate challenges. Potential research questions include the following: (a) How does exposure to interactive theater change boundary spanners’ knowledge of the diverse perspectives around managed retreat? (b) How does exposure to interactive theater change the way boundary spanners design engagement with communities on managed retreat? (c) Does exposure to interactive theater increase boundary spanners’ ability to effectively communicate with communities on managed retreat? Other potential lines of evaluation could compare interactive theater as a communications training tool with other types of training tools being used with climate resilience professionals or focus more generally on the benefits and challenges of integrating humanities and science to advance climate adaptation.

Feedback from the recent Social Coast Forum has also encouraged us to view *Undercurrents* more as workshop to broadly explore forms of art-based science communication available to boundary spanners, as opposed to a specific focus on managed retreat. One participant commented, *I thought we would talk about retreat more than we did. This was about interactions between people.* For those who work in the field of coastal resilience, the workshop’s content regarding what to do about managed retreat is indeed light. Rather, the workshop captures the

human dynamics around starting and having difficult conversations. In the future, we plan to emphasize the communication aspect of the workshop in addition to the focus on managed retreat. As one participant commented, *This seminar should be a required course for college graduation period.* The creation of additional characters is also being explored. One question that has been asked by the facilitator in some of the workshops has been “who is missing from this conversation?” A common response has been a person we could identify as a boundary spanner. As such, individuals are crucial in addressing multiple aspects of community engagement and could also be seen as an important beneficiary of this training; the development team sees this addition as an important next step.

Finding ways to deliver the program to communities in a cost-effective manner remains a challenge. This is particularly true if a presentation requires transportation and other travel expenses for the actors and the facilitator. One possible solution being explored is how effectively the program could be executed live but via cloud conferencing. As this form of interaction has become exceedingly common since March 2020 due to the Coronavirus pandemic, it is not a difficult step for audiences to take to imagine many of these conversations happening over Zoom or FaceTime.

Conclusion

As the popular saying goes, “the definition of insanity is doing the same thing over and over again and expecting a different result.” In the context of the Gulf of Maine in 2050, the insanity is to keep assuming that the scientific research *on its own* is building safe and productive and resilient future for the Gulf of Maine. Scientific research is foundational and critical, but it is not sufficient. If one wants to drive societal change, it is not enough to publish research and think the job is done. We need to speak both to peoples’ hearts and to their minds. Science has to interact with human beings and their attachments, biases, reluctances, economic–social–political realities, and human experiences. How do we better understand the personal experiences of people making decisions as well as people on the receiving end of those decisions?

In the end, *Undercurrents* is a program devised for deep self-reflection for all those engaged in climate change action. It is designed for session participants to examine their own strengths and weaknesses when engaging others on this subject, to be more prepared to accommodate a range of emotional connections to the subject matter, and to anticipate social dynamics at play. Furthermore, *Undercurrents* ask audiences to see the world through the eyes of other people who play a critical role in this real-life challenge. Through this theatrical construct, participants can utilize the scenes they witness as a mirror to better see themselves and others and what we all do or do not bring to the table of communication and eventually, collaboration. As Augusto Boal, the famed Brazilian theater artist and innovator of interactive theater, was known to say—it is a rehearsal for the future.

Supplemental files

The supplemental files for this article can be found as follows:

Text S1. *Undercurrents—Climate Monologues.* docx.

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Competing interests

The authors have no competing interests to declare.

Author contributions

Collaborated on the development of *Undercurrents*: WC, JP, CJL, DK.

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