

Engaging PEOPLE: A Scalable Communication Infrastructure for Broader Impacts

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Chapter 1

Welcome

Hello,

We wanted to give you a taste of what our project is going to look like. We decided to use our original proposal document (with some adjustments and updates) to do so. We divided each section into chapters, so the reader can appreciate the overall structure of a book.

We are currently working on our project re-scoping and the structure of the chapters.

Enjoy the test drive!

Chapter 2

Overview

Doing science in a world wracked by crises like climate change and COVID shifts public engagement efforts from vague commitments into urgent and personal practice. Unfortunately, for many researchers, neither the incentives for nor the impacts of broader impact efforts feel adequate to the global importance of such work (Rose, Markowitz, and Brossard 2020). This mismatch is complicated by the persistence of ‘deficit model’ approaches to science communication (Nadkarni et al. 2019), problematic assumptions about audiences, and the precarious nature of academic careers. Together, they produce a deficit-scarcity mindset: researchers feel increasingly troubled by public discourses, they experience frustration and/or helplessness with their inability to meaningfully shift those debates, and most of all, they feel there is no time for any work beyond the all-consuming need to produce scientific publications. To foster meaningful, impactful broader impacts work, we must therefore help researchers rebuild their sense of self-efficacy and strategic clarity.

The open science movement offers us inspiration (Lowndes et al. 2017). By unlocking multiple pathways for inclusive interactions with diverse groups of people along the entire research process, open science practices reduce delays and obstacles between knowledge production, sharing, and refinement. To date, most of the communication tools developed for open science focus on technical mechanics for the visual display of information and of sharing data and methods (Wickham and Grolemund 2017). The relational aspects of community building, as well as the strategic aspects of engagement, are largely disconnected from the tactical dimensions of information transfer. We think this represents an exciting opportunity.

To address priority 5: “Using evidence-based inclusive science communication principles in research impacts activities,” we propose an **extensible, self-guided, and scalable framework for strategic communication and engagement**. We are calling this framework $P^3 = PEOPLE, Products, and Pathways$. The term “*PEOPLE*” doubles

in meaning here as an acronym for *Points of Engagement Or Points for Leveraging Engagement*. We do so to emphasize the relational aspect of our proposed framework. This project is a collaboration between Dr. Francisco Guerrero and Liz Neeley, and it is primarily focused on synthesis, with some new scholarship.

Our framework is inspired by Communication Infrastructure Theory as it describes the conditions that enable collective action for common purpose (Kim and Ball-Rokeach 2006). For infrastructure, we think of everyone and everything that a community needs to produce and support the rapidly expanding set of communication *Products* (data visualizations, interactive applications, web content managers) that are continuously opening new *Pathways* for sharing ideas and insights (MacArthur et al. 2020). Together, *PEOPLE*, *Products*, and *Pathways* constitute the core of a communication infrastructure that builds community and can achieve broader impacts if combined with science communication principles and practices.

Our P^3 framework will guide users through a series of nested iterations of the engagement cycle (Nadkarni et al. 2019), and help them connect their impact identities as individuals to their broader impact activities as research teams or labs (Risien and Storksdieck 2018). By providing an evidence-based guide and supporting structures for exploring their options, creating valid theories of change, and iterating on their strategies, we hope that our approach will shift our users' thinking toward strategic, collective action. Such work should enhance both their perceived and real-world efficacy.

Our primary audiences are leaders of academic labs and anyone who is writing broader impact strategies, lab managers who oversee daily operations, and others who are focused on the praxis of broader impacts. We center these audiences because they wield institutional and positional power: they tend to create the systems and cultures that determine what actually happens within academic communities.

We embrace the universal communications rule of meeting our audience where they are, so we will approach the work using the software tools research labs are using to analyze, visualize, and share data. We will develop and pilot the P^3 framework as an Rmarkdown project that will be stored on GitHub and published with BOOKDOWN. Our work will begin with creating the initial framework and workflow. We will then create the structures for curating resources to support decision-making at each step. Our initial product will address questions in our shared areas of skill, like how to use open-source code to support training, how to create narratives that welcome underrepresented communities, and how to share data to build and enhance partnerships. In each case we will highlight the *PEOPLE* involved in effective engagements, and the *Products* (i.e. messages + assets) that are often exchanged resulting in open *Pathways* (i.e. long-lasting interactions).

Chapter 3

Outputs

The e-book R for Data Science provides a model for our outputs, both in format and content. The book ends in a “Communicate” section, which we would expand into an “Engage” module. The assets generated by our project (e.g., texts, figures, visualizations, and code) will be hosted in the customizable Rmarkdown ecosystem of document authoring, and will be renderable as a stand-alone book section, among many other formats (e.g. HTML, pdfs, notebooks, etc). Both the book section and the source code will be available for users within the ARIS fellowship community as well as within our target audiences and anyone interested. Our content for the stand-alone book section will be organized in six short chapters:

- Engaging PEOPLE: A scalable communication infrastructure for broader impacts
- Engage to Ideate
- Engage to Experiment
- Engage to Analyze
- Engage to Report
- Engaging PEOPLE: Beyond the Lab

We will apply our own framework in the development of the P^3 framework and document the process, including network building with communities beyond the ARIS fellowship like USGS Data Viz, OpenScapes, and more.

Chapter 4

Timeline

- **JAN-22:** Deploying the project's communication infrastructure: networks of collaborations, GitHub repository, channels for feedback and communication, etc.
- **MAR-22:** Chapters 1 and 2 drafts and internal feedback cycle
- **MAY-22:** Chapters 3 and 4 drafts and internal feedback cycle
- **JUL-22:** Chapters 5 and 6 drafts and internal feedback cycle
- **SEP-22:** Friendly review by external collaborators; submission to external reviewers
- **NOV-22:** Incorporating external feedback - I
- **JAN-23:** Incorporating external feedback - II
- **APR-23:** Presentation of final product

Chapter 5

Challenges

We anticipate challenges in the three following domains:

- **1.Creation.** We plan to create the P^3 Framework as an Rmarkdown project that will be stored in GitHub and published with BOOKDOWN. While Guerrero has more recent experience with these tools, Neeley hasn't routinely worked with raw code since grad school. Both of us are also aware that the necessary allocation of our time to complete this project far exceeds the direct value of the award, so we must subsidize this effort with other income sources. As a side project, we know that this effort is necessarily subject to prioritization that can slow our progress.
- **2.Curation.** An ongoing challenge for all projects in the broader impacts space is simply tracking the salient resources and initiatives in the space. Finding everything is difficult enough, but cataloguing is often an unappreciated hazard. In a relational map of the conceptual space, we know that there are countless many-to-many relationships, which complicate simple navigation.
- **3.Distribution.** One of the most common pitfalls of work like this is failure to launch. We have already identified the creation of the P^3 Framework as a heavy lift, but publicizing and socializing a tool can take just as much if not more effort.

Our plans for overcoming these challenges depend on our access to the support and expertise of the ARIS community, as well as our large networks of mentors and colleagues. We apply this same commitment to collaboration in distributing the P^3 Framework as a Github repository. By applying an open science approach to our own work, we will be able to learn and iterate more rapidly (challenge 1), build collaboratively upon the large body of knowledge that already exists (challenge 2), and to meet our audiences where they are

to minimize the cost and effort of adding the P^3 Framework to their standard operating procedures (challenge 3).

Finally, we have the exciting opportunity to use the daily operations of Liminal Creations LLC as a sandbox for deploying the P^3 Framework. Liminal is a small but rapidly growing consulting firm focused on science communication and sensemaking. Groundtesting the P^3 Framework at Liminal will help to surface the kinds of difficulties that only arise from daily use of a tool in real-world conditions.

Chapter 6

Profiles

We met through our participation in the Science Communication Trainers Network, and discovered our mutual passion for relaying complex information in beautiful visuals. We found in each other a rare partner who values the academic literature about science communication just as much as the creative practice of expressing it. This project emerges from our long-term commitment to social justice and inclusive science, open science, and evidence-based science communication.

We bring a wide variety of relevant skills: Guerrero serves as a knowledge broker into the scientific community employing coding, visualization, and scicomm skills, while Neeley brings six years of executive experience and intimately understands organizational information management and day-to-day practicalities of running an organization. Guerrero is currently working as Science Communication Liaison between the National Center for Ecological Analysis and Synthesis and COMPASS Science Communication. He is also a courtesy faculty with the College of Forestry at Oregon State University. Neeley also sits on the advisory boards of the Aspen Institute Program on Science and Society and the AAAS Committee on Science and Technology Engagement with the Public. Together, we count dozens if not hundreds of faculty, staff researchers, postdocs among our closest contacts. We have coached and earned the trust of hundreds, if not thousands, more. We intimately understand and deeply care about research and researchers both personally and professionally. It would be an honor and a privilege to earn an ARIS Fellowship to continue our work to support them.

Chapter 7

Biosketches

7.0.1 BIOGRAPHICAL SKETCH

7.0.1.1 Francisco J. Guerrero - Researcher and Science Communicator

7.0.1.1.1 Personal statement I was born in Santa Marta, Colombia, one of the oldest cities in Latin America. I grew up in a community which, due to centuries-long social injustices, struggled to have access to basic necessities like drinking water. This was my main motivation to start my professional career in water resources. While pursuing a dual major Ph.D. in Forestry and Water Resources Science at Oregon State University (OSU), I started leading science communication efforts. Around this time, besides the regular SciComm workshops I would design and offer to graduate students at OSU, I had the rewarding opportunity to teach science storytelling to a diverse community of migrant children to inspire them to fall in love with science. The sense of connection with my own childhood through those kids is something that firmly imprinted itself in my memory and upon my heart. These efforts in science communication resulted in my selection by the American Association for the Advancement of Science to be a Mass Media Fellow to work with CNN Español in 2018. I also have continued working with underrepresented communities through a number of mentorship programs for both undergraduate and early career scientists in the U.S.

After my graduation from OSU I was selected as a Water Science-Policy Fellow at the University of Wisconsin-Madison. During my time in Wisconsin, I continued to engage in science communication activities. I developed science communication training materials for state agency staff and helped agency managers explore the role of knowledge brokers in synthesizing and articulating science to support policy formulation. I also had the opportunity to connect

with several colleagues from the Life Science Communication Department at UW-Madison.

Through my current position as a Science Communication Liaison for the National Center for Ecological Analysis and Synthesis (NCEAS) at UC Santa Barbara and COMPASS, I work with a vast network of scientists who, working at the cutting edge of data science, develop solutions to harmonize the relationship between people and nature. My job there includes the design and implementation of workshops on effective communication and engagement. I want to learn more, though. I want to walk the walk of engagement in order to become not only a more knowledgeable science communicator, but more importantly to construct and deliver value to those communities that are historically marginalized.

Along my personal and professional journey I have persevered through the pressures of our academic system that forces us onto narrowing pathways, along which, very often, we must choose between doing either science or communication. I have chosen to interweave the two throughout my work with natural resources, which has resulted in amazing opportunities as a science communicator.

Education

- 2000 - 2005 University of Magdalena-Colombia, BS in aquatic biology
- 2007 - 2011 Pontifical Xavierian University-Colombia, M.Sc.hydrosystems
- 2013 - 2018 Oregon State University, Dual-major Ph.D. Sustainable Forest Management / Water Resources Science

Positions and Employment

- 2004 - 2005 Editorial Committee Assistant-Intropica Journal, University of Magdalena-Colombia
- 2006 - 2008 Research Assistant, Institute of Geophysics, Pontifical Xavierian University-Colombia
- 2008 - 2012 Director's Assistant, Engineering Doctoral Program, Pontifical Xavierian University-Colombia
- 2013 - 2018 Research Assistant, Forest Soils Lab, Oregon State University
- 2019 - 2020 Water Science-Policy Fellow- University of Wisconsin-Madison
- 2020 - present Science Communication Liaison-National Center for Ecological Analysis and Synthesis and COMPASS Science Communication
- 2020 - present Courtesy Faculty Appointee, College of Forestry, Oregon State University

Other Experience

- 2007 - 2012 Water Resources Consultant (The Nature Conservancy, Ministry of Environment, Pontifical Xavierian University)

- 2009 - 2012 Graduate and Undergraduate Instructor in Water Resources Engineering (Pontifical Xavierian University, Catholic University of Colombia)
- 2014 - 2018 Workshop Designer and Instructor (LaRGE: Making your Presentations Likable, Reliable, and Gettable)-Oregon State University
- 2017 Trainer-Mentor at McCall Outdoor Science School (MOSS), Solar Science Program, University of Idaho.
- 2018 AAAS Mass Media Fellow at CNN en Espanol.
- 2020 - Present Mentor for multicultural programs with ASLO and SFS

Most Recent Contribution:

- Voter. C. B., Guerrero-Bolaño, F., A. Latzka, B. Maitland & J. Hauxwell. 2021. Adaptable University-Agency Early-Career Fellowship Program Creates a Win-Win-Win for Wisconsin's Waters. *Journal of Contemporary Water Research and Education*.(Accepted for publication)

7.0.2 BIOGRAPHICAL SKETCH

7.0.2.1 Liz Neeley - Founder and CEO of Liminal Creations LLC

7.0.2.1.1 Personal statement In September 2020, I launched a new consulting firm focused on the sensemaking aspects of science communication. I felt compelled to do so by the catastrophic decision-making around me during the COVID pandemic. I saw how badly everyone, even science advocates, struggles to integrate science into their personal decision-making in moments of crisis. I have spent the past 15 years absorbing what academic research can tell us about things like risk perception, emotional decision-making, storytelling, and community deliberation. In this pandemic moment, I decided to act on my conviction that science communication is a survival skill for humanity. I named the firm Liminal to honor the process of emergence - that beautiful, difficult space we inhabit just before crossing the threshold from confusion into clarity.

My current work uses sensemaking as its core framework. Sensemaking is the term we use to describe how people collect information, generate plausible accounts of what is happening, make decisions about the best course of action, and translate their experiences into future iterations of the cycle. I am particularly focused on the roles of narrative, identity, and persuasion in sensemaking efforts, and I work in this space both as a trainer and as a practitioner. Despite acute disincentives, I read the academic literature, contribute to formal peer review, and build collaborations with social scientists. Rather than publications, however, my primary products are performances, trainings, and relationships. I believe that informal networks and personal ties profoundly shape modern professional spaces, and am intimately familiar with the challenges of building communities online and in person.

All together, I have spent nearly fifteen years supporting scientists as they struggle with questions of how to communicate complexity and uncertainty, as well as where to draw personal/professional boundaries. The work I do now expands on that foundation and looks to a future where we knit together bodies of knowledge wherever we find them to help us all become safer, braver, and more generous in a complicated and chaotic world.

Education

- 1998 - 2002 University of Maryland, BS in marine biology
- 2002 - 2005 Boston University, MA in ecology and evolution

Positions and Employment

- 2005 - 2006 Asia Pacific Program Associate, SeaWeb
- 2006 - 2008 International Coral Program Manager, SeaWeb
- 2008 - 2015 Assistant Director of Science Outreach, COMPASS
- 2010 - 2015 Affiliate Staff, University of Washington, College of the Environment
- 2015 - 2020 Executive Director, The Story Collider
- 2018 - present Lecturer, Yale University, Department of Psychiatry
- 2021 - present Senior Advisor for Science Communication, National Neuroscience Curriculum Initiative

Other Experience

- 2019 - 2021 Advisor, NPR SciComms
- 2018 - 2019 Organizer, National Academy of Science Colloquium on the Science of Science Communication: Misinformation in the Public Sphere
- 2017 - 2019 Senior Advisor and Fiscal Sponsor, ComSciCon
- 2016 - 2018 Advisor, Ensia Magazine
- 2015 - 2018 Advisor, MIT CommLab
- 2012 - 2013 Organizer, ScienceOnline Climate
- 2012 - 2014 Founder, ScienceOnline Seattle
- 2010 - 2016 Advisor, ENGAGE, University of Washington

Selected contributions

From 2005 to 2015, I focused on the nexus of ocean science, journalism, and policymaking. My contributions focused on extracting guiding principles for science communication from the literature and applying them in practice.

- Halpern et al. (2012) “An index to assess the health and benefits of the global ocean.” *Nature* 488(7413): 615–620.

- Baron (2010). *Escape From the Ivory Tower: A guide to making your science matter*. Washington DC, Island Press. (contributing author)
- Grorud-Colvert et al. (2010). “Communicating marine reserve science to diverse audiences.” *Proceedings of the National Academy of Sciences* 107(43).

Beginning in 2013, I focused on the challenges and opportunities that social media offers science communication, again working to ground new technologies in existing theory. I began to appreciate how narratives dominate popular understanding of current events.

- Neeley (2015) “Communicating Science in a Rapidly Changing World.” In *Principles of Conservation Biology*, 4th Edition, Sinauer Associates.
- McClain and Neeley (2014) “A critical evaluation of science outreach via social media: its role and impact on scientists” F1000 Research.
- Neeley (2013). “Risk Communication in Social Networks” In *Risk Communication*. Edited by Arvai and Rivers. London, Taylor & Francis.

From 2015 onward, I have focused on storytelling, narrative persuasion, and sense-making. I am particularly interested in how stories are used to understand events and social contexts, to imagine possible futures, and to position ourselves in the world.

- Finlay et al. (2021) “From the Margins to the Mainstream: Deconstructing Science Communication as a White, Western Paradigm.” *Journal of Science Communication* 20, no. 1
- Scheufele et al. (2021) “Misinformation about Science in the Public Sphere.” *Proceedings of the National Academy of Sciences* 118, no. 15
- Neeley et al. (2020) “Linking Scholarship and Practice: Narrative and Identity in Science.” *Frontiers in Communication*, 5.
- Gross et al. (2018) “Conservation Stories from the Front Lines.” *PLOS Biology* 16, no. 2: e2005226.

Research Support

National Science Foundation - Award ID 1255633 - 10/01/12 - 12/31/14. Culminated in GradSciComm: Mapping the Pathways to Integrate Science Communication Training into STEM Graduate Education, for which I was the lead author.

Chapter 8

References

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- Lowndes, Julia S. Stewart, Benjamin D. Best, Courtney Scarborough, Jamie C. Afflerbach, Melanie R. Frazier, Casey C. O’Hara, Ning Jiang, and Benjamin S. Halpern. 2017. “Our Path to Better Science in Less Time Using Open Data Science Tools.” *Nat Ecol Evol* 1 (6): 0160. <https://doi.org/10.1038/s41559-017-0160>.
- MacArthur, Brenda L., Laura A. Lindenfeld, Elyse Aurbach, Bronwyn Bevan, and Todd P. Newman. 2020. “Bridging Science with Society: Defining Pathways for Engagement.” *Communication Center Journal* 6 (1): 62–78.
- Nadkarni, Nalini M, Caitlin Q Weber, Shelley V Goldman, Dennis L Schatz, Sue Allen, and Rebecca Menlove. 2019. “Beyond the Deficit Model: The Ambassador Approach to Public Engagement.” *BioScience* 69 (4): 305–13. <https://doi.org/10.1093/biosci/biz018>.
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- Rose, Kathleen M., Ezra M. Markowitz, and Dominique Brossard. 2020. “Scientists’ Incentives and Attitudes Toward Public Communication.” *PNAS* 117 (3): 1274–76. <https://doi.org/10.1073/pnas.1916740117>.
- Wickham, Hadley, and Garrett Grolemund. 2017. *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. 1st edition. Sebastopol, CA: O’Reilly Media.