# Thinking and doing beyond science and risk communication as mere transmission

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## Abstract

I look back on my professional experience as both bench and social scientist, and examine my misunderstandings of science communication as a field, which were fueled by my ideologically-driven stance on the primacy of the bench sciences over all other fields of study. I begin with my work as a molecular biologist, continue with my socialization into the social sciences at the PhD level, and narrate my experiences as a researcher attempting to break down the notion of science and risk communication as mere vessels for sharing scientific information. I do this by discussing my research findings, and then ruminating on their meaning for the fields of science and risk communication. These fields must grow beyond their preoccupation with the centrality of scientific data in communication by 1) recognizing the ideological force exerted by such a stance, and 2) acknowledging the many voices of society that allow communication to be a complicated, and yet fruitful enterprise.

Keywords: science communication, risk communication, the nature of science, science communication research, risk communication research

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## Introduction

I began my career as a molecular biologist through the academe. After I completed my undergraduate degree in the field, I was hired as an instructor while I pursued my masters. I taught laboratory classes and delighted in the work that came with teaching and research combined: I could converse with students about their lives and plans, all while pursuing a higher degree in what I felt would be a life spent either in forensics or wildlife conservation. I was interested in both and many more topics besides that were within the purview of molecular biology, and all because I had grown up with films and documentaries that extolled the power of science to answer questions, plumb through the unknown, and disentangle the world's problems.

I had been socialized as much into the scientific field: I was constantly told that science held the keys to saving the world, and it was only through scientific research that we would be able to pull humanity out of its many morasses. It was also this perception of science's mission that pushed me toward science communication, a field that I had interpreted as communication paying homage to the systematic world of scientific work by speaking out for the logical, the scientific, and the objective.

It was only after I began earning my PhD when I realized that I had not been socialized into a field; I had been indoctrinated into an ideology, and it was harmful, both to myself as a scholar and to society as a whole.

When I finished my doctorate at Purdue University, I had earned units in sociology, education, communication, philosophy, and statistics — and I had found my true calling as a researcher. I was not to hold science above all other fields as the premiere source of knowledge. I was to assume nothing, not of science or of scientists, not of people, not of knowledge itself. Instead, I was to search for the truth in the lives of humans whose perceptions of the world had been ignored and erased. I was to be a true researcher, to ask questions, to admit my own shortcomings and biases, to listen to humanity – the way that I once thought science was about.

Today, I am a science and a risk communication researcher, and my work has told me a story that is far richer than any I had ever known, and would ever know had I chosen to remain in the molecular biology laboratory.

## The views of scientists across geographical divides

My doctoral dissertation examined how the worldviews and cultures of science differed across the Philippines and the United States (with Purdue's researchers being the representatives) (Ponce de Leon, 2011). More to the point, the dissertation examined scientists' views of science communication and the role of science in society.

My work was never published, but the discoveries I made would change my views of science as a field, as well as the tales that scientists tell themselves and their trainees.

I interviewed twenty scientists per location, and asked them to tell their stories. How did they get into research? What did they feel was important in their work? What did they believe was their role? Then, I asked them to talk about the culture of science itself, as it was practiced. What did scientists have to do to be considered legitimate scientists? What kind of research was deemed good, and what was deemed bad? What were the struggles of scientists today? Then, I asked them about their roles in communicating science and risk. Why was it important? Who was in charge of doing it?

I analyzed the hours of interview data using both typological and inductive qualitative analysis (Hatch, 2002). These are systematic qualitative methods that examine data in depth, using a specific theoretical framework and an open reading of the data, respectively. I was not concerned with how many times something was said. Rather, I wanted to examine how different statements in the data congealed into indications of a specific paradigm of research work, perceptions of the role of science, and perceptions of society – all of which would have ramifications on how science is practiced, how science communication is carried out, and how scientists themselves lived in society as people with careers and culture.

On both sides of the planet, scientists struggled with funding, but there were stark differences in how they dealt with the challenge. Those in the Philippines tended to view funding as the money pot over which many scientists would fight; may the most competitive player win. On the other hand, those in the US tended to view money as a reward to be shared. So scientists had to find fellow scholars who shared their research objectives, and therefore could collaborate with them on a project that would make all dreamers win.

Communication was another point of difference. Scientists in the Philippines tended to look down on social scientists and dismiss their work as less scientific and therefore less legitimate. Communication, therefore, had to be handed over to scientists whom they believed knew the content and material best. Meanwhile, scientists in the US tended to recognize the legitimacy of the social sciences, and respect their knowledge systems. They handed over the responsibility of communication to those who actually studied it, for they would know best how to engage with people.

Religion also came up as a concern. Scientists in the Philippines looked down on matters of faith as alien to science, while those in the US simply saw religion as another aspect of existence. One even said that to an extent, science was a religion: a scientist always had faith that those who had

performed prior work did so following the ethics and techniques of the field.

The stories of my dissertation also told me a story of diversity (Ponce de Leon, 2011). Science was not "the culture to end all cultures". Scientists were operating within societies that had molded them to adopt certain rituals and habits, that had taught them to value some things while discarding others, that had made them fully, truly human despite their best efforts to shed their emotions at the laboratory door.

Today, research into the views of scientists has allowed more scholars to examine the diverse cultures of science across the world, and how these science cultures interact with local cultures. Michael Schnegg's (2019) work, for instance, examined how Namibian scientists and local farmers differed in their understanding of the causes of rain. The study revealed that indigenous knowledge perceives the world as a system of irreducible moving parts, while Western science abstracts a phenomenon to its variables, and therefore articulates risks as variable-driven. John Durham Peters (2015) joined Schnegg in this regard, echoing Heidegger's assertion that a true appraisal of the world is that which acknowledges its entangled inability to be broken down into measurable constructs, and its melting of meaning into context and complexity. To Heidegger (as cited by Peters, 2015), a scientist could not truly see reality because technology and measurement were blinders rather than revealers of deep-seated truths. To insist on divorcing facts from context, to break down reality, to take a post-positivist approach (as it is called in the literature) is to espouse the colonizer's discourse (Peters, 2015). In such an approach, researchers assume that reality is filled with predictable patterns that should be measured and reported through numbers. Legitimate research under such a paradigm, therefore, values formulae and derived frameworks. This can lead researchers to believe that only they have a window into reality; that only those who are distant and objective have the power to determine how reality should be written about and represented; that only such people can be called experts – the way that colonizers defined the "other" as a savage to be "civilized" according to the standards of the West.

Despite its lack of presence in the public research sphere, my dissertation pushed me to unearth even more stories that had been imprisoned in the science-driven assumption that humanity was homogeneous and needed only scientific information to function. It also opened me to the notion that the dichotomy of scientist vs. non-scientist was an artificial divide that did justice to neither side. As there were many different scientists with varying levels of training, upbringing, and ancestry, so were there diverse cultures, psychologies, and lives that could feed into how people made sense of their lived environment. We are all both subject matter experts and yet not, my

research work said; we know only one part of the universe, and will forever struggle to measure that which might elude limited human senses.

I therefore needed to understand humanity first before imposing my understanding of communication.

## The pitfalls of misunderstanding science and risk communication

To discuss the theoretical and methodological choices I made as a researcher, I must first discuss the prevailing notion of science communication and risk communication as fields that merely act as handmaidens to the sciences themselves. In general, science communication is under-theorized (Baram-Tsabari & Lewenstein, 2017; Metcalfe, 2022), owing, perhaps, to its early beginnings as a means for expert scientists to present their research results to an audience in as effective and clear a manner as possible (Dohaney et al., 2016; Hebets, 2018) through the simplification and visualization of scientific reports (Aurbach et al., n. d.; Ruao & Silva, 2021). With the gift of information, scientists believed, people would be literate and therefore act based on information (Brown University Science Center, 2014; Ruao & Silva, 2021; Shivni et al., 2021). Risk communication, for its part, was often mathematically and rationally defined, where risks were deemed objective despite being embedded in democratic systems, and people were assumed to be homogeneous and predictable despite research demonstrating audience diversity (Chess et al., 1998; Stern, 1991).

Both these fields were hampered in their infancy by a lack of nuanced theories of human learning, memory, and decision-making. Though not explicitly stated, early science and risk communication research worked under the assumptions of a deficit model, and therefore employed the magic bullet/hypodermic needle theory – that is, people did not act correctly because they had no knowledge about a topic, and would therefore obey well-crafted information immediately, in predictable ways, regardless of individual identity or culture. Closely related to this are the very early models of Lasswell and colleagues (Griffin et al., 2023)including the ubiquitous, imagined-as-intuitive, but severely undertheorized Source-Channel-Message-Receiver model, which assumes that information simply passes from the source to the receiver with no feedback. Any interruption was laid under the general umbrella of "Noise," as though one's perceptions, culture, and abilities were bothersome flies to be swatted away by right-and-proper communication. Even the theories that came after, including Diffusion of Innovations, the Theory of Reasoned Action, and its descendant Theory of Planned Behavior, all assumed that human behavior and action were driven by rationality, could be broken down into variables that were measurable, and could be dictated once these variables were targeted (Griffin et al.,

2023). Once people were understood, the theories seemed to say, then a good message could be designed to move them as one willed and wanted.

More recent theory work, however, in science and risk communication and their allied fields, has provided both researchers and practitioners new opportunities for exploring and defining issues in communication. Culture, for example, has been explored as a driver of behavior (including its relation to science issues) in older models, such as those written by Mary Douglas and Aaron Wildavsky, or Margaret Mead (as cited in Ponce de Leon, 2011). More recently, Geert Hofstede's (2011) Cultural Dimensions theory provides a guide to examining differences among cultures and how these differences also mean different ways of communicating with such cultures. Hofstede's findings are based on surveys of various companies across the world, and show that a set of guideposts can allow for comparison across cultures: how cultures tolerate inequality, hierarchies, and power (the Power Distance index); how cultures value one's obligation to the growth of individual identity against the need to be part of a community, and, in so doing, sacrifice part of one's individuality (often referred to as Individualism vs. Collectivism, expanded through the work of Triandis); how culture deals with new situations and uncertainty through leaders and regulations (the Uncertainty Avoidance index); society's adherence to gendered roles and how these feed into the nature of effective leadership (Masculinity vs. Femininity); how culture views its time horizon (Long-Term Orientation vs. Short Term-Orientation); and how culture controls its impulses (Indulgence vs. Restraint). There is strong diversity among indices even for a particular culture, and even Hofstede acknowledged that the guideposts cannot capture individual experiences; to capture a deeper picture, a qualitative approach to explaining the data is best.

At the psychological, and local, level, Rogelia Pe-Pua and Elizabeth Marcelino (2000) elucidated Filipino psychology as a construct-in-progress that pushes for the growth of indigenous psychology, as explained and drawn from the experience of Filipinos rather than measured with both critique and stigma from the lenses of the West. This psychological approach holds no standards that the Filipino must meet; rather, it opens the research field to the idea that the Filipino is a blend of multiple cultures, such that doing research on the Filipino requires community work, where communities are given the space to speak their minds rather than be imposed upon with a set of questions that might lock them into answers that do not represent their local truths.

Today, science and risk communication research focus on publics that make meaning of science rather than act as mere recipients of information. Recent research shows that the many, diverse publics of risk do not

define risk based on information but a lack of personal control (Chess et al., 1988; Sandman, 2012; Sansom et al., 2021). Research, therefore, seeks to acknowledge the multidisciplinarity of both science and risk communication, incorporate culture and context, paint more detailed pictures of communities and their needs, and engage in community consultations that allow communities to take ownership of their solutions, rather than resort to merely measuring community characteristics and then providing communication materials as an antidote to researcher-identified problems (Abbot & Wilson, 2015; Campbell et al., 2020; Chess et al., 1988; Dohaney et al., 2016; MacArthur et al., 2020; Priest, 1995; Sansom et al., 2021; Shivni et al., 2021; Stern, 1991).

In the Philippines, however, both science and risk communication research are following a different trajectory. Science communication was first developed in the Philippine academe as a study of how to translate science for farming (Navarro & McKinnon, 2020; Samonte, 2021), hence the focus on science-for-the-people. However, the research has not moved past such a paradigm. Research today still relies on large-scale data, such as surveys, where people are examined as individuals in need of information, who can be asked questions derived from non-Filipino contexts (Casiño & Walag, 2020). Local science communication practice seems burdened by the notion that the field exists as a handmaiden to science: break down science or showcase its benefits, sometimes in massive information campaigns, sometimes in specific media channels and format, for public understanding and appreciation and to change people's perceptions, with scientists at the center of the message (Bunquin, 2020; Escano, 2013; Casiño & Walag, 2020; Samonte, 2021; Tababa et al., 2009). Scientists believe this as well, which might explain why they feel that information alone, delivered through one-way channels such as talks and social media, is necessary to make people take action (Navarro & McKinnon, 2020). As a result, science communication remains an afterthought in the research process, rather than an integrated activity (Samonte, 2021).

Researchers have referenced both scientists' sentiments and the World Values Survey, where, in the 2012 iteration, Filipinos agreed that it was not important for them to know science in their daily lives, but also agreed that science made life easier (Navarro & McKinnon, 2020). While some scientists might say that this would make people "allergic" to science, there is another way to interpret this apparent contradiction: it might mean that people are content with simply knowing that science is helping them, and see no obligation to find out more. It is not a lack of scientific knowledge, but a lack of curiosity.

Jon Benedik Bunquin (2020) pursued a similar tack in a study of science news articles in major Philippine newspapers. Through content analysis that examined readability based on language and sources used, Bunquin discerned that better written science articles could increase the visibility of science in the public domain. However, the articles analyzed were in English-language Philippine newspapers, and there was no accompanying study of actual readers perusing the articles and discussing what they understood. There was no empirical evidence that the badly-written articles had truly not been read, nor that the good ones had indeed facilitated learning.

While local research does show that facts alone cannot change behavior, and that the public has little interest in science (Escano, 2013; Navarro & Hautea, 2011), researchers persist in proposing marketing tactics by simply finding out what people want and then treating them as passive consumers (Casiño & Walag, 2020; Escano, 2013; Navarro & Hautea, 2011; Tababa et al., 2009).

Risk communication research has not fared any better. Like science communication research, research into risk communication in the Philippines leans heavily toward the assumption that scientific information alone is needed to elicit awareness about hazards, and that disseminating data packaged for lay understanding and decision making will solve risk management problems (Flores & Asuncion, 2020; Gomez & Cabilao-Valencia, 2015; Hartigan-Go, 2012; Ramos & Soliven, 2023; Stagen et al., 2022). Researchers have used surveys to study information awareness (Flores & Asuncion, 2020; Stagen et al., 2022) and media use (Ramos & Soliven, 2023; Stagen et al., 2022), and in general have concluded that people are misinformed, so that simply sending out information through media channels that people say they frequent will lead to scientific literacy.

Researchers have even talked to policymakers to get insights on how to effectively communicate information – but without asking the target audience themselves. In one such study, Mark Donald Renosa and colleagues (2022) talked to policymakers about the Dengvaxia scare and lessons learned from it. However, the study generated a story according to policymakers, and not the public's understanding of vaccination, which the researchers claimed. To arrive at a reliable measure of public understanding, the research should have conducted interviews with people who had encountered the issues in the press.

These local research studies in science and risk communication took for granted what is intuitively assumed to be aspects of communication: that information must pass from one office to the next; social media has to be used; received information from specific sources must be understood and acted upon. These assumptions have to be questioned: Is information

so objective that it passes hands without losing meaning? Does everyone indeed use social media, and in predictable ways? Does information truly lead to action?

There are a few studies, including mine, on local understanding and action of both science and risk, critiques of the media coverage of risk and science, assessment of the Philippine policy environment, and calls for culture, narratives, and local practices to be incorporated in risk communication projects (Asis et al., 2021; Barrameda & Barrameda, 2011; Cuaton & Su, 2020; Friedrich, 2020; Galeon & Gonzales-Flor, 2021; Pernia, 2021; Ponce de Leon, 2024, 2023a, 2023b, 2021a, 2021b, 2020a, 2020b; Ponce de Leon et al., 2019; Ponce de Leon & Gotangco, 2018; Ragragio, 2022; Robles & Ichinose, 2016; Rulloda et al., 2021; Samonte, 2021). Bunquin's (2020) work even criticized the local treatment of science issues and proposed a better understanding of newsroom routines. In addition, the 2021 issue of the local journal, *Philippines Communication Society's Review*, featured science communication pieces centered on the COVID-19 pandemic, but with a focus on critically examining the media, messaging, and communication rather than assuming the need for accurate information in health communication. The academe, too, is moving science and risk communication in the direction of holistic social sciences research, multi-way communication, and the recognition of indigenous knowledge systems (Ponce de Leon, 2024; Samonte, 2021)

Research on the Philippines has found that people can act in pro-social, pro-environmental ways without knowing the scientific basis of what they are doing (Cuaton Su, 2020; Friedrich, 2020), and that the media can portray science in ways that do not match its nature as practice, so that science is entangled in varying levels of politics and power (Gotangco & Ponce de Leon, 2018; Ponce de Leon et al., 2019;  Ragragio, 2022; Rulloda et al., 2021). These power structures give rise to struggles at the linguistic level, where scientific accuracy and local understanding often cannot come to a compromise when technical terms need to be explained (Friedrich, 2020); as well as at the governance level, as communities also have to contend with a government that values not indigenous knowledge (Cuaton & Su, 2020) but the indiscriminate use of social media and Western science instead (Cuaton & Su, 2020; Flores & Asuncion, 2020).

Various media channels also result in different risk communication situations. During the COVID pandemic, research on broadcast media messages showed that that risks were dwarfed by co-opted terms, such as resilience (Asis et al., 2021), and were imbued with political sentiment even as they appeared neutral (Rulloda et al., 2021). Meanwhile, research on social media users showed that people intentionally consumed information

online to have some knowledge on the pandemic, and that doing so alleviated their anxiety about COVID, but this still could not be translated into action (Galeon & Gonzales-Flor, 2021). Facts and fear tactics could not counter this anxiety; narratives that incorporated love and hope, however, were more salient (Pernia, 2021).

It was in this spirit of critically-grounded research, driven by a need to go beyond the constraints of surveys, pushed by a call for understanding communities on their own merits rather than on admonitions for obedience and compliance, and spurred by an inclusive model of science and risk communication, that I chose Stuart Hall's Encoding/Decoding Theory (1977, as cited in During, 1993; also cited in Aligwe et al., 2018) as a theory that would help me interrogate the notion of Filipinos simply being hard-headed, uneducated, or undisciplined when it came to dealing with natural hazards. Unlike previous communication theories that took for granted people's obedience to science, Encoding/Decoding describes a complex universe in which the cultures that surround people both allow them to create messages and interpret the messages they receive. Social forces can differ between those who craft and those who receive messages, and the first step is to acknowledge and accept the differences rather than problematize and seek to solve them by simply injecting knowledge. The next step is to study these differences critically, as products of socialization, norms, and ideology. Hall's theory prescribes no solution except to understand diverse groups on their own merits, to make no assumption about the power of a message no matter how masterfully created, and to expect that a public will act on a message in ways that the decoder does not expect (Demeritt & Nobert, 2014).

Encoding/Decoding would allow me to critique the Philippine government's focus on dissemination as the only means of communication for science and risk, as well as to criticize the top-down model of passing information from higher levels of government down to local levels. Such a theory would also allow me to address recent calls for understanding how people understand messages at the community and local levels (Friedrich, 2020; Lindell et al., 2017; Navarro & McKinnon, 2020; Priest, 1995) using methods that allow a community to speak its mind rather than force it to defend its lack of compliance (Pe-Pua & Protacio-Marcelino, 2000).

## Flooding risk studies: Marikina and Camarines Sur

My first major research project sought to examine flood risk communication, prompted by the rather vague, if not condescending, request by our government-based funding agency to find ways to improve evacuation warning dissemination. This request should come as no surprise, as even

researchers have forwarded dissemination as the most fool-proof way to convince people to evacuate. For example, simplifying scientific information, drilling people, and starting disaster education early (Baker, 1991; Cutter et al., 2015; Gomez and Cabilao-Valencia, 2015; Huang et al., 2016; Lindell, 2018; Norton et al., 2011; United Nations Office for Disaster Risk Reduction [UNISDR], 2015) are touted as methods for a population that is considered irrational and hard-headed, and acts on instinct regardless of the nature of the risk (Das, 2019; Demeritt & Nobert, 2014; Gomez & Cabilao-Valencia, 2015; Lindell et al., 2017; Priest, 1995). Rather than assume that people needed information to respond to flooding risks, my co-principal investigator and I critiqued the entire idea of simply providing information on floods to a ready and waiting population.

We chose Marikina and Bato, Camarines Sur as our locations for studying flood risk communication. Marikina was still learning from Ondoy, while Bato had long been used to floods. We used Hall's Encoding-Decoding Theory as a critical appraisal of the path of information from local government to citizens. We interviewed city risk management officials, barangay risk reduction officers, and media personnel in charge of conveying risk information. Then, we carried out focus group discussions with residents. We asked about how our participants understood flooding risks, communication materials, and what information had to be incorporated into communication materials for people to take action.

As we progressed through the interviews and group discussions, we came up against the message-centric model of risk communication (as espoused by a top-heavy risk reduction framework) clashing with residents' conceptions of risk and action as governed by their experiences.

In Marikina, city and barangay officials were preoccupied with ordering people what to do, and using science to do it (Gotangco & Ponce de Leon, 2018). They believed that simply feeding residents information would allow them to intuitively know how to act on the information. They believed in the power of posters, tarpaulins, and information materials that were rooted in scientific knowledge. Residents, however, ignored the materials because they knew that their local government would come knocking when the Marikina River threatened to overflow. Scientific information was not as important as being told by an elected official face-to-face that there was an impending threat of a flood and everyone had to leave.

Residents took on what sounded like a joyful tone as they recounted their evacuation experiences. The process of evacuation might have been difficult, but going to the center meant that they would meet friends, reconnect with neighbors, and even receive relief goods. True, it would be difficult to find space to sit or sleep, and it would be tedious to stand

in line for relief goods. But the evacuation center was also a place for a community to bond, for young people to talk. The participants appreciated how their barangay leaders would knock on their doors, be direct in their communication, and tell them to leave. Other means of communication such as Facebook posts were treated as warnings to be remembered later; knocks on the door and orders to leave were treated as orders to be followed as they were given. Within all these was a community thirsting, it seemed, for human interaction, whether with neighbors suffering the same inconveniences, or from local governments that felt closer during times of difficulty.

Marikina also practiced preemptive evacuation, and people were often pushed out of their houses long before a typhoon came—sometimes even before one could ascertain whether the typhoon would have any real, damaging effects on the city. This had also made people less attuned to the weather, desensitized to the nature of the risk that they faced constantly as a river valley.

Bato, Camarines Sur was an interesting location. People acknowledged the power of having science inform the warnings, but they also saw it as a foreign language being imposed upon their experiences. They tended to mix up wind and rain warnings, but they could remember what it felt like to be drenched with water, and they could remember what houses looked like after they had been toppled by strong winds. They called upon their experiences to help them read through warnings; so little attention was paid to the science even when their local government and trusted radio announcers all extolled scientific information as the be-all and end-all of the risk communication flow. Like the Marikina government, Bato local media and government believed that simply giving scientific information to people via Facebook, text, or radio announcements would make them evacuate.

Residents, however, called upon their experiences and referred to their contexts to help them understand the warnings. While they liked seeing scientific information written on the warnings, and while they remembered that their local government and radio announcers all sent scientific information, their concept of trust was different: they trusted their radio announcer because he was in the same location as they were, about to experience the same things that they did. However, they admitted that they could not understand what the wind speeds and water levels meant. They wanted to be given orders that were directly related to what they would expect to experience: would their houses be destroyed? Then residents would tie down the posts. Would coconut trees be felled? Then they would get out of the way and even cut down tall but weak trees.

The presence of scientific information lent an air of legitimacy, it appeared; but it was the presence and proximity of the messenger and message that elicited action.

Both of these locations show what much of previous research has spoken of as disaster sub-cultures (Das, 2019; Sharma et al., 2009). Every community has its own ways of dealing with disasters, and these have become part of the community's lexicon, culture, and bonding that allow it to face future disasters in specific ways. In the case of Marikina, they wanted in-person warnings, while in the case of Bato, they wanted contextualized warnings. And in both cases, science took a backseat to experience and perception, and it was these experiences and perceptions that needed to be described, detailed, and studied. It appeared that, indeed, both communities were the blend of East and West spoken of in Filipino Psychology (Pe-Pua & Protacio-Marcelino, 2000). The science of the West remains at the surface and is seen as a sign of knowledge to be trusted even as it is written in a foreign language, but it is the East's need for close-knit communities, its meaning-making of the proximal and contextualized, that is at the heart of action. Part of this context emerged, for instance, in Bato, where the participants wanted descriptions of the storm's impact on their locale and on familiar structures such as coconut trees and huts. Previous research in other locales already explored creating community-specific, impact-based warnings that were delivered in ways the community deemed most appropriate to their context – a technique that has spurred evacuation (Baker 1991; Casteel, 2018; Huang et al. 2016; Lindell 2018; Potter et al., 2018).

The funding agency ridiculed our recommendation of creating programs for local governments to connect directly with citizens and produce risk communication procedures attuned to community needs. They called it "too vague." They demanded posters that had better figures of scientific information, which they assumed would be enough for people to act, even when both Marikina and Bato were reticent in demanding local government presence and accountability. They demanded brochures and materials that simplified science, which they assumed was what people needed, even when both Marikina and Bato were insistent in demanding that they simply be told what to do.

To a naïve science communicator, the lack of need for scientific information might appear disturbing, because it seems that people were ignoring the calm of the rational for the chaos of the emotional. And yet there were no signs of chaos. Residents would go where they needed to go if they knew that their needs were being met; they would gather in an orderly fashion if they had been told by their local government that there was a great

risk for destruction if they remained where they were; they would address flood risks if they understood how it affected them at a personal level.

Such a setup required closer work between local governments and citizens rather than an overreliance on information that would be ignored or despised. To make more posters and brochures would not only increase our carbon footprint, but also add to the garbage already littering our streets and clogging our drainage systems. And to simply print science-based posters and brochures would be to disregard the empirical data that pointed to the need for communities to be listened to by their government. This is consistent with literature where researchers have advocated for risk communication-related activities that focus on local, meaningful participation and collaboration that value and include cultural practices in crafting communication strategies and enacting policies (Friedrich, 2020; Cuaton & Su, 2020).

We did not continue with the funding agency's bid to inject more money into more projects, as they were insistent on developing communication materials to be printed and posted. Instead, I took the lessons of the methods and theory that we applied in Marikina and Bato, and used them as the base for a new research project that criticized what were then popular, but misguided, conceptions about risk communication during Typhoon Haiyan.

## Haiyan and risk communication studies: Guiuan, Palo, Roxas, Camotes Islands, Coron

In late 2013, Typhoon Haiyan bore down on the eastern seaboard of the Philippines with meters-high storm surges and extremely strong winds, causing utter destruction. It came after over a week of warnings on national television, which told people to flee their homes, move out of the coastlines, and go to concrete evacuation centers. Despite days of constant warning, people stayed. Many died, and many are still missing (National Disaster Risk Reduction & Management Council [NDRRMC], 2014).

Haiyan swept through the country for days, obliterating towns and livelihoods. When the carnage was over, many people took to speculating on what had gone wrong. Research says that people were given templated messages and were not warned correctly. Others say, and in pedestrian fashion, that the term "storm surge" should simply have been translated into native languages so that people could understand and take action.

Once again, the government and the media assumed that simply disseminating information translated into local languages was enough to incite action (NDRRMC, 2014). This notion ignores local understandings of risk (Abbot & Wilson, 2015; Taddei, 2013), previous experience and indigenous knowledge (Gomez & Cabilao-Valencia, 2015), trust networks

(Baker, 1991; Huang et al., 2016; Lindell, 2018), perceived impacts of the storm (Dow & Cutter, 2000; Huang et al., 2016), the unique needs and contexts of a community (Taddei, 2013), and the culture of the community itself (Barrameda & Barrameda, 2011; Das, 2019; Lindell, 2018; Lindell et al., 2017; Sharma et al., 2009; Walch, 2018).

Super typhoon Haiyan was a fertile case for investigating risk communication and disaster management. However, research largely approached the problem from a deficit perspective, and assumed that the problem was the lack of understanding of the science behind storm surges, the inability to understand English-language warnings, and the dearth of disaster training (Esteban et al., 2015; Gomez & Cabilao-Valencia, 2015; Jibiki et al., 2016; Leelawat et al., 2014; Lejano et al., 2016; Montemayor & Custodio, 2014; NDRRMC, 2014; The World Bank, 2016). Some research, though sparse, did examine social networks, trust factors, and governance and how they aided in disaster recovery (Robles & Ichinose, 2016; Walch, 2018). And yet there persisted the notion that there were magic formulae to invoke and recipes to follow to make people do better in coming disasters, rather than the idea of examining communities on their own merits and for their respective culture's way of dealing with harsh, changing environments.

It was a critical appraisal of these assumptions that carried me through my study of five municipalities that were damaged, in varying degrees, by Typhoon Haiyan: Guiuan, the point of the typhoon's first entry, where it carried its maximum speed over water (Ponce de Leon, 2020a); Palo, one of the cities most devastated by storm surges (Ponce de Leon, 2020b); the Camotes Islands, where the award-winning purok system of San Francisco town supposedly had a 100% Haiyan survival rate (Ponce de leon, 2021a); Roxas, which sustained severe agricultural and fisheries damage, wiping out much of its sources of livelihood (Ponce de Leon, 2023b); and Coron, the last municipality to experience Haiyan before the storm's exit, and a resort town that had hardly experienced strong storms (Ponce de Leon, 2021b).

I used the same framework and methods of the flood risk communication study, but this time, my co-principal investigator and I looked at two different barangays in each town: a población, or inland barangay, which would be closer to aid and farther from the coastlines; and a coastal barangay, which would be closer to the devastated areas but farther from aid and government. We traveled to each location, spoke to local leaders and risk managers, then to locally elected officials and citizens, always noting how the message passed from the templates of the national to the ears of the local.

In general, we found that the message was oral and far removed from the colorful maps that depicted the cone of uncertainty, water volume, and wind speeds of a passing storm. The message was often relayed as one of

direct action, stripped of descriptions of the storm that would entail using numbers, and invoked a visual representation of what a storm could do. It could topple houses, break down concrete structures, uproot trees, throw whole tricycles or trucks into the air. The floods could sweep away wooden buildings, drag people helplessly, reach as high as a house's roof. The surges could go up to the few floors of City Hall, unlike the storm surges of Manila Bay, which simply inundated the basement of a nearby hotel.

In Guiuan, the población barangay said that the storm surge should have been called a tsunami. While they knew the difference between a tsunami and a storm surge, the storm surge that appeared looked like a tsunami to them. At the moment of risk, there was no consideration of scientific cause, only how the magnitude of a hazard could prompt immediate, appropriate action. And no translation was needed then, for to say "daluyong" was to put people to sleep.

Guiuan's coastal barangay had its own ways of coping with storms. When Haiyan came, people knew that they had to dig six-foot-deep holes and cover themselves with tarpaulins; or they had to search for the caves where their ancestors had taken refuge from previous typhoons. There was no appraisal of scientific information. There was an indigenous brand of knowledge that knew where winds blew based on the feel on fishermen's skin, that knew where a storm would go based on how the winds stirred the trees.

In Palo, the población barangay completely ignored scientific language in the warnings that were handed down to them. They were angry at both the local and national governments, because they expected a government that had experience with frequent, violent storms to have measures in place to ensure that people were properly evacuated, given relief goods, and generally kept safe. The discussion erupted into sobbing because everything fell apart during Haiyan: people were turned away from evacuation centers, they had to loot supermarkets for food. They were completely ruined because the local government had prepared nothing and made no effort at reparation. They blamed the deaths on the government, so that any warning that came later was either ignored or scoffed at. While their local leaders continued to advocate for more posters and other warnings filled with details about a storm, residents simply wanted to be told exactly where to go and what relief goods they would receive. They ignored any other information. Palo's coastal barangay talked about evacuation, not so much about the science in the warnings but the difficulty of making people move. They looked to animals as indicators of a coming hazard. Pigs and dogs fled their holds, which convinced people to run to the evacuation center.

In San Francisco, Camotes, the población barangay showed off their climate change action plans and the organized community gardens. But they could not articulate why storms were the way they were, nor why evacuation was necessary sometimes but always. Residents obeyed the purok system that subdivided their barangays and believed in its power to save them, even when they had no idea what was going on.

The same alienation was present in Camotes' coastal barangay. They did not invoke their knowledge of the sea's behavior, nor of the winds' influence upon it. Rather, residents spoke of who told what to whom, who would evacuate where, what people had to do when a storm warning came. They knew only of the process imposed on them, but not the reasons for engaging in such a process.

Roxas City grew from its experience with Haiyan. In the población barangay, local counselors started work on multi-story concrete evacuation centers, and constantly pushed science to local leaders as a source of facts. These were only part of the decision-making process, for local leaders liked to engage in consultations with residents on what had to be done. Residents, for their part, would watch the news about a hazard, then convene and decide who needed to bring what, and where to go.

In Roxas' coastal barangay, residents were afraid of their leader, who threatened them with expulsion if they did not obey her evacuation orders. They simply obeyed, though they could speak, to some extent, of how the seas behaved during a storm. They did not require a translation to know what a storm surge was, and, for they had always seen the sea swelling when a typhoon barreled into their town.

Coron had never experienced violent typhoons and was not prepared for Haiyan. Its residents simply listened to the news, thinking that all the issued warnings would apply to any other town besides theirs. Then, the power in Tacloban went out, and all the news thereafter became rumor. Rumor, however, was enough for the población barangay to start gathering people and evacuating them. They learned that they needed to listen to warnings that something dangerous was on its way. Haiyan tested and honed a community storm response system that had hitherto only been on paper: after the chaos of evacuation and relief goods, the people of the población knew when and where to evacuate in each subsequent storm, sometimes to the point that they were at the evacuation center long before their barangay officials arrived.

Coron's coastal barangay was far less proactive, though residents could say what a storm surge was and what the sea looked like when a great storm was arriving. The barangay, however, relied too much on city hall to tell

them what to do, and to hand over relief goods. Very little action was taken based on what the barangay already knew.

In all these sites, science was a tool foisted by those in power upon those who had none; and those who had none responded by either ignoring what the science described, and going ahead with what they needed to do, or waiting in place because their local government had always promised them relief goods. In every Haiyan-affected locale, there were people who appraised risk through different filters: relying on experience that told them a coming storm was to be no different from the previous one, or that it was to be one they had never experienced before so they need to get out of harm's way; ignoring scientific information because it did not match their immediate environment, or because they needed orders rather than facts that they had no desire to assess during an emergency; waiting for relief goods that made them resigned to their situation, waiting for news or instructions rather than striving to understand the risks they were facing,

In all these situations, I understood more deeply the previous research into Haiyan (Esteban et al., 2015; Gomez & Cabilao-Valencia, 2015; Jibiki et al., 2016; Leelawat et al., 2014; Lejano et al., 2016; Montemayor & Custodio, 2014; NDRRMC, 2014). A single, Hofstede-derived index could not possibly encapsulate all of the varied communities. In some cases, residents wanted to simply be told what to do by the powers that be. But in the Coron población, the local population took matters into their hands and did not wait for orders; not when the future promised more storms that had hitherto been unfamiliar. In some cases, disasters were a certainty, and were met head on. In Roxas and Camotes, there was no sense in being accustomed to disasters, so the locals got ready and did not leave anything to uncertainty. There, too, was a Filipino psychology emerging (Pe-Pua & Protacio-Marcelino, 2000), one that accepted the scientific explanation of a disaster, but listened and obeyed to the local, the near, the seen, and the experienced.

What the Haiyan research taught me was that I had been blind to stories that went beyond the assertion that facts alone mattered in situations of great risk. I had unknowingly built myself up as a researcher of great rationality, praising the systematic approach of the sciences into which I had been socialized. In so doing, I had contributed to the oppression of those whose stories disappeared behind the assumptions often made of the poor, the marginalized, and the vulnerable: that they simply needed to be given more money and better houses, that they were simple-minded and knew nothing about the world and had to be spoken to as though they were infants, that they were people whose lack of knowledge automatically translated to a need for knowledge alone.

This was something that haunted me as I wrote a final paper (Ponce de Leon, 2024) that examined the country's almost absent articulations of the wind in its disaster lexicon. It was present in PAGASA's warnings and almost always echoed by news outlets as signal numbers, but it was not spoken about as extensively in our research. People would talk about water, flooding, inundation, but in our research, winds, destructive as they were, were reduced to signals that would later be misinterpreted as warnings on how fierce the rains could be.

At first, I spoke of this absence as a crutch that defined my country's blindness to its environment. Later, however, following a workshop and more readings, I learned that the wind is not absent; it is embedded in our understanding of flooding risks. It cannot be reduced to wind or water, it is always enveloped in the strong floods or dangerous storm surges. We are not a people that analyzes the elements of nature; we appreciate their melding, their flows, their fluidity. We are a blend of East and West, situated in the many in-betweens of cultural dimensions that statistics attempt to neatly lay out, shaped by complications and complexities that science forces us to break down into elements that do not represent our reality.

What we need is not some scientific guru to pound sense into us; what we need is a true science that listens.

## Discussion

Both risk and science communication have been misconstrued in both research and practice as fields that convey simplified scientific information for people to take action. While research in other countries has begun to explore local understandings of science and risk, local research persists in assuming that a knowledge deficit is at fault for our science and risk-related woes. I have long struggled to dispel notions of a straightforward approach to communicating science and risk, and I have worked within the frame of worldviews (Hatch, 2002), or paradigms that drive research and also influence the practice of communication (Ponce de Leon & Gotangco, 2018).

Post-positivism sees the world as full of patterns that can be measured through objective means and reported through numbers that help researchers articulate generalizations. In such a model, quantitative research is held in high regard. At its most extreme, post-positivist work prizes the perspective of the distant, objective researcher. He is the one who does not live the hazard in everyday existence, the one whose pattern-focused lens can parse the world into variables.

Such an approach disregards the validity and truth of those who experience the hazard – Heidegger, Deleuze, and Guattari would perhaps

even go so far as to call it "violence." The indiscriminate use of post-positivist tenets would logically lead to a government's preoccupation with giving people expert-derived materials based on scientific knowledge as a solution to community problems. This violence, this colonization of indigenous knowledge, was most poignantly seen in my work in the Camotes Islands, where old knowledge of the sea's habits disappeared into the reminder that people must obey their government, and listen to the science that was imposed on them through a *purok* system that supposedly valued community power.

There are other ways of seeing reality, documenting it, and therefore communicating. The critical paradigm regards the world as full of patterns as seen through the ideological lenses characteristic of all human, researchers included. Knowledge of an environment, then, does not rest on an isolated scientist's objective assessments, but in the articulation of problems from the point of view of those who experience the problem directly. This objectivity, as spoken of by Sandra Harding (1995), precludes a brand of communication that allows people to speak of their problems and find their own solutions, rather than having these solutions foisted upon them. In lieu of what might be a public lecture or an advertisement for the post-positivists, critical researchers and practitioners might conduct workshops that will allow affected groups to articulate their problems and formulate solutions (and recruit scientists, but only if they so choose).

Constructivism makes no conclusions on the objectivity or patterns of the world, and instead looks at the structures that humans craft to make sense of their lived environment. There is no assumption of a universal truth, but one that is created in the moment, that captures an experience for a specific group. In such a model, communication is discussion-based – maybe among different communities experiencing a similar problem, or among scientists and communities in mixed groups – so that all parties can come to a common understanding of the problem and then cooperate on a solution.

In these three different worldviews, there are different options for science and risk communication. The key is not to assume that knowledge is missing, and that injecting more knowledge into the public will solve the problem. Rather, there is a need to understand what exactly a community needs, and then work on research that addresses that need. Is it knowledge? Or a means to empower the community to solve long-standing and deeply rooted problems? Or a venue to meet with other subject-matter experts to see different perspectives?

In all these cases, research is needed: quantitative if one needs generalizations, qualitative if one needs deep insights; framework-driven

theories for post-positivist work, Marxist-rooted ones for critical work, interpretivist ones for constructivist work; and compassion for people, whose stories must be listened to rather than wished away by some insipid assumption of "if only they knew." This research, as advocates of Filipino psychology will tell us (Pe-Pua & Protacio-Marcelino, 2000) should allow communities to tell their story rather than coerce them to examine their mistakes as defined by people other than themselves.

However, if government, media, and research persist in framing the public as ignorant non-experts in need of information, then there will be no end to the campaigns to correct this supposed ignorance, nor to the research that rests on unquestioned assumptions of science and risk communication (Friedrich, 2020). If there is no venue that welcomes contrarian research, no government agency that funds a project other than dissemination, then a preoccupation with knowledge, rather than what it means, where, and for whom will persist.

My studies have shown that knowledge is not the single driver of action, and therefore cannot simply be pushed *ad nauseam* to communities in languages and modalities that they ignore. This assumption has been prevalent in many government offices that I interviewed in my research: prioritizing information dissemination by designing posters or crafting Facebook messages, especially in the local governments of Marikina, Bato, Palo, and Roxas; populating announcements with scientific information, as advocated by the local governments of Guiuan, Coron, and Camotes; gathering data to design communication materials while ignoring studies that already stated the futility of such an enterprise, as in the auditor who reviewed our research work on Marikina and Bato.

Had the local governments sat in my chair as facilitator, they would have encountered communities seeking the faces and voices of their officials: Marikina residents asking for a government to stop with its posters and start knocking on doors, Bato residents regarding science as a veneer but requiring the presence of its government, Guiuan residents taking pride in how their local officials always efficiently organized evacuation by personally talking to people, Palo residents placing so much hope in a government that supposedly had been through the same storms, Camotes residents boasting about their close social ties, Roxas residents showcasing their close community discussions, Coron residents awakened out of their indifference to create a system of community evacuation. Even when residents spoke of simply waiting for relief goods, or taking no initiative to leave unless told by their government, I could sense that they had waited for someone to personally tell them that they would soon experience a dangerous hazard and it was best to get out of the way. There was hardly any space to force-

feed people scientific information. Instead, they wanted a government that spoke to them, that walked with them, that they trusted because they knew that the government walked the same ground that they did. My findings echo what Thomas Friedrich (2020) and Christian Jaycee Samonte (2021) advocated: we first need to understand who people are, instead of working on making them understand science.

## Conclusion

When I first entered science communication as a practitioner, I turned up my nose at the idea that we needed to tell stories. As a novelist, I believe that to tell stories is to create worlds, invent plots, craft whole people into being. But in my youth, I saw stories as only fictions anathema to the so-called factual world of science. As I slowly became more acquainted with the field and attuned to my own interests and the trajectory of what would be my career, I realized that stories are what we use to make sense of the world.

Stories are present in the laboratory: there is a story of searching, the shaping of a concrete question, the formulation of a process that is as systematic as it is elegant in answering the question, the analysis that allows the scientist to look through the lens of near invisibility to see a truth that others have yet to see.

Stories are present in the social sciences: there is a story of becoming, where a researcher once so convinced of the infallibility of objective facts finds her assumptions challenged by a cold plunge into the social sciences - and where a budding social scientist gasps in scholarly amazement when once again placed in the presence of scientists who are unaware of the limits and assumptions upon which their fields are built.

Stories are present in everyday life: the father who casts his net out to sea hoping to catch fish in an ocean surrounded by invaders, the mother who walks to and from work every day in the blistering heat because she cannot afford to be late if she relies on public transportation, the old man who looks upon the country and sees hope in its youth, the youth that look upon the country and feel their hearts wither at the prospect of a government that puts politics before the public good.

In all these stories, the bench and social sciences intermingle and cannot be separated from each other as we make sense of how to solve social ills. The fisherman is affected by climate change as well as by years of colonization that have pushed urbanization to the forefront at the expense of underdeveloped rural areas. The mother grapples with a variety of illnesses from her exposure to the elements and is part of a labor force that is unduly compensated in an economy designed to make the rich richer. The old man suffers from sicknesses due to his age, and has perceptions shaped by

decades of socialization and human interaction. The youth contend with a rapidly degrading environment even as they brace for how their perceptions are to be formed by the coming years.

In all these contexts, there are stories that must be heard rather than problematized. While the fisherman's tale is shared by many other fishermen who work in our seas, his tale is unique to his location and age. While the mother is a representative of the many mothers who toil in our cities, she, too, carries her own accounts of a life in a specific place and time. While the old man represents other senior citizens, his unique trajectory is his alone. And while the jaded youth might stand for many others in their age group, there is merit, too, in listening to the young crying out against injustice.

While there is much that unites us, there, too, is much that sets people apart without dividing them. We can appreciate how poverty and lack of sustainable livelihood is a problem for all fisherfolk, while also listening to how one fisherman's account of his struggles in the West Philippine Sea are changing the way he does his work. We can appreciate how all women are represented in their marginalization in one mother who struggles to work, while listening to her story of how, despite her lungs having been damaged by pollution, she soldiers on. We can appreciate how those in their twilight years have bright wisdom to share, while we listen to one old man talk with hope of a government that must serve its people. We can shake our heads at the sometimes distressing nonchalance of youth in the face of problems while still listening to one young person speak up against a tide of silence.

This individuality is something I missed in the bench sciences, where I was told that the truth could be found only in the majority, and where my task was to cater to the middle of the bell curve while explaining the presence of outliers. In my new field, I can appreciate both the generalizations and the stories, and what are often called "concrete universals," or the themes generated from smaller stories that actually tell great truths.

This pursuit of concrete universals has influenced my choice of research. There is little merit in finding out how much people know about science, because in their lives complicated by the daily measures and ways of living they could have forgotten why the mitochondria are the powerhouses of the cell. Their forgetfulness is not so much deliberate as it is the consequence of greater priorities and more pressing tasks that call for action rooted in intuition rather than thinking through knowledge. Their lack of knowledge is not a disadvantage, but an oppression that can be reversed when we talk to them directly instead of assuming that throwing more knowledge at them will change how they deal with science-related issues.

I have been implicitly reprimanded for my views. A person whom I once considered a mentor told me that taking science communication

for my PhD made no sense: I knew so little of the science, so how could I communicate it? I recognize now that this was no malicious response to my dream of telling the stories of science, but was a manifestation of how the scientific ethos relies so much on knowledge, worships its presence and objectivity, and assumes its superiority. It was a way for my mentor to tell me that in the language of science, having no knowledge was akin to death. It was a way for science to tell me that the social sciences had to work within the assumptions of the bench sciences, namely the objectivity of knowledge, the distant scientist, the information deficit in those who do not act as predicted. These assumptions are repeatedly propagated in the literature, in phrases like "science must serve the people" or "only factual information should be communicated" or "we simply need to disseminate the facts in the quickest way possible." Such assumptions, aside from promulgating the perception of an information deficit, also perpetuate the image of a rational science clashing with an irrational world; and of lone scientists serving the needs of a waiting, ignorant population. No wonder research in science and risk communication has progressed so slowly in a country so rich in culture, language, and history, and so beset by hazards. Research in science and risk communication must now learn how to question the world and its assumptions. It must learn to listen first.

Even as it looks back on my research, this paper also positions itself within research in the Philippines and, by extension, the Global South. It joins a critique of mass media that has been subject to the whims of sponsors and pulls of political rage (Rulloda et al., 2021), has overglorified or misrepresented terms that are consequential to meaning making in our chaotic times (Asis et al., 2021; Ponce de Leon et al., 2019), and has written stories of science that might be complete in their reporting but obscure and unengaging to their readers (Bunquin, 2020). This paper joins a condemnation of a top-down brand of science and risk communication that is employed so heavily by government in a country rich with indigenous knowledge and experience (Barrameda & Barrameda, 2011; Gomez & Cabilao-Valencia, 2015). It joins the call for acknowledging the uncertain nature of science itself (Ponce de Leon et al., 2019; Samonte, 2021), for bench scientists to be humble in their work and to be partners with the social sciences. It joins the plea to recognize the diversity of our many publics (Chess et al., 1998; Friedrich, 2020; Priest, 1995; Stern, 1991) by incorporating culture and narratives into science and risk communication (Cuaton & Su, 2020; Galeon & Gonzales-Flor, 2021; Pernia, 2021), going beyond surveys and second-hand anecdotes, and truly sitting down with communities to listen to their voices, in their context, and on their own terms (Pe-Pua & Marcelino, 2000). It contributes to theory by providing a

communication lens to sociological and psychological work in the social sciences (Hostede, 2011; Pe-Pua & Marcelino, 2000) by proposing that we must first understand how people construct science and risk. We can do this by examining their narratives: how they construct reality, science, and valid knowledge; how they know what they know, how they acknowledge that which they do not; how they construct the environment in which they are placed, and how they believe greater forces like governance, legislation, and regulation work. We cannot assume that people are misinformed, and will move predictably once educated. We cannot lay the burden on the level of the individual, for individuals cannot move in a faulty infrastructure.

In the social sciences, knowledge is but a piece of a greater story, of the fisherfolk and the working women and the grandfathers and the students – and humanity, in general. There is history, social pressure, individual psychology, economics, culture. There is a story richer than an assumption of knowledge and knowing, and it must be unearthed, examined, and told. Without this, we are at risk of communicating mere words.

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