

When Abnormal Becomes Normal: How Altered Perceptions Contributed to the Ocean Ranger Oil Rig Disaster

Mary Furey
Memorial University of Newfoundland

Daphne Rixon
St. Mary's University

Using an in-depth case study of the Ocean Ranger Disaster, this paper builds on prior work showing that normalization of deviance promotes altered perceptions in crisis situations; this phenomenon can ultimately lead to disaster. Themes emerging from the case study extend theory in this area beyond the techno-centric to social practice and demonstrate the importance of social construction in normalization. A contribution is made to the literature on sensemaking and normalization by demonstrating the importance of collective sensemaking and organizational culture in avoiding future disasters. Implications for safety and future research are discussed.

INTRODUCTION

On Valentine's Day, 1982, a storm raged off the shores of Newfoundland, Canada. One hundred and seventy nautical miles east of St. John's, Newfoundland's capital city, waves higher than 20 feet beat against the "unsinkable" Ocean Ranger (OR) oil rig. As the storm unfolded, the rig began to tip. It later capsized, causing the entire 84-man crew to lose their lives. When the Ocean Ranger sank to the bottom of the North Atlantic on February 15, 1982, it was the largest self-propelled semi-submersible offshore drilling unit in the world.

The purpose of this paper is to examine whether workers' altered perceptions of events in a crisis situation make it seem less serious. A case study of the Ocean Ranger Oil Rig Disaster is used to explore this question. The theoretical underpinnings of normalization theory are used to explore the circumstances that result in workers' perceptions that accidents are normal.

While it is clear that organizations do not set out to create risky situations where there is a catastrophic loss of life, the history of unexpected disasters continues. Notably, it includes the sinking of the Titanic off the coast of Atlantic Canada, the Westray Mine disaster in Nova Scotia, the Cougar Helicopter crash off Newfoundland, and the British Petroleum (BP) fire off the coast of Texas. The paper explores factors in organizational culture that contribute to such disasters.

It is important to conduct this study in light of the many workers who risk their lives to work in the offshore sector as well as in other high-risk environments. This case study adds to the literature on how altered perceptions can have a negative and sometimes catastrophic impact on workers and managers dealing with a crisis situation. Moreover, according to Bogard, Ludwig, Staats, and Kretschmer (2015),

the oil and gas industry is looking to behavior science to enhance their understanding of how normalization of deviance from standards becomes the norm over time.

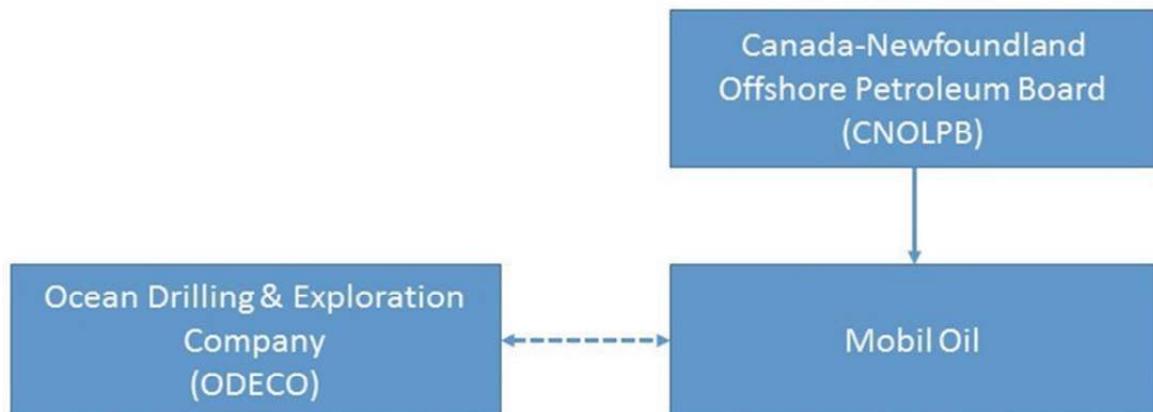
This study has implications for how organizational corporate culture, and particularly how companies develop their strategic plans to train their employees to recognize and report serious events. This research adds to the literature on normalization through insights gained by examining the Ocean Ranger disaster public inquiry report as well as from in-depth semi-structured interviews with oil rig workers who worked on the Ocean Ranger before the sinking and with workers employed with the same company on other rigs after the sinking of the Ocean Ranger. While there are numerous studies on normalization, there is a paucity of research focused specifically on the impact of normalization on the offshore industry.

Context

The province of Newfoundland and Labrador is located in the North Atlantic; it is the most easterly of the 13 jurisdictions in Canada. The province has a significant offshore oil and gas industry; indeed, oil revenue accounts for about one third of the provincial government's total revenues of nearly 6.9 billion dollars (Barnes, 2014; Province of Newfoundland & Labrador (NL), 2015). The Hibernia oil field is located about 200 miles east of St. John's.

As illustrated in Figure 1, there were several players involved in the operation of the Ocean Ranger on the Hibernia Oil field. The Hibernia oil field was regulated by the Canada-Newfoundland and Labrador Offshore Petroleum Board (CNLOPB), which was in charge of managing the regulatory aspects of petroleum resources in NL on behalf of the federal and provincial governments. Mobil Oil was the company involved with exploration, drilling and production. The Ocean Ranger oil rig was manufactured and owned by the Ocean Drilling & Exploration Company (ODECO) and it was leased to Mobil Oil at the time when the oil rig capsized.

FIGURE 1
HIBERNIA/OCEAN RANGER ORGANIZATIONAL CHART



LITERATURE REVIEW

An abundance of research exists on normalization during a crisis, and the terms normalization and displacement are well established in the literature. Bogard et al. (2015) contend the public investigations of various disasters point to the normalization of deviance. They claim that the root causes of these accidents can often be traced to past actions. Furthermore, management is generally unaware of the dangerous practices. Drawing on Vaughan's (1996) study of the Challenger Space Shuttle explosion, Bogard et al. (2015) note that when deviant behavior has been ignored, it becomes accepted or

normalized. Further evidence of normalization was identified by Mufson (2007) from the investigation into the BP Texas refinery explosion. The investigation revealed that procedures were frequently not followed.

Vaughan (1990) contended normalization is a psychological tendency among those responsible for identifying and responding to crises. Specifically, over time they redefine and accept previously unexpected anomalies as expected events and, ultimately, as acceptable risks. Perrow's (1984) influential 'normal crisis' theory posited that high-risk technology, tightly coupled with other organizational factors, is almost certain to lead to crisis due to the systematic inability to handle the effects of human error.

Perrow (1984) coined the term "normal accidents," yet recognized that some organizations are adept at avoiding "normal" accidents. Specifically, high-risk technologies can be characterized by "interactive complexity" and "tight coupling." Technology is seen as offering great advances in production while simultaneously creating the potential for serious destruction. "Most high-risk systems have some special characteristics, beyond their toxic, explosive or genetic dangers, that make accidents in them inevitable, even normal" (p. 4).

Perrow's (1984) normalization theory has been applied to high-risk industries by other researchers. For example, Vaughan (1990) applied Perrow's (1984) theory to the 1986 disintegration of the Challenger space shuttle over the Atlantic Ocean off the coast of Florida, United States. This disaster resulted in seven people losing their lives. Vaughan (1990) observed that whenever there were abnormalities, people both in the control room and on the Challenger found reasons to explain them. Thus, they normalized them so they could forget about them. Vaughan (1990) termed the observed phenomenon as "normalization of error" during the study of the O-ring failures in the Challenger accident. Weick and Sutcliffe (2001) also analyzed the same disaster and observed:

The range of expected error grew from the judgment that it was normal to have heat on the primary O-ring, to normal to have erosion on the primary O-ring, to normal to have gas blowby, to normal to have blowby reaching the secondary O-ring, and finally to the judgment that it was normal to have erosion on the secondary O-ring. (p. 40)

Perrow's (1984) normalization theory is used as the theoretical underpinning for the OR study. However, it should be noted that in the three decades since its introduction, a wide array of researchers have challenged or modified the original framework. For example, Le Coze (2015) contended that Perrow's (1984) theory is valuable when looking at the entire body of work it has inspired. Others have modified the framework (e.g., Rochlin, La Porte, & Roberts, 1987; La Porte & Consolini, 1991; Bierly & Spender, 1995; Weick, 1995) or rejected it completely (Hirschhorn, 1985; Hopkins, 1999; 2001). Not surprisingly, a third group of researchers (Starbuck & Milliken, 1988; Sagan, 1993; Vaughan, 1996; Snook, 2000; Evan & Manion, 2002; Farjoun & Starbuck, 2007; Downer, 2011) have focused on extending Perrow's original framework. Furthermore, as depicted in Table 1, (adapted from LeCoze, 2015) the definition of normalization has evolved considerably over time.

TABLE 1
CLASSIFICATION OF ACCIDENTS

Classification	Meaning
Normal (system) accident (1)	Hidden interactions create events (technological determinism)
Normal operations (2)	In opposition to accident investigation, normal operation is about what is observed and/or expected in daily operations of high-risk systems
Normal accident (3)	Extended version of (1), accidents are inevitable products of technical/organizational/social dynamics (socio-technological type of determinism)
Normal accident (4)	Different versions of (1) and (2) and critical version of (3): it is the repetition of (component) accidents in the past 30 years that makes them now normal despite knowing that they could in principle be prevented by managerial practices

Source: Adapted from La Coze (2015)

The term ‘crisis,’ as utilized in this paper, is defined as deviant events that disrupt an organization’s activities (Maitlis & Sonenshen, 2010; James, Wooten, & Dushek, 2011). Prior research on crisis has focused on the following topics as depicted in Table 2 (James et al., 2011):

TABLE 2
SELECTED SAMPLE OF CRISIS RESEARCH

Topic	Researchers
Interpretation of crisis	(Dutton & Jackson, 1987; Weick, 1988; Maitlis & Sonenshen, 2010)
Development of crisis typology	(Gundel, 2005)
Decision making during crisis	(Smart & Vertinsky, 1977; Anderson, 1983; Tjosvold, 1984)
Crisis response strategy	(James & Wooten, 2006)

Notwithstanding the broad array of research on crisis, deviant behavior and normalization, Perrow (1999) and Vaughan (1996) make important contributions to understanding the technological application of normalization. The authors show that normalization or displacement occurs during, not prior to, a crisis. This has the effect of a breakdown of socially constructed meanings. Vaughan’s (1996) normalization theory has been applied to solely technological matters that occur prior to and during the crisis, and is applicable to the Ocean Ranger disaster. However, there has been minimal research conducted on the application of normalization theory to the offshore oil sector.

METHOD

The methodology for this research is a case study comprised of semi-structured interviews with 37 oil rig employees, including workers on shore and workers on the rig. It is noteworthy that two of the respondents had worked on the OR prior to its sinking, while the remaining 35 were employed by the same company after the OR sinking. The findings from the interviews were supplemented with a documentary review of the Royal Commission on the Ocean Ranger Disaster (RCORD).

Potential interview participants were identified using the snowball selection method, an informal way of reaching the appropriate oil and gas workers. The snowball technique was implemented in this study as an economically feasible, efficient, and effective means of reaching onshore and offshore oil and gas

workers from different levels of the organizational hierarchy of more than one company in the oil and gas industry. The researcher asked interviewees to nominate people they knew well or knew by name, but only those who might have important information about the effect of distributed decision-making in a virtual environment. Participants were comprised of union, non-union, management, and non-management personnel from both offshore and land locations.

Thirty-seven respondents were interviewed using semi-structured interviews with open-ended questions. Only two referrals contacted did not agree to be interviewed. The high level of participation (two refusals) may be attributed to the fact that workers could remain anonymous by checking the appropriate item on the consent form prior to the interview. The rationale for using the interview process was to ensure that respondents had sufficient time to respond to the open-ended questions, thus providing the depth and breadth of information needed. The process encouraged respondents to speak freely by simply telling the interviewee a story. The same interview protocol was administered to management, non-management, offshore, and onshore workers to ensure continuity and consistency across all interviews. All interviews were conducted in a face-to-face format, taped, transcribed and coded.

A primary concern of the snowball sampling research method is the quality of the data, in terms of a selection bias that might limit the validity of the sample (Kaplan, Korf, & Sterk, 1987; Van Meter, 1990). This might restrict researchers from generalizing from the particular sample (Griffiths et al., 1993). The lack of rigorous controls typically associated with case studies, as well as the possible reflexivity of the researcher and the potential influence of active listening, were partially mitigated through taping the interviews (McCracken, 1988).

The semi-structured interview data collection process provided the researcher with the lived experiences of participants from the oil and gas industry (Abusabha & Woelfel, 2003; Billingsley, 2004; Moustakas, 2004; Creswell, 2009). Abusabha and Woelfel (2003) argued that the perceptions of individuals who are being interviewed allow the researcher to gather, analyze, and report accurate information in a way that is free of bias. Abusabha and Woelfel (2003) asserted that “qualitative researchers argue that, in the absence of close connection with the object of study, results will be distorted” (p. 1). The present study was conducted incorporating face-to-face interviews to establish such a close connection. The semi-structured interview process with open-ended questions was appropriate for the study because a lived experience of an interviewee provides a deep understanding of the phenomenon being studied (Silverman, 2005). Furthermore, James et al. (2011), advocate the case study as best suited to enabling researchers to capture more insight and understanding of the issues resulting in a crisis or disaster.

FINDINGS

During the semi-structured interviews, all 37 respondents provided examples of a close call situation on the rig. Moreover, they also indicated these were just one example of many incidents that they had experienced during their time on the rig. The following section provides examples from the semi-structured interviews where there were close calls with respect to accidents that were normalized.

Normalizing is based on the solving of a problem and the resultant belief that all similar problems can be solved in this same way. When normalizing, people are being creative and often doing dangerous things in close call situations. However, crises are averted. In the case of offshore rig personnel, the ability to normalize a close call situation determines the response and interaction with management on shore.

The semi-structured interviews revealed that workers appear to have a system in place for monitoring and reacting to near misses. First and foremost, they try to prevent them from happening. When recalling a near miss situation that involved an iceberg, a respondent said they managed to avoid a situation or normalize the event. Reflecting on the situation, he said of the men involved in the event, “they are wondering now what about if that hits us and what kind of damage will that do, what speed is it going, and there was a lot of unknowns there and they were really nervous and apprehensive, but, we managed to

avoid a situation.” Although the workers have anxious and panic-stricken moments of uncertainty in a crisis, they are left with a feeling of confidence after the near miss situation.

Another worker explained a close-call situation that was normalized and labeled as a near hit as opposed to a serious hit. The labeling of the situation and indication that it could have been worse is indicative of a move by workers to normalize situations early. This happens mainly because of the desire to prevent the crisis but also because of the need to decrease the number of serious hits, which are “closer calls.”

One respondent spoke of a close call with a piece of scaffolding that collapsed. The situation was initially labeled a serious hit but later as a near hit, making the occurrence seem more normal. He said, “We had a bit of scaffold fall about 30 feet. There was no one in the area. They logged it as a serious near hit first, but then logged it back to a near hit because no one was around.” The worker was referencing the fact that there were no workers around, which allowed the incident to be downgraded to a close call situation. This particular example illustrates normalization because the worker downgrades the situation and indicates that it did not turn out to be disastrous after all.

When describing a close call with an iceberg, a respondent said that the decision was made quickly and a crisis was normalized. When describing another close call, he explained the decision to stop drilling in stormy weather was often left to the last minute but then the decision to stop and the following actions were taken quickly. He explained, “a lot of decisions seem to have been made, when it comes to storms and things like that, on... not on the ship itself but in town [St. John’s]. I think sometimes there has been times when the rig has been drilling where you think, gee, they should not be drilling, you know, and then they wait for the last minute.”

Similarly, another respondent described a situation with an oil leak. It was seen as an event that happened quickly and was normalized by shutting down the platform. Once recognized as a quick event, it received quick response. Explaining the oil leak, he said, “A line broke and oil was just pouring out, but no one was there to check until later.”

Citing a similar incident, another respondent spoke about being busy problem solving and running around on the night of an iceberg close call. This limited available time to think about how he actually felt about the situation. He did not think about the main event that could lead to an eventual crisis but instead started to normalize the situation. He said, “I do not think anyone would have spent too much time... because you were that busy figuring a way to solve this problem that you were not really thinking about the iceberg too much... but everybody was just running around and there was an awful lot of stuff happening.”

In describing a near crisis event with a power outage aboard the platform, a respondent noted the inability to know what was going on in the plant because the control system, which is a key to plant safety, was not working. He said, “It could have been seriousI cannot see it happening again.” The worker expressed confidence in what was done to rectify the situation and indicated that a recurrence is unlikely. His construction of the next similar crisis situation will likely be impacted by what he now deems normal. The semi-structured interviews revealed several examples of situations where there were close calls that did not result in a crisis.

The Royal Commission on the Ocean Ranger Disaster (RCORD) also found support for employees normalizing the abnormal as illustrated in the following examples where workers downplay problems as a means of buoying confidence. The RCORD found that the ballast control operators (ballasting and de-ballasting is a process by which sea water is taken in or out of the rig) were told to record that all anchor tensions were within the 235-250 kips (a unit of force of 1000 pounds), even when this was not the case (RCORD, Vol. 1, p. 47). On the night of February 14, 1982, Jacobsen, Mobil’s senior drilling man on the rig reported that all anchor tensions were within the 249 kips range. This was impossible under the environmental conditions prevailing that night. The RCORD indicated that “evidence was given that commencing in January 1982, the anchor tensions listed in reports were fabricated” (RCORD, Vol. 1, p. 47). Further evidence of normalizing prior close calls is reflected in the second last OR rig transmission which was stated in a calm voice. At 1:14 a.m. February 15, 1982 Jacobsen stated, “The rig was listing and not coming back for us” (RCORD, Vol. 1, p. 64).

DISCUSSION

This research study found that workers altered the close-call event to make it seem less serious than it actually was. While the event is prevented from becoming a full-blown crisis, there is no guarantee that the situation will not reoccur at another time. One possible reason for the workers' actions is justification to their co-workers for actions taken. Another possible explanation is peace of mind for the workers. Workers downplay problems as a means of buoying confidence. For example, the ballast control operators were told to record that all anchor tensions were within the 235-250 kips, even when this was not the case (RCORD, Vol. 1, p. 47). It is likely that the figures were deliberately misstated to comply with the directive to cover up any further damage to the organization's image, and thus buoy confidence from stakeholders. Another possibility for the inaccurate recording of the data could be evasive answering from the company regarding safety conditions aboard the rig. Throughout the night the crew repeatedly reported that all was functioning normally. Perhaps this misstatement had become normal for the crew. However, the hiding or changing of various operating figures suggests there was a data error that likely compounded crisis planning.

In close call situations, when a crisis is averted it builds confidence in the personnel's abilities to handle future similar crisis situations, even in time-sensitive cases. Whether a situation is defined as a crisis is impacted by the variables of excessing waiting, confusion over the identity of the decision maker and the avoidance of responsibility due to fear of repercussions. It is likely that neither the rig crew nor management saw the OR list as a crisis. The crew may have framed the crisis inaccurately because their practice had been to focus and continue trying to solve or normalize the problem.

This study found that workers re-interpreted events to diminish their seriousness. In the case of the OR, the normalization hypothesis was supported by the normal practice of not de-ballasting the rig. Data indicated that even though the OR crew had consistently not adhered to accepted de-ballasting practice; the rig demonstrated a capability to continue drilling in weather conditions too severe for other rigs. This left the workers with a false sense of security.

The OR disconnected because of weather conditions only once in its five-year operating history. This happened on January 16, 1982, but the rig did not de-ballast at that time. In addition, the rig had a close call prelude the event on February 6, 1982. It developed a sudden port heel (list or lean) of six degrees while taking on liquid cargo from a supply vessel. In the February 14, 1982, crisis, the crew once again did not follow the de-ballasting rules; this eventually led to the catastrophic result of sinking the rig. The crew's lax approach to de-ballasting had become acceptable and common practice aboard the rig and, in that sense, was considered normal. It was not until the model failed that the practice was shown to be flawed and representative of a serious threat. The crew may have framed the crisis inaccurately because their practice had been to focus and continue to try to solve the problem.

The RCORD provides support for finding that workers alter events to make them seem less serious than they actually are. Whether workers intentionally or unintentionally downplay crisis events is unclear; however, misreporting activities and lists had become normal occurrences aboard the OR rig. Prior to the rig disaster, workers had altered severe events to make them appear less serious. Consequently, a truly serious event had become a ticking time bomb embedded in what was deemed normal rig culture.

Interviews with oil and gas workers indicate the majority of fleets today have no secondary means of ballasting their rigs. It is somewhat astonishing that after the OR rig disaster and Royal Commission inquiry steps were not taken to ensure all rigs addressed the problem with secondary ballasting. It is alarming that the oil and gas industry has normalized list situations. This normalization of the ballasting process has acted as a security blanket by becoming embedded in practice and feeding back into the breakdown in socially constructed meanings during a crisis.

Moreover, the existing problem with the ballast control valves, identified at the time of the OR disaster in 1982, was not rectified by one particular platform until 2007. This provided a clear indication of crisis events becoming normalized, thus feeding back into the social construction of what then became the workers' reality. Following the OR disaster, the problem with the ballast controls once again became normal.

A circulatory link exists between the normalization variable and the variable associated with a breakdown of socially constructed meanings during a crisis. The connection between the two variables is considered circulatory because the variables feed on themselves and are in constant motion. The normalization of an event as non-crisis impacts the social construction of meaning during subsequent close call or crisis events. Normalization applies a comfort blanket or the embeddedness in practice of situations that are not normal, thus eliminating further complication in the breakdown of socially constructed meanings.

These research findings support the abundance of research on normalization during a crisis. Accounts by Vaughan (1996) and Perrow (1999) show that normalization or displacement commonly occurs during a crisis, and not prior to a crisis. In Vaughan's application of Perrow's theory to the Challenger disaster, she observed that whenever abnormalities existed, people found reasons for them and thus normalized them so that they could forget about them. In the Challenger accident, "the range of expected error grew from the judgment that it was normal to have heat on the primary O-ring...and finally to the judgment that it was normal to have erosion on the secondary O-ring" (Weick & Sutcliffe, 2001:40).

In comparison, this research provides support for normalization or displacement activities of social systems. Similar to Perrow and Vaughan's findings, this research offers an understanding of how workers respond to close-call situations based on their working knowledge of similar situations. It also indicates workers' inclination to deal with circumstances they are confronted with through actions such as normalization.

Both scholars' work deals with techno-centric systems whose workings are complex and tightly connected. This research, however, deals with social systems because it addresses how personnel behave in terms of social construction or sensemaking. The research extends Perrow's (1984) normalization theory to social systems, extending beyond the solely technological matters that occur during the crisis. Technical causes of accidents vary, but there are organizational failures that accident analyses reveal are similar (Hopkins, 2000). Social systems analysis provides a means of generalization and learning that can be transferred among crisis situations. This normalization process is a component of the decision-making process. It also adds to the number of rules, thus becoming embedded in practice and acting as a comfort blanket. This occurs at the onset of the crisis decision-making process, further complicating the breakdown of socially constructed meanings during a crisis. Normalization has an effect on the breakdown of socially constructed meanings.

CONCLUSIONS

The objective of this study was to determine the extent to which normalization of prior accidents and close calls contributed to the series of events that culminated in the sinking of the OR. The findings from the semi-structured interviews and documentary review found normalization was indeed a contributor to this case. These research findings indicate that through normalization people are flexible and engage in risky actions that most often result in acceptable and non-catastrophic endings. For example, the practice of not de-ballasting in stormy weather conditions had only once resulted in a crisis for the crew. Instead of being bound by formal rules and procedures, workers became more inclined to respond with actions such as avoidance, displacement and normalization. This provides reinforcement for dangerous habits that could lead eventually to a major crisis, as was the case in the OR rig disaster.

The RECORD provided support for findings from the semi-structured interviews that workers alter their views of events to make them seem less serious than they actually are. Downplaying and misreporting of activities aboard the rig, as well as the acceptance of lists as natural, support the findings regarding normalization. Whether workers intentionally or unintentionally downplay crisis events is unclear; however, misreporting activities and lists had become normal occurrences aboard the OR. Prior to the rig disaster, workers had altered severe events to make them appear less serious. Consequently, a truly serious event was not perceived as such in what was deemed normal OR culture.

Furthermore, this research contributes to Vaughan's (1996) normalization theory by extending the application beyond the techno-centric to social practice. Social practices are also prone to normalization.

Organizational theory (Morgan, 1989) tends to exaggerate structure and neglect process (Kivy, Tsoukas, & Knudsen, 2003). Social construction erodes organizational structure in crisis situations. The conflicting organizational structure and social construction requires a process-based theory about how organizations behave that is more amenable to social construction. The findings from this study support Bogard et al.'s (2015) suggestion that industry should use behavioral science contributions to identify deviant behavior and to develop a cultural will to report deviations.

The study also found that in the 25 years subsequent to the OR disaster, there were still instances of normalization on the company's oil rigs. In fact, it took 25 years for the ballast control rules to be formalized. The study makes a unique contribution to the literature since it is based, in part, on interviews with oil rig workers employed by the same company some 25 years after the OR sinking. In addition, two of the respondents had worked on the OR prior to its sinking. The experiences of these respondents provide unique insight into organizational practices and culture that continue to evolve into normalization even after such a major tragedy.

Since this case study is based on a non-statistical sample, as described in the methodology section, it cannot be generalized to the offshore oil industry at large. However, the study provides strong evidence that normalization does occur and can lead to devastating results.

A fruitful area for future research would be to examine whether normalization had any discernable impact in more recent disasters such as the Cougar Helicopter crash or the BP fire. In addition, it would be beneficial to explore why there is little evidence of organizational learning from these catastrophic events. Finally, a further area for research would be how managers can develop a strategy that fosters or creates a corporate culture which ensures workers recognize risks and abnormalities and report them appropriately.

REFERENCES

- Abusabha, R., & Woeful, M. L. (2003). User-centred design goal setting: The interplay between user research and innovation. *Journal of the American Dietetic Association*, 5, 103–104.
- Anderson, P. A. (1983). Decision making by objection and the Cuban missile crisis. *Administrative Science Quarterly*, 28(2), 201–222.
- Barnes, P. (2014). *An overview of the Newfoundland and Labrador oil and gas industry*. C. A. o. P. Producers (ed).
- Bierly, P. E., & Spender, J. C. (1995). Culture and high reliability organizations: The case of the nuclear submarine. *Journal of Management*, 21(4), 639–656.
- Billingsley, B. S. (2004). Special education teacher retention and attrition: A critical analysis of the research literature. *The Journal of Special Education*, 38(1), 39–55.
- Bogard, K., Ludwig, T. D., Staats, C., & Kretschmer, D. (2015). An industry's call to understand the contingencies involved in process safety: Normalization of deviance. *Journal of Organizational Behavior Management*, 35(1-2), 70–80.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage.
- Downer, J. (2011). "737-Cabriolet": The limits of knowledge and the sociology of inevitable failure 1. *American Journal of Sociology*, 117(3), 725–762.
- Dutton, J. E., & Jackson, S. E. (1987). Categorizing strategic issues: Links to organizational action. *The Academy of Management Review*, 12(1), 76.
- Evan, T., & Manion, M. (2002). *Minding the machines: Preventing technological disasters*. Upper Saddle River, NJ: Prentice Hall.
- Farjoun, M., & Starbuck, W. H. (2007). Organizing at and beyond the limits. *Organization Studies*, 28(4), 541–566.
- Griffiths, P., Gossop, M., Powis, B., & Strang, J. (1993). Reaching hidden populations of drug users by privileged access interviewers: Methodological and practical issues. *Addiction*, 88(12), 1617–1626.

- Gundel, S. (2005). Towards a new typology of crises. *Journal of Contingencies and Crisis Management*, 13(3), 106–115.
- Hirschhorn, L. (1985). On technological catastrophe: Normal accidents. *Science*, 228(4701), 846–847.
- Hopkins, A. (1999). The limits of normal accident theory. *Safety Science*, 32, 93–102.
- Hopkins, A. (2001). Was three mile island a “normal accident”? *Journal of Contingencies and Crisis Management*, 9(2), 65–72.
- James, E. H., & Wooten, L. P. (2006). Diversity crises: how firms manage discrimination lawsuits. *Academy of Management Journal*, 49(6), 1103–1118.
- James, E. H., Wooten, L. P., & Dushek, K. (2011). Crisis management: Informing a new leadership research agenda. *The Academy of Management Annals*, 5(1), 455–493.
- Kaplan, C. D., Korf, D., & Sterk, C. (1987). Temporal and social contexts of heroin-using populations an illustration of the snowball sampling technique. *The Journal of Nervous and Mental Disease*, 175(9), 566–574.
- Kivy, P. (2003). *The Oxford handbook of organization theory: [meta-theoretical perspectives]*. New York: Oxford University Press.
- La Porte, T. R., & Consoling, P. (1991). Working in practice but not in theory: Theoretical challenges of “high-reliability organizations.” *Journal of Public Administration Research and Theory*, 1, 19–47.
- Le Coze, J.C. (2015). 1984-2014. Normal accidents. Was Charles Perrow right for the wrong reasons? *Journal of Contingencies and Crisis Management*, 23(4), 275–286.
- Maitlis, S., & Sonenshein, S. (2010). Sensemaking in crisis and change: Inspiration and insights from Weick (1988). *Journal of Management Studies*, 47(3), 551–580.
- McCracken, G. D. (1988). *The long interview* (12th ed.). Newbury Park, CA: Sage Publications.
- Morgan, G. (1989). *Creative organization theory: A resource book* (2nd ed.). United States: Sage Publications.
- Moustakas, C. E. (1994). *Phenomenological research methods* (6th ed.). Thousand Oaks, CA: SAGE Publications.
- Mufson, S. (2007, January 17). BP failed on safety, report says. *Washington Post*. Retrieved from <http://www.washingtonpost.com/wp-dyn/content/article/2007/01/16/AR2007011600208.html>
- Perrow, C. (1984). *Normal accidents* (8th ed.). New York, NY: Basic Books.
- Perrow, C. (1999). *Normal accidents: Living with high-risk technologies, with a new afterword and a postscript on the Y2K problem*. Princeton, NJ: Princeton University Press.
- Province of Newfoundland & Labrador (2015). *Consolidated Summary Financial Statements*. Finance, (ed.): House of Assembly
- Rochlin, G., La Porte, T., & Roberts, K. (1998). The self-designing high-reliability organization: Aircraft carrier flight operations at sea. *Naval War College Review*, 51(3), 97-113.
- Sagan, S. D. (1993). *The limits of safety*. Princeton, NJ: Princeton University Press.
- Silverman, D. (2009). *Doing qualitative research: A practical handbook* (3rd ed.). Thousand Oaks, CA: SAGE Publications.
- Smart, C., & Vertinsky, I. (1977). Designs for crisis decision units. *Administrative Science Quarterly*, 22(4), 640.
- Snook, S. (2000). *Friendly fire : The accidental shootdown of U.S. Black Hawks over Northern Iraq*. Princeton, N.J.: Princeton University Press.
- Starbuck, W. H., & Milliken, F. J. (1988). Challenger: fine-tuning the odds until something breaks. *Journal of Management Studies*, 25(4), 319–340.
- Tjosvold, D. (1984). Effects of crisis orientation on managers’ approach to controversy in decision making. *Academy of Management Journal*, 27(1), 130–138.
- Vaughan, D. (1990). Autonomy, interdependence, and social control: NASA and the space shuttle challenger. *Administrative Science Quarterly*, 35(2), 225.
- Vaughan, D. (1996). *The challenger launch decision: Risky technology, culture, and deviance at NASA*. Chicago: University of Chicago Press.

- Weick, K. E. (1988). Enacted sensemaking in crisis situations [1]. *Journal of Management Studies*, 25(4), 305–317.
- Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks: Sage Publications.
- Weick, K. E., & Sutcliffe, K. M. (2001). *Managing the unexpected: Assuring high performance in an age of complexity*. San Francisco, CA: Jossey-Bass Inc.