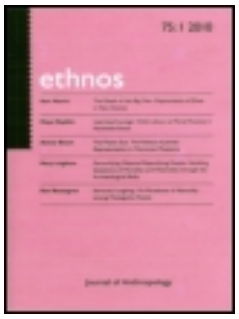

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Crying 'Crying Wolf': How Misfires and Mexican Engineering Expertise are Made Meaningful

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ABSTRACT
On 28 July 2014, a smartphone app warned Mexicans of an earthquake that never came. Engineers took this misfire seriously, concerned that it might have a 'cry wolf' effect. They were concerned that people could lose confidence in the early warning system and then, the next time that alerts sounded before one of Mexico's frequent and violent earthquakes, people might fail to take potentially life-saving action. In this article, I argue that these responses to the misfire reveal cries of 'crying wolf' as enactments and explorations of particular forms of responsibility integral to Mexican engineering subjectivities.

KEYWORDS: Mexico; earthquake early warning; misfire; infrastructure; engineering;

Introduction

Just after noon on 28 July 2014, thousands of people in Mexico City rushed out of buildings and into the streets, expecting an earthquake. None of the participants at the event I was observing that afternoon was among them, however. I was sitting in on an ordinary meeting of high-level administrators at the Centro de Instrumentación y Registro Sísmico, or CIRES, the NGO that built and maintains Mexico's public earthquake early warning system. Speakers mounted on the walls around us remained silent. Because we did not hear the Sistema Alerta Sísmica Mexicano's distinctive warbling warning, we stayed seated around the conference table, comfortable in the knowledge that no earthquake had ripped out of the subduction zone to the west or the faults deep under the mountains to the south. The silty, seismically sensitive soil below us remained still. It was not long after the thousands evacuated when concerned texts and phone calls began to flood in.

A false alert had been issued at 12:16:54 pm by a popular smartphone app called Sky-Alert. The app, operated by a private company, was not under the control of CIRES engineers and operated without their technical support.[1] Nonetheless, its misfire was worrisome to the people in the room with me because of what it might entail for

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earthquake early warning as a project and for Mexicans at risk. Engineers' responses to this event demonstrate the complex expert commitments to public safety.

Although none of us at CIRES evacuated for safety's sake, the meeting room soon began to empty. The two dozen engineers and administrators who had been gathered there with me abandoned their weekly meeting's agenda and went to work, instead, on mitigating the potential for what they called a 'cry wolf' effect. 'Crying wolf' or, in Spanish 'gritar que viene el lobo', references a fable attributed to Aesop that is often called 'The Boy Who Cried Wolf'. Here, when a boy tasked with guarding sheep warns his community about a wolf that doesn't exist, he loses credibility. A wolf finally arrives, though, and he loses his sheep, and, in some versions, his life.[2] When false alerts like the SkyAlert misfire jeopardise trust in the person or mechanism that issues them and consequently impede response to subsequent alerts about real threats, they have 'cried wolf'.

SkyAlert's misfire had reached over one million subscribers. If there had truly been an earthquake sweeping inland from the west coast of Mexico that day, more would have received the warning, because the smartphone app would not have been alone in sounding the alarm. The Sistema Alerta Sísmica Mexicano's broadcast would have triggered SkyAlert and also started sirens howling throughout the meeting room and in hundreds of other buildings around Mexico City. Radio and television stations would have blared alarms, too. The Sistema Alerta Sísmica Mexicano's network of field stations can detect earthquakes and trigger these alarms more than one minute before most earthquakes can reach Mexico City. That only allows people seconds to prepare for a coming quake,[3] and these seconds could easily be lost to disbelief or indecision. Those of us sitting around the conference table at CIRES headquarters would have evacuated. We would have had plenty of time to get to a safer place than the second floor of a converted residential building.[4]

My analysis of this event is informed by 17 months of ethnographic and archival research undertaken between 2011 and 2017.[5] Throughout this time, I was primarily based in Mexico City, conducting research on how experts and authorities approached earthquakes and earthquake risk management; for 10 of those months, I was embedded in CIRES offices. In conjunction with observing ordinary and extraordinary work, I conducted interviews with engineers, policymakers, emergency managers, academics, entrepreneurs, and others who are invested in seismicity.[6] These methods and research sites allow me to interrogate engineering expertise and related practices.

The earthquake early warnings that publics in Mexico City encounter are the product of partially-integrated infrastructures that can be challenging for laypeople to parse.[7] The technologies that spread these warnings may be considered, alternately, crucial to the system or mere users of the warnings that the core Sistema Alerta Sísmica Mexicano generates. I learned that 'cry wolf' effects are a matter of particular and explicit worry for engineers involved with earthquake early warning in Mexico.

Despite the best efforts of engineers like those who work at CIRES and SkyAlert, infrastructural failures are never out of the ordinary (a point that has been explored by Larkin 2008; Kockelman 2010; Anand 2017, and others). These failures can be consequential: breakdowns can make infrastructures obvious and even important to those

who might ordinarily take them for granted (Bowker & Star 1999; Star 1999). In this article, I consider the SkyAlert misfire as it emerged in the context of, and then had consequences in, the social and material world. This approach is in keeping with Jensen and Morita's recent call to take infrastructures as '*open-ended experimental systems*' (2017: 617; emphasis theirs), that is, to engage with what infrastructures (and their failures) make possible or evident in new ways.

I argue that experts' responses to the misfire reveal cries of 'crying wolf' as enactments and explorations of particular forms of care and agency. Here, I attend to expertise not in terms of the knowledge it requires, but the subjectivities it entails and creates. Doing so, I contribute to a lively and critical scholarly conversation about how engineers understand their roles in society and the practical effects that these understandings can have (for example, Wisnioski 2012; Ottinger 2013). My analysis of engineering expertise is informed by work in feminist science and technology studies which addresses what Donna Haraway has called a 'praxis of care and response' (2012: 302; see also Puig de la Bellacasa 2017). This praxis is sometimes described as a matter of 'response-ability', or the paired obligation and capability to take action. By considering the SkyAlert misfire in relation to these issues, I illuminate Mexican engineers' expertise in ways that research focused on political structures (as in Adler Lomnitz 1982; Camp 1985) or ideologies of power (Wolf 1998; Ferry 2003) cannot.

In what follows, I address both 'cry wolf' effects and Mexican engineering subjectivities at greater length. I show how the infrastructures of earthquake early warning in Mexico have developed in the context of changing communication technologies and political conditions. Then, I return to the story with which I began the article to address engineers' responses to the SkyAlert misfire and how, in its aftermath, 'cry wolf' effects became a significant concern.

Misfire and Meaning-making

'Crying wolf' can only happen when a false alert is interpreted, not as an accident, but as an indication of unreliability. A 'cry wolf' effect may begin with a state of full public trust in emergency communication and good faith efforts to respond to alerts, but that trust and good faith willl be shown to be finite. A failed alert can make a future warning fail in new ways, the logic goes, even when earthquake registration, analysis, and warning communication are handled perfectly. People may hear a siren, and the siren may be related to an oncoming earthquake, but if they do not trust an alert, they will not act. If people do not act then the effort to warn them has failed.

What the SkyAlert app did on 28 July 2014 very much in keeping with philosopher J. L. Austin's definition of a misfire – that is, a communicative effort to bring about a certain response which fails for reasons including, for example, being made under the wrong conditions. Austin's work on performativity builds on the key insight that a number of circumstances need to be fulfilled in order for an action like warning people of an oncoming earthquake to be successful. These pertain to conventions, participants and conditions, the execution of the procedure in question, and correct actions

and responses (1975: 14–15). For Austin, misfire is a way of thinking about ordinary 'infelicities' which interfere with these conditions and, consequently, the efficacy of a performative action.

The social consequences of false alerts have been a topic of significant research, too. 'Cry wolf' effects have been found in controlled settings (as in Breznitz 1984; LeClerc & Joslyn 2015), but are inconsistent outside of them. Developing broad conclusions about the effects of false alerts for populations at risk has been troublesome (Barnes *et al.* 2007). The same events that produce 'cry wolf' effects for some actually encourage others to increase their efforts to prepare for an event (Tierney 1993; Atwood & Major 1998 documented this in their work on the effects of the Ibn Browning false earthquake prediction). 'Cry wolf' effects may be deeply context-dependent and far from certain, but they are an issue of powerful concern for Mexican engineers responsible for earthquake risk management technologies.

These engineers' interest in public wellbeing is not incidental. Not only have engineers been integral to state developmentalist agendas throughout the nineteenth and twentieth century (see Fortes & Adler Lomnitz 1994; Ramos Lara & Rodríguez Benítez 2007; Bazant 2014), but Mexican engineering education routinely frames the discipline as a means to support nationalist projects for public good. As Juan Lucena suggests, Mexican engineers have been, and are, often explicitly taught to consider their expert identity in relation to the project of building and serving the Mexican nation and its people (see Lucena 2007).

Concern for public applications of technoscience are by no means unique to this Mexican community – after all, Collins and Evans have described expertise itself as a matter of 'decision-making at those points where science and technology intersect with the political domain because the issues are of visible relevance to the public' (2002: 236). Nonetheless, histories and narratives that relate technical efforts to the common good have powerful implications for the way we can understand Mexican engineering. These concerns not only animate Mexican engineering discourse, but have particular consequences for practice when infrastructures that have direct implications for public wellbeing are at stake.

Mexican engineers have a position of obligation and ability for public safety. Feminist science and technology studies scholarship on 'response-ability' is particularly helpful for thinking about what that means. Work on 'response-ability' draws attention to the relationship between having the capacity to take some action and feeling an obligation to do so (see, for example, Haraway 2008; 2012, as well as Hayward 2010; Schrader 2010; Martin *et al.* 2015). Attention to these issues allows me to consider and analyze the ways that Mexican engineers enact their expertise through both agency and care. When these experts care about public wellbeing and take steps to reduce threats – or are understood to do so – this is not only a personal matter. Instead, should be understood as an integral, and complex, aspect of their professional identity.

The engineers I study have been explicit about how their responsibility for public wellbeing informs and is performed through their earthquake early warning work. Lives could depend on a well-executed and reliable alert, I have often been told. It is their job to make sure the system works and that people are able to trust it.

However, while these experts may understand their roles in terms of obligation to safeguard public welfare and the ability to do so, their work is also subject to significant critique. Their work may be interpreted in different ways, and be understood to do harm as well as, or instead of, good. In the context of Mexico's national legacy of corruption and public fascination with it (for example, see Lomnitz 1992; 1995), it would be a surprise if the engineers involved in earthquake early warning were universally trusted. Diverse effects and interpretations do not make it any less important to consider how engineers' responsibility functions as a form of ethical practice, though. Feminist science and technology scholar Michelle Murphy recently reminded her readers of a Foucaldian insight that remains important: 'the exercise of power operates through care' (2015: 719, see also Gupta 2012). Care like this is not simple, and must be interrogated with respect to its material and symbolic attributes and effects.

While early warning systems are certainly sites where politics of anticipation (see Choi 2015) or of inquiry and identification (see Farías 2014) emerge, their misfires also provide opportunities to consider expert forms of responsibility. As Michel Callon reminds us, misfires are essentially productive. They can 'spawn issues, matters of concern' that then inform 'controversies over the nature of relations between that which is delegated a domain and that which remains outside of it' (2010: 165). Indeed, the SkyAlert misfire was not only an opportunity for engineers to take responsibility of a public at risk, but also opened space for them to debate and explore what that might mean.

The Wolf is Coming

In the past century there have been forty-one earthquakes generated along Mexico's Pacific coast or in its mountainous interior that were measured at magnitude 7 or greater and fully capable of causing moderate to heavy damage to the built environment. Three of them have been at or above magnitude 8, exponentially larger and more threatening (USGS 2018). Hundreds of thousands of people have been displaced, and nearly 500 lives were lost to earthquakes in 2017 alone.[8] Mexican engineers worry that experiences with a misfire might diminish the credibility of alerts that will eventually sound in advance of very real hazard – a 'wolf' that is, inevitably, coming.

Earthquakes threaten human safety and projects in relation to the amount of energy that they release, their hypocentres or origin points, the soil conditions directly under populations at risk, and physical resonance factors in the built environment. Almost 33 million people around Mexico – accounting for more than a quarter of the nation's population – live in places that are not only unstable, but also designated as particularly high-risk sites due to frequent temblors both small and large (CENAPRED 2018).

The nation's capitol megalopolis, Mexico City, is especially sensitive to seismic action. Situated on a high plateau, over 7,000 feet above sea level, it is circled by flows of lava, volcanic rocks, and ash laid down over the last 66 million years. The conditions produced in lava flow, fine floating ash, and urban growth frame present-day Mexico City's uncommon sensitivity to seismic motion. The city was built on tremendously shaky ground. In 1985, an earthquake from the western coast of the nation killed

more than 6000 people and injured over 100,000.[9] Perhaps 250,000 were left homeless (see Dynes *et al.* 1990). Mexico City's sensitivity, along with its wealth, its population, and the way that its builders sidestep the city's rigorous structural regulations has made it a focus for the development of early warning technology. It was in Mexico City that the first public earthquake early warning was funded and built as the city recovered from the destruction and loss of life in the late 1980s.

The Mexican public earthquake early warning system, the Sistema Alerta Sísmica Mexicano, was the first of its kind in the world when it came online in 1991. It was designed, funded, and built by engineers at CIRES, an NGO charged with developing and maintaining seismic instruments in response to the disastrous 1985 quake. The system began as a network of twelve sensors strung along the Pacific Coast, positioned to warn Mexico City about earthquakes that might emerge from the active plate interface there (Espinosa-Aranda *et al.* 2009 offers a detailed history). It slowed subway trains before it became available to publics more generally. This technology made it possible for people to take cover or evacuate a building in the seconds before an earthquake even began to shake them. Its growing network of sensors numbered 98 by 2014, and promised to give people in Mexico City, then Oaxaca, Chilpancingo, Acapulco, Puebla, and Morelia some warning before the next big quake emerged from the far south or the west cost of the country.

The advantage time offered by earthquake early warnings depends entirely on where an earthquake starts and the time that it takes to travel from there to shake people and built environments at risk. Engineers at CIRES developed the Sistema Alerta Sísmica Mexicano to send out a broadcast warning signal to warn regional publics in standardised, reliable ways. In Mexico City, they installed and maintained dedicated sirens in businesses, government agencies, and schools themselves. They reached agreements with other communications systems operators: area television and radio stations would pass along warnings alerting viewers and listeners about impending earthquakes.

Although an early warning was useful for Mexican conditions – that is, conditions in which buildings and infrastructure cannot be relied upon to protect their occupants – support from the state was inconsistent and the technology's use was not widespread until recently. In a 2009 study, researchers identified only 205 users aside from radio and television studios (Suárez *et al.* 2009). Although there was an attempt to distribute further emergency radios in the late 2000s, many devices did not make it to their designated recipients.[10] Although some studies in Mexico City, loudspeakers placed around the city only began to broadcast early warnings in 2015.

In the meantime, the precise identity of the system's publics has remained somewhat blurry to the engineers who build and maintain early warning infrastructure. In part, this can be attributed to the fact that most people's access to the warnings has depended on communications systems beyond the scope of the Sistema Alerta Sísmica Mexicano. For many years, this was a matter of television and radio, making access dependent on whether people were listening to broadcast media at the moment an earthquake began. Apps have been developed recently in step with other Mexican communications technology trends. 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. 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. If relatively few Mexicans living in these cities had access to earthquake early warning through other means, then apps like SkyAlert had plenty of potential customers. SkyAlert was not the only app to use the signal that CIRES broadcast in a product for concerned Mexican smartphone owners. It was the most successful of them, though; the most able to communicate about immediate seismic threats and catalyse response. In 2014, the SkyAlert app had over 1 million users and a substantial social media presence, while CIRES engineers estimated they had the potential, with all all of their users and rebroadcasters, to reach 20 million people across the nation. Many Mexico City residents who I encountered in my fieldwork used its smartphone app. However, as important as it was technically, our conversations made it clear that the distinction between CIRES's system and SkyAlert's were unclear to many. In the wake of the misfire, managing this confusion was on engineers' minds.

The Response-ability to Manage a 'Cry Wolf' Effect

In 2014, as soon it became evident that the SkyAlert app had sounded a warning for a quake that was not coming, CIRES engineers took action. First, they began investigating the extent of the misfire. They picked up their phones and showed each other tweets and messages that they had received. Some began making calls to policymakers, emergency managers, and representatives of other organisations focused on public safety around the city. The news of the non-quake was circulating widely, and they were concerned that it could have consequences for Mexican people at risk and for Mexican earthquake early warning broadly – that is, for the public Sistema Alerta Sísmica Mexicano as well as SkyAlert. 'They're going to say it was *our* equipment that failed', one man told his colleagues, concerned about the CIRES system's reputation.

He was right; SkyAlert social media accounts soon suggested that their app had responded automatically to a message from CIRES's system. The meeting table emptied as people broke off into various conversations and errands. How had the misfire happened? Could it be CIRES equipment that had fouled up somehow? When had it last been serviced? People checked their records and debated strategy. The CIRES offices were usually full of dozens of people moving between departments, talking to their peers and collaborators; but now they were 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.

Several of the senior CIRES engineers went directly to the Public Outreach Department. This department was run out of a small room ringed with desks and PCs. It was not precisely cramped, but it was far from spacious. There, senior engineers crowded around the software engineer who managed CIRES's social media accounts. The organisation's online presence had higher stakes that day than it ordinarily did, so together, the senior engineers composed careful messages, dictating to their junior colleague as she typed.

CIRES engineers' goal was to distance their organisation from SkyAlert publicly – to make it clear that the misfire was SkyAlert's, and to make sure that any negative attention was associated with the SkyAlert app alone rather than with CIRES or earthquake early warning in general. If people thought that it was CIRES technology that had misfired, then the 'cry wolf' effects could have systemic implications, they explained to me. Their organisation could lose credibility with people who should respond and with the governments that funded their work. Not only might individuals fail to respond to their alerts, but Mexico City, Oaxaca, Chilpancingo, Acapulco, Puebla, or Morelia could cancel their contracts for use of the Sistema Alerta Sísmica Mexicano. Then, earthquake early warnings would no longer be publicly available at all.

In light of these concerns, the social media messages that CIRES engineers crafted were efforts to manage the misfire's effects by influencing how publics understood earthquake early warning infrastructure. The engineers not only addressed the misfire itself, but also called the SkyAlert app's ordinary function into question. Stationed in front of a screen few feet away from them, I watched their carefully-crafted posts go live.

'The #SkyAlert #SkyAlertApp is not well-integrated', the CIRES accounts on Twitter and Facebook read. 'Lags have already been identified. They do not disseminate the alert simultaneously to their subscribers'. The wording that they had chosen referenced the SkyAlert app's ordinary processes and priorities as well as the misfire itself. Integration and lags were long-standing topics of some concern for CIRES engineers. Both merited attention: the very fact of the misfire showcased poor integration, but the way that the misfire circulated also demonstrated the lags that CIRES engineers found to be deeply troubling in the SkyAlert app's communications. SkyAlert's data indicated it had reached fewer than half of their 1.5 million users in the first 5 seconds, and had still not reached all of its users after 15 seconds.[12]

Lags can be moments of jarring disjuncture between various temporal operations (see Boellstorff 2008). The SkyAlert app pushed messages to smartphones, and the lag meant that while one person's phone might jangle with an alert in time for her to take shelter, her neighbour might not receive the same message until after the earthquake had passed.[13] The engineers at CIRES understood reliability to be key to effective early warning, and unpredictable lags meant trouble for their efforts to build the kind of trust that led people to respond efficiently to alerts. To them, SkyAlert's lags alone made it unreliable. The lags were, however, an unavoidable consequence of the way that push notices were sent to mobile phones. Lagging warnings could even 'cry wolf' even without misfires, engineers at CIRES explained to me. People might receive lagged messages and expect a new earthquake event that would never arrive, and become hesitant to respond to warnings later. Early warning apps destabilised the principles of communication that public early warning that CIRES engineers had built the Sistema Alerta Sísmica Mexicano around. However concerned CIRES engineers might be, though, the proliferation of smartphones had facilitated new forms of interaction with earthquake early warnings that CIRES could not easily regulate.

In my visit to SkyAlert's offices in the autumn of 2014, I also heard concern about the misfire. It was worrisome for business. If people lost confidence in SkyAlert's app service, they would stop responding to its warnings and stop downloading the app, and perhaps avoid other products. SkyAlert was working with government organisations, but they were not as closely involved in public, state-supported risk management work as their CIRES counterparts were. On this, SkyAlert and CIRES were agreed. They were agreed on more topics than their relative integration into state projects, though: SkyAlert and CIRES representatives all spoke with me, as they did in other public messaging, about civic responsibility and the importance of saving lives, and how they understood trust for engineers and technology to be essentially entangled. They did not, however, describe the same approaches to building that trust. While misfires were certainly bad for the app's reputation and business, CIRES engineers' concerns about lags were not shared by SkyAlert's leadership.

A representative of SkyAlert argued that whatever the lag in SkyAlert's system, it operated responsibly as a crucial part of Mexico's earthquake early warning infrastructure. 'I'd rather alert 1.2 million people than 300,000', he told me, offering a much lower assessment of the reach of publiv broadcast earthquake early warning than CIRES engineers did. Besides, SkyAlert's app offered users other ways of being intimately and immediately with earthquake early warning. They could test to see if their device was working with the press of a button, and the app platform had the potential to pass on even more information than the broadcast alert could; information, for example, about the likely intensity of a given quake for its users' particular location. This articulation of the obligations entailed in earthquake early warning diverged from those advocated by people at CIRES. Rather than trying to create a lag-free experience, he explained that SkyAlert's ethical goal was to put earthquake early warning into as many hands as possible.

There was some disagreement about events likely to have 'cry wolf' effects. However, engineers at both CIRES and SkyAlert understood that these effects could have consequences for the systems they oversaw. While representatives of each organisation were comfortable discussing their work in terms of responsibility for public wellbeing straightforwardly, I have come it in other ways, too.

Response-able Use of a 'Cry Wolf' Effect?

In the hours that followed the misfire, it became evident that the event was attracting attention. #NoEraSismo (which could be translated as #ThatWasNoQuake) trended on Twitter as comments circulated. News articles were published in Mexico and around the world.[14] SkyAlert soon accepted culpability publicly, but discussion of the misfire and its effects did not end there. The ways that engineers might act in light of their responsibility for Mexican publics remained a topic of conversation.

'I think that this could have been a huge coincidence', one member of the Mexican seismic risk management community told me over coffee a few months later. But he had another explanation for what had happened June 28: 'It could have been something very evil'. He suggested that the event had been a matter of intentional sabotage; an effort on

the part of CIRES engineers to damage SkyAlert's reputation. He put it more plainly than most, but he was not alone in experimenting with the idea that engineers at CIRES made the SkyAlert misfire happen. For people like him, the misfire itself could be interpreted as an effort to manage public wellbeing, albeit through nefarious means. This lent a new Austinian infelicity condition to the 'cry wolf' effects that the engineers worried about. If SkyAlert could be made to lose the precious trust of users, and the public withdrew their support from SkyAlert's app, then the company might shift its focus away from its app and stop generating this kind of push-notice alert. Were that the case, CIRES would have no rivals challenging their model of alerting and no semi-integrated systems troubling their abilities to keep early warnings trustworthy and lag-free.

When I encountered the theory that the SkyAlert misfire was a matter of sabotage, I struggled to make sense of it in relation to the concern I had witnessed about the potential for a 'cry wolf' effect. The way that the CIRES engineers with whom I spoke understood this effect seemed to provide a strong counter-argument to the theory that they were somehow the authors of the misfire. Engineers at CIRES knew that few members of the public made a distinction between their agency and SkyAlert, or had any sense of the ways that their infrastructures interfaced. Indeed, when I asked Mexico City residents unconnected with seismic risk management the time of the misfire, most were unable to clearly articulate any distinctions between the systems. Understanding, and trying to arrange, the relations between these infrastructures was important to engineers, but evidently not so much to public use of earthquake early warnings.

Public knowledge about the differences between CIRES and SkyAlert was limited in ways that could be consequential for both if the reputation of either was damaged. Certainly, SkyAlert was a private company and sold several other products. However, app subscribers were important to its business. Damage to its reputation could have appreciable consequences. CIRES, a non-profit, funded the maintenance and expansion of the entire earthquake early warning system through contracts with user communities that were re-assessed year-to-year. These contracts meant the system's on-going viability was never sure, and was subject to the changing sentiments of policymakers. Any 'cry wolf' effect that had consequences for CIRES would trouble other earthquake early warning efforts, since early warning at that time relied entirely on CIRES infrastructure. In 2014, there were no significant parallel sensory networks for city governments or TV or radio broadcasters to draw on. CIRES engineers spoke frequently about their obligation to maintain it and avoid jeopardising a tool that could mean the difference between life and death for users.

More mundane explanations of the SkyAlert misfire existed. Engineers at CIRES and SkyAlert told me that an ordinary test message was automatically broadcast by the CIRES system and misinterpreted by SkyAlert's when a slew of circumstances, including signal interference, a coded timestamp, and ongoing inter-organizational communications challenges all came into troublesome alignment. This explanation presented the SkyAlert misfire as utterly quotidian. I have been called on to tell the story of the interrupted CIRES meeting several times in the weeks and even years after the misfire. People involved in Mexican risk management were especially interested to hear

about the CIRES directors' reactions to the news. The observations that I have recounted in this article did not always persuade them of the CIRES team's innocence – instead, some used this misfire as an opportunity to feel out what it seemed reasonable that CIRES engineers could have done and, in that way, what engineering subjectivities might entail.

Sabotage rumours were never formalised as accusations, but persisted. Their very existence in the wake of the SkyAlert misfire is the product of, and reproduces, ideas about the ways that experts do their work. The misfire here functions as an 'experimental system', to use Jensen & Morita's 2017 term, through which the scope of engineers' responsibility might be understood. Exerting control over the social world is, to some extent, the role of successful Mexican engineers. There could be no doubt, as the man who shared a coffee and conspiracy theory with me explained, that CIRES engineers believed that they were doing the right thing and helping people. Nonetheless, he found them broadly uncooperative, and knew how little they liked the SkyAlert system's lag. He understood them to be embedded in Mexican systems of power. In that context, trying to conjure and use 'cry wolf' effects seemed like something that engineers at CIRES, with their three-decades-old system and comparatively close relation to state actors, might do.

These engineers exercise power within Mexico's official processes of authority and influence, and may be expected to enact its well-known corruptions (see Adler Lomnitz 1982; Gledhill 1994; de Vries 2002). Here, managing relations is understood to be crucial to maintaining support for a project. In this context, it is little wonder that idea that the SkyAlert misfire was caused by sabotage found such traction. Anthropologists have explored corruption as ordinary practice (see for example Hasty 2005; Anjaria 2011), and in Mexico, rumours about it are ordinary, too. Mexican discussions of expert practice often involve hidden strategies like this, making them a centrepiece of rumour, or *chisme.* Such rumours form 'alternative communicative relationships' that some scholars consider necessary to Mexican political life (Lomnitz 1995: 36, see also Briggs 2004). Accusations of corruption here should be understood as a hermeneutics in and through which subjects and their capabilities are constructed (as in Hetherington 2011; Gupta 2012; Muir 2016; Musaraj 2018). In other words, the sabotage rumour itself demonstrates how people imagine that engineers practicing their responsibility and caring for the publics potentially confused or endangered by SkyAlert lags by taking action to curtail the app's popularity.

If engineers work to save lives in state-sponsored projects, then their obligations and abilities necessarily entangle them with the operations of Mexican power – and with practices that are generally understood to be necessary for any expert involved in public service. The idea that engineers could trigger a misfire and make use of public sentiment in this way speaks to experiences with, and notions of, their expertise.

Conclusion

Changing technologies have led to the development of new tools and infrastructures designed to confront earthquake threats. Infrastructures, however, can act as

'*experimental systems*' and when they break down or misfire, they make new opportunities for expert forms of care to be practiced, debated, and interpreted. In this context, cries of 'crying wolf' are enactments and explorations of expert responsibility.

It is worth noting that the Mexicans whose trust and lives are involved in 'cry wolf' effects may have had different kinds of reflections about the repercussions of the misfire than engineers did. On Twitter and Facebook, some commenters focused on the immediate consequences of the SkyAlert misfire for their technologically-mediated relations to the seismic environment. They berated SkyAlert or earthquake early warning technologies in general for scaring them; for creating a panic that might itself be dangerous to their health and well being.[15] These comments may have been deployed hyperbolically, but they did display concern regarding the effects that a misfire, and an earthquake that had not happened, could still have.

They were also worried about longer-term effects. People complained of irresponsible warning, and the consequences that this misfire could pose to their future responsiveness. The SkyAlert misfire was not, however, universally derided. Mexicans discussed the kinds of efficacy that other investigations of 'cry wolf' effects have highlighted elsewhere. 'Thanks for the warning … personally, I prefer a false alert to never having alerts at all', wrote one commenter on SkyAlert's Facebook page the day that it happened. 'It worked as a drill', wrote another. These commenters made the SkyAlert misfire part of a regimen of training for speedy and organised evacuation. It was an opportunity to rehearse for a more dangerous earthquake, running through the physical steps and the tension of an unexpected experience so that, in the future, one is more likely to know what to do and, moreover, to be able to do it confidently.[16]

At CIRES headquarters and outside of them, I was more often drawn into conversations about the negative effects that the SkyAlert misfire could have than about its potential utilities. 'Cry wolf' effects have been documented in the world; these are real risks to human life. However, the attention to 'cry wolf' effects that I have described here reveals more about experts involved in earthquake early warning than it does about social effects of a misfire.

When earthquake early warnings are issued in Mexico, some people respond to them while others fail to. A substantial 'cry wolf' effect has not been documented in the Mexican population, although, as the saying goes, the absence of evidence is not the evidence of absence. Engineers' concerns on the topic are likely to be merited. The Sistema Alerta Sísmica Mexicano's infrastructure operated by CIRES has grown to include public sirens. SkyAlert now relies solely on its own independently-deployed network of sensors to generate information about oncoming earthquakes rather than on CIRES's public broadcast. Recent earthquakes and on-going seismic activity in Mexico have made further growth of both CIRES and SkyAlert's earthquake early warning infrastructure possible (see Notimex 2017; Espejo 2017). Between them, more people have access to emergency messaging, and the ability to take action when warned, or, for that matter, to lose trust in alerts.

Along with technoscientific knowledge and power, Mexican engineering expertise entails certain response-abilities. The SkyAlert misfire and its potential 'cry wolf'

effect surfaced these aspects of expertise. It also made opportunities for engineers and observers to debate and explore what it might mean to be responsible for public well-being and what such engineers might conceivably do.

Notes

1. While the SkyAlert company had made a formal agreement with the Mexico City government to disseminate the earthquake early warning through a radio broadcast in 2011, dissemination through the app was not undertaken with CIRES support or supervision.
2. In some versions of the story, the false alarms and the subsequent inability of the titular shepherd boy to find help when he needs it costs him his flock of sheep. In others, he pays with his own life. On fables and the project of thinking through cultural practices with reference to animals more broadly, see Hartigan (2014).
3. While it might take minutes of steady shaking for a building to fall, non-structural elements slide or fall over more quickly. Early warnings can allow users to evacuate or take shelter before they are in any danger. Indeed, earthquake injuries are often associated with non-structural elements. For a survey of the applications of such systems, see Strauss & Allen (2016).
4. This is certainly not always the case. The tragic earthquake of 19 September 2017 originated from very close to Mexico City, so the system was only able to give city residents between 5 and 10 s of warning. Usually, though, as earthquakes tend to start hundreds of miles from the city, a minute is a conservative estimate of the lead-time that an earthquake early warning system can offer.
5. Archival research was undertaken in Mexico and the United Kingdom; primarily in the collections of Centro Nacional de Prevention de Disastres (CENAPRED), the Centro de Investigaciones y Estudios Superiores en Antropología Social (CIESAS), and at the Royal Geological Society in London.
6. As part of this research, I conducted 61 formal, semi-structured interviews. Of particular relevance to this paper are interviews with CIRES and representatives from SkyAlert as well as those of peer organisations and companies.
7. This is not an unusual state in which to encounter an infrastructure; see for example Hughes (1987; 1993).
8. This includes assessment of only the powerful earthquake of 8 September 2017, which might have killed as many as 100 people and the quake that followed on 19 September 2017, which the Mexican government estimates caused 369 additional deaths (as reported in Ureste 2017).
9. Counts vary significantly. While the Mexican state offers the official number of six thousand deaths (CENAPRED 2008) other official sources offer something closer to 20,000 (see CIRES 2018).
10. See Martínez (2017).
11. It was estimated that Mexico had roughly 33.3 million smartphone users at the time of the misfire (GSMA 2013).
12. From an interview with the author.
13. A smartphone app was limited by Mexico's telephone infrastructure, which didn't facilitate broadcast texts, but might still warn more people of an impending earthquake than a radio or television message that they had no way of receiving.
14. BBC (2014).
15. 'YOU'LL GIVE ME THE SUGARS!!' read one tweet, riffing on a classic joke from 1970s Mexican sitcom *El Chavo del 8*. Some tweets mentioned encounters with the traumatic pasts, and the experiences of people who still suffer from their encounter with the 1985 quake. Fright and encounters with trauma could have consequences more immediate than a 'cry wolf' effect: both the aforementioned 'sugars' (diabetes, which is popularly understood to be caused by stress and fright) and other health problems.

16. Sorensen (2000) remains an excellent summary of emergency communication best practices. Such logics and practices of preparation have been explored in Lakoff (2008); Anderson (2010).

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