4 INTEGRATING INFRASTRUCTURES

I learned what trouble the infrastructure for early warning could be in an ordinary meeting of high-level administrators at CIRES headquarters. The popular smartphone app SkyAlert issued an earthquake early warning out of the blue. In the meeting room, smartphones around the room buzzed as people texted to let us know that they had received warnings. Elsewhere, thousands of people in Mexico City rushed out of buildingss and into the streets.[1] The speakers mounted on the walls around us remained silent, though. We were all usually prepared to take an earthquake early warning seriously, but this one did not add up. If there had truly been an earthquake sweeping inland from the west coast of Mexico that day, detected and analyzed by SASMEX stations, the building would have resounded with *¡alerta sísmica!*

Since we did not hear the distinctive warble, we remained seated, certain that we were in no immediate danger. No matter what the apps on our phones said, or what text messages we received, we were confident that no earthquake had been detected ripping out of the subduction zone to the west or the faults deep under the mountains to the south. After all, at that time, SASMEX, administered from the very building we were sitting in, had the only network of seismic stations that could provide early warnings to Mexico City.[2] There was nowhere else a real warning could come from, if it was not coming from CIRES instruments.

As it happened, we were right to be skeptical. As seconds passed, the silty, seismically sensitive soil below us remained still. Soon enough, we could put words around what had happened: a misfire. At 12:16:54 p.m. on July 28, 2014, a popular smartphone app called SkyAlert had issued a

false alert. If there had truly been an earthquake that day, the SkyAlert app's warnings would have joined a chorus of alarms echoing across Mexico City. SASMEX's broadcast would have triggered howling sirens throughout CIRES headquarters and in hundreds of other buildings around Mexico City and other user communities. While there were not yet sirens on street corners in 2014, radio and television stations would have blared warnings, too. If the earthquake in question had indeed whipped out from the Pacific coast, where the false alert suggested, we would have had around one minute between when the sirens began blaring and when the comparatively slow seismic waves began to reach us, plenty of time to get to a safer place than the second floor of a converted residential building.[3]

Although none of us at CIRES evacuated in response to the SkyAlert warning, the meeting room I was sitting in soon emptied. The two dozen engineers, technicians, and administrators present for the meeting abandoned their weekly agenda. They went to work, instead, on managing the effects of the misfire event. Mexico City's population was living not only with earthquakes but also with multiple forms of earthquake early warning, and SkyAlert reached over a million people who had subscribed to earthquake early warnings via its app.

Later, company representatives at SkyAlert helped me understand what had been happening at their headquarters when the false alert was triggered. The team showed me the signal they had received from CIRES on July 28. The message in question had appeared to the SkyAlert system as all signals from CIRES do: as a series of alphanumeric characters indicating the date, time, and nature of the message.[4] They showed me on a computer screen how the series of characters in the test message, the kind that they and the other organizations receiving CIRES alerts multiple times each day, had been garbled—letters in the alphabet replaced by @ signs to show an absence of information (see figure 4.1). The SkyAlert system extrapolated from what it had, though, and it found a pattern. This particular message had ordered its code for date and time in such a way that, with the changeable interference of city life, SkyAlert's system was able to register the message it received as an earthquake early warning. This is the genesis of the SkyAlert false alert: simple bad luck. There was no protocol for SkyAlert to confirm receipt of a message from CIRES or make sure that their system had interpreted it correctly, so the app automatically pushed a warning to client smartphones. In

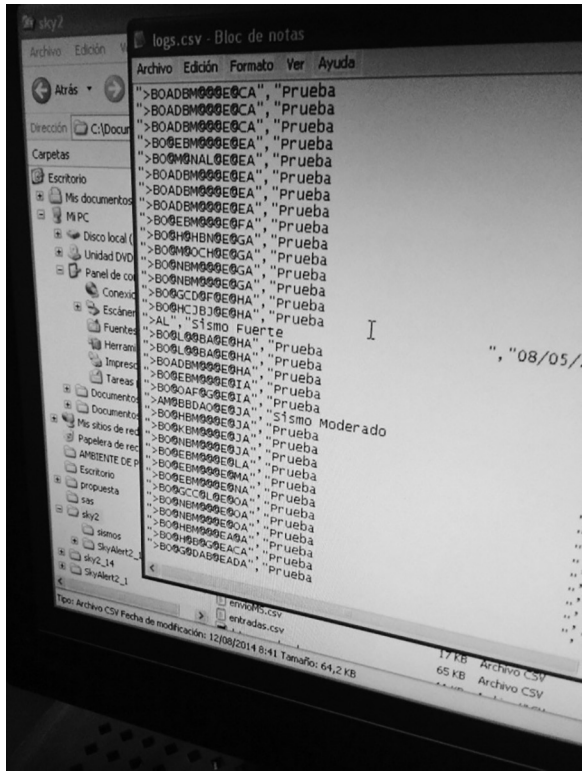


FIGURE 4.1
A record of CIRES signals interpreted by SkyAlert's system. *Source*: Author (2014).

a complicated situation, they explained, a simple technical error and a lack of coordinated confirmation procedures made the misfire.

Such a neat technical explanation belies more complex conditions of possibility. I heard few arguments that that this kind of event was simply an unfortunate part of life with earthquakes and earthquake early warning systems. Instead, many experts in the disaster risk mitigation community, authorities, and Mexico City residents treated the false alert as far more than a technical glitch to be marked, analyzed, and repaired. It was a serious problem, disturbing to the technical experts involved. They were deeply concerned that people who lost faith in earthquake early warnings would not respond effectively to hearing them in the future. Some told me that early warnings were

designed to save lives, and that could only happen if people were willing to trust them. Events like this were worrisome indeed.

Advocates explained their worries about false alerts in terms of a "crying wolf" effect.[5] In the weeks after the incident, people at CIRES and elsewhere told me that the misfire could not only jeopardize trust in earthquake early warning, and consequently impede response to subsequent alerts about real threats, but it could also have consequences for any project of earthquake early warning in Mexico. They worried that the misfire would undermine any effort related to earthquake early warning—whether operated by SkyAlert, CIRES, or other agencies. The maintenance of the earthquake early warning system required ongoing investment, whether in the form of app purchases or contracts with the governing bodies of user communities. Additionally, this was not the first time that an early warning app had misfired. It was not even the first false alert propagated by an app while I lived in Mexico City. The frequency of hiccups in the integration of different systems was alarming to the engineers responsible for making early earthquake warning work.[6]

In this chapter, I show how engineers shoulder the burden of making what many assume to be integrated infrastructure functions. The SkyAlert misfire stands as an indicator of just how challenging it is to maintain multiple communication channels in the context of a semi-articulated system. Common principles in emergency communications suggest that sending a warning through multiple channels is an important technique to reach different publics. These principles, however, often disregard the context of the system that actually propagates the warnings. Here, diverse channels of communication come along with confounding conditions. Technology development at CIRES and SkyAlert were siloed and structured by competing priorities about public risk management, and this created conditions for incompatibilities. By describing the misfire in 2014 and the responses of technoscientific professionals at CIRES and SkyAlert, I demonstrate how semi-integrated infrastructures form the basis of conflict. I then turn to a rumor of sabotage that I encountered shortly after the misfire. While I found no evidence that this rumor was true, its mere existence is important to note. The rumor's elements shed light on the misfire and, more broadly, on what happens when channels for warning communication multiply. This single controversial event reflects many challenges related to developing a system to support new ways of engaging with earthquakes.

A PARADOX OF PROLIFERATING CHANNELS

The SkyAlert app was different from anything offered by CIRES in 2014. While CIRES, a state-funded NGO, broadcast general alerts using radio signals to companies, schools, and TV and radio stations, SkyAlert was a for-profit company and pushed personalized messages to the smartphones of subscribers through wireless data connections. Although both were run primarily by engineers, they could reach people in different situations and appealed to different populations. These differences are, theoretically at least, a good thing; they could reach a broader audience together than either could alone, and if people received both, the warnings could reinforce messaging.

Emergency communication scholars suggest that good alert messages should generally be consistent, clear, and offer guidance. It should, moreover, come from sources considered credible by anyone who is meant to use information provided.[7] When populations receiving emergency messaging are diverse, content must be suitable for many different needs. It should come to people through appropriate means, ideally from multiple sources, and should be followed up with communication that explains the event in more detail.[8]

Engaging and supporting multiple modes of alerting has the potential to create tension, though. This tension has marked the development of the semi-integrated infrastructural system in which CIRES, SkyAlert, and other agencies develop and distribute early earthquake alerts to Mexican people. In practice, the distinction between a consistent message that has been modified for diverse people and an inconsistent message is muddy. Some might even see the same earthquake event described in different ways—perhaps in intensity by one channel and magnitude by another, or projected to reach different magnitudes at their source or intensities as experienced—and consequently be confused.

For alerting authorities, the potential for others to adopt warning tools that do something significantly different from their established practice is real and worrisome. This issue is not limited to Mexico. In California, for example, Los Angeles mayor Eric Garcetti's choice to lower the threshold for ShakeAlert earthquake early warnings was met with consternation from emergency managers who wanted communication to be clear and consistent throughout their system.[9] Contests over messaging become further complicated when private technology vendors get involved. When warning channels proliferate, some providers may seek to expand their user base

by undermining others' work in a competition for limited attention and money.[10]

While warning channels may compete, many people do not have significant choices about what system they use. Earthquake early warning systems are rarely either technologically or conceptually straightforward. In Mexico, most people have not historically received warnings directly from SASMEX. For many years, warnings went out primarily via television and radio, making access dependent on whether people were listening to broadcast media at the moment an earthquake began. Apps do the same work as intermediaries between CIRES and people at risk of earthquakes. Smartphone use is high in Mexico and growing fast.[11] Around one-quarter of people in the nation (or more, depending on use practices) had access to smartphones in 2014, when the false alert happened. More recent reports put that number at approximately two-thirds.[12] This trend has offered a new point of access to a warning signal already broadcast publicly in the seconds, or sometimes minutes, before earthquakes strike some major metropolitan areas. Because relatively few Mexicans living in these cities had access to the specialized radio receivers located in schools, hospitals, and television studios, apps like SkyAlert could fill an important gap and have plenty of potential customers.

Of various smartphone apps doing earthquake early warning, SkyAlert was among the most successful. As of 2014, the app had over a million paid subscribers and a substantial social media presence. For $3.99 USD, users could interact with the clean, active interface on their smartphone screens to learn about earthquakes and extreme weather events. They might also receive recent news items and shortcuts to Mexican emergency services numbers, elegant against a geometric orange and black branded background. When the misfire happened, SkyAlert was still only just beginning to build the utilities that the app offers today.[13] At every opportunity, though, SkyAlert's developers had already found ways to differentiate their project from that of CIRES.

SILOED DEVELOPMENT OF WARNING TECHNOLOGIES

SkyAlert began as a project of SkyTel, a prominent name in the Mexican telecommunications industry since the late 1980s. SkyAlert's founder, Alejandro Cantú, the son of the SkyTel CEO, had trained as an industrial engineer at prestigious Iberoamericana University. The family company's reputation

and financial support bankrolled the new project's development. Only two years before I began my fieldwork, outside investors had helped SkyAlert became a fully independent company with ambitious plans to take processing to the cloud, build a seismic sensor network independent of CIRES, and allow users to choose the warnings that they would receive. The SkyAlert app was only one of SkyAlert's products, but it was core to the company's vision for transforming emergency communications in Mexico.

When SkyAlert came on the scene, CIRES had been operating an earthquake warning system entailing robust accelerography, data analysis, telecommunications, and broadcast to communities across Mexico for more than two decades. SkyAlert launched its app as a tool that received messages broadcast by CIRES, supplemented with data from its own small but growing seismic network, and pushed warnings to users. However, the app was designed less to build out the SASMEX system than to make something wholly new. The SkyAlert team may have identified an opportunity in relation to what CIRES was doing, but they developed their technology largely independently of CIRES. This allowed SkyAlert and Cantú, now the CEO of the new company, to build an app that relied on very different logics than the public earthquake early warning system did.

The priorities that informed the SkyAlert app's development were sharply distinct from those of the SASMEX system it interfaced with. One basic conflict stemmed from the different ways that SkyAlert and CIRES understood the people who might benefit from warnings. SkyAlert considered users to be individual people. SkyAlert's app offered users ways of being intimately and immediately engaged with earthquake warnings. Users could, for instance, choose to test to see if their device was connected to the SkyAlert system with the press of a button. The smartphone format offered users greater flexibility and more information, allowing them to customize their messaging and learn more about an earthquake. This was markedly different from the CIRES mode of alerting: a siren howl with little detailed information, broadcast to anyone and everyone at once.

I learned about these differences at CIRES and my understanding of their importance grew more nuanced when I visited SkyAlert's offices in Iztacalco, on the east side of Mexico City. SkyAlert's space was smaller than CIRES's, had accumulated less equipment, and boasted fewer people moving about. I went to tour the office on a rainy day in August, just a month after the misfire. I heard about novel plans under way to develop new earthquake

early warning functionalities, a sharp contrast to CIRES's efforts to simplify and standardize earthquake communication. The messages that SASMEX broadcasts are coded to indicate where a quake originated, whether an earthquake detected is worth alerting, and, if so, whether it is likely to be of moderate or strong intensity. Its sirens, however, can do one of two things: go off or stay silent. Cantú himself explained how different his company's approach was from the public earthquake early warning system simply, saying, "It's not about me *deciding*. We're providing information, we're providing them with things they want to know."[14] His goal was to offer options and information, not just alerts.

Taking a coffee break, Cantú introduced me to a few engineers on his team. They were full of enthusiasm for the project. The app, one explained, was a self-conscious exercise in Mexican innovation. Another described it as revolutionary. Then-president Enrique Peña Nieto's government was already actively reorienting the Mexican state agenda around digital innovation, and these engineers told me that they saw SkyAlert as part of a national movement.[15] This point of contrast was as meaningful from CIRES's perspective as it was from SkyAlert's. CIRES had institutionalized processes of incremental system development, and insightful engineer Antonio Duran even explained to me, very seriously, that "if it is obsolete, then it works," was one of the key principles or, in his words, "laws," of CIRES.[16] New technology might be unreliable, but CIRES engineers and technicians could be confident in older technology and in their ability to make repairs if something did go wrong. This axiom was not conducive to the kinds of digital innovations that excited Cantú and his team. Where SkyAlert was self-consciously innovative, CIRES relied on old, well-vetted technologies and procedures. Where SkyAlert pushed notifications to individuals, CIRES broadcast to populations. Consequently, it was no surprise to me that the organizations' products were similar but distinctive. Nor was it a surprise that they only coordinated their work when necessary. The misfire, however, showed the trouble that could occur at their interface.

Scholars of infrastructure have long insisted that no matter how concrete or organized they seem, we must remember that systems are changeable and contingent. Sociologist Susan Leigh Star famously argued that while infrastructures like the system by which CIRES signals were broadcast to SkyAlert certainly appear easy to ignore until they break down, there are

people who never assume a system will work: those responsible for its maintenance.[17] The challenge of integrating CIRES's signals with smartphone apps complicates the idea that infrastructure is either working and invisible, or broken and salient. Certainly, the misfire was an emergency that commanded international attention, moving the technoscientists working at CIRES and SkyAlert to take quick action. The breakdown forced CIRES and SkyAlert engineers to consider aspects of their respective systems that they typically took for granted, and further required that they explain them to publics who had very little sense (if any) of how earthquake early warning worked and how the various warning channels were related. And yet, it would be a mistake to say that earthquake early warning infrastructure worked smoothly before the misfire; indeed, integrating multiple channels of warning delivery makes the very idea of "working" seamlessly and smoothly an elusive if not an impossible goal. Instead, in a complex system of related networks, the practices and priorities that connect an organization like SkyAlert to one like CIRES are constantly on the verge of potential breakdown as they react to internal and external conditions.[18]

Anthropologist Brian Larkin has defined infrastructures as "things and also the relation between things"—a broad definition to say the least.[19] Nonetheless, this definition is a particularly useful way of thinking about how infrastructures work. It suggests that the system that broke down on July 28, 2014, is both a topic for inquiry in and of itself and an incident through which to consider the shifting, changeable relationships between different early warning systems. Proliferating channels for disseminating warnings offer the promise of supporting emergency communication, but without means to regulate how they interact with one another, their existence may come at the expense of the mutual trust and coherent processes that a flexible and integrated warning system requires.

RESPONDING TO A MISFIRE

How can channels for emergency communication that are so different and so incompletely integrated co-exist, each asking people to trust them to signal oncoming earthquakes? After the SkyAlert misfire, CIRES and SkyAlert had to negotiate their relationship, and determine what publics they sought to serve—including those who were already making #NoEraSismo

(#ThatWasNoQuake) trend on Twitter and talking about how things may have gone wrong.

As soon it became evident that the SkyAlert app had sounded a warning for a quake that was not coming, the CIRES team leapt into action. They began by investigating the extent of the misfire. They picked up their phones, showing each other tweets and messages they had received. Some began making calls to policy makers, emergency managers, and representatives with other organizations focused on public safety around the city. News of the false alarm was circulating widely.

The meeting table emptied as people broke off into various conversations and errands. CIRES had never encouraged the companies that now promised to disseminate their early warnings via apps; most of their engineers regarded smartphone notifications with skepticism, at best. But how had the misfire happened? When had the device that SkyAlert used to receive and process coded CIRES signals last been serviced? People checked their records and debated how to respond. The usual scene at CIRES offices included dozens of people, some sitting at their desks and others moving between departments, talking to their peers and collaborators; but now everyone seemed to be moving at once, and with purpose. Some continued with ordinary projects, certainly, but many set aside the tasks that they had planned for the day. Even though the erroneous message had come from SkyAlert, SASMEX was not in the clear. "They're going to say it was our equipment that failed," one man told his colleagues, concerned about the CIRES system's reputation.

At 12:51 p.m., less than an hour after the misfire, SkyAlert's representatives publicly declared that the app had responded automatically to a message from CIRES's system. Their tweet was soon quoted in many popular news outlets: "Our platform received a seismic activation by CIRES, we are investigating the causes."[20] Several of the senior CIRES administrators went to the Public Outreach Department to work on a response. This department was based in a small room ringed with desks and computers. The CIRES leaders crowded around the software engineer who managed CIRES's social media accounts. Today, the stakes of the organization's online presence were higher than usual. Together, the senior administrators composed careful messages, dictating to their junior colleague as she typed and posted them on social media to deny any culpability.

CIRES needed to distance itself from SkyAlert to make people understand that the misfire was not the organization's responsibility nor an opportunity to indict earthquake early warning in general. The CIRES team was concerned that any fault the public attributed to CIRES would have implications for the entire system. The organization could lose credibility with people who should respond to warnings, and CIRES might lose contracts with the governments that enabled its work. CIRES, a nonprofit, funded the maintenance and expansion of the entire earthquake early warning system through annual contracts with user communities. These contracts meant the system's on-going viability was never certain and was subject to the changing sentiments of policy makers. If CIRES lost contracts, then the municipalities of Mexico City, Oaxaca, Chilpancingo, Acapulco, Puebla, or Morelia might stop broadcasting earthquake early warnings to their residents through SASMEX. They mounted a spirited social media response to defend the system's reliability.[21] To do so, they not only addressed the misfire, but also called the SkyAlert app's ordinary function into question. I watched their messages post live from a screen a few feet away.

"The #SkyAlert #SkyAlertApp is not well-integrated," the CIRES accounts on Twitter and Facebook proclaimed. "Lags have already been identified. They do not disseminate the alert simultaneously to their subscribers."[22] The wording that they had chosen referred to both SkyAlert's ordinary processes and priorities as well as the misfire itself. This issue—"lags" as opposed to "simultaneity"—invoked a long-standing topic of some concern to CIRES's engineers. Lags are moments of jarring disjuncture between various temporal operations.[23] SkyAlert's data indicated that the false alert reached less than half of the 1.5 million smartphones with the app in the first five seconds, and had still not reached all of them after 15 seconds.[24] One subscriber's phone might have jangled with an alert in time to take shelter, while her neighbor might not have received the message until after the time of the predicted earthquake had passed.[25] For the technical experts at CIRES who understood reliability to be key to effective early warning, SkyAlert's lags alone made the product unreliable and therefore a reason to distance themselves.

Lags, like false alerts, presented more than a reputational problem, CIRES engineers explained. Lags could generate confusion. People who receive delayed messages might expect a new earthquake event that would never arrive, thereby reducing trust and future willingness to respond. Lags were

antithetical to the kind of early warning that the CIRES team wanted to provide, but the proliferation of smartphones had facilitated new forms of interaction with earthquake early warnings that CIRES could not easily regulate. The integration with smartphones destabilized the principles of early warning that SASMEX was built around. Smartphone apps could give warnings to people who were far from radios, televisions, or dedicated emergency signal receivers,[26] but they were unreliable. While the lag was a considerable concern, there were more simple ways smartphones might fail to warn people—if they ran out of batteries, were placed far away, if in-app alarms were somehow silenced by other phone settings, or if they simply had patchy data connections.[27] Even so, these potential pitfalls did not dim SkyAlert representatives' enthusiasm for disseminating warnings through smartphones.

SkyAlert's leadership did, however, recognize misfires as a concern. On my visit to the business's headquarters in the autumn of 2014, I heard that the misfire was bad for business and public safety. If people lost confidence in SkyAlert's app service, they could stop subscribing. While SkyAlert was working with government organizations, they were not as closely involved in a public, state-supported project as their CIRES counterparts were. SkyAlert and CIRES representatives all spoke with me, as they did in other public messaging, about civic responsibility. Both groups, like the people at the conference with which chapter 3 opens, referred to the opportunity to save lives when they discussed their projects' promises.[28]

For all that they used a similar language that referred to high stakes, SkyAlert engineers measured their success differently than CIRES engineers did. Cantú told me that whatever the lag in SkyAlert's system, it was worth it. He thought that SkyAlert was crucial part of Mexico's earthquake early warning infrastructure. He explained that his system had recorded 92 percent of all users receiving messages and opening their apps within fifteen seconds of the misfire. If nothing else, he argued, this had been an opportunity to see how the system worked. He did the math for me. If they had 1.5 million users, a 92 percent response rate would mean alerting more than 1.38 million people. That was excellent, to his mind. "I'd rather alert 1.3 million people than three hundred thousand," he said, comparing the fraction of SkyAlert users who got the false alert to a much lower number that he imagined the CIRES broadcast could reach without the help of apps like his. Rather than trying to create a lag-free experience, Cantú argued that

it was his obligation simply to put earthquake early warning into as many hands as possible.[29]

CIRES and SkyAlert's responses to the misfire demonstrate how siloed system development can provide the basis for divergent understandings of earthquake risk mitigation. As it happened, Mexico City government authorities supported CIRES and called for sanctions of SkyAlert,[30] but both organizations were able to continue their work. The question of managing the margins of the systems, where different alerting priorities and system processes made miscommunications possible, remained neglected. While people I interviewed at SkyAlert and CIRES focused on the conceptual and technical distinctions between the two systems that they had observed, other commenters hypothesized about actions that these differences might inspire.

MAKING SENSE OF MISFIRE

After recriminations from Mexico City's leadership, SkyAlert soon formally and publicly accepted culpability for the misfire. The company's official account tweeted "We offer sincere apologies for this unfortunate incident."[31] For some, the issue was still unsettled, though. A few people professionally invested in earthquake risk mitigation continued to discuss the incident and its effects. The explanation advanced earlier in this chapter, which presented the false alert as the product of bad luck, was insufficient for them. These people continued to think through the case in light of what they knew of CIRES, SkyAlert, the relationship between the two organizations, and Mexico.

Some suggested that the misfire had not been a technical malfunction at all, but rather a strategic act of sabotage on the part of the CIRES team to discredit SkyAlert. I was surprised to hear technoscientists who were active and respected in the earthquake early warning community discussing this theory. However, several spoke with me about this in serious tones. "I think that this could have been a huge coincidence," one man admitted; but, he continued, "It could have been something very evil."[32]

This man, who I will not describe further here, put his concerns plainly. He was, however, not alone in suggesting that CIRES might have intentionally caused the 2014 misfire to discredit SkyAlert. There were others like him—professionals who were skeptical of how SASMEX operated. CIRES engineers, their theory went, might have intentionally composed and sent

the message that caused the SkyAlert system to issue its false alert. For those who voiced this conspiracy theory, the misfire itself was a sign of human action. They understood it as an effort on the part of the CIRES team to manage the infrastructures of earthquake early warning; to control who could participate and how. If SkyAlert lost the precious trust of users, then the company might shift its focus away from its app and stop generating this kind of push-notice alert. In that case, CIRES would have fewer rivals challenging their model of alerting and reduce the semi-integrated systems troubling their efforts to keep early warnings trustworthy and simultaneous.[33]

When I first encountered the theory that the 2014 misfire might have been sabotage, I struggled to make sense of it in the context of everything I knew about the CIRES team's worries about muddled emergency messages. First, sabotage would be logistically difficult to pull off reliably—was I to understand that these saboteurs imagined a potentially troublesome coded test message, and then waited for both the date and time for it to be pertinent and the right unpredictable circumstances of interference to confuse things, and then when it did, acted out an emergency? It seemed unlikely that anyone at CIRES could pull all that off, even if only a few people were in on the conspiracy. Few actions at CIRES were taken without the approval of the NGO's leadership, and the leaders I saw during the misfire event did not look to me like people whose elaborate scheme had come to fruition. Beyond that, though, I sincerely doubted that the people I had met at CIRES would ever consider it possible to damage SkyAlert's reputation without harming that of earthquake early warning itself. Many people at CIRES had spoken with me at length about how few members of the public could really understand SASMEX or distinguish between CIRES and SkyAlert. My ethnographic research corroborated their sense of popular earthquake early warning awareness: of the Mexican residents I have spoken to since 2011 who have no connection with seismic risk management, only a handful have been able to clearly articulate the distinctions between the systems. Members of the CIRES team had also voiced deep concerns about "crying wolf" effects to me during my time with them. Their concerns that people could lose faith in early warning, combined with their awareness of just how much CIRES and SkyAlert were elided in popular imagination, made me very skeptical of the conspiracy theory.

The more mundane explanation, which I offer at the begining of this chapter, takes the incident as an utterly ordinary product of under-integrated system lacking confirmation procedures. It was insufficient for some. In the weeks and even years since, I have been called upon to tell the story of the interrupted CIRES meeting multiple times. People involved in disaster risk mitigation have been especially interested in hearing how leading figures at CIRES reacted to the news. My observations about their surprise, the distinctions between technological goals of CIRES and SkyAlert, and jagged interfaces between the two systems have not always persuaded skeptics of the CIRES team's innocence. For all that my research demonstrated the limitations and inconsistencies of Mexican state support for CIRES's earthquake early warning system, critics still considered CIRES "insiders" with special connections and influence over matters of public safety. To them, an act of intentional sabotage represented just one more instance of corrupt Mexican elite technoscientists allied with the state trying to maintain their privileged status, exclude outsiders, and undermine approaches to alerting that differed from their own.

Although I find the sabotage story unbelievable in and of itself, the fact of its existence is important to note. Most crucial to this case, when people engage in speculation about corruption, they showcase underlying ideas and attitudes.[34] This theory and its persistence should not only be considered in relation to empirical events—that is, as a potentially factual or false claim—but rather, it should be understood to signal efforts to think about the necessarily social nature of technology.

When people suggest that CIRES engineers sabotaged SkyAlert, they do so in the context of a long and well-documented history of the power that elite technical experts have in Mexico.[35] They can obtain political favor, which in turn can mean influence over policy decisions large and small. Some political maneuvers are obvious to astute Mexican publics, and others are less so. Nonetheless, many simply assume that such activities are happening even in the absence of evidence.[36] They are the topic of rumor, or *chisme*. Anthropologist Claudio Lomnitz has described *chisme* as a key part of "alternative communicative relationships" as necessary to Mexican political life, crucial for navigating a complex and secretive world.[37] When playing upon political relationships is considered crucial to maintaining the support of policy makers, it is little wonder that the sabotage theory found such traction.

Talking conspiracy like this means putting social relationships at the center of conversations that are otherwise focused on technologies alone—and as I have shown elsewhere in this book, attempts to bracket off technologies from the social and environmental world lead to limited and unsatisfactory analysis. The motivation that conspiracy theorists who spoke to me offered to explain the sabotage they proposed was the CIRES's interest in controlling the systems involved with earthquake early warning. The theory, however dubious, addresses the complexity of operating an earthquake early warning system. Its very existence highlights the frustrations of infrastructure integration that often fall out of more narrow accounts of risk mitigation technology.

SILOED EFFORTS CONTINUE

Well-established principles of emergency communication suggest that it's better to have more ways to get an emergency warning—more "channels"—than it is to have fewer. A warning system benefits from multiple ways to reach people. More channels means reaching more people or reinforcing a message's power by making sure that a person can encounter it multiple times, in different ways. In practice, however, the divergences between channels, both technical and conceptual, create new problems. SkyAlert is a different channel than a television broadcast, so theoretically it should be valuable. However, the engineers at CIRES worried that SkyAlert's negative impact on public trust for earthquake early warning would outweigh the benefit of having an additional channel. Without adequate public education efforts or coordinated messaging, multiple communication channels seemed dangerous for warning efficacy rather than advantageous.

Technologies, and infrastructures, change. Mexico's public system started to broadcast through radio, then began setting off sirens. Integrating mobile technologies has become increasingly important as use proliferates, and new technologies mean new partnerships. Regardless of the tools or partners involved, systems of emergency communication are always emergent. Like any other form of infrastructure, their state is in flux. They may break down or misfire, potentially producing confusion. Reflecting on these incidents allows us to consider how technological systems can be both deeply related and siloed.

At CIRES headquarters and outside its walls, people told me that they were concerned that in a real earthquake they would be slow to take cover or evacuate if they doubted the veracity of an alert. On Twitter and Facebook, commenters also focused on shorter-term consequences of the incident for their technologically mediated relations to the seismic environment. People berated SkyAlert and earthquake early warning technologies in general for scaring them; for creating a panic that might itself be dangerous to their health and well-being. These comments may have been deployed hyperbolically, but they did display concern regarding the effects that a false alarm, and an earthquake that had not happened, could still have.

In these conversations, commenters put the onus of successful warning almost entirely on technical experts and their separate, siloed efforts. This was an impossible task in the face of inevitable breakdowns. Perhaps technoscientists *could* integrate their technologies and work together to support new ways for people to live with earthquakes, but the misfire and events that followed it demonstrated just how radical a change in approach to early warning would have to be.

Since 2014, SASMEX's infrastructure has grown to include public sirens. SkyAlert has limited its involvement with the public system, developing a private network of 120 low-cost sensors to generate information about oncoming earthquakes rather than relying on CIRES's more sophisticated equipment and its public broadcasts.[38] While SkyAlert's efforts promote earthquake early warning broadly, they are now even less integrated into a coherent infrastructure with CIRES than they were when I was doing fieldwork. While this reduces the chance of a misfire of the sort that happened in 2014, it also reduces the opportunity for any sort of consistency in alerting publics that may be confused by the two now-parallel systems, which promote warnings about the same earthquakes in very different ways. Recent earthquakes and ongoing seismic activity in Mexico have made further growth of both CIRES and SkyAlert's earthquake early warning infrastructure possible. Between them, more people have access to emergency messaging. However, no matter how these infrastructures change, siloed efforts may mean that similar challenges will remain.

This is a section of doi:10.7551/mitpress/14328.001.0001

¡Alerta!

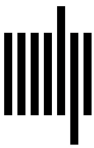
Engineering on Shaky Ground

By: Elizabeth Reddy

Citation:

¡Alerta!: Engineering on Shaky Ground
By: Elizabeth Reddy
DOI: 10.7551/mitpress/14328.001.0001
ISBN (electronic): 9780262374385
Publisher: The MIT Press
Published: 2023

The open access edition of this book was made possible by generous funding and support from MIT Press Direct to Open



The MIT Press

The MIT Press would like to thank the anonymous peer reviewers who provided comments on drafts of this book. The generous work of academic experts is essential for establishing the authority and quality of our publications. We acknowledge with gratitude the contributions of these otherwise uncredited readers.

This book was set in Stone Serif and Stone Sans by Westchester Publishing Services.

Library of Congress Cataloging-in-Publication Data

Names: Reddy, Elizabeth, author.
Title: ¡Alerta! : engineering on shaky ground / Elizabeth Reddy.
Description: Cambridge, Massachusetts : The MIT Press, [2023] | Series: Engineering studies | Includes bibliographical references and index.
Identifiers: LCCN 2022029552 (print) | LCCN 2022029553 (ebook) | ISBN 9780262545518 (paperback) | ISBN 9780262374378 (epub) | ISBN 9780262374385 (pdf)
Subjects: LCSH: Earthquake prediction—Mexico—History. | Environmental monitoring—Mexico—History.
Classification: LCC QE538.8 .R43 2023 (print) | LCC QE538.8 (ebook) | DDC 551.220972—dc23/eng20221028
LC record available at https://lccn.loc.gov/2022029552
LC ebook record available at https://lccn.loc.gov/2022029553