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Abstract

Organizations are important sources of communication during natural-hazard crises. How members of an organization perceive these communications (e.g., creating confusion, causing disorder, providing clarity, and restoring order) influences response and recovery from such a crisis. Using Chaos Theory as a guiding framework, the authors developed a new instrument measuring the perceived effects of an organization's communication on crisis-organizing processes. Three distinct studies were conducted to assess the reliability and validity of this new instrument: the "Perceived Effects of Communication on the Crisis-organizing Process (PEC-COP)" scale. This one-factor scale can be used by both scholars and practitioners to assess the effects of an organization's communication on how people organize (i.e., react and respond) during a crisis. By gaining greater insight into how an organization's communication is perceived, the organization can better prepare to communicate in ways that promote efficient and effective crisis-organizing processes throughout a natural-hazard crisis. Effective communication can create order out of chaos.

Keywords

crisis communication, chaos theory, organizational communication, survey

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Global pandemics, wildfire, drought, extreme heat, earthquakes, floods, hurricanes, landslides/mudslides and debris flow, snowstorms and extreme cold, thunderstorms and lightning, sustained strong winds, tornadoes, tsunamis, and volcanic eruptions (Ready.gov, 2020, Sept. 15) are examples of the many natural hazards that societies are facing today. A natural hazard is defined as "an unexpected and/or uncontrollable natural event of unusual magnitude that might threaten people" (Bokwa, 2013), and disasters are natural hazards that lead to significant physical damage or loss of life. While natural hazards and disasters have always threatened communities, in recent times they are becoming more frequent, intense, and expensive worldwide (Bucholz, 2020, August 25). According to the National Centers for Environmental Information (2020), between 1980 and 2020, there have been 279 weather and climate-related disasters in the United States at or exceeding $1 billion in damage. According to the John Hopkins Coronavirus Resource Center (October 2020), over 45 million individuals have been reported as testing positive for COVID-19, over a million people have lost their lives, and the numbers continue to rise worldwide.

Organizations are important connectors between individuals and communities. Organizations—for-profit, non-profit, and government—provide employment, goods, services, and opportunities for civic participation and enrichment to their communities. Their responses to natural hazards, then, are significant not only to the safety and wellbeing of community members, but also to the vitality of communities and their residents in recovery and rebuilding (Adekola & Clelland, 2019; Doerfel et al., 2013). When a natural hazard affects an organization's operations, its leaders often have to communicate with internal and external stakeholders about important and urgent issues such as evacuation or shelter-in-place orders to protect human life, duration of the disruption, and business continuity (Ready.gov, 2016, January 21).

Although organizations are not responsible for causing natural hazards, they may exacerbate a situation due to poor risk management or communication errors (Cotton III et al., 2015; Ulmer et al., 2019). Effective communication in responding to natural hazards events can mitigate potential damages, foster collaboration among stakeholders, and create a virtuous circle (Doerfel et al., 2013; Ulmer et al., 2019). Ineffective communication, however, including non-communication or silence, can create confusion, disorder, and conflict (Sellnow et al., 2002) and potentially put people's lives in harm's way.

The primary purpose of this research is to develop and test a new instrument that measures the construct of perceived effects of an organization's communication on crisis-organizing processes. Understanding how members of an organization perceive their organizations' communication has implications for responding to, and rebuilding from a natural-hazard crisis. Will communication from organizations contribute positively to how organization and community members organize (i.e., respond)? Or will organizations' communication create further confusion and inhibit members to effectively organize? By gaining greater insight into how an organization's communication is perceived, the organization can better prepare to communicate in ways that promote efficient and effective crisis-organizing processes throughout a natural-hazard crisis.

We adopt Chaos Theory as our guiding framework in this research. Although Chaos Theory is still an emerging field of study, it has quickly crossed over from natural sciences to corporate crises management. Chaos Theory has been adopted by management communication scholars to understand and respond to crisis dynamics, particularly natural hazards (Seeger, 2002; Sellnow et al., 2002). Crises such as natural hazards are unexpected events that produce extreme uncertainty and generate threats, while simultaneously affording organizations and communities new opportunities that might not have been available in normal times (Ulmer et al., 2019).

One construct that is vital to understanding chaotic crises is the perceived effects of communication on the crisis-organizing process. Despite the importance of these effects, existing scales do not measure all potential effects (i.e., positive ones) of communication on the crises organizing process. Three distinct research studies resulted in the development and testing of a new measure—Perceived Effects of Communication on the Crisis-organizing Process (PEC-COP). This instrument assesses the perceptions of both positive and negative effects of an organization's communication during crises involving natural hazards. Moreover, it responds to the call by crisis scholars to move beyond the tendency to focus on single case studies (Liu & Fraustino, 2014) and to develop and implement quantitative measures for formal research, which entails systematic data collection and hypothesis testing (Coombs, 2010). This measure can be used by other scholars in the field who are interested in assessing how perceived effects of organizational communication during times of crises relate to other variables.

There are a number of practical implications from this research as well. Leaders of organizations can use our measure to evaluate communication choices and effects on the situation. Given that many countries around the world are prone to natural hazards, organizations may be interested in using this measure to assess their current approaches to crisis communication. Leaders could integrate the instrument in the organizational learning section of a crisis management plan and use the results to drive improvement, not only for recurrent disaster seasons (e.g., fire, hurricane), but also anomalous events such as 500-year floods and 100-year pandemics.

In the next sections, we review relevant literature on Chaos Theory from the communication crisis research. Descriptions of three distinct research efforts are followed by methods used to collect and analyze data. Findings from the three studies in natural hazard contexts are presented, along with a discussion of research and practice implications and future directions for this research.

Chaos Theory and Communication Crisis Research

Chaos Theory and Natural Hazards

Scholars have offered new systems perspectives to recast organizations as dynamic, nonlinear systems (Contractor, 1999; Levy, 1994) that exhibit change over time, and for which the magnitude of a change in a variable's value does not correspond to its effect on the system. Chaos Theory, one of several new systems perspectives, is the

study of systems that are extremely sensitive to small changes in initial conditions and cycle through iterations. Unlike traditional systems theory, Chaos Theory focuses on the difficulty of making causal predictions due to the nonlinear nature of phenomena. As Gregersen and Sailer (1993, p. 778) note, "chaos. . . does not imply antisocial or psychopathic meanings." Rather, chaotic systems are dynamic and exhibit discontinuous behavior.

A crisis exemplifies the dynamics of a chaotic system in that it is unexpected, unpredictable, and marked by sudden shifts (Gregersen & Sailer, 1993; Seeger, 2002; Ulmer et al., 2019). Consequently, crisis communication researchers have highlighted the potential for Chaos Theory as a model for issues and crisis management (Murphy, 1996) and as a general model for crisis communication (Seeger, 2002). Seeger (2002) foregrounded the role of communication in an organization's pre-crisis state, its disruption, and its emergent organization.

Although small changes or errors in initial conditions can come from any source, Sellnow et al. (2002) conceptualize communication processes as possible sources of small variance. Communication errors such as breakdowns, oversights, failures to pass on and receive warning messages, faulty interpretations of messages, and misleading or inaccurate messages, have contributed to crisis events. Second, crises are often sparked by bifurcation, or "flashpoints of change where a system's direction, character, and/or structure are fundamentally disrupted" (Sellnow et al., 2002, p. 271). Third, bifurcation, triggers cosmology episodes (Weick, 1993), or the moments in crisis when individuals in a system feel overwhelmed. These moments represent a total loss of equilibrium—the system is shocked into immobility by the need for unprecedented sensemaking.

Although Chaos Theory seems focused on disorder and unpredictability, a centerpiece of the theory is emergent self-organization that ultimately leads to order (Vanderford et al., 2007, p. 23). Self-organization is the tendency of order to reassert itself following the chaos of bifurcation (Stewart, 1997). Systems rely on the underlying structures, guidelines, and principles that drove them pre-crisis to reestablish order post-crisis. One of the ways a system recreates order is through feedback loops that amplify changes (e.g., Plowman et al., 2007) or dampen changes (Sellnow et al., 2002).

We adopt Chaos Theory as a framework because natural hazards represent chaotic events. Perhaps the most naturally chaotic types of event faced by communities and organizations are disasters. Disasters are "uncertain and highly mutable situations often marked by a combination of both information overload and information dearth, depending on one's relationship to those events" (Shklovski et al., 2008, p. 127). Disasters typically represent bifurcation for organizations and communities affected and will tend to function as cosmology episodes for individuals caught in the direct or even in the tangential impacts of the disaster.

Recent communication research has largely focused on natural hazards such as floods (Atkinson, 2014); hurricanes (Bartesaghi, 2014; Chewning et al., 2013; Doerfel et al., 2013; Porter, 2013; Richardson & Maninger, 2016); earthquakes (Matheson & Jones, 2016); rockslides and tsunamis (Rød et al., 2012); winter storms (Smith et al.,

2012); and wildfires (Alder, 1997). While health-hazard crises have been examined such as pandemics (e.g., Avery & Kim, 2009; Kim & Liu, 2012), they have been studied to a lesser extent compared to other natural hazards (Lin et al., 2017).

Case-Based Research

Much of the research that applies Chaos Theory and that is focused on particular natural hazards, organizations, and communities is case based. Case research is justified when a situation or scenario is rare, common, or critical to theory development (Yin, 2014). Case studies are also supported when scholars gain access to previously inaccessible situations or to a setting over multiple points in time (Yin, 2014). Crisis communication research frequently deals with rare events that are often inaccessible to researchers and contribute to theory development. As mentioned earlier, crisis scholars have called for researchers to move beyond the tendency to focus on single case studies (Liu & Fraustino, 2014) and to develop and implement quantitative measures for formal research, which entails systematic data collection and hypothesis testing (Coombs, 2010).

Although some organizational researchers have developed measures of organizational chaos, these studies focused on chaos' meaning in common parlance (negative connotation), associated with antisocial and psychopathic meanings (Gregersen & Sailer, 1993), or do not measure perceptions of the effects of organizational communication on the crisis-organizing process. For example, Chamberlain and Hodson (2010) do not include communication within their operationalization of chaos. Roscigno et al. (2009) focus on poor organizational communication, in addition to bad organization, poor leadership, and disrepair. While Xu (2018a) develops a model of community coping in a crisis, organizational members' perceptions of the effects of their organization's communication on the crisis-organizing process are not included.

Our research responds to calls for more quantitative measures during a time of increased frequency in natural-hazard crises ranging from wildfires engulfing California, hurricanes hammering the southeastern corner of the United States, and the COVID-19 global pandemic taking over a million human lives (and counting) around the world. More specifically, the authors develop and test a new instrument that measures the construct of perceived effects of an organization's communication on crisis-organizing processes. A construct that measures perception that can help organizations communicate more effectively is critical and has the potential to generate positive outcomes for the organization.

Methods

Development and Testing of PEC-COP

The initial development of the items that comprise the PEC-COP scale was informed by more than two decades of case-based research. The collective findings suggest that communication in a chaotic system (e.g., a crisis) has the potential to: disrupt or

restore order; raise uncertainty or reduce it; expose an organization to greater risks or reduce its harm; constrain or enable an organization's abilities; lead to over-reliance on routines or creation of novel messages and communication techniques; divide or connect stakeholders; prolong the crisis or expedite recovery; and, create vicious or virtuous cycles (Freimuth, 2006; Getchell, 2018; Horsley, 2014; Liska et al., 2012; Murphy, 1996; Seeger, 2002; Sellnow & Seeger, 2001; Sellnow et al., 2002; Vanderford et al., 2007).

Items that comprise PEC-COP focused on an organization's communication in the role of emergent order and disorder. Nine 7-point semantic differential items were developed (see "Survey items and measures" section for specific items). Three distinct research efforts (i.e., studies) were conducted to assess the reliability and validity of PEC-COP. The first research effort (Study 1) was designed as an exploratory factor analysis intended to explore the factor structure of the measure. The second research effort (Study 2) was designed as a confirmatory factor analysis to assess the construct validity of the measure by assessing other variables and their relationship to PEC-COP, and the third research effort (Study 3) was a replication of the previous studies.

Eligibility to Participate in Studies

Potential respondents were considered eligible to participate in the studies if they were members of an organization—such as full or part-time employees, volunteers, or students—that recently (within in the past 2 years) experienced a natural hazard(s) and received communication from their organization about that crisis. If potential respondents did not meet these criteria, they were either not allowed to complete the survey or were excluded from the analysis.

For the first two studies, a wide range of events were characterized as natural hazards, including: drought, extreme heat, earthquakes, floods, hurricanes, landslides/mudslides and debris flow, pandemic, snowstorms and extreme cold, thunderstorms and lightning, sustained strong winds, tornadoes, tsunamis, volcanic eruptions, and wildfires (Ready.gov, 2020, Sept. 15). In cases where participants experienced multiple events within the previous 2 years, they were instructed to select the event that was either more recent or more salient. If more than one of these occurred during the same incident (connected series of hazards), they were instructed to select as many as applied. For example, the 2017 Thomas Fire in Santa Barbara and Ventura Counties was a wildfire that later created conditions for flash flooding and mudslides when the rains arrived. The third research study focused on solely on one natural hazard—COVID-19 pandemic.

Data Collection

For all three studies, data were collected through online surveys between November 2019 and May 2020. For Study 1 and Study 3, potential survey respondents were recruited using a network sampling method similar to Jian et al. (2014). In exchange

for extra credit points, undergraduate students from two large universities in the United States provided names and email addresses of individuals who were perceived as eligible (i.e., meeting the criteria outlined in the previous section). These potential participants were then invited to complete the electronic survey. Study participants' eligibility were verified through screening questions. If they were ineligible, the survey was terminated.

For Study 2, potential respondents were recruited via Amazon's Mechanical Turk (MTurk). MTurk samples include diverse participants and have findings consistent with other sources (Clark et al., 2014), and have been used in business communication (Mayfield et al., 2017) and crisis communication research (Fuller et al., 2019; Xu, 2018b). With MTurk, researchers post tasks online to a diverse pool of potential respondents. Tasks include the eligibility requirements, time required, and compensation for completion (Mayfield et al., 2017). Potential participants for this study were informed about a research study on natural hazards and organizational communication. Participants self-enrolled based on the eligibility criteria described above and were paid $2 for completing the questionnaire. To ensure that participants were eligible and humans (not robots) (Chandler et al., 2014), attention-check questions along with a short narrative description of the crisis were included. Participants' responses were removed from the dataset if any of the following occurred: (a) failing the attention-check questions, (b) providing nonsense responses to the narrative question, or (c) failing to meet all of the participant-eligibility criteria.

Survey Items and Measures

For all three studies, the online survey included demographic questions and items that comprise PEC-COP. For Studies 2 and 3, two additional measures and their related items were included—satisfaction with their organization and the number of communication channels their organization used during a natural-hazard crisis.

Perceived effects of communication on the crisis-organizing process. As discussed earlier, the items developed for this scale were informed by two decades of Chaos Theory studies in crisis communication research. We developed nine 7-point semantic differential items with a specific focus on communication in the role of emergent order or disorder. The participants were instructed to "Select the choice that you believe best represents your organization's communication during the incident. If you have no position, select the midpoint (i.e., "4"). The negatively worded descriptor was on one of the continuum and counted as seven with the positively worded descriptor at the other end and counted as 1. The nine items are: (1) caused disorder—restored order, (2) raised uncertainty—reduced ambiguity, (3) exposed it to greater risks—protected it from harm, (4) constrained its abilities—enabled extraordinary actions, (5) prolonged crisis mode—expedited crisis recovery, (6) divided constituents—connected stakeholders, (7) sowed confusion—provided clarity, (8) over-relied on routine—adapted to the situation, and (9) set off a vicious cycle—started a virtuous cycle.

Satisfaction with the organization. Satisfaction was measured with five Likert-type items (1 = strongly disagree; 4 = neither agree nor disagree; and 7 = strongly agree), and included items such as "Generally speaking, I am pleased with the relationship this organization has established with people like me" (Paine, 2003).

Number of communication channels. Participants were also questioned about communication channels their organization employed during the natural-hazard crisis. They were instructed to check all that applied from the following list: meetings, email, internal web site, phone and voicemail, print media, SMS (text messages), instant messaging, and video conferencing (Horsley & Barker, 2002; Lee, 2018). To reflect the number of channels an organization used, a composite variable was constructed from all of the channels added together, and ranged from 0 to 9.

Data Analysis

Basic statistics were calculated for information about respondent demographics, size of organization, status of organization (closed due to hazard or stayed open), type of natural-hazard crisis reported, and channel of communication from organization during crisis. Exploratory factor analysis (EFA) was employed to assess the dimensionality of our measure. To provide support for the factor structure of the PEC-COP scale, confirmatory factor analyses was conducted. To demonstrate goodness of fit, several common measures including chi-square (χ^2); the ratio of chi-square to degrees of freedom (χ^2/df); Comparative Fit Index (CFI); and Goodness of Fit Index (GFI). Model fit criteria are $p > .05$ for χ^2; $>.95$ for CFI and GFI; and <5 for χ^2/df Construct validity was assess by measuring this new construct along with established variables (DeVellis, 2016). In addition, some basic correlations were conducted to assess if there were any significant relationships among PEC-COP, satisfaction with the organization, and number of communication channels used during the natural-hazard crisis.

Results

Basic Statistics

A total of 580 viable surveys (i.e., participants met the eligibility criteria) were collected from study respondents across the three research efforts. Approximately, 52% of the respondents were male and 48% female. The overwhelming majority (83%) of the employees were employed: 61% reported full-time employment, 22% reported part-time employment, and 12% were students, and 5% volunteers/other. A total of 74% percent of the respondents were between the ages of 18 and 34.

A total of 65% of the respondents categorized their organization as having under 500 employees, and 35% categorized their organization as having 500+ employees. Of the reported organizations, 77% closed due to the natural hazard, while 23% stayed open. The breakdown of the natural hazards reported is: pandemic (35%), wildfire (17%), flood (17%), hurricane (9%), excessive heat (9%), snowstorm (9%), and strong

winds (5%). The breakdown of the communication channels reported is: email (38%), phone (22%), face-to-face meetings (12%), text messages (11%), websites (9%), and video conferencing (8%) (Table 1).

Table 1. Summary Statistics.

Summary statistics	Study 1	Study 2	Study 3
580 surveys	155	219	206
Gender			
Male (52%)	61	139	78
Female (48%)	88	95	109
Employment status			
Full-time (61%)	78	189	83
Part-time (22%)	29	20	79
Student (12%)	35	1	35
Volunteer (3%)	7	6	6
Other (2%)	3	3	3
Age in years			
18–24 (35%)	61	15	127
25–34 (39%)	54	118	52
35–44 (13%)	15	51	8
45–54 (10%)	16	28	13
55+ (3%)	6	7	6
Size of organizations			
Under 500 employees (65%)	94	149	133
500 employees or more (35%)	61	70	73
Status of organization			
Closed due to natural hazard (77%)	109	187	150
Stayed open (23%)	45	32	55
Type of natural hazard			
Pandemic (35%)			206
Wildfire (17%)		100	
Flood (17%)	76	28	
Hurricane (9%)	54		
Excessive heat (9%)	28	29	
Snowstorm (9%)	43		
Strong winds (5%)		29	
Communication channel			
Email (38%)	134	177	184
Phone (22%)	79	132	106
Face-to-face meeting (12%)	67	93	
Text message (SMS) (11%)	67	77	
Website (9%)			110
Video conferencing (8%)			97

Table 2. Exploratory Factor Analysis and Descriptive Statistics for PEC-COP.

Question stem		

Select the choice that you believe best represents your organization's communication during the incident. If you have no position, select the midpoint (i.e., "4").

	Mean (SD)	Factor loading
The organization's communication . . .		
CT1. caused disorder (1) . . . restored order (7)	5.11(1.70)	0.74
CT2. raised uncertainty (1) . . . reduced ambiguity (7)	5.12(1.58)	0.76
CT3. exposed it to greater risks (1). . . protected it from harm (7)	5.45(1.60)	0.75
CT4. constrained its abilities (1). . . enabled extraordinary actions (7)	4.80(1.53)	0.68
CT5. prolonged crisis mode (1). . . expedited crisis recovery (7)	5.20(1.48)	0.82
CT6. divided constituents (1). . . connected stakeholders (7)	5.03(1.64)	0.74
CT7. sowed confusion (1). . . provided clarity (7)	5.43(1.54)	0.82
CT8. over-relied on routine (1). . . adapted to the situation(7)	5.29(1.55)	0.79
CT9. set off a vicious cycle (1). . . started a virtuous cycle (7)	4.78(1.45)	0.84

Note. $N = 152$, KMO = 0.933; Bartlett's test of sphericity = $\chi^2 = 749.53$, df = 36, $p < .000$.

Exploratory Factor Analysis: PEC-COP

An exploratory factor analysis (EFA) was conducted on the PEC-COP data collected in the first study. The EFA produced a single-factor solution explaining 59.8% of the variance. The scale was reliable (9 items; Cronbach's $\alpha = .91$), and had a KMO sampling adequacy of .93. The scale range was 8 to 63, and the mean was 46.2 ($SD = 10.85$). Table 2 contains items, descriptive statistics, and factor loadings.

Confirmatory Factor Analysis: PEC-COP

The single-factor structure revealed during exploratory factor analysis was tested using confirmatory factor analysis of PEC-COP on the data collected from Study 2 and Study 3. Based on the data collected in Study 2, the PEC-COP measure demonstrated adequate fit, $\chi^2 = 63.62$, $p < .0$, df = 27, $\chi^2/df = 2.35$, RMSEA = .08, CFI = .95, GFI = .99. However, average variance extracted was 46%, less than the 50% required to demonstrate validity. Nevertheless, composite reliability was $> .6$, at $\alpha = .88$. The scale mean was 49.96 ($SD = 8.66$). Table 3 provides factor loadings and other descriptive results for the items.

The PEC-COP single-factor measure was tested once again using confirmatory factor analysis on the data collected in Study 3. The measure demonstrated adequate fit,

Table 3. Confirmatory Factor Analysis of PEC-COP–Study 2.

Item	Mean (SD)	Factor loading	R^2
CT1.	5.73 (1.31)	0.77	0.59
CT2.	5.75 (1.49)	0.68	0.46
CT3.	5.67 (1.23)	0.66	0.44
CT4.	5.10 (1.32)	0.59	0.35
CT5.	5.57 (1.25)	0.77	0.59
CT6.	5.55 (1.34)	0.62	0.39
CT7.	5.90 (1.41)	0.70	0.50
CT8.	5.71 (1.36)	0.66	0.43
CT9.	5.14 (1.30)	0.65	0.42
	$M = 49.96$, $SD = (8.66)$, $\alpha = 0.88$		AVE = 0.46

Note. $N = 219$, $X^2 = 63.62$, $p < .0$, df = 27, $X^2/df = 2.35$, RMSEA = 0.08, CFI = 0.95, GFI = 0.99.

$\chi^2 = 68.30$, p $< .0$, df = 27, $\chi^2/df = 2.53$, RMSEA = .09, CFI = .97, GFI = .98. The scale mean was 45.66 ($SD = 12.10$). The scale was reliable ($\alpha = .94$.) and explained 64% of the variance. Table 4 provides factor loadings and other descriptive results for the items.

Construct Validity and Correlations: PEC-COP

In Study 2 and Study 3, additional measures were included to assess the construct validity of PEC-COP and explore if PEC-COP was related to organization satisfaction or the number of communication channels an organization uses during a natural hazard crisis. The 5-item scale used to measure satisfaction of the organization measure was proven to be reliable in both Study 2 (Cronbach's $\alpha = .91$) and Study 3 (Cronbach's $\alpha = .94$). In addition, satisfaction with the organization was positively correlated with PEC-COP in both Study 2 ($r = .39$, $p < .00$) and Study 3 ($r = .38$, $p < .00$). PEC-COP was also positively correlated with number of communication channels used to communicate with organizational members during a natural-hazard crisis in both Study 2 ($r = .16$, $p < .01$) and Study 3 ($r = .18$, $p < .00$).

Discussion and Implications

Development of a New Measure

Perceived Effects of Communication on Crisis-organizing Process (PEC-COP) is found to be a reliable and valid one-factor instrument. Following the guidelines for scale development, the factor structure of PEC-COP identified in Study 1 was tested using confirmatory factor analysis (CFA) on the data collected in Studies 2 and 3. By including additional measures—satisfaction with the organization and number of communication channels—we were able to demonstrate construct validity as well.

Table 4. Confirmatory Factor Analysis of PEC-COP—Study 3.

Item	Mean (SD)	Factor loading	R^2
CT1.	5.00 (1.62)	0.86	0.74
CT2.	4.91 (1.71)	0.76	0.57
CT3.	5.32 (1.66)	0.74	0.55
CT4.	4.86 (1.55)	0.74	0.55
CT5.	4.95 (1.60)	0.82	0.67
CT6.	4.91 (1.53)	0.85	0.73
CT7.	5.22 (1.76)	0.84	0.71
CT8.	5.46 (1.65)	0.78	0.61
CT9.	5.02 (1.56)	0.81	0.65
	$M = 45.66$ (12.10), $\alpha = 0.94$		AVE = 0.64

Note. N = 206, $X^2 = 68.30$, $p < .0$, df = 27, X^2/df = 2.53, RMSEA = 0.09, CFI = 0.97, GFI = 0.98.

In Study 3, we were able to replicate Study 2's findings by focusing on a single type of natural hazard, a pandemic. Replication is important for communication research (Benoit & Holbert, 2008) to build programmatic research by, for example, reinforcing conclusions and theoretical extension to new contexts. Confidence in a measure is increased when it can be replicated across samples and move from a variety of disaster types to a specific one.

This concise and reliable 9-item measure has implications for both scholars of crisis communication and practitioners. This instrument differs from others (Chamberlain & Hodson, 2010; Roscigno et al., 2009) because it measures the positive effects of communication on creating order during chaos (which is an inherent characteristic of a natural-disaster crisis). Management communication researchers interested in crisis management can use our measure in combination with other measures of crisis response such as renewal (Xu, 2018b), reputation (Coombs, 2004), charismatic leadership (Jamal & Abu Bakar, 2017), information adequacy (Tourish et al., 2004), and individual and organizational resilience (Kantur & Say, 2015; Kim, 2020) for example. Applying the measure in real-time also helps to address Ulmer's (2012) call for thought leadership to test normative theories of crisis leadership.

Leaders of organizations can use our measure to evaluate communication choices and effects on the situation. Given that many U.S. states are disaster prone, business, government, and public health leaders may be interested in using this measure to assess their organizational communication. Such an evaluation could enhance organizational learning and improve how the organization manages future crises. The measure is an aggregate representation of how stakeholders perceive the effects of the organization's communication on the crisis-organizing process. If an organization's score falls below the scale midpoint (i.e., 36), such a score suggests learning opportunities for the next crisis. Although the scale is intended as an aggregate interpretation, organizational leaders could examine the average scores for each item to address specific interventions for improvement as well as areas to reinforce. For example,

across our three studies the item "constrained its abilities. . .enabled extraordinary actions" scored lowest. A leader may interpret this statement as one where the organization's communication met the needs of the situation, and did not provide impediment, but perhaps did not inspire or transform. A consistently high average item across studies was item seven "over-relied on routine . . . adapted to the situation." An organizational leader could interpret this score as the organization adjusting in real-time rather than sticking to the script through pre-constructed messages. In sum, leaders could integrate the instrument in the organizational learning section of a crisis management plan and use the results to drive improvement, not only for recurrent disaster seasons (e.g., fire, hurricane), but also anomalous events such as 500-year floods and 100-year pandemics.

Relationship between PEC-COP and Organization Satisfaction

In addition to developing a new scale, a positive correlation was found between PEC-COP and satisfaction with the organization. This finding suggests that those members who perceive their organization's communication positively affecting the crisis-organizing process (e.g., restoring order, providing clarity, expediting crisis recovery, etc.) are more satisfied overall with their organization. This finding also suggests that those members who perceive their organization's communication negatively affecting the crisis-organizing process are less satisfied overall with their organization.

This finding has implications for organizational communication scholars interested in studying satisfaction with the organization as a relational outcome of corporate communication (Men & Sung, 2019). It has practical implications for organizations as well. How organizational communication during a crisis is perceived by its members has implications on overall satisfaction with the organization.

Relationship between PEC-COP and Number of Communication Channels

A positive correlation was also found between PEC-COP and the number of communication channels an organization used throughout a crisis. This finding supports results from other studies. For example, organizations that effectively employ multiple communication channels demonstrate greater adaptability to the crisis at hand (Chewning et al., 2013), a more positive impact on the crisis-organizing process (Nan & Lu, 2014), and greater satisfaction with the organization (Lee, 2018; Utz et al., 2013). Beyond the best practices set forth in crisis communication literature (Seeger, 2006), the effectiveness of this type of messaging has already been demonstrated in a variety of contexts, such as health communication (cf., Lang, 2006) and science communication (Myers et al., 2015).

We underscore that in chaotic systems such as crises, organizations should select channels that are appropriate to their crisis communication goals, rather than simply following precedent. This is particularly important for situations where an organization may be the key source of vital information for at-risk stakeholders. Freberg

(2012) found that stakeholders receiving a crisis message from an official channel will assess it as more credible and will respond to it more readily than if they receive a message from an unofficial or user-generated source. Organizations should therefore be proactive in communicating about crises and implement messaging across multiple channels.

Limitations and Future Directions

Our study has some limitations that may affect the generalizability of our findings. Because we relied on convenience samples, future research should continue to investigate the psychometric properties of the measure developed for this study. Moreover, our study focused only on natural hazards (first generally, then on a pandemic specifically) instead of all types of crises. Most organizations tend to be viewed as victims of natural hazards by their stakeholders (Ulmer et al., 2019), although there are some exceptions such as the Tokyo Electric Power Company in the Fukushima Daiichi earthquake, tsunami, and nuclear power plant meltdown (cf. Cotton III et al., 2015). Therefore, future research could also examine perceptions of organizational communication for other types of crises beyond natural disasters that are particularly disorienting for those caught in the middle, such as economic downturns, downsizings, mass casualties, and mass protests for example.

In addition, other crises that may be perceived as particularly chaotic are secondary or double crises, where the crisis started out as one incident and triggered another (Grebe, 2013). Beyond the limitations of the study, future research could collect organization-wide data and make comparisons based on managerial role and communication role in the crisis. Another useful avenue of study would include our measure alongside an examination of particular channels to assess the perceived credibility of one communication channel over others. This study focused on internal stakeholders; future research could ask external stakeholders about their perceived effects of communication on the crisis-organizing process. Moreover, future research could conduct cross-cultural research to enhance the generalizability of these measures beyond the U.S.

Conclusion

Under crisis, organizations face tremendous uncertainty, which can influence their response capabilities and create unintended consequences. Seeger (2002) suggested treating crises as chaotic systems because of inherent unpredictability and self-organization that occurs. Past research in this area has relied heavily on case studies and anecdotal evidence—something that has led to criticism of crisis-related research in recent years (Pyle et al., 2020). To expand on researchers' capacities to explore questions in this area, this study developed a reliable measure of perceptions of communication on crisis organizing. To answer the question posed in the title, yes communication can create order out of chaos.

Declaration of Conflicting Interests

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