# INTEGRATING BRAIN SCIENCE INTO CRISIS LEADERSHIP DEVELOPMENT

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Recent advances in neuroscience and psychology research ("brain science") provide a fruitful avenue for developing approaches to leadership development. Literature on the application of these advances to crisis leadership is sparse, despite significant neurological and psychological dimensions of crisis response scenarios. The current study analyzed the nature of perceived impact of leader behavior on outcomes in crisis management systems such as the Incident Command System (ICS) and National Incident Management System (NIMS), and explored the extent to which brain science principles are integrated into ICS/NIMS training. Analysis of survey data from a sample of 198 crisis leaders revealed that observed leader behaviors was related to ICS/NIMS performance and that typical ICS/NIMS training fails to address the behavioral aspects of crisis leadership. To address the identified deficiency, a training model incorporating brain science into crisis leadership training systems is suggested. Further research is recommended to better determine the impact of incorporating neuroscience and psychology research into formal crisis leadership training and to further evaluate effective measurement and teaching tools.

## Introduction

The purpose of the current study was to identify observed leader behaviors that may be related to perceived performance—positively or negatively—within current standardized and widely used incident command and crisis management systems, such as the Incident Command System (ICS) (Department of Homeland Security [DHS], 2017) and National Incident Management System (NIMS) (DHS, 2008a). Further, the paper explores the extent to which training for ICS and NIMS (ICS/NIMS) incorporate neuroscience and psychology research—referred to herein collectively as "brain science"—to address the behavioral and emotional context of crisis situations.



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The current study was grounded in a review of the application of brain science to leadership development. Elements of psychology research, and more recently neuroscience, have been integrated into *aspects* of leadership development (e.g., Hannah et al., 2013; Gaddis & Foster, 2015; Murphy & Johnson, 2011; Polsfuss & Ardichvili, 2008; Salati & Leoni, 2017; Waldman, Balthazard, & Peterson, 2011; Williams, 2010). Although literature evaluating the impact of brain science specifically on crisis leadership training is sparse, one neuroscience approach helpfully identified how harnessing brain capabilities may help create optimal human performance in crises and situations of extreme stress (Paulus et al., 2009).

To further explore the applicability of brain science to crisis leadership training, a survey of crisis leaders—those who prepare for and response to crisis situations—was conducted. The survey focused on crisis leader training in the predominant crisis management structures, ICS/NIMS, and asked how observed leader behavior may enhance or degrade perceived crisis response performance within ICS/NIMS. The data from the current study reflected that the integration of brain science into crisis leader training is in its infancy, suggesting that the potential to increase leader efficacy through behavioral training is a topic ripe for further study.

Survey results were contextualized using extant models of neurological and psychological function and training to help illustrate the connection of these principles to leadership in crisis. It was hypothesized that ICS/NIMS training does not adequately address the brain science aspects of crisis leadership and response, and that the failure to do so correlates with suboptimal implementation of ICS/NIMS. Survey results and existing literature on behavioral modification supplied the framework for an evidence-based example of how supplemental crisis leader training that utilizes insights from brain science may result in greater ICS/NIMS efficacy.

## Literature Review

### CRISIS MANAGEMENT TRAINING SYSTEMS CURRENTLY

Crises are dynamic, chaotic, complex events, undefined in timescale and requiring swift but high-stakes decisions to be made with limited information, some of which may be inaccurate (Boin & 't Hart, 2003; Pearson & Clair, 1998; Sayegh, Anthony, & Perrewe´, 2004). Responses require the coordination of multiple agencies, and the evolving nature of crises demand "unprecedented coordination of resources, information, and expertise" (Marcus, Dorn, & Henderson, 2006, p. 128). For major incidents, numerous layers of government may be involved, and the response may be further complicated by various jurisdictions and organizations that may or may not be accustomed to working together.

To orchestrate responses more effectively, the DHS established NIMS in 2003. Its articulated purpose is to provide "a consistent nationwide approach for federal, state, and local governments to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity" (DHS, 2003). As part of the Command and Management Component of NIMS, DHS introduced ICS to "[extend] the domain of rationality and bureaucratic organizing to the uncertain and often chaotic environment of disaster responses" (Buck, Trainor, & Aguirre, 2006, p. 1). In theory, the structure of ICS reduces the chaos and parses incidents into manageable procedures that are actionable for responders. By imposing order and reliability while allowing necessary flexibility and scalability, the ICS management system has improved crisis response (Farley & Weisfuse, 2011). Nevertheless, how much of the chaos of a crisis disrupts the use of the management structure itself?

Within ICS/NIMS, the person in the role of "incident commander" is responsible for overall strategy, tactics, and resource allocation as well as "overall authority and responsibility" for all operations (DHS, 2008b). In addition to management skills, efficacy in the role requires leadership abilities such mission articulation, trust-building, and sense-making (Marcus, Dorn, Henderson, & McNulty, 2015). Also required is emotional intelligence (Goleman, 2006), which is made up of five components: self-awareness, self-regulation, motivation, empathy, and social skills.

### NEUROLOGICAL AND PSYCHOLOGICAL IMPACTS ON ICS IMPLEMENTATION AND CRISIS DECISION-MAKING

The success of implementation of ICS is contingent upon several factors, including human tendencies and limitations in crisis response. Bigley and Roberts (2001) discussed cognitive and perceptual factors and shared mental models as important conditions that can overwhelm procedural structures and undermine situational awareness, thus inhibiting leader efficacy. Researchers also noted insufficiencies in including emergent groups and volunteers in the coordination structure of ICS, highlighting instead the need for interpersonal trust in response personnel (Buck et al., 2006; Moynihan, 2009b). ICS is most effective when applied to well-defined, stable goals by knowledgeable personnel who understand collective goals and approach the problem with technical prowess and interpersonal trust. Clear goals and consistent approaches can restore a sense of calm and competence that can aptly be applied in accordance with the prescriptions of the rational ICS structure (Buck et al., 2006). However, because these factors are frequently absent in large-scale crises, Buck et al. (2006) echoed the observations of responders that suboptimal performance arises from poor implementation, not deficiencies in the ICS construct itself (p. 21). The underlying assumption for effective ICS use is that it can operate under a rational form of organization, which is only true under specific conditions not typically present during crises.

Some behavioral difficulties in the use of ICS hinge on changes in the situation and management structure. Boin and 't Hart (2003) noted that those whose administrative roles are suddenly reduced through the reallocation of authority within ICS are less likely to actively participate in or enthusiastically comply with direction from crisis command structures (p. 547). Jensen and Waugh (2014) reviewed evidence indicating that the individuals acting under ICS do not necessarily use the system appropriately, even though successful implementation is predicated upon the individuals' ability to do so. It is true that leaders must adjust to changing structural dynamics, but Schoenberg (2004) also recommended that leaders assume more adaptive capacity in communication, goal-setting, and information-acquisition and processing. Further, Schoenberg (2004) argued that, "the situation often determines the leader" (p. 12), which echoes Zimbardo and Leippe's (1991) explanation that the structure of the environment profoundly influences behavior. The demand for increased adaptive capacity indicates that leaders must be able to bridge the gap between the human behavioral response to crisis and the rational implementation of ICS. Schoenberg (2004) argued that concentrating on leadership issues surfaces important discussion of "values, authenticity, trust, and leadership" beyond simple updates to processes and protocols (p. 14). Thus, leaders themselves must be rational and dynamically appropriate for the situation (Bigley & Roberts, 2001).

Rationality and flexibility, however, should not be preemptively ascribed to crisis response. The acceptance of the role of emotions in decision-making is now widely accepted and evidence suggests that trait anxiety can influence "increased avoidance of risky decisions and pessimistic risk appraisals" (Miu, Heilman, & Houser, 2008, p. 354). Moynihan (2009a) explained decision-making capacity can be degraded by the trying circumstances of a crisis. Stress has been shown to influence overall poorer choices made, even when stable and explicit information about outcomes and stochastic effects is available (Starcke, Wolf, Markowitsch, & Brand, 2008). Further, failure to appropriately consider alternative options reduces decision quality (Keinan, 1987). Moynihan (2009a) explained, "[n]ew, unexpected, and threatening conditions weaken the capacity of individuals to make sense of new contexts and develop adaptive solutions" (p. 192). In fact, emotions themselves influence the perception and processing of stimuli (Anderson, Siegel, & Barrett, 2011; Damasio, 1994), so a "rational" perception of the situation is never completely objective nor separated from emotion. Coget, Haag, and Gibson (2011) argued that leaders may even lose sight of their overarching mission. The interruption of decision-making capacity and reverting to automatic "freeze, fight, or flight" behavior has been termed the "amygdala hijack," a common threat response to fear-inducing and stressful situations (Goleman, 2006).

Crisis response imposes its own overlapping and additional challenges beyond those associated with more typical pressured decisions. Genovese (1986) explained that leaders' decision-making is subject to "shortness of *time* to act/decide; *seriousness* of consequences (high stakes); incomplete, incorrect, or skewed *information*; psychological *prejudices* (e.g., misperception, fear, hatred, groupthink, etc.); *complexity*; an atmosphere of *uncertainty*; poor *communication*…; *stress* or fatigue; and *bureaucratic* resistance" [emphasis added] (p. 302). In a crisis, the challenges above only intensify when leaders are subject to behavioral responses to high stress, such as the amygdala hijack. Moynihan (2009a) added that, during physiological stress conditions, responders are likely become fixated on a static definition of a threat despite the emergence of new information, impeding perception and cognitive processing (p. 192), factors that not only impair immediate response, but also impede learning in the crisis.

Therefore, understanding how phenomena like the amygdala hijack alter the neurological and psychological state of the individual leading in a crisis is necessary to identify potential degradation of decision-making capabilities and capacity for action. Only then can one hope to anticipate, mitigate, and ultimately overcome these impediments. Insights on how to do so provide the foundation for constructing training curricula, discussed below, to bridge the gap between the subjective leader response to crisis and the objective ICS structure.

## NEUROSCIENCE TO ADVANCE CRISIS LEADERSHIP DEVELOPMENT

Recent advances in neuroscience provide a fruitful avenue for developing leadership scholarship, with promising gains already enhancing the field (e.g., Eagleman, 2011; Konnikova, 2013; Pillay, 2011; Rock, 2009; Sousa, 2012). These findings center on improving neurological and psychological aspects of leadership, especially emotion-processing and response to stress. Research demonstrates that impaired emotion systems are unable to effectively inform decision-making processes in complex situations (Barrett & Gross, 2001; Damasio, 1994), and that such systems can be intentionally improved. "Optimal emotional responding results when individuals shape their emotions by regulating how these emotions are experienced or expressed" (Barrett & Gross, 2001, p. 287). According to the theory of constructed emotion (Barrett, 2006; Barrett, 2017), a person can construct the experience of an emotion and inhibit realization of a counterproductive emotion that has been primed by the situation. Barrett and Gross (2001) contended that the skill of constructing and modulating emotions can be intentionally developed.

While neuroscientific and psychological principles have been applied to the study leadership and leader development generally (e.g., Hannah et al., 2013; Murphy & Johnson, 2011; Polsfuss & Ardichvili, 2008; Waldman et al., 2011), there is a paucity of literature dedicated to the specific application of these findings to crisis leadership. Examination of how neuroscience and psychology impact leader behavior is important due to the particularly dramatic nature of both neurological and psychological responses to the challenges of the leadership scenario and downstream ramifications of difficult decisions in crisis situations. While research by Pillay (2011) demonstrated that having a plan and a response framework are effective means of overcoming factors that impede decision-making and action-orientation in crisis response, ICS/NIMS still faces impediments in effective implementation due to unmodulated behavioral responses. Therefore, truly effective implementation of ICS would rely upon leaders' ability to manage psychological and emotional aspects of the response and to correct the potential disconnect between the rational ICS system and the less rational, more reactionary human behavior during crisis. The ability of leaders to manage the emotional aspects and make the correction described is trainable, but training must address the specific challenge of optimizing crisis response by human agents.

Jensen and Waugh (2014) highlighted several vulnerabilities in ICS implementation efficacy related to leadership qualities. Leaders who are respected, confident, adaptive, technically competent, flexible, accountable, and responsible (p. 10) enhance ICS efficacy. The system must include trust among actors. Jensen and Waugh specified numerous recommendations that address behavioral components of effective leadership, based on assessment of ICS performance, noting that improved ICS efficacy is evident when the overall situation is continually monitored and the response adapted according to changing information; prudent, prompt decisions are made at the appropriate levels; and progress is made toward accomplishing crisis response tasks.

In highlighting the disparity between intended implementation and actual implementation and the factors causing this separation, Jensen and Waugh (2014) called for examination of the personal traits of a leader as an individual. They demonstrated the need for leadership qualities to stretch across multiple levels and agencies, echoing the prescriptions of meta-leadership–leadership for which "…guidance, direction, and momentum across organizational lines that develops into a shared course of action and a commonality of purpose among people and agencies…" (p. 130) whose work is synergistic but varied and autonomous (Marcus et al., 2006). Indeed, Jensen and Waugh's leadership framework enables what Bigley and Roberts (2001) deemed "appropriate activation and balance of explicit and implicit structuring processes" (p. 1290). Enabling the connectivity necessary to orchestrate emergent knowledge centers within a large and diverse response structure in a state of flux is key to ICS success (Bigley & Roberts, 2001). Closing the gap between intention and performance is a function of meta-leadership, however, which is grounded in the capacities and vulnerabilities of the individual leader in the crisis (Marcus et al., 2006), requiring commitment to examine the persona of the leader first.

## Methods

As the psychological aspects of decision-making are critical to performance and possible to train, the current study set out to test: (a) whether current ICS/NIMS training addresses relevant brain science aspects of crisis response; and (b) to explore whether the presence or absence of neurological and psychological elements could be related to observed leader behavior during crisis response. The ultimate aim was to determine whether current ICS/NIMS training sufficiently prepares individuals to understand and modulate behavioral elements of response, and if not, how to improve this aspect of training utilizing brain science.

### THE SURVEY INSTRUMENT

The initial literature review—related to ICS/NIMS, crisis leadership, and behavioral response patterns—identified key positive behaviors (e.g., calm response) and their opposite negative behaviors (e.g., panicked response) for incorporation into the survey instrument. Two researchers constructed a survey based on the literature, administered online to a population determined to have received crisis leadership training and likely to have had ICS/NIMS training. Survey items included questions about sector, timeliness of training in ICS/NIMS, and whether training included aspects of leadership brain science identified as prominent themes in the leadership literature. The survey also asked if crisis leaders had observed the influence of modulatory behaviors—or the lack thereof—on ICS function. Survey items omitted personal demographic information to protect participant identity.

The survey included two qualifying questions: (a) Does your organization use ICS/NIMS (or modified variant)? (b) How recently have you received training in ICS/NIMS (or modified variant)? Only cases indicating that the participant's organization uses ICS/NIMS or a modified ICS/NIMS structure were included the analysis.

One question was used to determine if respondents recalled any psychological or behavioral elements in their ICS/NIMS training. A follow-up question asked if the respondent thought that such training would be of value. One question was used to determine the sector of the respondent's organization. The final two questions asked if participants had observed any of 11 positive behaviors or 11 negative behaviors and if, in their opinion, such behaviors either enhanced or degraded performance within ICS/NIMS, respectively.

### DATA COLLECTION AND ANALYSIS

In March and April 2016, The National Preparedness Leadership Initiative (NPLI) contacted past participants of its executive education program, which focuses on crisis leadership. (NPLI, 2013). From the sample ($n = 567$), 321 emails were opened, and 198 responses returned after the initial invitation and one reminder email sent 2 weeks later. Data were analyzed using statistical analysis software to test for validity and reliability for the 22 survey items, focused on improvements to or detractions from ICS/NIMS function contingent upon the presence or absence of specific aspects of emotional modulation, the ability to intentionally express a range of emotions in ways that are contextually appropriate and socially acceptable

(Cole, Michel, & Teti, 1994). No extant measures with which to compare the questionnaire tool were identified, and hence, the data about discriminant properties were not collected. The 11-item scale assessing improved ICS function per facets of emotional regulation was combined with the 11-item scale to assess negative human behavioral impact on ICS function into a highly reliable 22-item scale (Cronbach $\alpha = .92$).

Although the scales in the current study measured both positive and negative perceived emotional and behavioral reactions to the stress experienced during crises, negative items were not recoded to yield a univalent scale. The presence of a negative behavior, recoded, would yield its absence, not the implicit presence of a positive behavior. However, the mean inter-item correlation of the scale was .357, indicating that one's observation of negative behaviors did not preclude observation of positive behaviors.

## Results

Of the 198 responses received, 185 participants indicated that their organization uses ICS/NIMS or a modified form thereof (93.4%), while the remaining 15 participants indicated use of a different structure for crisis management. Sector distribution was from public federal ($N = 101$, 54.6%), state ($N = 21$, 11.4%), and local level ($N = 37$, 20.0%) organizations, and from private ($N = 12$, 6.5%), and nonprofit ($N = 12$, 6.5%) organizations.

Of the respondents, 185 had received formal training in ICS/NIMS, or a modified ICS/NIMS structure, recency of training varied from less than 12 to more than 60 months, as set forth in Table 1.

**Table 1. Response Frequencies Indicating Recency of Training in Incident Command System/National Incident Management System or a Modified Form Thereof**

| Time | Response frequency |
|---|---|
| Within 12 months | 71 (38.4%) |
| 12–24 months | 29 (15.7%) |
| 24–60 months | 47 (25.4%) |
| More than 60 months | 31 (16.8%) |
| Unsure | 5 (2.7%) |

Most of the participants from organizations that use ICS/NIMS or a modified ICS/NIMS structure did not report receiving training in aspects of emotional modulation, as further illustrated in Table 2.

As described earlier, the amygdala hijack is a common threat response and one's automatic behavior

**Table 2. Response Frequencies Indicating Whether Crisis Leaders Had Undergone Incident Command System Training That Included Material Related to the Psychology or Personal Behavior of Leaders**

| Material | Yes | No | Not sure |
|---|---|---|---|
| Emotional intelligence[a] | 28 (15.1%) | 141 (76.2%) | 12 (6.5%) |
| The brain under stress (amygdala hijack)[b] | 27 (14.6%) | 147 (79.5%) | 7 (3.8%) |
| Cognitive bias[c] | 27 (14.6%) | 142 (76.8%) | 12 (6.5%) |
| Social/psychological safety[d] | 43 (23.2%) | 119 (64.3%) | 19 (10.3%) |
| Decision-making capacity[e] | 93 (50.3%) | 81 (43.8%) | 9 (4.9%) |
| Mindfulness[f] | 53 (18.9%) | 131 (70.8%) | 15 (8.1%) |

[a]Emotional intelligence has been broadly defined as covering aspects of self-awareness, self-motivation, empathy, and social skills (Goleman, 2006). According to Barrett and Gross (2001), emotional intelligence depends on emotional knowledge of one's self and of others and emotional regulation, which relates to "individuals' attempts to influence which emotions they have and how they experience and express those emotions."

[b]The amygdala hijack represents the interruption of thoughtful decision-making capacity, whereby the brain reverts to an automatic "freeze, fight, flight" behavior pattern, a common threat response to fear-inducing and stressful situations (Goleman, 2006).

[c]Cognitive bias "refers to the systematic pattern of deviation from norm or rationality in judgment, whereby inferences about other people and situations may be drawn in an illogical fashion." (Haselton, Nettle, & Andrews, 2005).

[d] Rock (2009) describes the workplace as a "foremost as a social system," and provides the foundation for the concept of socially safe work environment as one where "[f]ive particular qualities enable employees and executives alike to minimize the threat response and instead enable the reward response. These five social qualities are status, certainty, autonomy, relatedness, and fairness" (SCARF). Edmondson (2004) defines psychological safety as "individuals' perceptions about the consequences of interpersonal risks in their work environment. It consists of taken-for-granted beliefs about how others will respond when one puts oneself on the line, such as by asking a question, seeking feedback, reporting a mistake, or proposing a new idea." Kahn (1990), similarly described psychological safety as "feeling able to show and employ one's self without fear of negative consequences to self-image, status, or career."

[e]Moynihan (2009a) focused on what decision-making capacity means in crises, which "tend to narrow focus and limit information processing. New, unexpected, and threatening conditions weaken the capacity of individuals to make sense of new contexts and develop adaptive solutions (Weick, 2001)."

[f]"Mindfulness meditation involves the development of awareness of present-moment experience with a compassionate, nonjudgmental stance (Kabat-Zinn, 1990). It has been suggested that this process is associated with a perceptual shift (Carmody, 2009), in which one's thoughts and feelings are recognized as events occurring in the broader field of awareness." (Hölzel et al., 2011).

**Table 3 Response Frequencies for Whether Participants Observed Perceived Changes in Incident Command System (ICS) Functional Efficacy Due to Specified Personal Behaviors or Psychological Reactions**

| Behavior | Yes | No | Not sure |
|---|---|---|---|
| Positive (P) | | | |
| 1. Calmly/Intentionally moderating stress in self and others | 160 (86.5%) | 7 (3.8%) | 14 (7.6%) |
| 2. Confidence | 163 (88.1%) | 7 (3.8%) | 12 (6.5%) |
| 3. Maintaining a balanced disposition | 154 (83.2%) | 8 (4.3%) | 19 (10.3) |
| 4. Ego control/Mission-oriented behavior | 128 (69.2%) | 26 (14.1%) | 28 (15.1%) |
| 5. Appropriate balance of "big picture" and detail focus | 143 (77.3%) | 17 (9.2%) | 21 (11.4%) |
| 6. Evidence-based decision making | 135 (73.0%) | 17 (9.2%) | 29 (15.7%) |
| 7. Deliberate decision-making | 143 (77.3%) | 16 (8.6%) | 21 (11.4%) |
| 8. Clear and accurate communication | 155 (83.8%) | 11 (5.9%) | 16 (8.6%) |
| 9. Ensuring adherence to ICS processes and protocols | 128 (69.2%) | 23 (12.4%) | 29 (15.7%) |
| 10. Ability to adjust activities to changing circumstances | 157 (84.9%) | 7 (3.8%) | 18 (9.7%) |
| 11. Adaptive capacity to understand the realistic parameters of an evolving situation | 144 (77.8%) | 14 (7.6%) | 24 (13.0%) |
| Negative Behaviors (N) | | | |
| 1. Panic | 102 (55.1%) | 66 (35.7%) | 14 (7.6%) |
| 2. Fear | 103 (55.7%) | 60 (32.4%) | 19 (10.3%) |
| 3. Temper | 142 (76.8%) | 27 (14.6%) | 13 (7.0%) |
| 4. Ego-driven behavior | 159 (85.9%) | 12 (6.5%) | 11 (5.9%) |
| 5. Obsession with details ("getting stuck in the weeds") | 156 (84.3%) | 19 (10.3%) | 7 (3.8%) |
| 6. Inability to make a decision | 156 (84.3%) | 19 (10.3%) | 7 (3.8%) |
| 7. Rush to make a decision | 139 (75.1%) | 31 (16.8%) | 12 (6.5%) |
| 8. Failure to communicate clearly | 162 (87.6%) | 14 (7.6%) | 6 (3.2%) |
| 9. Failure to adhere to ICS processes and protocols | 132 (71.4%) | 31 (16.8%) | 19 (10.3%) |
| 10. Adherence to set plans even when the situation deviates from the assumptions in the plan | 114 (61.6%) | 42 (22.7%) | 26 (14.1%) |
| 11. Inability to accept situational changes as real | 122 (65.9%) | 43 (23.2%) | 17 (9.2%) |

when confronted with a stressful situation has been described as a critical influence on decision-making efficacy, yet this was the least trained area of emotional modulation (147 participants, or 79.5% had not received training on the amygdala hijack and its impact). Decision-making capacity was the most trained area (93 participants, or 50.3% had received this training). These results support the first hypothesis that the typical format of ICS/NIMS training does not adequately address the neurological and psychological aspects of crisis leadership.

Participants were asked if they had perceived improvement to or impairment of ICS function due to several behaviors as part of our 22-item survey. As indicated in Table 3, the behaviors are frequently reported as observed during event response by those whose organizations use ICS/NIMS or a modified ICS/NIMS structure.

One observation across all behaviors on the survey was that far more individuals recognized their impact on ICS efficacy than did not: a range of 69.2%–88.1% indicated "yes" for positive behaviors and 55.1%–87.6% indicated "yes" for negative behaviors. It is plausible that individuals who have received training in the psychological and behavioral aspects of ICS use would be more sensitized to consider behaviors in their assessment of ICS function. However, the results indicate that too few participants had received ICS training

**Table 4 Associating Psychological and Behavioral Material with Positive and Negative Behaviors Surveyed and Instructive Sources Cited**

| Material | Positive behaviors | Negative behaviors | Sources |
|---|---|---|---|
| Emotional intelligence | P1, P3, P4 | N1, N3, N4 | Gardner & Stough, 2002; George, 2000; Palmer, Walls, Burgess, & Stough, 2001 |
| The brain under stress (amygdala hijack) | P1, P2, P3, P8, P10, P11 | N1, N2, N3, N8, N10, N11 | Goleman, 2006 (amydgala hijack); Ashkenazi, 2007 (emotional basement), McNulty & Grimes, 2016 (mitigating tools) |
| Cognitive bias | P5, P6, P7, P10, P11 | N5, N6, N7, N10, N11 | Banaji & Greenwald, 2013; Hammond, Keeney, & Raiffa, 1999; Kahneman, 2011; Konnikova, 2013; Schacter, Gilbert, & Wegner, 2009 |
| Social/psychological safety | P1, P4 | N1, N4 | Rock, 2009 (social safety); Edmondson, 2004 and Kahn, 1990 (psychological safety) |
| Decision-making capacity | P1, P3, P4, P5, P6, P7, P10, P11 | N1, N3, N4, N5, N6, N7, N10, N11 | Moynihan, 2009a |
| Mindfulness | P1, P4 | N1, N4 | Hölzel et al., 2011 |

to account for the responses to questions about ICS function as a product of behavioral response. In fact, insufficient group size rendered a one-way analysis of variance (ANOVA) using corrections for nonparametric data impossible.

However, there were statistically significant between-groups for emotional intelligence, $F(4, 167) = 2.81$, $p < .05$, and also for decision-making capacity, Welch's $F(4, 25.63) = 4.77$, $p < .01$. In further investigating the differences in emotional intelligence, tests for a recency effect were conducted by separating the participants into two groups: (a) ICS/NIMS training within the last 24 months, and (b) ICS/NIMS training 24 months ago or longer. Using independent sample $t$ tests to compare the means of the two groups in exposure to content pertaining to emotional intelligence and decision-making capacity in ICS/NIMS training, Group 1, more recent trainees, were more likely to have been exposed to content pertaining to the psychological aspects of decision-making capacity ($M = 1.38$, $SD = .49$) than were those in Group 2 ($M = 1.56$, $SD = .50$); this difference was significant ($t(168) = -2.34$, $p = .02$). Thus, newer programs seem to have begun to incorporate aspects of leadership pertaining to decision-making capacity in ICS/NIMS training. The difference between Group 1 ($M = 1.80$, $SD = .40$) and Group 2 ($M = 1.87$, $SD = .34$) was not significant in emotional intelligence content ($t(159) = -1.14$, $p = .26$). Given the results above and those of the ANOVA, it is plausible to conclude that emotional intelligence concepts have not been consistently incorporated in ICS/NIMS training over the two different time parameters. Further study is required to determine any trend in training using brain science principles.

In testing for a potential priming effect, investigation was to undertaken to determine if participants who differed in their rating of the potential helpfulness of training in emotional and behavioral modulation also differed in their observations of positive and negative impact of psychological and behavioral factors on the successful implementation of ICS/NIMS. Only one significant relationship was found: that observation of appropriate balance of big picture and detail focus shows significant differences across levels of perceived utility of behavioral training ($F(4, 166) = 3.85$, $p < .01$). Otherwise, no priming effect was discovered, that is, that the belief in potential helpfulness of behavioral training would influence observations of positive and negative impact of behavioral factors on implementation.

The results in Table 3 demonstrate that respondents observed behaviors they interpreted to be positive or negative and that correlated to either perceived improved or degraded function within ICS/NIMS. Such an outcome supported the second hypothesis, that despite the importance of emotional modulation in decision-making and its omission from most crisis leadership training programs, leader behavior and psychological mechanisms are observed to account for perceived performance differences in the implementation of ICS/NIMS.

Notably, 136 participants (73.6%) indicated that training in human behavior would be "extremely helpful" or "very helpful" to the function of ICS in an actual incident, while only two participants (1.1%) indicated that training would not be helpful. The results would support the third hypothesis that a supplemental training program specifically tailored to address neurological and psychological aspects of crisis response may result in more effective use of ICS/NIMS.

## Discussion

Current training for ICS/NIMS tends not to include neuroscientific or psychological or elements that may impact system implementation. The current study suggests that the observed presence or absence of certain behaviors is related to perceived leader efficacy in crisis response, and most respondents believe that such training would be helpful in improving the ICS efficacy. Recency of ICS training was not related to any of the findings in the current study (although one participant did respond "yes" in favor of having an ICS training that includes psychological and behavioral aspects of leadership with a note that the inclusions of such were planned, not extant). Jensen and Waugh (2014) also highlighted that confidence in the success of ICS/NIMS function is well-supported, but its efficacy is contingent upon expected implementation. Therefore, it appears that targeted brain science training can be complementary to and may effectively close an identified gap in crisis leadership training.

One such training system utilized in an executive education program provides an example of how integrating behavioral elements might be undertaken. (NPLI, 2013). While the curriculum is neither comprehensive nor definitive, the program has been tested for effectiveness. An independent evaluation of the first seven cohorts of the program—covering those enrolled from 2003–2010—79% percent would recommend the program to others (Preparedness and Emergency Response Learning Center, 2012). At the core of the program curriculum is the meta-leadership framework (Marcus et al., 2006) which is composed of three dimensions: (a) The Person of the Meta-leader; (b) The Situation; and (c) Connectivity in and across the meta-leaders' system of individuals and entities necessary for success. Sixty percent reported that they were significantly influenced by the content in Dimension One, "The Person" of the leader, which covers the neuroscientific and psychological aspects of leadership. When asked about specific impact of the NPLI curriculum, 37% reported significant self-perceived strengthening of their ability to confront fear, 35% reported a significant self-perceived strengthening of their ability to self-regulate, and 48% stated that the curriculum significantly strengthened their perceived self-awareness as a leader (Preparedness and Emergency Response Learning Center, 2012). Thus, while such an approach has yet to be incorporated directly into ICS/NIMS or similar training, many people have received training on the neuroscientific and psychological aspects of leadership and separately have received ICS/NIMS training or a modified version thereof.

The NPLI curriculum has evolved over time to incorporate the latest relevant brain science into leadership scholarship. Table 4 summarizes these elements, correlates them to observed positive and negative behaviors, and provides relevant sources. Among these elements are an exploration of emotional intelligence, which plays an important role in leader effectiveness (e.g., Gardner & Stough, 2002; George, 2000; Palmer et al., 2001)—promoting behaviors P1, P3, and P4 while mitigating behaviors N1, N3, and N4. Leaders must be able to regulate stress and maintain control over their emotions and their egos, while limiting panic-, temper-, or ego-driven behaviors in order to effectively lead others through high stakes situations. Further, the training model incorporates tools for understanding and mitigating cognitive biases and heuristics that can shape perception of unfolding events (Banaji & Greenwald, 2013; Hammond et al., 1999; Kahneman, 2011; Konnikova, 2013; Schacter et al., 2009)—promoting behaviors P5, P6, P7, P10, and P11 while mitigating behaviors N5, N6, N7, N10, and N11. The identified behaviors relate to accurate situational awareness, decision-making, and the adaptability necessary to process and incorporate differing perspectives where appropriate.

Finally, and perhaps most important to crisis leaders, it explores the Triple F survival response to threat:

freeze, flight, or fight (LeDoux, 2014), also known as the "amygdala hijack" (Goleman, 2006) or trip to the "emotional basement"(Ashkenazi, 2007); as well as (d) a model for mitigating its effects (McNulty & Grimes, 2016)—promoting behaviors P1, P2, P3, P8, P10, P11, while mitigating behaviors N1, N2, N3, N8, N10, and N11. Again, leaders who can mitigate the personal effects of neurological and psychological impacts of stressful crisis situations, are better able to maintain control of their response to the situation, assist others in modulating their own behavior, and communicate and adapt effectively during an unfolding crisis. The NPLI training also incorporates *mindfulness practices* that have been shown to mitigate excessive amygdala activation (Frewen et al., 2010; Holzel et al., 2010; Pillay, 2011), potentially particularly helpful in tempering panic- or fear-based decision-making, poor communication, and inadaptability.

Behaviors P9 and N9, which relate to following ICS processes and protocols, are specific to ICS training and are not covered in the NPLI curriculum. They were included in the survey instrument as an indication of whether adherence to and deviance from ICS protocols and processes were affected by relevant behavioral phenomena.

## Conclusion and Recommendations

Crisis leaders face challenging circumstances, often with life-or-death consequences. Their behavior can enhance or degrade performance—even within a highly structured and tested system such as ICS/NIMS. Extensive efforts and resources have been expended to create ICS/NIMS as a national standard as well as for ongoing training to ensure competency across the field. However, no management system obviates the human aspects of crisis response. Paramount to crisis leaders' efficacy is an enhanced understanding of themselves, their followers, and the interpersonal dynamics between them and other stakeholders. Integrating a more robust discussion of neurological and psychological phenomena and techniques for managing their impact is one pathway to nurturing such understanding.

While the application of brain science to leadership training and development generally is promising, the current study identified a gap in crisis leadership training and explored an option for closing that gap with a specific example of a training structure that incorporates brain science research. Additional quantitative studies comparing ICS/NIMS function led by individuals who have received brain science training to a control population without such training could yield further insights into its value. Also, advanced study of brain function in an ICS/NIMS environment would be useful to advance current understanding of ways to optimize crisis leadership and ICS/NIMS implementation. Leadership researchers should further evaluate tools and techniques for teaching brain science in relation to crisis leadership, both within formal ICS/NIMS systems and in less structured crisis response scenarios. Finally, research to further validate the scale of personal behaviors and psychological reactions, and their perceived impact on crisis leadership, would be beneficial.

Crisis leadership development is crucial, especially in the current context of ongoing world events. The current study provides insight into how crisis leaders can be affected by neurological and psychological factors during critical leadership moments. Training curricula including practical tools for understanding brain function, overcoming the amygdala hijack, building emotional intelligence, and mitigating biases and heuristics may be essential for making the latest brain science research relevant and useful to crisis leaders as they work to save lives, protect property, and foster community resilience.

### LIMITATIONS

Although the NPLI-driven sample pool could give a biased result in favor of executive education, the current study utilized a system of purposive sampling for two main reasons. First, the association with NPLI provided access to a participant population that otherwise would not have been possible to query, that is, one with a high likelihood of having participated in ICS/NIMS training. Second, the unique perspective of individuals who are aware of emotional regulation mechanisms appeared to provide a more nuanced picture. Such training is part of the NPLI curricula, and attendees bring the knowledge they gain back into environments that utilize ICS/NIMS for crisis response (Marcus et al., 2015). As Barrett (2008) describes, conceptualization of emotion is important to one's understanding of it.

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