Designing a Communication Practice to Build Community Capacity for Safer Housing

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ABSTRACT

Communities in hazard-prone regions worldwide are navigating adverse impacts from increasing disasters, leaving many in a constant state of recovery and preparedness. In particular, in regions with weak regulatory enforcement of construction, such as Puerto Rico, housing is often built informally, i.e., builders without formal training construct housing that may not adhere to formal building codes or other regulations. The safety of this informally constructed housing directly influences disaster impacts and a community's recovery. In this study, we administer and analyze surveys on perceptions of safe building in Puerto Rico's informal construction sector and compare this to engineering performance assessments of typical shelter designs in earthquake and hurricane events - two hazards to which Puerto Rico is exposed - to reveal design or construction practices that may be misaligned. We describe one of these misalignments, the preference for infill over confined masonry construction in seismic regions. We then propose an initial framework for the creation of a communication design practice that targets perceptions that do not align with engineering assessments of housing safety, applying communication theory to intervene in housing construction practices and reduce disaster risk.

INTRODUCTION

In regions with weak regulatory enforcement on construction processes, housing is often constructed informally, which we define as builders without formal training building housing without necessarily adhering to permitting, building codes or other regulations. When regions prone to this informal construction are also exposed to hazards, such as hurricanes and earthquakes in the Caribbean, informal builders make design and construction decisions primarily based on past hazard and construction experience. Recognizing the expected increase in global disaster vulnerabilities in hazard-prone, resource-limited communities worldwide (Ahmed 2011; Dinan 2017), many implementing organizations have created communication strategies aimed at building community capacity to reduce disaster risk by training informal builders or households to construct safer housing (Clinton 2006; Kennedy et al. 2008). However, researchers have noted problems with these common capacity-building programs (i.e., Zerio et al. 2016), which depend on strategies that primarily disseminate technical information through one-way communication, such as the distribution of flyers throughout a community. Recognizing the shortcomings of these methods of communicating risk and housing safety and general community demand for more formal guidance on construction in hazard-prone regions (Goldwyn et al. 2021), this study argues for the need to involve communities more directly in the practice of communication to reduce disaster risk.

While communication scholars have studied and designed approaches to intervene in ongoing practices, organizations seeking to reduce disaster risk rarely incorporate these evidence-based strategies into their programs to intervene in housing design and construction practices. Communication scholars explain that conveying technical information is not primarily about simplifying a study's findings and imposing new knowledge. Instead, these scholars argue that communication should be a practice of conveying information to engage with people's emotions and visions in a way that inspires them (Davies and Horst 2016). A communication design process involves applying theory to develop practical approaches to intervene in societal processes and solve problems (Harrison 2014) by changing perceptions, attitudes, and behaviors. Communication designs take personal preferences, cognitive abilities, and value systems into consideration and engage individuals in dialogue about a specific idea or practice (Mokros and Aakhus 2002). Thus, creating a communication design that intervenes in informal housing design and construction practices entails designing an intervention that engages an audience in activities, such as different housing construction practices, and encourages discourse around the activities. This study proposes an initial framework for creating a communication design that draws from constitutive and practice theories and existing informal construction activities to challenge the transmissive and informational strategies traditionally employed to reduce disaster risk. Ultimately, the goal is to intervene in informal housing construction practices in ways that are impactful, meaningful, and consequential for the long-term adoption of safer housing design.

Thus, as the first phase of this multi-method study, we seek to gain a more complete and holistic understanding of informal housing construction practices in Puerto Rico, where over 55% of all commercial and residential construction is completed informally (Hinojosa and Melendez 2018), by collecting and analyzing data on construction practices and housing safety perceptions of informal builders, specifically those related to the order of construction of concrete and masonry housing. Then, as the second phase of this study, we suggest an initial framework for creating a communication design to rethink the process of communicating technical information to build capacity for safer housing construction. This second phase lays out the framework to be used as part of a larger project by the authors to guide a practical intervention alongside local community-based organizations (CBOs) with communication design. Overall, this study proposes the co-creation of a communication design alongside local CBOs to shape the discourse around safe and unsafe housing construction practices, intervene in these housing construction practices, and ultimately encourages behavior change to reduce the disaster risk of informally-constructed housing in Puerto Rico, a U.S. territory in the Caribbean.

BACKGROUND

In this background, we summarize the underlying theories of communication that inform our initial framework for the co-creation of a communication design alongside local stakeholders to intervene in housing construction practices and reduce disaster risk. Then, we describe elements of communication strategies and practices that inform this design.

Shifting from Transmissive to Constitutive Theories of Communication

Engineers and implementing groups working to reduce disaster risk have long viewed communication through a transmissive model, viewing communication as the process by which information is sent and received, or transferred, as a commodity from one individual to another (Axley 1984). This transmission model of communication outlines a linear process, where one isolated individual is the “sender” of intentional information and the other is the “receiver”

(Ashcraft et al. 2009). This theory does not consider the simultaneous sharing of intentional and unintentional information conveyed through outside individuals, events, or power structures. Many of the flyers or other learning materials historically shared by those seeking to train communities on safer construction focus on transmitting information from the organization (the sender) to the communities (the receivers) without engaging the communities in a way that allows builders to recall or prioritize specific recommendations (Opdyke et al. 2018; Zerio et al. 2016). When implementing groups do not engage the communities of interest in their strategies, and instead see communication as a tool to transmit their information, they will not understand or tackle the societal barriers that prevent builders from constructing safer housing.

Alternatively, rather than considering communication as a tool for the transmission of information, constitutive theories view communication as a continuous process of meaning negotiation and social construction (Ashcraft et al. 2009). Craig (1999) explains how communication produces societal processes, explaining how individuals jointly co-create meaning, order, and power through their communication. This constitutive theory views communication as *formative* in societal processes (Craig 1999), explaining how communication can both create and dismantle systems and processes (Deetz 1992). A constitutive view of communication also reveals how hidden forms of power and control are embedded within communication processes (Koschmann 2012) and how individuals construct authority. Taking a constitutive view allows us to identify how communication has shaped housing safety perceptions and authority within informal construction sectors to create a communication design that dismantles housing safety perceptions that are not aligned with engineering assessments of safety.

Understanding Communication as Practice

Practice theory describes how societal processes and human agency interact to explain which actions are and are not taken (Vaara and Whittington 2012)**.** By understanding the links between societal processes and behaviors, practice theories explain that individuals cannot act fully independently because they are social beings attached to a set of specific social contexts and practices that shape everyday life and underlie societal processes. Many practice theorists have studied how practices are produced, reinforced, and changed. For instance, the field of strategy-as-practice studies the micro-level social activities and practices involved in the accomplishment of strategy (Spee and Jarzabkowski 2011) to understand the ways practices can be changed through deliberate strategy. Thus, by drawing from theories of practice and the field of strategy-as-practice, it is possible to create a communication design that invokes a specific group's sensemaking processes and engages them in discussion and critique as a practice itself.

Overview of Communication Strategies and Materials

To inform the creation of a communication design for safer informal construction practices, we review evidence of different communication strategies and materials. Studies have indicated that *demonstrations* of safer housing construction practices can encourage behavior change by allowing observers to learn the positive outcomes of changed practices while increasing participants' perceived self-efficacy, or ability to change the behavior (Fishbein 2000). Ahmed (2011) explains the value of this "demonstration effect" in promoting safer construction practices among skeptical community members in Peru when, after donor-built housing withstood an earthquake, the pragmatic community members could see evidence of the positive outcomes of changing their construction practices. Several studies have also discussed the value of demonstrations implemented in combination with lecture-based training for local builders (i.e., Bartolini and

Schacher 2017). Researchers have also long argued for the role of both clarity and *cost-effectiveness data* in demonstrations to encourage wider adoption (Macey and Brown 1990; Magill and Rogers 1981). Others have noted the success of interventions that *include trusted local leaders* (Barker 2004). By having these local leaders share the information, these strategies recognize the role of normative pressures in a community, or one's perceptions of what others will think about his or her behavior, is a key element of behavioral change theory (Fishbein 2000). Further, several studies have noted problems increasing attendance of working men at training events due to the traditional and cultural expectations of them to prioritize immediate obligations to provide for their families or communities rather than preparing for future events (Asharose et al. 2015). Many programs aimed at training local builders have *incentivized attendance* by awarding attendees with formal certification upon completion (Bartolini and Schacher 2017; Zerio et al. 2016).

Strategies that focus on one specific, single phase of the housing process, such as training builders on safer construction techniques without *considering the existing housing safety perceptions* and practices that determine which construction decisions are made, will likely be unsuccessful at changing behaviors (Burtolos et al. 2020). For instance, an approach to communicating risk that trains builders on strategies to build safer housing, such as the effective locations and quantities of hurricane straps on wooden roofs, may not consider a households' perceptions, preferences, and priorities regarding their wooden roof. A household may not be willing to pay for these construction methods despite the increased hurricane resistance provided by this change at a minimal cost difference.

METHODS AND RESULTS

Puerto Rico's existing informal housing construction process and the discourse surrounding this process comprises a culture-specific practice. Thus, to create a communication design that seeks to intervene in and disrupt these existing practices to encourage safer housing construction, this study seeks to first understand the existing discourse surrounding Puerto Rico's informal construction processes. As the first phase of this multi-method study, we identify and explain one example of a housing safety perception of those involved in informal housing construction that does not align with engineering assessments of safety. Specifically, we investigate the results of a survey of informal builders and hardware store employees, who frequently advise on informal housing construction, currently being administered in-person by local enumerators at hardware stores and informal job sites across Puerto Rico to understand the perceptions of the relative safety of design decisions for a concrete and masonry house. Then, in the second phase, we draw from communication theory to propose an initial framework for a communication design that engages informal builders and households in dialogue around safer construction practices to address this misalignment between housing safety perceptions and engineering assessments of safety. This framework serves as the initial step to challenge existing transmissive approaches to communicating technical information and rethink the process of community capacity-building.

Phase 1: Identifying a Point of Intervention into Existing Housing Safety Perceptions

Based on the data collected from the survey being administered in Puerto Rico, this study identifies a set of housing safety perceptions that do not align with engineering assessments of housing safety. Within this paper, we analyze the construction practice of confined versus infill masonry. Confined masonry housing construction consists of horizontal and vertical reinforced concrete members built on each side of masonry wall panels (Brzev and Meli 2012). While confined and infill masonry structures look alike, these methods of construction are completed in different

sequences and have different resistance to gravity and lateral loads (Brzev and Meli 2012). Confined masonry is constructed with the masonry walls first, followed by cast-in-place reinforced concrete tie-columns and then tie-beams along with floor and roof slabs. Alternatively, in infill masonry construction, a reinforced concrete frame is built first and then infilled with masonry walls. These construction sequence differences result in confined masonry walls acting as shear walls while infill walls act as diagonal struts. Confined masonry buildings are able to withstand major earthquakes without collapse or significant damage, as demonstrated in Chile's Maule 2010 M 8.8 earthquake (Brzev and Meli 2012). While placing blocks before columns and including tie-beams does not guarantee a house is a safely constructed confined masonry structure, as there are details to consider (Mix et al. 2011) including appropriate tie-beam-to-tie-column connections, the *lack of* this order of construction does guarantee a building is *not* confined masonry.

Phase 1 Data Collection and Analysis

Within our survey, we asked a series of questions to understand perceptions of the relative safety of confined masonry and infill construction techniques. First, respondents were asked whether they believe it is safer to first lay the CMU blocks and then confine them with reinforced concrete columns (indicating potential confined masonry techniques) or to first cast the columns followed by infilling them with blocks (indicating infill techniques). We also ask respondents to select the construction decisions made by individuals informally constructing houses that potentially lead to damage in earthquakes and the primary reasons why they believe builders are making these potentially unsafe design or construction decision. We also ask for job titles so this can be considered within our analysis of housing safety perceptions.

For the structural analysis results, we refer to existing reconnaissance reports from the southwestern region of Puerto Rico after the 2019-20 earthquakes as the best indicator of structural performance. We have found one reconnaissance report that notes "severe damage to masonry infill" (Miranda et al. 2020), but without further information. While limited data is available on this construction practice in Puerto Rico, there is information on the practice in neighboring Haiti, where the prominence of infill masonry housing likely contributed to the significant damage and loss of life in the 2010 earthquake (Marshall et al. 2011; Nguyen and Corotis 2013). However, there is considerable difference between the quality of construction materials available in Haiti and Puerto Rico, with CMU blocks having greater strength in Puerto Rico than Haiti (Marshall et al. 2011). Nevertheless, researchers investigating housing damage in Haiti after the 2010 earthquake revealed that confined masonry even without the tie-beam above the structure resulted in an improved wall-column bond, and thus, houses built with confined masonry had less visible earthquake damage than those built with infill techniques (Marshall et al. 2011).

Phase 1 Results

The preliminary survey responses to questions related to the relative safety of confined masonry versus infill construction and to the placement of a tie-beam begin to give insight into a potential area of housing safety perceptions that are not aligned with engineering assessments of safety for masonry structures in earthquakes. At the time of writing this paper, 25% of the expected number of surveys have been conducted due to the challenges presented by the Covid-19 pandemic. As data collection continues over the following months, the results will be continuously evaluated to determine if this misalignment remains prominent. Of the eighty-seven respondents to date, forty-six (53%) were hardware store employees and forty-one (47%) were informal builders. Figure 1 shows responses to the question asking respondents, by job title, whether it was safer to construct

housing with blocks first, then confining the blocks with reinforced concrete columns; with reinforced concrete columns first, then infilling those columns with blocks; that neither order of construction is safer than the other, or that the respondents do not know which is safer.

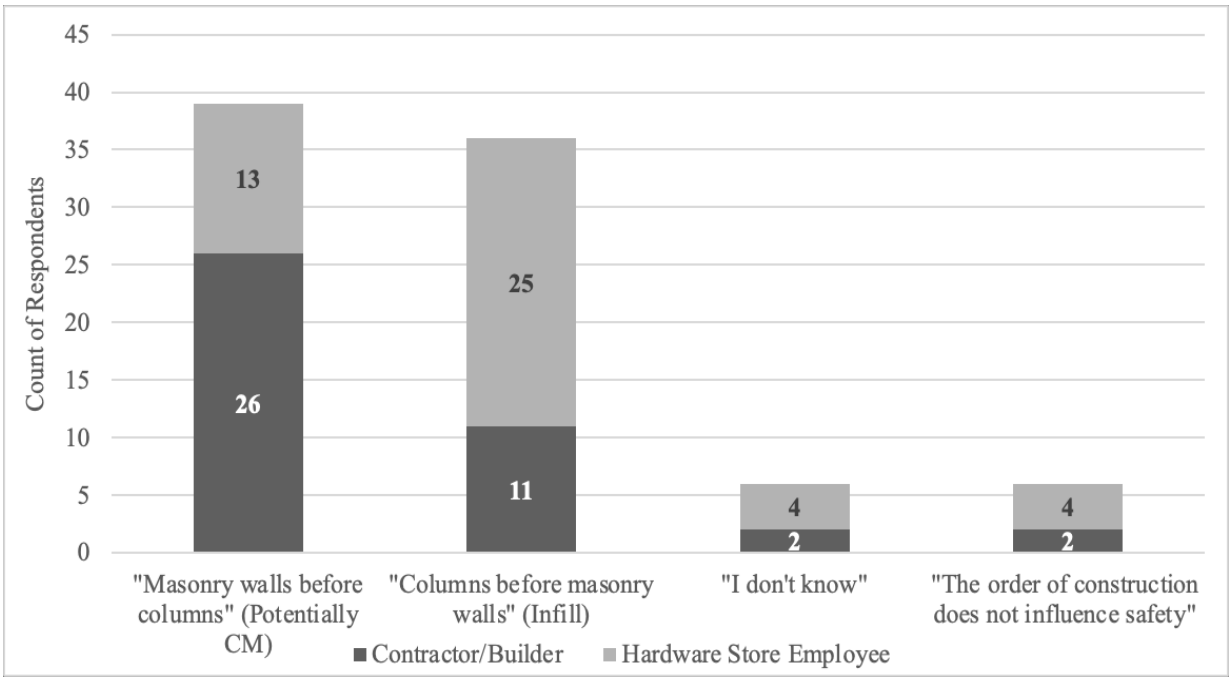

Figure 1. Respondent Perceptions of the Relative Safety of Infill and Confined Masonry listed by Job Type (N=87)

Of the eighty-seven total respondents, 45% of the respondents indicated it was safer to lay the blocks first, followed by the concrete columns, which aligns with structural reconnaissance findings of which type of construction is safer in earthquakes (Marshall et al. 2011). Of these thirty-five respondents indicating confined masonry construction as safer than the other options, thirteen were hardware store employees and twenty-six were informal builders. Alternatively, 41% of respondents indicated that casting the concrete columns and then infilling with masonry was the safer order of construction, of which twenty-five were hardware store employees and eleven were informal builders. This finding is expected because, while hardware store employees often advise on informal housing construction in Puerto Rico, they typically have less experience with housing construction than builders. Next, 7% of respondents indicated that the order of construction does not affect the house's safety, of which four were hardware store employees and two were informal builders. Finally, 7% respondents said they did not know which method of construction was safer, with four respondents being hardware store employees and two informal builders. Table 1 shows the comparison of housing safety perceptions and structural engineering assessments of safety to identify misalignments. Responses indicating it is safer to construct masonry walls prior to tie-columns met the criteria for "potential alignment" with engineering assessments, while all other responses did not meet this criterion and were assigned "misaligned." These data indicate that over half of the builders and hardware store employees may have housing safety perceptions that are not aligned with engineering assessments of safety regarding the relative safety of confined and infill masonry.

Table 1. Comparing housing safety perceptions and structural engineering assessments of safety to identify (mis)alignments

Survey findings: Pilot survey responses (N = 87)		Seismic Performance Assessments	Comparison of Survey Findings and Seismic Performance Assessments
Respondents believing it is safer to construct masonry walls prior to tie-columns	39 (45%)	Confined masonry construction outperforms infill masonry in seismic events (Brzev and Meli 2012; Marshall et al. 2011)	*Potentially* Aligned (assuming to be confined masonry)
Respondents believing it is safer to cast the columns prior to infilling with masonry	36 (41%)		Misaligned
Respondents indicating the order of construction does not matter	6 (7%)		Misaligned
Respondents who do not know which is safer	6 (7%)		*Neither aligned nor misaligned*

Respondents were also asked about tie-beams. Seventy-seven (84%) of respondents indicated in the survey that choosing to not put a beam at the top of a block wall could lead to damage in an earthquake, which is aligned with structural performance expectations of masonry without tie-beams in earthquakes. When asked why informal builders frequently do not build with tie-beams, the majority of respondents said it was due to a combination of financial (64%) and technical knowledge (79%) constraints. Respondents also indicated aesthetics (9%), and lack of material availability (5%) as reasons why builders may choose not to include a tie-beam.

Phase 2: Proposed Framework for Communication Design and Rationale

In this phase of the study, we propose the initial framework for a communication practice that draws from communication theory and practice to intervene in informal housing construction practices in a way that is meaningful and consequential. This framework serves as an initial step at rethinking the process of promoting safer housing construction. Future work by the authors will put this framework into practice in collaboration with local partners.

After reviewing both communication literature and evidence of existing communication strategies to promote safer informal housing construction, we propose that, in order to change the behaviors of those informally constructing housing in Puerto Rico, a communication practice must be led by local community leaders, engage individuals involved in the informal housing delivery process in two-way dialogue around safer construction, include demonstrations of the positive outcomes of changing construction practices, and incentivize builder attendance. Thus, for this example, we propose a two-hour workshop led by trusted local CBO staff, such as P.E.C.E.S. Inc., a non-profit organization based in Humacao, Puerto Rico, and featuring a combination of lectures and hands-on demonstrations for participants.

By engaging individuals involved in the entire informal housing delivery process in this dialogue at the proposed workshops, we hope to encourage attendees to ask questions and engage in discussion about how these recommendations for the order of construction of masonry housing and the inclusion of a tie-beam in design can fit within their technical and financial capacity.

Recognizing that researchers have noted combinations of lecture-based and hands-on training can increase self-efficacy around construction (Bartolini and Schacher 2017), this proposed workshop will include a lecture where attendees will be asked about their specific housing safety perceptions. Then, trusted local leaders will lead a discussion about the relative safety and cost of confined and infill masonry housing, encouraging attendees to ask questions and discuss the reasoning behind different construction decisions. The lecture-based training will include photos from confined and infill masonry houses that were and were not damaged in earthquakes along with information on how to ensure a confined masonry house is constructed safely. Local leaders will demonstrate the relative safety of two structures using shake tables built with wooden blocks and magnets. Then, each participant will have a chance to interact with their own demonstrations, testing and experiencing the difference between confined and infill masonry houses built with and without a tie-beam and engaging in dialogue with attendees and leaders about relative cost and safety.

Recognizing Puerto Rico's informal construction sector involves many interacting components, including both household demand for specific housing designs and costs and informal builder knowledge on housing construction practices, we propose two versions of this workshop: one for informal builders and the other for households. The first workshop will engage local builders specifically, with more complex explanations of the design elements that must be included. The second workshop will be directed at households to increase demand for safer housing. By engaging with households to discuss the value of building safe, confined masonry houses, households may feel more empowered telling builders how they want their house built. Based on the higher proportion of hardware store employees than informal builders with housing safety perceptions that may not be aligned with structural performance assessments, we hypothesize the hardware store employees will be included within the workshop with households.

We propose recruitment through trusted local, CBOs that we have met with on past fieldwork trips. For example, during one fieldwork trip in February 2020, we were told by one hardware store employee that the CBO P.E.C.E.S., *"would be the one to teach people about safe construction*." P.E.C.E.S. advertises its events through Facebook, and word of mouth in the area. We plan to work with similar organizations to disseminate information about this intended workshop in a culturally appropriate way. We hope to incentivize informal builders to attend by with items or funds equaling the transportation costs and cost of lost wages for each of these attendees. Despite several documented programs incentivizing attendance at training sessions by awarding attendees with formal certification upon completion (Zerio et al. 2016), we do not believe this approach would be successful in Puerto Rico due to low trust in government certifications.

CONCLUSION AND RECOMMENDATIONS

With increasing global disasters, many organizations seek to reduce disaster risk of hazard-prone, resource-limited communities through capacity-building initiatives where technical information of safer construction is transmitted or disseminated as a commodity. With extensive research from communication scholars arguing for the shift from transmission to constitutive theories of communication for lasting and impactful interventions, this study argues for the importance of capacity-building programs that are rooted in this communication theory.

This study identifies a misalignment between engineering performance assessments and housing safety perceptions of those involved in Puerto Rico's informal construction sector and then proposes an initial framework to create a communication design that seeks to intervene in ongoing housing construction practices. We identify that there may be a lack of alignment between the housing safety perceptions of informal builders in Puerto Rico regarding the relative safety of

housing constructed through infill and confined masonry techniques. After identifying this misalignment, this study takes an initial step towards a better understanding of the ways implementing agencies and organizations can apply communication theory to create a communication design that works within existing systems, such as Puerto Rico's informal housing construction processes to change behaviors and ultimately reduce disaster risk. To gain a more robust understanding of how the informal construction process actually happens in Puerto Rico, future studies by the authors will leverage this work and draw from practice theory and strategy-as-practice research to implement a practical intervention based upon this initial framework.

This initial framework suggests the creation of a communication design alongside local CBOs that employs a combination of discussions and demonstrations to intervene in the informal construction of masonry housing. By hosting several workshops designed with different audiences in mind, this communication practice will engage stakeholders from the entire informal housing delivery process in Puerto Rico, including builders, households, and hardware store employees. These workshops will engage stakeholders in dialogue surrounding the practice of confined masonry construction to challenge existing housing safety perceptions. Once this framework is implemented alongside local CBOs in Puerto Rico as part of a larger study by the authors aimed at communication design, it will be possible to gain a more holistic understanding of the proposed communication design to iterate upon the design process and ensure consequential intervention.

LIMITATIONS

This paper provides an analysis of preliminary survey data, findings from structural analyses, and communication theory to establish an *initial* framework for communication design based on pilot data that can be iterated upon with future work to design a practical intervention alongside local community-based organizations. The data discussed within this paper reflects 25% of the total surveys that will be administered for this study and thus does not fully capture the distribution of the informal construction sector of Puerto Rico on their own.

REFERENCES

Ahmed, I. (2011). "An overview of post-disaster permanent housing reconstruction in developing countries." *International Journal of Disaster Resilience in the Built Environment*, 2(2), 148–164.

Asharose, Saizen, I., and Sasi, P. K. C. (2015). "Awareness Workshop as an Effective Tool and Approach for Education in Disaster Risk Reduction: A Case Study from Tamil Nadu, India." *Sustainability*, Multidisciplinary Digital Publishing Institute, 7(7), 8965–8984.

Ashcraft, K. L., Kuhn, T. R., and Cooren, F. (2009). "Constitutional Amendments: 'Materializing' Organizational Communication." *Academy of Management Annals*, Academy of Management, 3(1), 1–64.

Axley, S. (1984). "Managerial and organizational communication in terms of the conduit metaphor." *Academy of Management Review*, 9, 428–437.

Barker, K. (2004). "Diffusion of innovations: A world tour." *Journal of Communication*, 9, 131–137.

Bartolini, I., and Schacher, T. (2017). "Introducing Confined Masonry in a Fragile State: The Case of Haiti After the 2010 Earthquake." 12.

Brzev, S., and Meli, R. (2012). "International Guideline for Seismic Design of Low-Rise Confined Masonry Buildings in Regions of High Seismic Risk." Lisboa.

Burtolos, C., Kijewski-Correa, T., and Talfanidis, A. (2020). "The Housing Market Value Chain:

An Integrated Approach for Mitigating Risk in Informal Residential Construction in Haiti." *Sustainability*, 12(19), 8006.
Craig, R. (1999). "Communication Theory as a Field." *Communication Theory*, 9(2), 119–161.
Davies, S. R., and Horst, M. (2016). *Science Communication*. Palgrave Macmillan UK, London.
Deetz, S. (1992). *Democracy in an Age of Corporate Colonization: Developments in Communication and the Politics of Everyday Life*. SUNY Press, New York.
Dinan, T. (2017). "Projected Increases in Hurricane Damage in the United States: The Role of Climate Change and Coastal Development." *Ecological Economics*, 138(C), 186–198.
Fishbein, M. (2000). "The role of theory in HIV prevention." *AIDS care*, 12(3), 273–278.
Goldwyn, B., Javernick-Will, A., and Liel, A. (2021). "Dilemma of the Tropics: Changes to Housing Safety Perceptions, Preferences, and Priorities in Multihazard Environments." *Natural Hazards Review*, American Society of Civil Engineers, 22(3), 04021012.
Harrison, T. R. (2014). "Enhancing Communication Interventions and Evaluations through Communication Design." *Journal of Applied Communication Research*, Routledge, 42(2), 135–149.
Hinojosa, J., and Meléndez, E. (2018). The Housing Crisis in Puerto Rico and the Impact of Hurricane Maria. Centro, 24.
Koschmann, M. (2012). *What is Organizational Communication?*
Macey, S. M., and Brown, M. A. (1990). "Demonstrations as a Policy Instrument With Energy Technology Examples." *Knowledge*, SAGE Publications, 11(3), 219–236.
Magill, K. P., and Rogers, E. M. (1981). "Federally Sponsored Demonstrations of Technological Innovations." *Knowledge*, SAGE Publications, 3(1), 23–42.
Marshall, J. D., Lang, A. F., Baldridge, S. M., and Popp, D. R. (2011). "Recipe for Disaster: Construction Methods, Materials, and Building Performance in the January 2010 Haiti Earthquake." *Earthquake Spectra*, 27(S1), S323–S343.
Miranda, E., Acosta, A., Aponte-Bermudez, L., Archbold, J., Du, A., Cortes-Delgado, M., Gunay, S., Hassan, W., Heresi, P., Lamela, A., Messina, A., Miranda, S., Navarro, J., Padgett, J., Poulos, A., Scagliotti, G., Tsai, A., Kijewski-Correa, T., Mosalam, K., and Roueche, D. (2020). *StEER - 7 Jan. 2020 Puerto Rico Mw 6.4 Earthquake: Preliminary Virtual Reconnaissance Report (PVRR)*.
Mix, D., Kijewski-Correa, T., and Taflanidis, A. A. (2011). "Assessment of Residential Housing in Léogâne, Haiti, and Identification of Needs for Rebuilding after the January 2010 Earthquake." *Earthquake Spectra*, 27(S1), S299–S322.
Mokros, H. B., and Aakhus, M. (2002). "From Information-Seeking Behavior to Meaning Engagement Practice: Implications for Communication Theory and Research." *Human Communication Research*, 28(2), 298–312.
Nguyen, L. T., and Corotis, R. B. (2013). "Seismic Risk and Society Development Indicators: Examination of Three Countries." *Natural Hazards Review*, 14(2).
Opdyke, A., Javernick-Will, A., and Koschmann, M. (2018). "Household construction knowledge acquisition in post-disaster shelter training." *International Journal of Disaster Risk Reduction*, 28, 131–139.
Spee, A. P., and Jarzabkowski, P. (2011). "Strategic planning as communicative process." *Organization Studies*, SAGE Publications Ltd, 32(9), 1217–1245.
Vaara, E., and Whittington, R. (2012). "Strategy-as-Practice: Taking Social Practices Seriously."
Zerio, A., Opdyke, A., and Javernick-Will, A. (2016). "Characterizing post-disaster reconstruction training methods and learning styles." 6, 142–154.