The Role of Cue Utilisation in Project Management Sensemaking: A Focus on the Disaster Recovery Context

By Eva Marie Gacasan

Master of Arts in Psychology – Industrial/Organisational Psychology

University of San Carlos

Bachelor of Science in Psychology

Mindanao State University – Iligan Institute of Technology

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Faculty of Human Sciences

Department of Psychology

Macquarie University, Sydney, Australia

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Abstract

Project management has been defined as an exercise in the management of complexity whereby project managers are continuously required to cope with the intricacies and uncertainties associated with their projects (Baccarini, 1996). Effective project managers are constantly acquiring, integrating and comparing project-related information against shorter and longer-term goals. This process involves deriving 'sense' from a complex and complicated array of data—only some of which are directly relevant to the progression of the project.

The capacity to 'make sense' of information from disparate sources underpins the process of project management. Although 'sensemaking' is recognised as a critical capability associated with project management, the existing literature is largely descriptive. Further, there is little exploration of sensemaking in the context of disaster recovery project management.

The aim of this research programme was to develop and evaluate a measure of individual sensemaking as applied in project management, specifically in disaster recovery. Sensemaking was examined through the basic constructs of cue utilisation. The research aim was divided into three research questions and addressed through three corresponding studies:

In Study 1, cues pre-empting sensemaking in the general context of project management were identified. Using naturalistic decision making (NDM) as a frame, overt and difficult-to-articulate cues (Kahneman & Klein, 2009) that serve to guide skilled project managers were established. Cognitive interviews were conducted using cognitive task analysis (CTA) and applying the critical incident technique (CIT), where the participants were asked to recall critical project incidents that threatened the progression and outcomes of their respective projects. The critical incidents served as units of analysis in the extraction of the cues. The outcomes revealed three categories of cues that aided project management sensemaking: feedback cues, context cues and tacit knowledge.

In Study 2, the cues identified during the cognitive interviews were tested to ensure that they constituted valid representations of cues that are used in the project management domain. The cues were examined in relation to project-specific constructs, including project complexity and stages of project management (initiation, execution and closing). An online survey was distributed to participants with and without experience in project management. Statistically significant differences were evident in the perceived utilisation of cues wherein experienced project managers demonstrated relatively greater perceived utilisation and discrimination in the use of cues in comparison to the naïve cohort. The results provided support for the validity of the sensemaking cues that were identified in Study 1.

Finally, Study 3 was designed to evaluate a measure of cue utilisation in the context of disaster recovery project management. Cue utilisation was measured based on four-component tasks: cue identification, cue association, cue discrimination and cue prioritisation. Statistically significant differences in performance were evident between naïve and non-naïve groups in cue identification, cue association and cue prioritisation.

This research programme provides empirical support for the role of cue utilisation as a fundamental cognitive process in project management sensemaking. Conceptually, it has established, for the first time, the role of cue utilisation in disaster recovery project management. It also demonstrates associations between sensemaking, project complexity and the progression of projects. At a practical level, this research provides an empirical basis for training and assessment in cue identification and utilisation.

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Declaration

This thesis has not been submitted for a higher degree to any other university or institution. The work is predominantly that of the PhD candidate. Components of the thesis that involved collaboration have been noted as such. The Macquarie University Ethics Committee approved the research reported in this thesis on 15 November 2012 (Reference No: 5201200812), 29 January 2014 (Reference No: 5201300800) and 16 February 2015 (Reference No: 5201401123).

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Overview of the Thesis Structure

This PhD thesis is organised into five major chapters. Chapter 1 sets the background and direction for this research by introducing the research context, providing the conceptual bases, and articulating the overall research aims and study designs. The subsequent three chapters present the research programme that was formulated to systematically address the research questions at the different stages of the research investigation. Chapter 2 presents Study 1, a qualitative study that formed the foundation of the remaining research components. Chapter 3 reports the outcomes of Study 2 that was designed as a confirmatory study to validate the results in Study 1. Chapters 2 and 3 are extended papers. A published paper based on Chapter 2 (Study 1) and Chapter 3 (Study 2) can be found in Appendix A. Chapter 4 presents the final research component, Study 3, with outcomes from an experimental investigation. Chapter 5 synthesises the three component studies by revisiting the specific research aims, providing discussions on the findings and outcomes, and evaluating the overall contributions of the research.

Chapter 1: Introduction

Overview of Introduction

The introduction of this thesis comprises three sections: Section 1 introduces project management in the context of disaster recovery. To understand the impetus for, and the growing interest in, this domain, this section provides background information concerning disasters at a global level and the consequent proliferation of disaster recovery projects. The complexities of disaster recovery projects and the developments in disaster management are subsequently examined. The section concludes with the identification of sensemaking as a critical project management skill that acts as a mechanism to enable the early diagnosis of complex project situations.

Section 2 describes contemporary perspectives concerning sensemaking, drawing from the relevant literature on organisation behaviour and cognitive science from which the early works on sensemaking have emerged. This section also considers sensemaking research that has been conducted in the context of disaster management/project management. A gap is identified in the application of sensemaking to disaster recovery project management in both research and practice.

Section 3 presents the thesis aims, divided into three research questions. The specific research questions are outlined, together with the supporting rationale. Finally, this section presents a summary of the thesis' contribution in terms of its conceptual value and the practical application of the sensemaking construct in both disaster management and project management domains.

Section 1: Disaster Recovery Project Management: The Research Context

Disasters in a global scenario and the proliferation of disaster recovery projects.

Major natural disasters including floods, storms, droughts, landslides, earthquakes and tsunamis continue to cause large-scale destruction that includes loss of life and socio-economic costs that challenge the capabilities of affected societies and the world at large. Natural disasters are defined as any geophysical, meteorological, hydrological, climatological, biological or extra-terrestrial event that results in the deaths of ten or more people, affects 100 or more people or leads to the declaration of a state of emergency or a call for international assistance (Below, Wirtz, & Guha-Sapir, 2009). In 2015, there were 346 natural disasters in 113 countries that killed 22,773 people, affected 98.5 million lives and caused economic damage valued at US$66.5 billion (Centre for Research on the Epidemiology of Disasters (CRED), 2016). The previous decade witnessed an annual record of 367 disasters occurring in 116 countries and resulting in 76,424 deaths, with 173 million people displaced or affected and US$155.8 billion in economic losses.

Following large-scale disasters, there is generally a proliferation of various projects targeted towards disaster response and recovery (Crawford, Langston, & Bajracharya, 2013). Projects, or short-term organisations, provide mechanisms to deliver aid assistance through the contribution of knowledge and labour-intensive activities (Pilbeam, 2013). As temporary entities, disaster-related projects follow non-routine processes to achieve non-routine outcomes, bound by predefined timeframes and sets of performance criteria and involving conscious efforts to organise different actors (Packendorff, 1995).

During the early stages of disaster recovery, projects are directed towards protecting life and health, providing relief and accommodating the immediate needs of the affected community. Later recovery efforts are targeted towards the rehabilitation and reconstruction of the community (International Federation of Red Cross and Red Crescent Societies (IFRC), 2012).

Disaster recovery projects embody a distinct identity (Chang-Richards, Rapp, Wilkinson, von Meding, & Haigh, 2015). They are multi-objective in nature (Trivedi, & Singh, 2016), combining both a humanitarian (Pilbeam, 2013) and a profit orientation (Haigh & Sutton, 2012). Humanitarian motives address the need for efficient management of the flows of goods, information, and services urgently required by the affected communities (Trivedi, & Singh, 2016). Profit orientation arises from the participation of profit-orientated enterprises that are typically selected by national and international non-government organisations to deliver complex and capital-intensive construction projects (Haigh & Sutton, 2012). Since major disasters usually impact the local economy, infrastructure and resources, there tends to be a lack of local capability and expertise to manage and deliver recovery and reconstruction projects thereby necessitating the assistance of these private business entities (Chang, Wilkinson, Potangaroa, & Seville, 2012; Haigh & Sutton, 2012).

Typically, disaster recovery projects are implemented outside of business-as-usual models wherein the operational environment is denoted by a high degree of uncertainty and complexity with incomplete or unavailable information (Trivedi, & Singh, 2016). There is an acute sense of urgency (Walker & Steinfort, 2013) to effect the prompt stabilisation and recovery of disaster victims and the recovery of damaged infrastructure (Kim & Choi, 2013). Clearly, both humanitarian and entrepreneurial objectives drive disaster recovery projects.

Complexity in disaster recovery projects.

One of the most difficult tasks for any disaster recovery worker is making sense of the complex and dynamic environments of disaster recovery projects (Weeks, 2007). Complexity is a property of projects where the comprehension, control and prediction of outcomes can be quite difficult, despite the availability of information (Vidal, Marle, & Bocquet, 2011). Two interrelated dimensions that describe the complexity of disaster projects are multiplicity and ambiguity.

Multiplicity refers to the number and variety of components and interdependencies within and outside a disaster project (Davies & Mackenzie, 2014). Typically, multiple stakeholders participate in disaster recovery projects and often have overlapping responsibilities and activities (Chang-Richards et al., 2015) that may vary at the agent (e.g., individuals, families and disaster responders), organisation (e.g., local and national government agencies, international and local non-government agencies, medical assistance teams and engineering and construction companies) and cross-territory (across jurisdictions) levels (Kim & Choi, 2013; O'Sullivan, Kuziemsky, Toal-Sullivan, & Corneil, 2013). Diverse and dynamic interactions typically manifest through differences in objectives and approaches, access to resources, training, expertise and mandates (Cox & Danford, 2014). Naturally, a major challenge in disaster-related projects is the integration of different project components, where each contributes and influences how the project will unfold (Walker & Steinfort, 2013).

Ambiguity arises from a lack of awareness and knowledge about and/or foresight into the project state and the connections between different project elements (Yang, Lu, Yao, & Zhang, 2014). In the disaster context, these ambiguities arise mainly from technical or socio-political issues. There might be insufficient knowledge or a lack of information regarding the technical nature of a given disaster—including the necessary skills or techniques as well as potential risks and impacts on people and the environment—or there may be a lack of understanding of the socio-political milieu, including cultures as well as the needs of, and existing relationships within, communities (Denis, 1991).

Ambiguity and uncertainty concerning the procurement of resources constitute major challenges in disaster recovery operations. The procurement of resources is impacted by several factors including market conditions, transportation capabilities, stakeholder relationships, political, socio-economic and environmental conditions and governmental regulations (Chang-Richards, Wilkinson, Potangaroa, Seville, 2013). Consequently, disaster recovery projects are often associated with resource shortages, supply disruptions, 'cost

surges' and profiteering, leading to cost overruns and deferred delivery (Chang-Richards et al., 2013).

Complexity in information acquisition and coordination.

Timely and accurate information is critical in disaster recovery project operations (Hayes & Hammons, 2002). It is a vital resource impacting the rate and effectiveness of disaster responses, including rescue and the preservation of lives, livelihood and properties. Disaster recovery operations rely on a supply of information concerning the whereabouts and status of affected communities, the impact and risks of the disaster on and for communities and the environment, the vulnerabilities and histories of affected communities, and the actions taken responding to present and future needs (e.g., adaptation strategies, risk reduction, resilience-building and early warnings and predictions) (Mutasa, 2013). As Mutasa (2013) elaborates, disaster-related information informs and determines management interventions in different project areas, including risk management.

The capability of disaster recovery project practitioners to form judgments and respond rapidly to disaster situations is often hampered by the difficulty in obtaining real-time, accurate and reliable information (Preece, Shaw, & Hayashi, 2013). Typically, there can be an information 'drought' (Mutasa, 2013) during the aftermath of a disaster within which the necessary information or expertise is not available and/or is difficult to acquire when necessary (Zhang, Zhou and Nunamaker, 2002). However, there may also be a 'flood' of information (Mutasa, 2013) consisting of both relevant and irrelevant information. Rumours, gossip and misinformation can become widespread so that any information needs to be filtered and assessed for reliability and accuracy (Preece et al., 2013).

Because of the urgent demand for information sharing, the speed of acquiring information may affect the quality of the information acquired (Preece et al., 2013). Information may be collected haphazardly, analysed, managed and distributed inefficiently, or not acquired at all (Mutasa, 2013). When information is inaccurate, unavailable or

inaccessible, it often creates a sense of uncertainty, frustration and stress among practitioners and community members alike (Dawes, Creswell & Cahan, 2004). Most importantly, low quality and untimely information affects decision-making and the speed/efficacy of responses, thereby increasing the risks for both victims and responders.

One of the problems highlighted in the IFRC Real Time Evaluation Report for Typhoon Haiyan in the Philippines (2014a) related to challenges in communication and information coordination. The initial response phase was particularly problematic for the local host community, the Philippine Red Cross (PRC), which was not properly informed of the number, assignment and locations of some of the international delegates. There was a perception that some of the foreign emergency response units (ERUs) were operating independently. Similarly, a recurring theme in analyses following Hurricane Andrew in 1992, the 9/11 terrorist attacks in 2001, and Hurricane Katrina in 2005 was that information collection and coordination between key actors and the public was deficient, which accounts for the slow and inadequate rescue and recovery responses (Kapucu, Berman, & Wang, 2008).

Indeed, disaster recovery operations typically deal with complex communication issues relating to the exchange of dynamic information, planning, coordination, and negotiation among diverse key players (Bui, Cho, Sankaran, Sovereign, 2000). Tensions between government and non-government organisations inherently occur due to differences in orientation, strategies, and infrastructures. Non-government organisations (NGOs) typically have a decentralised organisational structure with field offices exhibiting high levels of autonomy, are orientated towards short-term goals, and possess technological capabilities that are connected to their mission and culture (Maiers, Reynolds, & Haselkorn, 2005). On the other hand, government emergency management organisations emphasise bureaucratic process, centralised operational structure, and long-term approach. The differences in goals and practices between these two entities have led to criticisms. NGOs may view government agencies as restrictive of their freedom through authoritative control, corrupt and inefficient

practices, whereas, government agencies may regard the NGOs as over-resourced, opposed to transparency and accountability, donor-driven, and overcritical of government policies (Harvey, 2010).

Communication and coordination in disaster operations are also highly impacted by mass and social media. Traditionally, mass media channels (e.g. radio and television) deliver disaster warnings and disaster coverage (Houston et al., 2015). Recently, there is an increasing utilisation and recognition of the value of social media in the different disaster phases (pre-event, during, post-event) (Wiederhold, 2013). Unlike mass media that tends to provide information derived from a single source, social media sites and applications offer greater potential for richer, faster, dependable and interactive communication (Houston et al., 2015). Furthermore, social media enables the projection of the current state of crisis. This occurred during the earthquake-tsunami in Japan in 2011, where news spread faster via Twitter, with 20,000 tweets per second and during the Hurricane Sandy in 2012 where photos were uploaded at the rate of 10 per second in Instagram (Wiederhold, 2013). Both social and mass media sources are important for data collection and the management of aftermath of disasters in the future.

In sum, disaster recovery projects are complex environments that typically involve an intricate network of stakeholders and systems, a high degree of uncertainty and ambiguity, and challenges in integration and coordination. From a management point of view, an assessment of the nature of project complexity provides a useful reference for the type of management necessary to successfully complete a project (Lu, Luo, Wang, Le, & Shi, 2015; O'Sullivan et al., 2013). Planning, coordination and control activities together with the selection of appropriate organisational forms, arrangements, and tools, are all necessary in managing project complexity (Baccarini, 1996).

The management of disaster recovery projects.

The occurrence of deadly disasters in the past decades and the inevitability of disasters have led to the creation and adoption of frameworks that targeted disaster risk reduction. The Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters provided a decade-long blueprint to reduce the impact of disasters (Kelman, & Glantz, 2015). Learning from the successes and shortcomings of the HFA, the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 was adopted in March 2015 at the United Nation's Third World Conference on Disaster Risk Reduction as the global blueprint to approach disaster management (The United Nations Office for Disaster Risk Reduction (UNISDR), 2015). The SFDRR is viewed as shifting in emphasis from mere disaster management to the disaster risk management. It articulates four priorities for action that include: understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience, and enhancing disaster preparedness for effective response and to 'build back better' in recovery, rehabilitation and reconstruction. Its global targets include substantial reductions in global disaster mortality, the number of affected people, economic losses, the damage to critical infrastructures, and disruptions of basic services, and a substantial increase in the number of countries with national and local disaster risk reduction strategies, international cooperation to developing countries, and the availability of, and access to, multi-hazard early warning systems and disaster risk information and assessments. Therefore, the SFDRR framework provides important indicators for disaster management efforts and outcomes.

Disaster management.

The scale, complexity and compressed schedules of disaster recovery projects demand the efficient management of recovery efforts (Hayes & Hammons, 2002). Disaster management consists of plans, structures and arrangements that are established to coordinate

the endeavours of various stakeholders involved in given projects, including governments and voluntary and private agencies (Tun & Pathranarakul, 2006).

Disaster management or disaster risk management encompasses all phases of a disaster event, including mitigation, preparedness, response, and recovery. In practice, this involves risk assessment, preparedness programmes, emergency responses, rescue operations, aid distribution, and reconstruction programmes (Othman & Beydoun, 2013). Disaster management is described as a public form of project management (Tun & Pathranarakul, 2006), as a result of the participation of various stakeholders from different backgrounds who form collaborative partnerships in disaster project operations.

Four principles guide disaster management: comprehensiveness, progression, integration and professionalism (Suhaimi, Marzuki, & Mustaffa, 2014). According to Suhaimi et al. (2014), the first principle dictates that disaster managers consider all of the hazards, stakeholders and implications associated with the disaster. The second principle refers to the disaster manager's ability to anticipate, by instituting prevention and preparatory measures to develop disaster-resilient communities. The third principle describes the task of disaster managers to ensure the coordination of efforts among different stakeholders at community, government and non-government levels. The final principle advocates the competence of disaster managers to demonstrate scientific and knowledge-based approaches through education, continuous training and improvement, experience, ethical practices and public stewardship.

In the context of managing the changes and the communication, process and priority requirements that arise following a disaster, Hayes and Hammons (2002) refer to the importance of skilled 'disaster recovery project management'. The term suggests the interrelated nature of disaster management and project management. Project management is a skilled process of directing and coordinating human material resources throughout the life of a

project by using various management techniques to achieve predetermined objectives concerning the scope, cost, time, quality and client satisfaction (Wideman, 1989).

Despite Hayes' and Hammons' (2002) assertions, there are only limited references to the application of project management in the context of disaster management and disaster recovery (Crawford et al., 2013). In fact, it is only relatively recently that the Project Management Institute (PMI) has considered the interrelatedness of the two fields. This occurred at a US Senate Hearing attended by the Federal Emergency Management Agency (FEMA) in 2011. The discussion highlighted, in particular, the practical application of project management expertise in the context of relief efforts ('Project Management Institute,' 2011).

Project management and its application to disaster recovery.

The emergence of project management as a field of endeavour has been at least partly in response to the increasing trend towards 'projectification' or the use of projects by modern organisations to achieve their goals (Aubry & Lenfle, 2012). Instead of a traditional management approach, whereby tasks are performed by functional units within an organisation, specialist teams are delegated to accomplish tasks in a way that brings organisational advantages such as speed, quality and cost-efficiency. In effect, project management has been adopted as a dominant model for strategy implementation, business renewal and improvement, and new services or product development (Winter, Smith, Morris, & Cicmil, 2006).

Project management only emerged as a discipline in the second half of the 20th century (1952–1953) when concepts and tools began to be identified with the management of projects (Morris, 2013). Organisations such as the PMI and the International Project Management Association (IPMA) have contributed to the advancement and professionalisation of the field through their development of a body of knowledge and their endorsement of competencies and standards in practice (Thomas & Mengel, 2008).

As an area of research, two main streams have shaped the current approach to project management. The first stream is associated with prescriptive models, including project management tools, guidelines, and sets of best practice (Lalonde, Bourgault, & Findeli, 2012). The early influence of engineering sciences and applied mathematics created the 'hard systems model' that emphasised planning and the control of projects (Söderlund, 2004; Winter et al., 2006). The second stream transitioned outside the traditional engineering and operations research frameworks to other theoretical approaches focusing on aspects such as policies, strategies, communications, and the social dimensions of behaviour (Lalonde et al., 2012). Evidently, the field has evolved into a multidisciplinary domain, as frameworks have been borrowed from the social sciences and the humanities. A third stream is slowly emerging that involves the exploration of project management through a more phenomenological and pragmatic viewpoint (Lalonde et al., 2012). This advocates a 'project actualities' approach in which the focus is directed towards the context-dependent judgement, situational ethics, and reflexivity exercised by project actors (Cicmil, Williams, Thomas, & Hodgson, 2006).

In practice, project management involves the application of both global and domain-specific competencies (Hodgson & Paton, 2015). The global competencies or generic skills associated with project management are categorised by IPMA according to 46 competency elements grouped into technical, contextual and behavioural competencies (Loufrani-Fedida & Missonier, 2015). Ten knowledge areas are also targeted: integration, scope, time, cost, quality, human resource, communications, risk, procurement and stakeholder management (PMI, 2013). Aside from the application of generic skills, skilled project management also entails task-specific competencies relating to the particular industries in which they are applied (Cheng, Dainty, & Moore, 2005).

Advancements in research and practice pertaining to project management can be adopted in the context of disaster recovery. The different phases of disaster recovery require the combination of technical competencies or 'hard systems' with non-technical skills such as

cognitive and social/interpersonal skills (Willems, Waxman, Bacon, Smith, & Kitto, 2013) that enable effective planning, monitoring and control of project operations.

There is some speculation that existing project management frameworks and models may be too rigid or time consuming in disaster contexts where there are high levels of complexity and uncertainty and rapid responses are required (Crawford et al., 2013). Both the project management and disaster management communities express the need for more evidence-based competencies and approaches that can improve disaster management and operations (Chang-Richards et al., 2015; Willems et al., 2013). In particular, there is a growing interest in the sets of knowledge, skills, and behaviour to effectively respond to crises (Cranmer & Aschkenasay, 2014).

Competencies in disaster recovery project management.

Competence broadly encompasses the application of knowledge, understanding, skills, attitudes and values to enable the effective, safe and ethical practice of designated roles (Cox & Danford, 2014). Ideally, the skill sets required by disaster responders or practitioners need to be outlined clearly so that communities and organisations can prepare for, and effectively respond to, and manage disaster events (Cox & Danford, 2014). Basically, recruitment for various professional, paraprofessional, and support personnel for disaster recovery operations considers both technical-operational ‘hard’ skills and non-technical ‘soft skills’ (Tatham, Kovács, & Larson, 2010). Although, competency frameworks operating in disaster settings may vary or be only vaguely defined as a consequence of the different orientations of recovery workers (e.g., surgeons, nurses, firefighters, military personnel, religious aid workers or beginning volunteers). Quite commonly, a number of actors who participate in disaster project operations lack or have limited practical experience in disaster recovery, meaning there are important concerns about their preparation and training (Rowlands, 2007).

Existing training programmes provided by government agencies, educational institutions and traditional providers are aimed towards the overall disaster response of a

facility or unit (Willems et al., 2013). Disaster training programmes are delivered through different learning strategies including drills, lectures, video recordings, computer exercises or the simulation of events (Willems et al., 2013). However, a systematic review of training interventions conducted with in-hospital and out-of-hospital providers in response to disasters revealed the available evidence to be insufficient to determine the effectiveness of training in improving knowledge and skills in disaster-related operations (J. Williams, Nocera, & Casteel, 2008).

Most humanitarian organisations tend to be more concerned about technical, rather than non-technical solutions. Indeed, technical knowledge is essential in the different phases of humanitarian operations including preparedness, relief response, recovery, and development (IFRC, 2012). For instance, preparedness requires information sharing, collaboration, and joint governance while relief and recovery phases involve situation awareness, needs assessment, logistical management, and information and knowledge management (Apte, Gonçalves, Yoho, 2016). Knowledge, ability and experience in these areas impact the efficient delivery of the project goals, in meeting the needs of the beneficiaries.

Recently, attention has been drawn towards the non-technical skills of recovery workers. For example, Willems et al. (2013) suggest the inclusion of four categories of non-technical skills in surgical disaster response curricula: interpersonal skills such as communication, teamwork and leadership; cognitive strategies such as flexibility, adaptability, innovation, improvisation and creativity; physical and psychosocial self-care; and conflict management through collaboration, professionalism, health advocacy and teaching. Peller, Schwartz and Kitto (2013) identified three categories of non-technical core competencies: flexibility, including adaptability, improvisation, physical and psychological self-care and innovation; interpersonal skills such as communication, teamwork, sense of humour, cultural competency, education, teaching and leadership; and cognitive skills,

including big-picture thinking, problem solving, situational awareness, critical thinking and creativity.

Previously, Rowlands (2007) developed and implemented a range of training programmes for social workers and other recovery workers participating in the recovery efforts following the Indian Ocean Tsunami of 2004. For their 'train-the-trainer' model, these recovery workers incorporated into the programme psychosocial skills such as community-based methodologies and community recovery interventions, the consideration of cultural issues, values and ethics as well as debriefing, supervision and self-care.

An integrated competency framework was developed by Cox and Danford (2014) in an effort to include a wide range of recovery workers and align them with the different levels of psychosocial responses that they are expected to fulfill. This framework, presented in Table 1.1, illustrates the different levels of knowledge, skills and abilities among recovery workers and their corresponding roles and competencies in an attempt to standardise expectations for different levels of psychosocial support interventions.

Table 1.1

An Integrated Framework for Psychosocial Competency in Disaster Response (Cox & Danford, 2014)

Level	**Roles**	**Competency Domains**
Level I Minimally trained volunteers	General supportive presence providing: Contact and engagement Active listening Initial assessment of needs and referral to other levels of care	Personal attributes General disaster and emergency psychosocial preparedness Supportive presence
Level II Para-professionals and professional mental health workers without graduate degrees	Supportive presence plus: Emotional support Psychological first aid	Domains 1 through 3 plus: Psychological first aid
Level III Professional mental health workers with graduate degrees and/or extensive experience; preferably members of relevant professional associations	Supportive presence plus basic and more advanced emotional support including: Psychological first aid Delivery of specific psychosocial interventions Worker care Assessment and referral	Domains 1 through 4 plus some combination of: Workforce resilience CISM* Crisis intervention Community and family outreach Mental health triage Spiritual care Death notification support and bereavement and grief support
Level IV Professional mental health workers with graduate degrees and/or extensive experience, management experience and membership of relevant professional associations; preferably with previous disaster response training and experience	All the support and intervention strategies from previous levels. In addition, programme development, coordination, education and training plus: Leadership Evaluation Supervision	Domains 1 through 11 plus: Disaster psychosocial and organisational consulting, coordination, programme development and evaluation Disaster psychosocial education and training

*CISM: Critical Incident Stress Management

In the disaster recovery context where the operational environment is constantly changing, uncertain and high pressured, there tends to be greater reliance on non-technical

skill sets, rather than on formal mechanisms such as technical tools or models. In particular, flexibility, adaptability, reflective thinking and sensemaking—or the ability to make sense of information—are among the most important non-technical characteristics that assist in the management of complex situations (Peller et al., 2013; Thomas & Mengel, 2008).

It is often the case that the complexities and risks associated with a disaster environment make it difficult for project managers to visualise clearly and to understand situational demands as they occur (Walker & Steinfort, 2013). Consequently, they may overlook or dismiss early warning signs, direct their attention for extended periods to a single issue or concern, or only recognise problematic features at a late stage when interventions are no longer effective or necessary (Havelka & Rajkumar, 2007). The consequence is potentially the poor scoping, planning and execution of what should be timely and appropriate responses.

Existing models of disaster recovery training generally provide little preparation in the non-technical/ behavioural aspects associated with responses to project complexity. This is noted within disaster medical assistance teams comprising professional, paraprofessionals, and support staff (Peller et al., 2013), including surgeons (Willems et al., 2013). Importantly, there is little emphasis on information processing and sensemaking. Sensemaking, in particular, must form part of the disaster preparedness or pre-deployment training, especially for less experienced workers (e.g. civilian volunteers who may have lack or limited exposure to the cognitive demands of actual disaster operations), since it provides the basis for early intervention and recovery.

Section 2: Sensemaking in Disaster Recovery Project Management

Disaster recovery projects are examples of temporary organisations formed on ad-hoc bases where individuals with specialised skills work interdependently to fulfil a complex or challenging task (Maitlis & Christianson, 2014). Unlike permanent organisations that operate under a business-as-usual framework, disaster recovery projects are constantly in the process of organisation and reorganisation (Maitlis & Christianson, 2014). Under these conditions, disaster project managers are expected to be highly proficient in organising and making sense of messy, confusing, urgent and unique situations (Walker & Steinfort, 2013).

Sensemaking is intrinsic in disaster environments where disaster project managers cope with changes, surprises and emergencies. They are required to engage in an iterative cycle of perception, interpretation and action (Weber & Glynn, 2006) as they work with other actors to respond to situations, formulate rapid decisions and implement solutions.

The role of sensemaking in disaster recovery is largely understudied (See Appendix C: Inventory of Sensemaking Studies in Project Management Publications). A few references to sensemaking have appeared in disaster-related publications, which focus mainly on methodologies or tools to improve sensemaking activities in the field. For instance, the Soft System Methodology (SSM) is a tool for sensemaking during the situational analysis phase of project planning (Walker & Steinfort, 2013). SSM uses a rich picture approach to visualise messy, complex problems and relationships and decode layers of meaning through colour coding and process mapping.

Gunawan, Alers, Brinkman, & Neerincx (2011) adopted a situation map that was tested in an experimental setting. The map provided an overview of a disaster situation and helped actors orientate their location and make decisions. The authors acknowledged that rapidly generating a complete and comprehensive situation map of a disaster area could be a complicated task because of the centralised nature of disaster management. They proposed that members of the affected population participate in the process of map-making to provide

additional resources. However, recent developments in technology have provided a solution to this problem through the use of crowd sourcing geographic data. The typical crowd sourcing data combines GPS track information like Open Street Map, collaborative data like Wikimapia, and social media sites like Twitter, Facebook and Waze (Wang, Li, Hu, & Zhou, 2013). These methods are superior to the conventional geographic data because the data obtained from various sources have been subjected to quality assessments including completeness, thematic accuracy, and positional accuracy. This method is advantageous because it provides quality information to the public that is generated by filtering large amount of information, at a low cost.

In another disaster sensemaking research, an interview approach has been used to explore the roles of time and knowledge in relation to the practical governance of disasters and crises (Lidskog & Sjödin, 2015). The context of the study was two storms that occurred in Sweden—Gudrun in 2005 and Per in 2007. Groups of forest owners and representatives from forest agencies and forest companies responded to questions related to their actions, feelings and thoughts during and after the storm and also pertaining to the risks taken, lessons learned, decisions made, and advice for the recovery stage. The authors concluded that a lack of time leads to reliance on the limited knowledge available when deciding a proper course of action.

Notably, the existing literature has yet to offer an empirical perspective as to what constitutes sensemaking at an individual, cognitive level. This scope of inquiry would address interest about what occurs during the sensemaking process and, specifically, what enables project practitioners to effectively assess and diagnose complex project situations.

Theoretical foundations of sensemaking.

Currently, there are two main perspectives on sensemaking that dominate the literature: the Weickian perspective that evolved from organisation science (Weick, 1979) and the cognitive/psychological viewpoint advanced by Klein (1998), Klein, Wiggins, and

Dominguez (2010), Brunswik (1955), Wiggins (2015a), and Wiggins, Brouwers, Davies, & Loveday (2014).

The Weickian perspective on sensemaking.

In organisation and management science, sensemaking has been associated with interpretative, social constructionist, process-oriented and phenomenological research influenced by the Weickian perspective (Brown, Colville, & Pye, 2015). Although, there is no universal definition, there is consistent reference to sensemaking as an organising process whereby people work to understand ambiguous, equivocal or confusing events or issues (Brown et al., 2015; Maitlis & Christianson, 2014; Weick, 1979). Sensemaking is considered central to organisational behaviour as it is the primary stage by which meaning materialises and acts as a springboard to action (Weick, Sutcliffe, & Obstfeld, 2005).

Sensemaking is identified with certain characteristics including being grounded in identity, responding to disruptive ambiguity or surprises as a trigger, retrospective and prospective thinking, being driven by plausibility, and being directed towards the extraction and interpretation of cues (Weick et al., 2005).

The concept of identity plays an important role in the organisational behavioural depictions of sensemaking. It is interwoven with identity as attempts to make sense of an environment are necessarily self-referential, since what is sensed and how it is perceived are tied to the actor's identity (Weber & Glynn, 2006). Events that threaten identity evoke uncertainty and a strong need for sensemaking to anticipate, prepare for or modify, actions and regain some stability (Weick et al., 2005).

Weber and Glynn (2006) describe the relationship between sensemaking and identity as context-dependent because situations or contexts provide constellations of identities, templates for action, scripts, schemas, logic and expectations. In particular, Weber and Glynn (2006) describe sensemaking as triggered by three contextual mechanisms that activate actor identities. First, the context or situation provides social cues (priming), allows social feedback

processes (editing), and/or creates puzzles arising from ambiguities or gaps that may be present (triggering). Sensemaking unfolds in a sequence by which people, concerned with identities within a social context, engage in ongoing activities that include extracting cues and making plausible inferences concerning observed irregularities to achieve an understanding of events (Weick et al., 2005).

Second, sensemaking originates in chaos (Weick et al., 2005) and/ or in violated expectations as it occurs when there are discrepancies between expectations and realities or as a consequence of the non-occurrence of anticipated events (Maitlis & Christianson, 2014). It emerges from experiences that are sufficiently significant to notice, that interrupt the ongoing flow of activities and that disrupt one's understanding of events, thereby creating uncertainties about how to act or respond (Maitlis & Christianson, 2014). Sensemaking starts in 'acts of noticing' and 'bracketing' or selecting part of a stream of circumstances that are then labelled as a concern, sign, opportunity or event (Weick et al., 2005).

Since people are part of an ongoing flow of experiences, the construction of meaning or the interpretation of events usually occurs through retrospective thinking (Brown et al., 2015). Memory is used to compare a current situation with a prior situation to identify whether and what expectations have been violated. There is then a latent recognition of events since interpretations and labels occur only after the completion of an act, when the dynamics of the event have already passed (Weick et al., 2005). However, sensemaking does not consist exclusively of retrospective thinking. It also incorporates prospective thinking whereby the actor makes interpretations based on an imagined future (Wright, 2005). Sensemaking is driven by plausibility, rather than accuracy, as the actor continually redrafts an emergent story through an exploration of a more comprehensive story in an environment that is resilient to criticism (Weick et al., 2005).

As a social process, sensemaking is facilitated by a conversational and narrative process involving both verbal and nonverbal exchanges and formal and informal

communication (Balogun & Johnson, 2005). Actors engage in gossip and negotiations, exchange stories, rumours and past experiences and observe physical objects or manifestations to construct meanings and interpretations (Balogun & Johnson, 2004). Communication is an important medium in sensemaking as it allows for the articulation and social validation of an actor's assumptions (Weick et al., 2005).

Cues are important aspects of sensemaking as they function as triggers to actor's attention (Maitlis & Christianson, 2014). By their very nature, cues are discrepant, strange or anomalous. However, they can also appear weak or unclear, thereby escaping notice or attention.

From a Weickian perspective, disaster recovery settings constitute a complex environment due to the constant flux of concerns, issues and/or crisis. They tend to be less comprehensible, more interactively complex, and difficult to control with communication and social exchanges that are replete with confusion and ambiguous information (Weick, 2010). Therefore, any observation of cues or symptoms can provide some useful insights.

Cognitive/psychological viewpoints on sensemaking.

The cognitive/ psychological perspectives on sensemaking provide explanations on the individual's mental process and mental representations of the external world that help achieve a sense of understanding about a context. Four relevant cognitive frameworks are presented here that include the recognition-primed decision (RPD) model developed by Klein (1998), the data/frame model advocated by Klein et al. (2010), the lens model developed by (Brunswik, 1955) and the cue utilisation construct from Wiggins, Brouwers et al. (2014) and Wiggins (2015a).

The recognition-primed decision (RPD) model.

The RPD model was developed by Klein (1988) and explains sensemaking as a product of two processes: the way that actors 'size up' the situation to recognise the most effective course of action and the way that they evaluate that course of action through mental

stimulation. The model illustrated in Figure 1.1 incorporates a basic strategy and variant strategies corresponding to how sensemaking is engaged according to contextual demands.

At a basic level, an actor recognises four elements in a situation: (1) whether the situation is typical or atypical; (2) goals that make sense and form the basis for the priority setting; (3) the cues that are most relevant and the probable scenarios; and (4) the typical course of action. This type of situation follows the 'if… then' rule in which an antecedent is followed by an expected response (Variation 1). In more complex and unfamiliar situations, diagnosis may require more attention or interpretation may need to be re-evaluated so that the 'if (???)… then' rule applies (Variation 2). However, actors who are skilled in sensemaking often demonstrate a single option evaluation wherein they evaluate the best course of action, rather than form a simultaneous comparison of options. In this instance, sensemaking takes the form of the 'if… then (???)' rule (Variation 3).

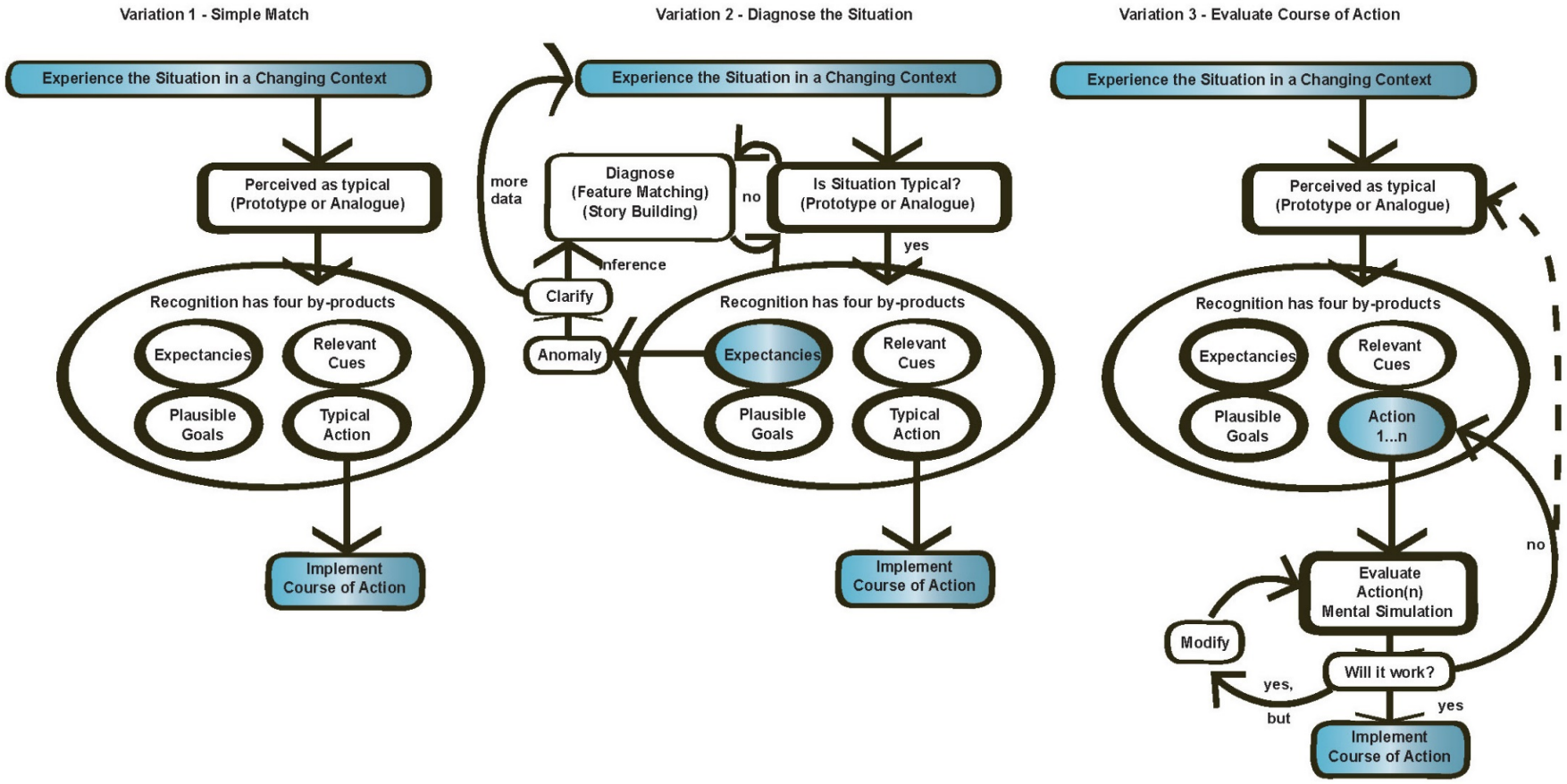


Figure 1.1. A graphical representation of the RPD model (Klein, 1998) indicates three variants of sensemaking strategies as applied in simple and complex situations and when evaluating options.

The data/frame model.

In another model, the sensemaking process is described using a data/frame analogy (Klein et al., 2010). During sensemaking, a reciprocal process occurs between data from the environment and cognitive frames consisting of stories, maps, diagrams or scripts. Data are used to identify a frame, while the frame defines the information that constitutes 'data'. This model contrasts with the standard waterfall model in which information processing is viewed as a linear transformation of data into information, then into knowledge and finally into understanding. The criticism of the waterfall model is that it fails to capture the simultaneous action between data and frame and the end states of sensemaking—that is, the identification of the most suitable frame.

The data/frame model also accounts for anomalous and complex data that can mandate changes to frames. In these situations, sensemaking can involve the elaboration of a frame when new data or new relationships are sought, the questioning of a frame when doubts or conflicts are raised or reframing as occurs when comparing existing frames or creating a new frame. Figure 1.2 presents an integrated data/frame model that shows sensemaking as a simple data-frame matching process and as an elaborated procedure that requires changes to both the frame and data.

At the core of the both the RPD and data/frame models is pattern recognition or 'finding the best fit' between external features and mental prototypes. The development of a rich repertoire of mental models assists in pattern matching and 'short-circuits' option generation thereby resulting in more efficient information processing (Klein, 2015). In the context of the two-system or dual-process theory, pattern recognition appears as a spontaneous, involuntary and almost effortless characteristic of System 1 thinking, rather than the deliberate, voluntary and effortful process that is descriptive of System 2 operations (Kahneman & Klein, 2009).

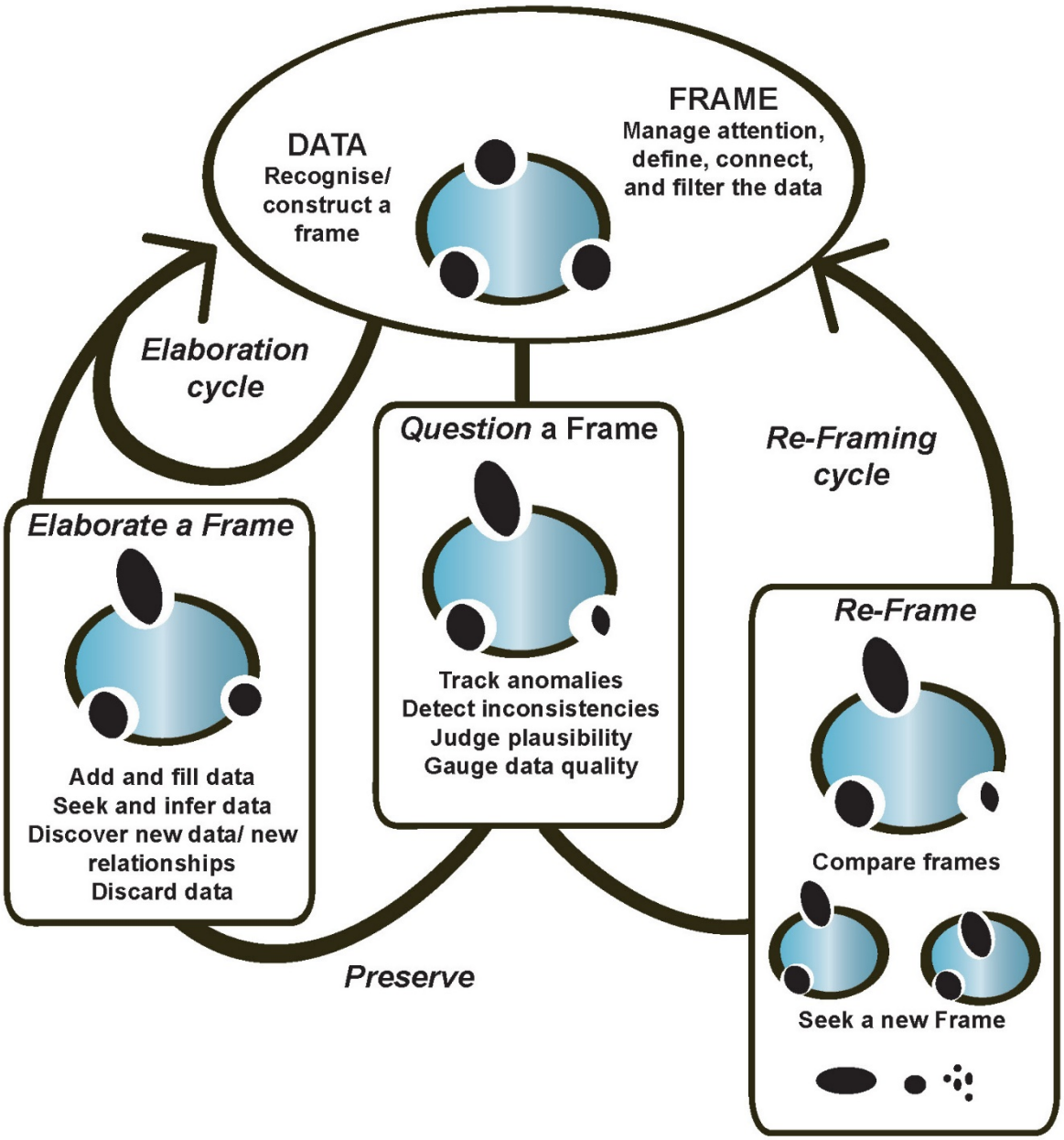


Figure 1.2. An adaptation of the expanded data/frame diagram (Klein et al., 2010).

Brunswik's lens model.

Brunswik's lens model is based on probabilistic functionalism in which the relationship between an individual and environmental variables can only be inferred because of the presence of uncertainty (Thompson, Foster, Cole, & Dowding, 2005). The distinctive feature of the lens model is the identification of two characteristics of cues: ecological validity refers to the objective value of a cue that is based on the correlation between a cue and a criterion (O'Hare, 2015; Poon, Rubin, & Wilson, 1989) and cue utilisation pertains to the

subjective value ascribed to a cue (Hartwig & Bond, 2001). In projects, figures constitute important criteria and indicators of project outcomes (e.g. dates, budgets and numbers of deliverables). However, different project actors may associate different meanings with the figures. The incongruence in perception between the objective and subjective values of cues is often considered the basis of inaccurate judgements (Connolly, Arkes, & Hammond, 2000) where valid cues may be ignored or cues of low validity may be over-utilised (Brunswik, 1955).

Figure 1.3 illustrates an adaptation of Brunswik's lens model. The actual (true) state is represented on the left side whereas the actor's subjective reality is indicated on the right side of the diagram. The context consists of a number of cues, each with a weight that contributes to the ecology and a subjective weight attached by the actor.

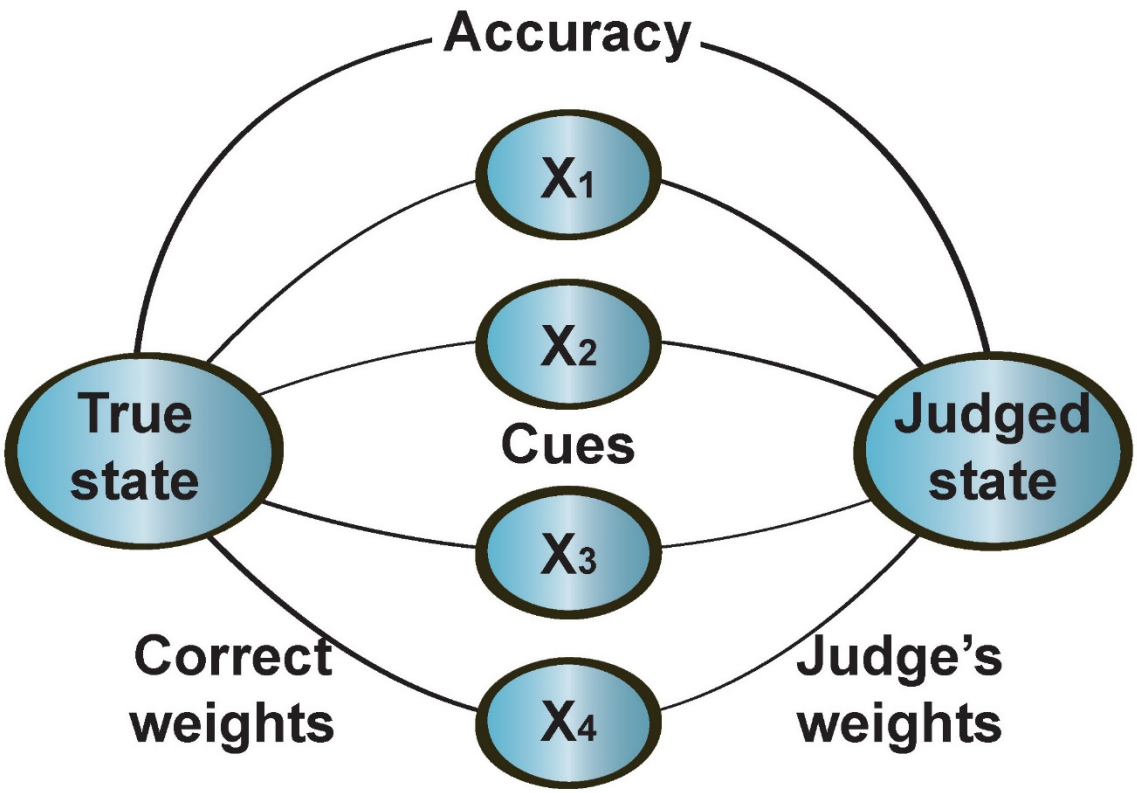


Figure 1.3. An adaptation of Brunswik's lens model (Thompson et al., 2005) that illustrates cognition and information use.

Cue utilisation: The foundational basis of sensemaking.

Both the Weickian and cognitive perspectives reflect the central role of cues in the sensemaking process. Cues are embedded in the environment and represent feature/object-event associations in memory (Wiggins, Brouwers, at al., 2014). They operate based on the notion of cue-based associations, which "suggests that features associated with an environment may trigger the activation of a particular memory set which, in turn, enables the activation of specific feature/object-event relationships in memory" (Wiggins, 2015a, p. 3). In this sense, the terms 'features' and 'cues' are not synonymous although they can be equivalent on occasions. A feature is described as a characteristic of the environment, but has no associated context until it is coupled with an event or object in memory—it is only at this stage that a feature embodies a cue (Auton, 2014).

From an information processing perspective, cue utilisation presents several advantages. It enables rapid responses to familiar situations, discrimination between familiar and unfamiliar situations, causal inferences, the prediction of future events, and reductions in anxiety and demands on cognitive resources (Wiggins, 2015a). Klein (2015) notes that cue utilisation is not solely related to cues but to the intersection between cues and capabilities that enable rapid diagnoses and decision making in the absence of time-consuming and demanding comparative assessments. In the same vein, Wiggins (2015a) describes the interwoven processes of cue utilisation and diagnoses wherein the accuracy of diagnosis is dependent upon the precision and breadth of feature–event/object relationships in memory.

In sum, the cognitive perspectives on sensemaking offer an explanation of how actors in disaster recovery engage in information processing and where potential failure in sensemaking originates—that is in the inability to form and understand the feature/object and event associations that present in situations.

Section 3: Research Aims and Design

Disaster recovery projects can be characterised as operational environments wherein recovery workers, regardless of role and rank, engage in iterative sensemaking to monitor projects that are in a perennial state of being at the 'edge of chaos' (Thomas & Mengel, 2008), are noisy or distracting, and/or embody a high degree of complexity (Kahneman & Klein, 2009). Disaster response operations require faster and more coordinated actions that are dependent upon the ability of workers to capture and understand the shifts in, and dynamics of, the environment. The role of sensemaking in early disaster management interventions is critical as it enables the early detection of cues that signal emergent problems.

The perception of relevant cues in the environment forms the basis for awareness and comprehension of the actual state of the system, together with the projection of its future status (Endsley, 1995). Consequently, inadequate or ineffective sensemaking contributes to several common challenges in disaster management including difficulties with coordination, situational awareness and information sharing (Seppänen & Virrantaus, 2015). When disaster project managers overlook important information and respond to irrelevant information, it has the effect of hampering the flow of activities and causing harm and damage (Seppänen & Virrantaus, 2015). Consider the anecdote below where a critical cue was overlooked in a work routine:

> In our view, the communication of disaster risk during Typhoon Haiyan, which struck the Philippines in November 2013, could have been better.
>
> The typhoon was one of the strongest tropical storms ever to make landfall, registering category five on the Saffir-Simpson scale. Despite forecasts of winds of more than 300 kilometres per hour and a predicted seven-metre storm surge, the city of Tacloban was caught underprepared: thousands died from the inundation.
>
> The storm surge was predicted in a report by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) that was sent to

> local agencies and communities. Unfortunately, it was simply a line at the end of a routine weather bulletin. It was apparently not otherwise highlighted, elaborated on or, in our opinion, in any way explained in order to transmit its urgency to key agencies and the public.
>
> After interviewing agency personnel, we concluded that a well-intended adherence to routine and pro forma communication could have been at play. Feedback loops for conveying tacit information (for example, the implications of modelling outputs) seem to have been inadequate.
>
> PAGASA's Tacloban team stayed in its single-storey coastal office, which was demolished by the storm surge, claiming a team member's life.
>
> Many other factors influenced the impact of Haiyan, but this example indicates that routines need to adapt to deal with extreme events that lie beyond personal and institutional memory. (Lejano & Tan, 2015, p. 35)

This example demonstrates how significant cues can go unnoticed because, for the observer, the features hold no specific association with an event in memory (Weick, 2010). While typhoons are a regular occurrence, there was no association with a storm surge (Takagi et al., 2015). In Brunswikian language, the features had yet to become cues. A similar lack of cue utilisation was evident in the Bhopal disaster where a loss of expertise within Union Carbide was associated with an inability to accurately interpret information derived from the system:

> Operators found it difficult to generate plausible conjectures about the meaning of fragmentary evidence. The plant is in such a poor overall condition that a cue or a symptom could mean anything. Instead, because of the loss of expert operators and cutbacks in the length of training, the remaining operators worked with concepts that were ungrounded and empty. These empty concepts in turn meant that operators had little idea what to look for, what they saw or what things meant. (Weick, 2010, p. 39)

These cases highlight the importance of cue utilisation as the basis of sensemaking in high consequence environments (Weick, 2010).

The overall aim of this research programme was to provide an empirical basis for sensemaking in disaster recovery project management at the level of the individual decision-maker. Sensemaking was assessed and measured using cue utilisation constructs.

This research adopted a deductive approach that examined sensemaking, firstly, from a broader project management perspective, and subsequently, through the specific context of disaster recovery. This is based on the contention that project management practice involves the application of both universal and domain-specific knowledge (Hodgson, & Paton, 2015). The Project Management Body of Knowledge (PMI, 2013) espouses the multidisciplinary and localised nature of the project management practice. This is equally true in the disaster recovery context. A diverse group of professionals and non-professionals are at work, each tasked to understand and deal with the specific requirements and complexity of a project. Therefore, an aim of this research was to explore the key sensemaking cues that are present in project management contexts. An allied aim was to validate the sensemaking cues as indeed project management features when presented within project-specific constructs. Lastly, this research was intended to examine the association between cue utilisation and sensemaking in the context of disaster recovery.

Specific research questions.

This programme of research followed a deductive approach to understand the role of cue utilisation from a general project management sensemaking perspective, to the more specific area of application that is in disaster recovery. It combined both qualitative and quantitative methods to systematically address the research aims. Figure 1.4 presents the line of inquiry that was undertaken in this research beginning with the first research question as addressed by Study 1 and concluding with the third research question as addressed by Study 3.

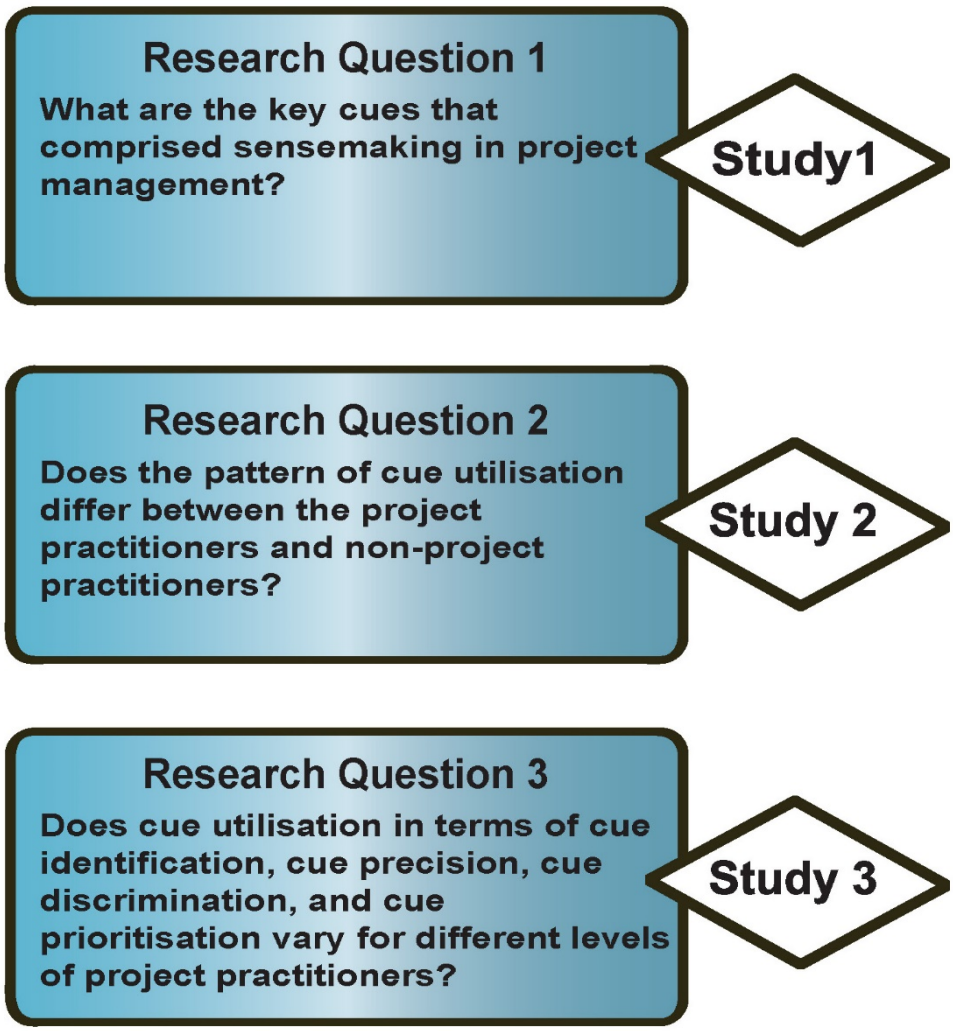


Figure 1.4. The research framework and the associated studies.

Study 1 involved a descriptive investigation that shared the same pursuit as NDM research in identifying the key cues—including overt and difficult-to-articulate cues—that formed the basis of skilled diagnosis (Kahneman & Klein, 2009). Study 1 examined the cues that were utilised by successful project managers during sensemaking. Cues are important in the study of cognitive skill acquisition as they represent feature-object and event associations in memory that are responsible for priming appropriate responses, focusing attention, and integrating task-related information (Loveday, Wiggins, Searle, 2014). Cue utilisation is relatively well established across domains as a component of expert cognition (Shanteau, 1992; Loveday, Wiggins, & Searle, 2014). Therefore, the objective of Study 1 was to identify

the universal characteristics or forms in which cues manifest to a diverse group of project practitioners on the assumption that project management is a multidisciplinary domain.

The research question raised in Study 2 was derived from the findings of Study 1. Study 2 was designed as a confirmatory study to test whether the sensemaking cues identified in Study 1 were indeed project management-related cues. A comparative analysis was undertaken between project practitioners and non-project practitioners using simulated project scenarios of different complexity and targeting different project phases including initiation, execution and closing. The assertion was that project practitioners would demonstrate greater discrimination towards the project management-related cues relative to project situations in comparison to the non-project practitioners. The use of comparative assessments in Study 2 is consistent with several studies on cognitive skills acquisition and/or performance that utilised comparisons between different levels of performers to differentiate the features in their cognitive processing (Loveday, Wiggins, Harris, O'Hare, & Smith, 2013).

Finally, Study 3 was designed to investigate cue utilisation in the context of disaster recovery. Study 3 involved an experimental study that examined cue utilisation using simulated disaster recovery project scenarios. It involved a comparative analysis of different groups comprising different levels of project management experience (naïve, low experience, and high experience project practitioners). Specifically, the study tested the cohorts in their performance and strategies in cue identification, cue precision, cue discrimination, and cue prioritisation that, in combination, formed the measures of cue utilisation.

Summary of thesis contributions.

A central aim of the thesis was to establish the role of cue utilisation in project management sensemaking, particularly in the disaster recovery context. Conceptually, the research contributes to the expansion of perspectives on sensemaking by providing an empirical basis for cue utilisation as a fundamental aspect of the process of sensemaking. The research also demonstrates, for the first time, the conceptual links between sensemaking and

project characteristics including project complexity and stages of project management. Therefore, the present research is designed to respond to the call for evidence-based perspectives that can inform both disaster management and project management practice.

Chapter 2:

Study 1: Sensemaking Cues in Project Management

Aim

Study 1 was intended to identify the basis of project management sensemaking by determining the cues that assist project managers in the identification of critical project issues. This was based on the assumption that sensemaking can be deconstructed by examining those cues that form the basis of perception and diagnosis (Kahneman & Klein, 2009). Sensemaking is initiated by the recognition of cues, where the situation provides the cues and the cues provide the actor with access to information stored in memory (Simon, 1992).

Since Study 1 was concerned with the identification of the relevant categorisations of cues, the data in this research were sourced through in-depth cognitive interviews with successful project managers who were recruited through peer recommendation on the basis of having effectively managed a project in the twelve months prior to the interview. Peer-judgement is a common approach to the identification of expertise or superior performance; typically, "the criteria for judging expertise are based on a history of successful outcomes rather than on quantitative measures" (Kahneman & Klein, 2009, p. 519). The participants in Study 1 comprised five project managers from Australia and four from the Philippines. They were drawn from different backgrounds reflecting the multidisciplinary context of disaster management where individuals from different orientations are brought together according to their expertise or capabilities (Maitlis & Christianson, 2014).

Publication History

Study 1 was intended to complement the next stage of this research programme. A paper that reported the outcomes of Study 1 and Study 2 was submitted for publication. The paper was published online on the 2nd of April 2016 in the *Journal of Construction Management and Economics.* The published paper uses American English. The author of this

thesis contributed approximately 85% of the work in the published paper (See Appendix A for the published article).

Study 1

Sensemaking Cues in Project Management Sensemaking

(An Extended Paper)

Eva Marie Gacasan & Mark Wiggins

Macquarie University, Sydney Australia

Correspondence concerning this article should be addressed to:

Eva Marie Gacasan

Department of Psychology

Macquarie University

New South Wales, Australia 2109

Email: eva-marie.gacasan@students.mq.edu.au

Abstract.

Skilled sensemaking is critical to the management and control of organisational performance. However, little is understood of the process of sensemaking in the context of project management. This paper presents the outcomes of a qualitative study exploring the cognitive representations of project managers as they engaged in sensemaking in relation to critical project incidents. Nine project managers, five from Australia and four from the Philippines, who were recognised by their peers as successful project managers, were recruited to participate in the study that involved an interview using the critical incident technique. The outcomes revealed three categories of sensemaking cues that are employed in the project environment: feedback cues, context cues and implicit knowledge. The implications are discussed in terms of theory and practice.

Keywords: Cues, Sensemaking, Project Management

Introduction.

By their very nature, projects are ever-changing environments comprising multi-stage processes whereby stakeholder interactions, businesses and operations continually evolve (Zhang, 2013). There are varying degrees of complexity at each stage of the project that make prediction and the process of control quite difficult (Vidal, Marle, & Bocquet, 2011). As a result, assumptions and plans often fail or require revising and redefining (Zhang, 2013).

Despite attempting to cope with complexity, uncertainty, changes and risks, a considerable number of projects fail (Thomas & Mengel, 2008). They fail for different reasons (Havelka & Rajkumar, 2007): *Challenged* projects consist of those that are over budget, behind schedule and/or unable to meet business requirements. *Runaway* projects refer to those that double the original requirements in schedule, cost and functionality. Finally, *impaired* projects are those that are terminated prior to completion.

At an organisational level, formalised systems are implemented to mitigate and manage potential threats to projects. For instance, risk management constitutes a collection of techniques that are established to identify, analyse, respond to, and control, risks. The objective is to reduce the likelihood and impact of negative events and increase the probability and impact of positive events (Project Management Institute, 2013). Further, assessment protocols are established at different stages of projects to identify and pre-empt failures. These protocols include project reviews, health checks, benchmarking and project audits (T. Williams, Klakegg, Walker, Andersen, & Magnussen, 2012). Practical tools such as software programs and Gantt charts are also used to monitor project activities and the progress of projects (White & Fortune, 2002).

In general, contemporary project management and assessment practices reflect the use of formal, technical and quantitative approaches corresponding to a ‘hard systems model’. These systems embody principles from the mathematical and engineering sciences (Söderlund, 2004; Winter, Smith, Morris, & Cicmil, 2006). Although such approaches offer

managerial efficiency, there are limitations to their use, particularly in detecting early warning signals that reflect changes in the state of a project (T. Williams et al., 2012).

As the complexity of a project increases, there tends to be less reliance on formal assessments and a growing dependence on non-technical skills (T. Williams et al., 2012). The ability to 'make sense' of observations, to understand the meanings behind actions and events and to benefit from previous experience constitutes a highly valued control capability that is essential for effective and efficient project management (Thomas & Mengel, 2008).

Sensemaking represents a different set of tools, primarily cognitive in nature that allows for sensing, interpreting and bringing into awareness crucial project features that can then be articulated in other forms. It enables the recognition of potential project risks and changing project realities (Alderman, Ivory, McLoughlin, & Vaughan, 2005), thereby allowing comparative assessments of project goals. Therefore, it is a key requirement for the accurate and timely identification of threats that, in turn, forms a critical step necessary for the successful recovery of a project (Havelka & Rajkumar, 2007).

Although sensemaking may be relatively well-established in permanent organisations involving routine processes and products, the role of sensemaking is less clear where projects are short lived (Alderman et al., 2005). In a government-funded research programme in the United Kingdom that was designed to redefine a research agenda for the expansion of a project management knowledge base, project practitioners highlighted sensemaking as an important topic (Winter et al., 2006).

The aim of the current study was to examine the nature of sensemaking in the context of project management at an individual, cognitive level. Narrative accounts were sought from successful project managers that demonstrated sensemaking activities in the context of critical project incidents. The sensemaking process was examined at a basic level that included the identification of key cues that aided project managers in the diagnoses of emergent, complex issues associated with projects. A contention of the study was that project situations provide

early warning signals (Simon, 1992) that, when skilfully detected, enable the recognition of impending challenges.

The sensemaking construct.

Sensemaking at the organisational level.

Sensemaking is an activity central to organising, since 'organisation' emerges from an ongoing process whereby people make sense of equivocal inputs and enact that sense back into the world to make it more orderly (Weick, Sutcliffe, & Obstfeld, 2005). It is a critical factor in temporary organisations, including projects that are in a constant process of being organised and reorganised and where nothing exists until 'organisation' has been achieved (Maitlis & Christianson, 2014).

The sensemaking process activates the actor's identity and mental models as people generate what they choose to interpret (Brown, Colville, & Pye, 2015; Weber & Glynn, 2006). Organisational roles shape the ways that people interpret and enact, in the same way that their role identities affect how others treat or perceive them (Weick et al., 2005). From this standpoint, sensemaking is not context-free as the association between sensemaking and identities is dependent upon the context in which the network of identities exists (Weber & Glynn, 2006).

The project context provides an impetus for sensemaking since there is the constant pressure of uncertainty and a need for integration and urgency (Turner & Müller, 2003). Project actors engage in sensemaking to understand issues or events that violate expectations, are novel, ambiguous, and/or confusing (Maitlis & Christianson, 2014). It is a process often triggered by anomalies, irregularities or a sense of chaos (Weick et al., 2005). For instance, in a product development project, discontinuities or discrepancies may occur at any stage of project implementation. Issues can occur during the translation of client requirements into project specifications, during the transition from detailed specifications to design freezes when changes are no longer allowed, in the period between design freezes and the

development of artefacts and systems, and when artefacts or prototypes are developed into operations or actual products (Alderman et al., 2005). At these various stages, the sensemaking narratives of actors must form part of their communication exchanges to articulate doubts, issues and concerns to other project stakeholders.

As project actors construct meanings of events, they engage in a range of processes including observations, conversations, gossip and rumours (Balogun & Johnson, 2004). Language and communication are important components of sensemaking (Maitlis & Christianson, 2014) that facilitate the articulation and validation of actors' observations and the co-construction of meaning or shared understanding. Further, shifts in conversations and languages (Balogun & Johnson, 2005) serve as indicators of the state of the system as they also convey conflicts, disagreements, doubts, confusion and problems.

Sensemaking at the cognitive level.

Sensemaking is regarded as a precursor to higher-order strategies that are triggered during critical, complex and emergency situations (Klein, Moon, & Hoffman, 2006b). It is synonymous to the concept of situation assessment that comprises the cognitive process leading to situational awareness or a state of knowledge (Endsley, 1995; Klein, 1998). Further, sensemaking functions as part of an individual's information processing mechanism that is hypothesised to then shapes decision making and the performance of actions.

Sensemaking organises a stream of actions through the simplification of experience that involves the categorisation of an event (Weick et al., 2005). This is achieved by interweaving perception, interpretation and action (Weber & Glynn, 2006). It begins with acts of noticing and bracketing, whereby discrepant and salient cues trigger attention and a portion of a stream of actions is labelled as an event, a concern, a mistake or an opportunity that is then enacted (Weick et al., 2005). It also occurs through an overlapping process of retrospective and prospective orientation in which people make sense of what has recently occurred and what can occur (Brown et al., 2015; Weick et al., 2005).

Sensemaking is typically depicted through a data-frame model in which data from the environment constitute the 'pieces' or 'blocks' that are matched with the individual's existing cognitive frames, including stories, mental models, maps, scripts and schemata (Klein, Wiggins, & Dominguez, 2010). Beyond a simple process of data-frame matching, this model describes the interaction as reciprocal and iterative, where data are used to identify the frame and the frame determines the nature of the data and where a fitting and refitting of frames occurs until the best match is achieved. This model also explains how sensemaking occurs in an extended context such as project management. Project managers acquire various pieces of information that they assess continually and filter according to an organisational script or framework demanded by the situation. As other actors become involved in the process, further reframing and elaborating of frames occurs.

Sensemaking through cue utilisation.

Fundamentally, sensemaking is a process initiated by cues or feature/object-event relationships that are formed in memory and that are present as a stimulus in the environment (Wiggins, 2013). The concept of cues is based on the notion that they are local signs or signals that are embedded in the environment through patterns of relationships (Wiggins, Brouwers, Davies & Loveday, 2014). The recognition of patterns of cues facilitates matches with existing prototypes in memory and thereby enables the diagnosis of the problem (Wickens & Hollands, 2002). Cues aid cognitive processing by reducing the time and effort involved in the search for information, stimulating selective attention, minimising cognitive overload and enabling the discovery of alternative cues with greater levels of reliability (Einhorn & Hogarth, 1988).

Brunswik's (1955) lens model provides an explanation of the relative values of cues in terms of ecological validity or the objective value of the cue based on its trustworthiness in representing an object in the environment (Poon, Rubin, & Wilson, 1989) and cue utilisation, or the subjective value of the cue (Hartwig & Bond, 2001). The differences in the

responsiveness towards cues or cue utilisation correspond to the ability to discriminate relevant from irrelevant features based on their relative importance (Shanteau, 1992). The incongruence between objective and subjective cues is often considered the basis of inaccurate judgements (Connolly, Arkes, & Hammond, 2000).

In the context of project management, cues are not simply evident in project descriptors, but are also associated with narratives and boundary objects. Narratives constitute communication between project actors and involve a 'politics of meaning' in the way that meanings are selected, promoted, legitimised and institutionalised (Alderman et al., 2005). These narratives may be created to depict an event, or they may be reproduced to reinforce and lobby for existing accounts.

Other cues are embodied in the socio-materiality of the situation that includes felt body experience, a sense of place and space, and ecological materials (Maitlis & Christianson, 2014). Therefore, the physical environment provides social–contextual cues whereby objects and actions evoke particular meanings for the actor. Primary boundary objects or artefacts are objects within which the entire project is organised, such as a piece of software or a building to be delivered, while secondary objects facilitate the coordination of functions and project operations such as contracts and project management tools (Alderman et al., 2005).

Method.

This study was designed to identify the key cues that were utilised in project practitioner sensemaking during the course of successful project management. Consistent with a 'project actualities' approach (Cicmil, Williams, Thomas, & Hodgson, 2006), the collection of the data in this study was practice-based and reflective of the participants' actual project experiences. This approach shifted the emphasis from the existing 'black box' or established frameworks to the lived experiences of the practitioners, allowing for the discovery of the features and patterns that constituted cues (Söderholm, 2008).

Participants.

The participants consisted of five project managers from Australia and four from the Philippines who had successfully delivered projects. They were identified through peer recommendation and recruited on the basis of eligibility requirements that included having managed a project six to twelve months prior to the interview and having completed the project within the prescribed time, budget and scope. Of the nine participants, four were female and five were male, with ages ranging from 36 to 57 years old and with project management experience spanning three to over 25 years.

The nature of the projects managed by the participants was diverse and included the development of a government-mandated research report, a university online curriculum support system, a university online-learning management system, an architecture enterprise for a government agency, a software program in a finance organisation, a regional teacher-training course, an information technology capability project for provincial high schools, an international student research conference and a university-sponsored cultural production show. Cognitive interviews with participants from diverse backgrounds provided a basis to explore commonalities in the themes that emerged prior to, and during the projects (Kaulio, 2008).

Data gathering procedures.

Following ethics approval, potential participants were invited to an interview by email or through personal contacts. Separate interviews, lasting between 40 minutes and an hour, were conducted with the participants in their offices or at their preferred venue. These interviews were audio recorded with the consent of the participants.

Narrative data were acquired through the application of cognitive task analysis (CTA) in the form of the critical incident technique (CIT). The CTA is a set of tools that enables the examination of an individual's knowledge, strategies, motivations and decisions during the performance of tasks under a complex network of interacting individuals, technologies and

systems (Clark et al., 2012). One strategy is the CIT that involves the collection of data through the systematic assessment of incident reports (Crandall, Klein, & Hoffman, 2006). Flanagan (1954) describes incidents as any human activity within observable scope that can adequately describe, make inferences, and make predictions about the actor. The incidents must clearly illustrate the purpose or intent and the effects of the act. Since the incidents are drawn from the participants' experiences, the most relevant memories are activated (Gremler, 2004). The incidents provide both flexibility and a focus on data collection (Coetzer, Redmond, & Sharafizad, 2012) as participants are provided some freedom of response. This balances the dilemma that is most often encountered in qualitative studies, in which the tools used either generate too general or too limited insights from the respondents.

In the present study, a semi-structured interview protocol guided the participants to recall from memory: (a) critical incidents encountered during the project execution, since this stage is denoted by coordinating, managing and integrating resources and activities and where changes and unanticipated risks usually occur (PMI, 2013); and (b) the cues from each incident that served as early warning signals for emergent issues and events.

Analysis procedures.

To ensure the accuracy of the transcription of the dialogues, native speakers from the two study locales assisted in the transcription of the audio files. Portions of the interview transcripts in the local dialect (Cebuano) were then translated into English. The narrative data were organised and subsequently subjected to content analysis using a software platform. Nvivo is a tool for qualitative data analysis that enables systematic, thematic organisation of data. A coding system was adopted whereby the critical incidents formed the parent nodes and the specific cues comprised the child nodes. Subsequent analysis of the child nodes resulted in the identification of the similarities and differences between cues that formed the basis for the categorisation of the cues.

Results.

A total of 63 critical project incidents were collected from the narrative accounts of the nine participants. They served as the units of analysis in the study that demonstrated participants' sensemaking in emerging 'situations' characterised by psychological states such as confusion, ambiguity, conflict or crisis that threatened the continuity of each project. These incidents were selected as they impressed on the participants the need to intervene in the situation and to regain some sense of equilibrium within the project state.

Generally, the reported incidents were associated with the inherent complexity of the projects that is a combination of ambiguity and uncertainty. Ambiguity refers to a lack of awareness about certain states and causal relationships of project elements while uncertainties relate to known risks, although their exact impact may be unknown (Yang, Lu, Yao, & Zhang, 2014). The ability to proactively manage a situation depends on whether the threats or risks are known or not known (PMI, 2013). Nevertheless, project managers were aware of, and prepared for, the possibility of unknown factors. The following accounts illustrate this preparedness:

> There's always going to be some unknowns. So, it's not until we start actually working with the system and working with the staff that you actually find out what's going on. (Participant 3)

> Because it's a project, it moves outside of policy. You couldn't have a policy for this particular thing … In fact, the project was making it up as it went along. (Participant 2)

> Estimations were very generic in the first place which is kind of okay for a briefing or for initial scoping of a project. But then once you get into more detailed planning, you expect to be able to flesh that out and get closer to a sense of truth. (Participant 1)

A number of the reported incidents were associated with ambiguous situations in which events or conditions were outside the control of the project manager or the project team. In particular, the incidents occurred as a result of failures, limitations, responsibilities or conflicts with third-party providers that caused chains of reaction in the projects. These included the delivery of incorrect outputs/business requirements by external providers, changes of requirements, modification/technical breakdowns of third-party systems, a consultant's ineffective project plan, conflicts of interest with other stakeholders in the ownership of the build/management of project activities, differences between the project team and the project owner as to the products/deliverables, and/or the abandonment of responsibilities/poor performance by key project actors. Some incidents also occurred during the actual release of the product or the delivery of the project where there were gaps and insufficiencies that became manifest only during the final stages of the project.

Some of the incidents reported allowed for a proactive approach where potential risks were recognised, particularly where they had potential positive or negative effect/s on the scope, schedule, cost and/or quality of the project (PMI, 2013). These incidents related to the identification of problematic and unclear business requirements; the creation and working around of a common map to visualise project interdependencies; the establishment of a comprehensive strategy for data collection and the thorough determination of business requirements; the effectiveness of a change management process in system migration; the foreseeing of additional requirements; the anticipation of opportunities to acquire necessary resources; the prediction of probable delays, needs or issues with external stakeholders; and/or the organisation of effective stakeholder communication and the integration of project management. These were identified as some of the defining points in the projects, demonstrating the positive consequences that resulted from early diagnosis of emergent issues and/or the implementation of early intervention.

Further, the incidents reported by participants often arose due to *risk conditions* or aspects of the project or the organisation's environment that contributed to the risks of the project (PMI, 2013). Among the incidents were the lack of understanding by the project sponsors/owners of the project requirements and project management practices, the organisational culture and established business practices, the lack of resources, concurrent projects in organisations, the lack of an integrated system, and the geographical and cultural contexts of the project. The nature of the processes surrounding the project also made the project environment less predictable in comparison to work domains operating under a business-as-usual management approach.

> Because we were in a project mode, we didn't go through some of the checks and balances that another system would have done. (Participant 2)

The critical project incidents that were extracted from the interviews were associated with a feature or features that signalled an impending concern, issue or opportunity. These features or cues appeared to converge into three broad themes labelled: (a) feedback cues, (b) context cues and (c) tacit knowledge.

Feedback cues. Feedback cues constituted a key cue that was accessible and readily available to the participants during the course of the projects. It arose primarily in the narratives of other project actors directing attention to aspects of a project. Feedback appeared as a three-component cue comprising form, content, and/or the source of the feedback.

The *form* of feedback referred to the channels/media through which feedback was expressed. Meetings, fora, drop-in consultations, one-on-one and group sessions and casual conversations were recognised by the participants as the means by which they acquired direct, verbal feedback from project participants and/or obtained a rapid assessment of the project status and issues. The following statements highlight the emphasis on the various forms of feedback according to the stage of the projects, where more feedback was sought during the

crucial stages of project implementation, while reliance on feedback appeared less frequent during the latter stages of the projects.

> We had weekly project team meetings, weekly technical team meetings. As we got closer to our delivery date, probably the last two months, we had stand-ups, every day, stand-up meetings. (Participant 1)
>
> What I had were a lot more one-on-one sessions, small group sessions and I even had a day where anybody who had a—two days, actually—anybody who had timetable problems would just come in. (Participant 2)
>
> But I would probably try and spend after three-quarter's of my time in a meeting actually listening to people as opposed to actually talking. 'Cause that's what's telling you what's going on. (Participant 5)
>
> We kept track of tasks in meetings. "Have you done this, yes/no?" "Have you done that, yes/no?" (Participant 1)
>
> So, we've scaled back the frequency of the meetings. But we still meet regularly. And at those meetings, we still receive a report from the X technical stream in particular, because that's where—because the way in which the software itself works, means that there are major releases to our software every six months. So, it's important that we're aware of dependent variables, dependencies and criticalities around that and how we are managing either a process or mitigation or whatever it happens to be. (Participant 3)
>
> So, those, what I called consultations sessions, were examples where people could come in and they could have … they could be angry, and they want to get this fixed up, and it's disgusted. But every single one of those people is an engaged person. And, you are either fixing their issue, which might have been a mistake on your part; or it might have been a mistake on their part. (Participant 2)

The participants also identified other channels of feedback including emails, telephone calls, lodged tickets and/or fax messages as sources of feedback cues. As indicated by one participant, strategies were implemented during the project to facilitate communication: “Call, text, but you really have to follow up with a call, then meeting” (Participant 9).

While various channels provided an opportunity for feedback, the frequency or changes in the frequency of the communication also offered information to project managers concerning the progress of the project.

> The particular people [that] I was dealing with, I knew they wouldn’t call me unless they needed me. (Participant 5)

> But, critically, one of the things that we noticed, anecdotally, was a drop in the kind of tickets that we might expect and an increase in unsolicited support and praise for some of the things that we were doing. (Participant 3)

> It’s quite interesting, actually, seeing the pattern of activity within those … But we’ve seen that the nature of the kind of enquiries and the requests for help that we get have moved during the course of the project from just the basic kind of “How do I get the system to work?” to now, “How do I make augmentations to? Yeah? Or how do I make this different?” (Participant 3)

The participants also highlighted different forms of feedback as important cues as they conveyed a variety of messages. These forms included information and news, unsolicited suggestions, questions, enquiries, requests, complaints, demands, problems, snide comments, criticisms, concern, support, praise, reactions and arguments. In effect, the contents were conveyed by the chosen form of communication as is evident from the following:

> Yes. Yeah. So we had the system down. We had to effectively, you know, egg on our face because we had to explain to people: “Look, I’m sorry, we announced the system; but it’s no longer available because we had to do some reprogramming.” Oh! And you

know there were some angry conversations and there were some nasty emails going back and forth. (Participant 2)

There are also others who would hurl insults in some way, like regional directors who would say, “Well things are not supposed to be as it should be seen …” (Participant 7)

The form in which feedback occurred assisted in establishing meaning where the content incorporated subtle or dual-meaning, as is evident from the following:

It wasn’t a clear insult what was going on but that was a very clear signal that instead of reinforcing what everybody in his team had just been through and sort of at least acknowledging their input and assistance: nothing; so everybody’s thing is just not—everybody’s feeling a little disenfranchised. (Participant 4)

Questions appeared to constitute a particularly important source of cues, whether in the form of a relayed cue (being asked a question by others) or as a priming cue (asking others). Questions from other project actors provided cues as to their motivation and levels of understanding of issues within the project thereby bringing concerns, problems or disagreements into awareness. This was reported in two separate incidents in which the participants recognised dissonance in the objectives and levels of engagement of their project sponsors as reflected in the examples below:

People had not really understood what the program was so, by giving them the survey, it (was) effectively telling them something but also getting some feedback, a great vehicle...and the sponsors like… “Again...why are we doing this. Why are you doing this?” (Participant 4)

And he suddenly says, oh so what benefits are we going to derive through this project? You know, we’re almost throughout development, and he’s saying, “what benefits are we gonna derive?” He should be thinking about this since before we even started developing the requirements. (Participant 5)

As a priming cue, project manager participants reported asking questions to yield explicit feedback from project actors. For instance, one participant reported being guided by three standard questions during a project team meeting: what has been done, what shall be done and what are the challenges or issues that currently pose impediments to the project? These questions appeared to provide an opportunity for the elucidation of cues that might pre-empt difficulties with the conduct of the project.

These cues were drawn from summaries of the status and achievements of the project considered in relation to the project plan, any changes in scope, plan, risks and quality requirements, issues and open items, subsequent project activities, analyses of trends, and the quality and progress measures ascribed to the project (Müller, 2003).

The source of feedback was another feature to which participants directed their attention during sensemaking since it provided an indicator as to the quality and reliability of the information being communicated. A distinction was made between primary and secondary sources, with the former comprising information derived from sources directly involved in the issue or event. Secondary sources comprised observations or reports from sources that were not directly involved in the occurrence. For instance, one participant relied on a 'process observer' to report on training sessions, as indicated in the narrative below:

> That's why I have a monitoring team; then every day the trainers would go to the accreditation centre for the debriefing…. Then I also observe a process. I also have process observers. So if they (trainers) won't tell the truth, I have process observers; for instance, one would go to a Science class, another would observe. Even my very own working students were mobilised. I really hired….They would run the errands; they will also give me feedback. (Participant 7)

The absence of any information was also regarded as a form of feedback in itself. This was a cause of significant concern in some instances, indicating that little or no progress had occurred in a given task and/or that other issues had emerged in the intervening period.

> When there's no report and nothing is said about the work. If you can't say anything about the work, that means you are not doing the work. Like, even when you asked several questions, and they would just reply, "Oh, I've already told this person" and the other person also says, "I've already told this person". In that case no one is really working. (Participant 9)

Overall, the feedback cues reported by participants were multi-faceted and could be distinguished by their form, content and/or source.

Context cues. Context cues involved observations of relevant information within the physical environment. Participant narrative accounts comprised anecdotes of material and non-material objects contributing to their sensemaking. In some instances, their attention was drawn to problematic outputs or deliverables. At other times, they were directed by secondary objects or tools that assisted in keeping track of issues and the progress of a project, including Gantt charts, checklists, contracts, project maps and change-implementation plans. Both primary and secondary boundary objects provided direct inputs as to what the project had achieved against its objectives.

Together with the material objects/cues, the project environments were rich in intangible or dynamic cues. For instance, participants developed an awareness of clients' organisational and departmental cultures, the relationships between roles and positions, organisational bureaucratic processes and politics and/or their projects' geographical compositions. These cues were derived from interactions with other project actors and provided macro-level understandings of the projects and, in particular, their technical, organisational or environmental contexts.

At the micro-level, project managers reported directing their observations towards other actors whom they encountered within the project. Participants reported being particularly aware of how individual differences, such as personality, motivation, emotion, levels of competencies and understandings manifested based on the behavioural reactions and

body language of actors. They reported being conscious of the internal state of project actors, including stress, confusion or the harbouring of hostility. In some cases, these psychosocial cues provided triggers for action concerning the state of the project.

> In fact, sometimes when I'd have a meeting with my core committee, I'd say, "when we meet with them (project partner), be careful with your words, okay?" … Because we can see that they are very sensitive to what we say … because of their verbal and nonverbal gestures … We really need to be careful because they're sensitive to hearing that we're better than them. (Participant 6)

> So this is part of that dissonance, I did go up to him and gave him a status, and it's like less than an enthusiastic reception. (Participant 4)

In sum, context cues consisted of products or manifestations of human activities that occurred as the projects unfolded. They emerged as overt characteristics that were observable at the individual, project or organisational level. Table 2.1 lists examples of context cues that were identified during the cognitive interviews.

Table 2.1

Context Cues

Boundary objects	
Actual outputs, e.g., exemplar, product design, service operation, training delivery	
Project management tools, e.g., checklist, Gantt chart, performance target, change-implementation plan	
Project-related documents, e.g., abstract, contract, canvass papers, data/reports, reference materials	
Behavioural/social cues	
Activities and preoccupations of project actors at work	
Speech and behaviour of individuals	
Positions, roles and connections of individuals	
Verbal and nonverbal gestures/reactions	
Degree of commitment and engagement of the different project stakeholders	
Reactions and expectations of project stakeholders	
Individual differences: personality, motivations, levels of ability and understanding of different project stakeholders	
Contextual (technical–organisational–environmental) cues	
Activity duration estimates	Cultural, linguistic, economic and political aspects of the project environment
Actual work progress, pace of activity	Geographical locations of team members
Actual risk incidents	Organisational and departmental culture
Business/operational agreements	Organisation protocols, rules and regulations
Change agreements	Organisation's ongoing projects and activities
Different skills requirement of project actors	Organisational structure/set-up
Documents/existing data and information	Organisation's project management maturity
Expert advice	Project-specific criteria/business requirements
Existing beliefs and assumptions	Technical requirements
Existing processes and systems	Project management structure
Available physical and human resources	Project governance
Interdependencies of systems and processes	Project roles and responsibilities
Periodic software modifications	Vendor reputation
Blame-sharing/conflicts/disagreements/objections with the project	Vendor activity
Reference groups and influential bodies	Acquired knowledge about project stakeholders and their activities
Nature of project client	
Degree of freedom allowed in role performance	
Project sponsor support and engagement	

Tacit knowledge. As a cue, tacit knowledge is an internal stimulus that is expressed as an idea that may not necessarily be triggered by any external prompts. It stems from project managers' breadth of understanding of situations and manifests as an intuitive 'sense' that helps determine right from wrong, ascertain what is absent in the environment and predict how different elements of a system are likely to behave in the future.

Usually, tacit knowledge is difficult to articulate directly and is explained through metaphors, drawings or hypothesis/hunch validation (Koskinen, Pihlanto, & Vanharanta, 2003). An example is provided by Participant 3:

> I saw that we would need—it was not scoped out in the original plan, but it quickly became apparent to me that we would need a piece of technology that was not originally scoped for; and that realisation came, not from working within the project. It came from, I suppose benchmarking what we—partly benchmarking—what we were doing with other institutions, but also looking at some of the literature in this field and starting to test out with people, "Well, do you think we are going to need one of these?" And … that took maybe three to six months lobbying before people realised that we were going to need that. (Participant 3)

The participants generally attributed their insights in critical incident management to having encountered similar experiences in the past that allowed them to develop their tacit knowledge and to operate in the environment based on these implicit understandings.

> I mean, it's quite important from a project point of view. The process I was implementing here was almost identical to what I had previously. There were some differences, of course, with timings and how you rate things—and there's things I would have improved there if I had stayed there and so forth, but basically I was very comfortable with the project because I was coming in, even learning, what I had already been doing for many years and that really flavoured a lot of the things. (Participant 2)

> In my academic career, I've worked in mechanical engineering as well as art and design. So, along the way, I've picked up a wide variety of understandings of how things work, how mechanical things work, how software things work, but also how the people that operate those things talk about them, within—using the registers and language and so on, that they have to. (Participant 3)

> My principle is, I'll ask you first, "what do you think of the situation?" Because I've been to that job before, so I know. (Participant 6)

The tacit knowledge evident among participants included an understanding of different project stakeholders and service perspectives, a recognition of key project players, a recognition of best practice, a reference to previous benchmarking activities and literature reviews for standards and decision making, the use of follow-up agreements and the development of a logical and orderly process for dealing with complexities and uncertainties.

Tacit knowledge represents a distinct type of cue as it may relate to the absence as much as the presence of information. It can thereby function as a cue for pre-empting the acquisition of additional information and establishing connections that might otherwise be difficult to perceive. Participant 2 illustrates this issue in the following account:

> You know. I could dwell on this because, in retrospect, it was really obvious that this was going to happen; but it wasn't obvious at the time. For other people, though, we put together connections they themselves weren't aware of. (Participant 2)

Table 2.2 summarises participants' recollections of tacit knowledge that was described as significant at critical periods during their respective projects. The tacit knowledge was classified as pertaining to people or project management.

Table 2.2

Tacit Knowledge

People	**Project Management**
Individual differences Trustworthiness of people's responses or information shared Degree of power and influence of different stakeholders Competencies and limitations of team members in terms of deliverables Background knowledge of different stakeholders	Best practices Benchmarking Knowledge areas Methodologies Problem solving skill requirements, e.g., evaluation of options through testing, literature reviews, collection of multiple perspectives Project management maturity of organisations Project-specific requirements Jargon and language of technical experts Risk thresholds Locus of control Maturity of client in terms of project delivery

Discussion.

The outcomes of this study contribute to the developing discussion surrounding sensemaking in the context of project management. Earlier studies have examined the phenomenon by reflecting on various project stakeholder narratives (Alderman et al., 2005) and considering it as an intermediary object of design (IOD), the forms and content of which vary across the life cycle of a project (Papadimitriou & Pellegrin, 2007). The present research complements these studies through a detailed, descriptive analysis of cognitive representations of sensemaking, specifically in the form of cues by which particular features are perceived in the environment. Based on participant narrative accounts, awareness of threats and opportunities in a given environment may be triggered by external prompts such as feedback and context cues.

The role of tacit knowledge in sensemaking has not been well explored in the project management literature but emerged in the present study as an apparent precursor to feedback and context cues. It appeared to provide an abstract representation of the environment that highlighted either the absence of information or a conflict between expectations and

observations, thereby providing a trigger for the acquisition of project-related information incorporating feedback cues and context cues. In this sense, tacit knowledge can be described as an intuitive representation of the underlying structure and features characterising an environment (Reber, 1989).

Tacit knowledge appears to be expressed through behaviours such as forming evaluations, attitudes, points of view, commitments and motivation (Koskinen et al., 2003). Since it is implicit knowledge, project managers express some difficulty in explaining how they arrive at decisions or conclusions (Koskinen et al., 2003; Reber, 1989). This is consistent with the principle that much of this knowledge is non-conscious and retained in memory in the form of cue-based associations.

The results suggest that sensemaking is a spontaneous and dynamic activity, rather than a linear progression of data–information–knowledge–understanding (Klein et al., 2010; Weick et al., 2005). In fact, the awareness may be triggered by data from the environment in the form of feedback and/or context cues, or it may be recognised intuitively based on expectations derived from tacit knowledge.

Another outcome of the study points to the role of project complexity as an important precursor to sensemaking. It was a theme that emerged in the participants' narratives as an aspect in the project that was less difficult to predict and control, and that created a sense of ambiguity, and uncertainty.

Limitations of the present research.

Despite the fact that the cues emerged as an outcome of actual project management cases, the process of information acquisition involved a retrospective process whereby participants were asked to recall an incident using the CIT. Although the process is reasonably robust, inevitably memory errors may have impacted the recollection of participants, thereby affecting the nature of the cues that were identified.

Due to the need for an in-depth exploration of the participants' actual experiences to extract cues that were associated with critical project incidents, the sample size was relatively restricted. However, while a greater sample size may have yielded a greater frequency of cues, it was unlikely to have resulted in the generation of additional categories of cues.

In the present study, the categorisation of cues – feedback cues, context cues, and tacit knowledge – represented the general characteristics or universal forms of cues in which they manifest in the wider project management-related contexts. From a knowledge perspective, this is critical to project managers who deal with complex project environments. Due to the temporal nature of projects, project managers constantly find themselves in new and complex work environments where greater flexibility and breadth of understanding must be applied. Therefore, a global understanding of an aspect in project management, such as the types of sensemaking cues present in project situations, is advantageous to the project manager, alongside his/ her domain-specific knowledge (Hodgson, & Paton, 2015). Of interest in the later stage of this investigation is to examine domain-specific cues, where particular feedback cues, context cues, and/or tacit knowledge embody different values.

Clearly, the generation of the project management-related cues in the present study requires a confirmatory study to test their construct validity. This can be accomplished by establishing whether the utilisation of cues occurs differently for experienced and inexperienced practitioners. Further, the utilisation of different categories of cues should be more or less evident, depending upon differences in the context, including levels of complexity. Finally, differences in the utilisation of categories of cues should be evident at different stages of a project from project initiation to completion.

Implications for practice.

The outcomes of this study present important applied contributions in the context of project management. First, they offer a broader view of sensemaking as a phenomenon that cannot be interpreted outside the context of a project. They also point towards the role of cues

as a basis for effective sensemaking. Developing and maintaining these cues is perhaps one of the most important ways in which the sensemaking performance of project managers can be improved.

To facilitate the development of skilled sensemaking during project management, training initiatives should begin to target cues associated with feedback from stakeholders and actors and cues that emerge from the environmental context, particularly pertaining to complexity and uncertainty. Through systematic training and the provision of feedback, project managers should be better equipped to address the complexities and uncertainties associated with project management.

Study 1 References

Alderman, N., Ivory, C., McLoughlin, I., & Vaughan, R. (2005). Sense – making as a process within complex service-led projects. *International Journal of Project Management, 23*(5), 380-385. doi:10.1016/j.ijproman.2005.01.004

Balogun, J., & Johnson, G. (2004). Organizational restructuring and middle manager sensemaking. *Academy of Management Journal, 47*(4), 523–549. doi:10.2307/20159600

Balogun, J., & Johnson, G. (2005). From intended strategies to unintended outcomes: The impact of change recipient sensemaking. *Organization Studies, 26*(11), 1573–1601. doi:10.1177/0170840605054624

Brown, A. D., Colville, I., & Pye, A. (2015). Making sense of sensemaking in organization studies. *Organization Studies, 36*(2), 265–277. doi:10.1177/0170840614559259

Brunswik, E. (1955). Representative design and probabilistic theory in a functional psychology. *Psychological Review, 62*(3), 193–217.

Cicmil, S., Williams, T., Thomas, J., & Hodgson, D. (2006). Rethinking project management: Researching the actuality of projects. *International Journal of Project Management, 24*(8), 675-686. doi:10.1016/j.ijproman.2006.08.006

Clark, R. E., Pugh, C. M., Yates, K. A., Inaba, K., Green, D. J., & Sullivan, M. E. (2012). The use of cognitive task analysis to improve instructional descriptions of procedures. *Journal of Surgical Research, 173*(1), e37–e42. doi:10.1016/j.jss.2011.09.003

Coetzer, A., Redmond, J., & Sharafizad, J. (2012). Decision making regarding access to training and development in medium-sized enterprises: An exploratory study using the critical incident technique. *European Journal of Training and Development, 36*(4), 426–447. doi:10.1108/03090591211220348

Connolly, T., Arkes, H. R., & Hammond, K. R. (2000). *Judgment and decision making: An interdisciplinary reader*. Cambridge: Cambridge University Press.

Crandall, B., Klein, G., & Hoffman, R. R. (2006). *Working minds a practitioner's guide to Cognitive Task Analysis*. Cambridge, Massachusetts: The MIT Press.

Einhorn, H. J., & Hogarth, R. M. (1988). Behavioral decision theory: Processes of judgment and choice. In D.E. Bell, H. Raiffa, & A. Tversky (Eds.), *Decision making: Descriptive, normative and prescriptive interactions* (pp. 113–146). Cambridge: Cambridge University Press.

Endsley, M. R. (1995). Toward a theory of situation awareness in dynamic systems. *Human Factors, 37*(1), 32–64.

Flanagan, J. C. (1954). The critical incident technique. *Psychological Bulletin, 51*(4), 327–358. doi:10.1037/h0061470

Gremler, D. D. (2004). The critical incident technique in service research. *Journal of Service Research, 7*(1), 65–89. doi:10.1177/1094670504266138

Hartwig, M., & Bond, C. F. (2001). Why do lie-catchers fail? A lens model meta-analysis of human lie judgments. *Psychological Bulletin, 137*(4), 643–659.

Havelka, D., & Rajkumar, T. M. (2007). Using the troubled project recovery framework: Problem recognition and decision to recover. *E-Service Journal, 5*(1), 43–73.

Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: A failure to disagree. *The American Psychologist, 64*(6), 515–526. doi:10.1037/a0016755

Kaulio, M.A. (2008). Project leadership in multi-project settings: Findings from a critical incident study. *International Journal of Project Management, 26*(4), 338–347. doi: 10.1016/j.ijproman.2007.06.005

Klein, G., Moon, B., & Hoffman, R. R. (2006b). Making sense of sensemaking 1: Alternative perspectives. *IIEE Intelligent Systems, 21*(4), 70–73.

Klein, G., Wiggins, S., & Dominguez, C. O. (2010). Team sensemaking. *Theoretical Issues in Ergonomics Science, 11*(4), 304–320. doi:10.1080/14639221003729177

Koskinen, K. U., Pihlanto, P., & Vanharanta, H. (2003). Tacit knowledge acquisition and sharing in a project work context. *International Journal of Project Management, 21*(4), 281–290. doi:10.1016/S0263-7863(02)00030-3

Maitlis, S., & Christianson, M. (2014). Sensemaking in organizations: Taking stock and moving forward. *Academy of Management Annals, 8*(1), 57–125. doi:10.1080/19416520.2014.873177

Müller, R. (2003). Determinants for external communications of IT project managers. *International Journal of Project Management, 21*(5), 345–354. doi:10.1016/S0263-7863(02)00053-4

Papadimitriou, K., & Pellegrin, C. (2007). Dynamics of a project through intermediary objects of design (IODs): A sensemaking perspective. *International Journal of Project Management, 25*(5), 437–445. doi:10.1016/j.ijproman.2006.11.002

Poon, L. W., Rubin, D. C., & Wilson, B. A. (1989). *Everyday cognition in adulthood and late life*. Cambridge: Cambridge University Press.

Project Management Institute (2013). *A guide to the project management body of knowledge: PMBOK guide* (5th Ed.). Newtown Square, Pennsylvania: Project Management Institute, Incorporated.

Reber, A. S. (1989). Implicit learning and tacit knowledge. *Journal of Experimental Psychology: General, 118*(3), 219–235.

Shanteau, J. (1992). How much information does an expert use? Is it relevant? *Acta Psychologica, 81*(1), 75–86. doi:10.1016/0001-6918(92)90012-3

Simon, H. A. (1992). What is an "explanation" of behavior? *Psychological Science, 3*(3), 150–161.

Söderholm, A. (2008). Project management of unexpected events. *International Journal of Project Management, 26*(1), 80–86. doi:10.1016/j.ijproman.2007.08.016

Söderlund, J. (2004). Building theories of project management: Past research, questions for the future. *International Journal of Project Management, 22*(3), 183–191. doi: 10.1016/S0263-7863(03)00070-X

Thomas, J., & Mengel, T. (2008). Preparing project managers to deal with complexity—Advanced project management education. *International Journal of Project Management, 26*(3), 304–315. doi:10.1016/j.ijproman.2008.01.001

Turner, J. R., & Müller, R. (2003). On the nature of the project as a temporary organization. *International Journal of Project Management, 21*(1), 1–8. doi:10.1016/S0263-7863(02)00020-0

Vidal, L.-A., Marle, F., & Bocquet, J.-C. (2011). Measuring project complexity using the analytic hierarchy process. *International Journal of Project Management, 29*(6), 718–727. doi:10.1016/j.ijproman.2010.07.005

Weber, K., & Glynn, M. A. (2006). Making sense with institutions: Context, thought and action in Karl Weick's theory. *Organization Studies, 27*(11), 1639–1660. doi:10.1177/0170840606068343

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science, 16*(4), 409–421. doi:10.1287/orsc.1050.0133

White, D., & Fortune, J. (2002). Current practice in project management—an empirical study. *International Journal of Project Management, 20*(1), 1–11. doi:10.1016/S0263-7863(00)00029-6

Wickens, C. D., & Hollands, J. (2002). *Engineering psychology and human performance* (3rd ed.). New Jersey: Prentice Hall.

Wiggins, M. W. (2013). Making sense of sustainability: A cue-based approach to sustainable organisational performance. In G. Avery & B. Hughes (Eds.), *Fresh thoughts in sustainable leadership*. Melbourne, Australia: Tilde University Press.

Wiggins, M. W., Brouwers, S., Davies, J., & Loveday, T. (2014). Trait-based cue utilization and initial skill acquisition: implications for models of the progression to expertise. *Frontiers in Psychology, 5*, 541. doi:10.3389/fpsyg.2014.00541

Williams, T., Klakegg, O. J., Walker, D. H., Andersen, B., & Magnussen, O. M. (2012). Identifying and acting on early warning signs in complex projects. *Project Management Journal, 43*(2), 37–53. doi:10.1002/pmj.21259

Winter, M., Smith, C., Morris, P., & Cicmil, S. (2006). Directions for future research in project management: The main findings of a UK government-funded research network. *International Journal of Project Management, 24*(8), 638–649. doi:10.1016/j.ijproman.2006.08.009

Yang, Q., Lu, T., Yao, T., & Zhang, B. (2014). The impact of uncertainty and ambiguity related to iteration and overlapping on schedule of product development projects. *International Journal of Project Management, 32*(5), 827–837. doi:10.1016/j.ijproman.2013.10.010

Zhang, L. (2013). Managing project changes: Case studies on stage iteration and functional interaction. *International Journal of Project Management, 31*(7), 958–970. doi:10.1016/j.ijproman.2012.11.014

Chapter 3:

Study 2: The Utilisation of Feedback Cues and Context Cues in Project Management Sensemaking

Aim

The aim of this study was to provide confirmatory evidence of the sensemaking cue categories that emerged in Study 1. To recall, these categories comprised feedback cues, context cues, and tacit knowledge. Building on the outcomes of Study 1, Study 2 was intended to provide an empirical basis for the sensemaking categories by testing the association with different levels of project complexity and different stages of project management.

Study 2 comprised a comparative study between experienced project managers and a naïve cohort. The experienced project managers were recruited from a project management organisation while the naïve cohort, described as a group with no formal project management background either in work or voluntary organisations, was recruited from a university research pool. The university research pool mainly consists of Psychology students who voluntarily enlisted on the study and received a course credit for research participation. The use of the two comparative cohorts – experienced project managers and naïve participants – was based on the proposition that, if feedback cues and context cues constitute features that are applied during project management, then those participants with operational experience in the domain ought to demonstrate greater levels of discrimination in the utilisation of these cues by comparison with their naïve counterparts.

As in Study 1, Study 2 is an extended paper. Shortened versions of Study 1 and Study 2 were integrated and published in the article, ‘The role of cues in expert project manager sensemaking’ in the *Journal of Construction Management and Economics*.

Study 2

The Utilisation of Feedback Cues and Context Cues in Project Management Sensemaking

(An Extended Paper)

Eva Marie Gacasan & Mark Wiggins

Macquarie University, Sydney Australia

Correspondence concerning this article should be addressed to:

Eva Marie Gacasan

Department of Psychology

Macquarie University

New South Wales, Australia 2109

Email: eva-marie.gacasan@students.mq.edu.au

Abstract.

Effective project management is a critical factor for project success and its function becomes even more significant with increasing project complexity. As a mechanism for diagnosing emergent complex situations, project managers rely on the utilisation of cues as a basis for sensemaking. The aim of this paper was to examine whether there are differences in utilisation of categories of cues that contribute to sensemaking in response to varying levels of complexity throughout the progression of projects (e.g., initiation, execution, and closing). Twenty-three experienced project managers and 78 naïve participants responded to an online, scenario-based survey. Significant differences in patterns of cue utilisation were evident whereby, compared to a naïve group, experienced project managers recorded greater perceived utilisation of feedback cues throughout all stages of a more complex project and in the use of feedback cues and context cues in specific stages of a low-complexity project. The results suggest greater variability in the utilisation of cue categories among experienced project managers, depending upon the complexity and stage of a project. The research outcomes provide further evidence to support the utilisation of feedback and context cues in the context of project management sensemaking.

Keywords: Cues, Sensemaking, Project Management

Introduction.

Project management is associated with the management of project complexity (Baccarini, 1996). Complexity is a property of a project that refers to difficulty in understanding, controlling and predicting the project state, even when provided with sufficient information (Vidal, Marle, & Bocquet, 2011). It is attributed to the number of components involved, their interdependencies and the degree of influence among the components (Davies & Mackenzie, 2014).

Complexity poses a major threat to the progression of a project and the achievement of its goals and objectives (Baccarini, 1996). It reflects the 'edge of chaos' between stability and instability where project managers must make decisions based on a number of unknown variables and potentially high-risk consequences (Thomas & Mengel, 2008). The underestimation of complexity and the inability to manage and cope with increasing project intricacies have been identified as the common causes of a number of project failures (Bosch-Rekveldt, Jongkind, Mooi, Bakker, & Verbraeck, 2011).

Assessments of project complexity play an important role in determining appropriate managerial actions including planning, coordination and control, and assisting in the establishment of criteria for project inputs, structure and processes (Baccarini, 1996). The complexity of a project is rarely specified at the outset as it manifests as emergent, rather than as a planned situation (Perminova, Gustafsson, & Wikström, 2008; Thomas & Mengel, 2008). The early warning signs of project complexity are often captured by non-technical or informal mechanisms such as intuitive judgement or the ability to 'make sense' of information (Sampo, Kirsi, & Mervi, 2010; T. Williams, Klakegg, Walker, Andersen, & Magnussen, 2012). In comparison to traditional project management tools such as numeric models and techniques, making sense, constructing meaning and reflective learning tend to be more important activities during the management of complex situations (Thiry, 2001; Thomas & Mengel, 2008).

Sensemaking is a process that underpins project management. It thereby coexists with project management throughout its life cycle (Fellows & Liu, 2016). It is driven by the need to be aware of anomalies, discontinuities or irregularities that could occur in the operational environment (Maitlis & Christianson, 2014). Sensemaking allows for a comparative assessment between the current and projected project status, and is an enabler of flexibility and rapid decision making in response to situations (Perminova et al., 2008).

Ineffective, inaccurate or poorly timed sensemaking can result in inaccurate interpretations and/or delayed responses. Project managers or other stakeholders may not be aware of emergent issues so that recovery interventions are not immediately implemented (Havelka & Rajkumar, 2007). A lack of sensemaking may also lead project actors to maintain existing paradigms or ideas (Thiry, 2001) or ignore the severity of a problem, thereby hindering the successful management of a project (Musca, Mellet, Simoni, Sitri, & de Vogüé, 2014).

Although sensemaking is a construct investigated in the context of project management, its implications have yet to be fully explained (Alderman, Ivory, McLoughlin, & Vaughan, 2005). Specifically, it remains unclear when sensemaking is of greatest value during the execution of a project and whether different types of projects are more or less dependent upon effective sensemaking. Therefore, the aim of this paper was to examine the role of sensemaking in projects of greater and lesser complexity and to establish whether the relative importance of sensemaking changes as a project progresses towards completion.

Project management and its evolution.

Project management is a construct that has emerged partly in response to the challenges faced by contemporary organisations to deliver new products and services of good quality at high speed (Aubry & Lenfle, 2012). Although World War II witnessed thousands of de facto projects and provided the foundation for project management, it was only in the late 1960s and early 1970s that it emerged as a formal discipline (Morris, 2013). Professional

organisations, including the Project Management Institute (PMI) and the International Project Management Association (IPMA), steered developments in the field that included organising and articulating a body of knowledge and formulating standards and competencies (Thomas & Mengel, 2008).

Despite the advancements in practice, sensemaking remains a construct with which organisations struggle (Aubry & Lenfle, 2012). Delays in completion, together with project failures are evident in many organisations and industries despite relatively high levels of oversight (Havelka & Rajkumar, 2007; Sage, Dainty, & Brookes, 2014). Issues of complexity, chaos and uncertainty often emerge as factors explaining delays and poor project outcomes (Thomas & Mengel, 2008).

Project complexity.

Every project is characterised by varying degrees of complexity arising from two dimensions: multiplicity and ambiguity. Multiplicity refers to the number of varied elements including tasks, specialists and components that form intricate networks and interdependencies (Baccarini, 1996). Different components including stakeholders and systems interact and, in the process, are affected by the actions of other components (Davies & Mackenzie, 2014). The multiplicity of actors, systems and processes connotes multi-objectivity with varying objectives, approaches and end states being pursued as part of the project (Bosch-Rekveldt et al., 2011; Kennedy, McComb, & Vozdolska, 2011).

The outcomes of interactions between components often create ambiguity. Ambiguity is often used as a collective term for a lack of awareness of certain project states, insufficient understanding of the causal relationships in project activities, inadequacy of project-related information, and the presence of conflicts and uncertainties (Pich, Loch, & De Meyer, 2002; Kennedy et al., 2011; Yang, Lu, Yao, & Zhang, 2014). McComb, Green, & Dale Compton (2007) have shown that these dimensions collapse into a factor labelled ‘ambiguity’.

Project complexity may manifest during the different stages of project management, including initiation, execution, and closing. Each of these stages of project management has its own specific objectives and challenges (PMI, 2013). During the initiation and planning stages, guidelines, criteria, policies and templates are established. During the execution stage, monitoring and control are exercised through change, financial and risk control, issue and defect management, and the organisation and monitoring of communication. Finally, during the closing stage, the outcomes of each project are assessed against the initial guidelines and goals.

The interrelated nature of project complexity and sensemaking.

The complexity of a project typically manifests in symptoms of 'trouble' that trigger sensemaking. The early warning signals may be evident in the form of an event (e.g., a key project actor abandoning the project) or state (e.g., a missed milestone or deliverable), suggesting deviations in expectancies (Havelka & Rajkumar, 2007). These situations trigger a search for clarification and/or a search for new explanations or alternatives (Thiry, 2001).

Sensemaking comes into play as people work to understand issues or events that are novel, ambiguous or that may have violated expectations (Maitlis & Christianson, 2014). It is through sensemaking that people are able to deal with uncertainty and ambiguity by creating rational accounts of their observations that enable action (Maitlis, 2005).

The sensemaking process.

As a construct, sensemaking has developed from two separate scholarly directions—organisation behaviour and applied cognitive psychology—through the early efforts of Weick (1979) and Klein (1998) respectively.

Sensemaking through the organisational behaviour lens.

Sensemaking is defined as "a process, prompted by violated expectations, that involves the attending and bracketing of cues in the environment, creating intersubjective meaning through cycles of interpretation and action and thereby enacting a more ordered environment

from which further cues can be drawn" (Maitlis & Christianson, 2014, p. 67). Weick, Sutcliffe, & Obstfeld (2005) refer to sensemaking specifically as an organisational process in the intrinsic flux of human action. People come to identify an 'event' by bracketing a portion of the stream of experience that they then label as a specific event or story and which is then used as currency for communication. The act of 'noticing' is initiated by salient, disparate or anomalous cues that capture the attention.

Weick et al. (2005) describe other distinguishing features of sensemaking as shaped by: the identity of the actor, retrospective and prospective thinking, and plausibility and social processes. In terms of identity, making sense of the external world is often a self-referential process where what is sensed and how it is perceived are based on the actor's identity (Weber & Glynn, 2006). Sensemaking tends to be employed in situations where identity is involved (Weick et al., 2005). For instance, in an ethnographic study involving routine meetings among organisational actors in a Swedish evening newspaper, actors who appeared to be discussing their work were shown to be constructing and making sense of situations using their multiple identities as references (e.g., social, group, professional and organisational) (Kärreman & Alvesson, 2001). Their identities were said to provide the cues that determined how each actor interacted with the larger social group.

The nature of sensemaking is an ongoing, retrospective–prospective cognitive process. When people label a stream of circumstances as a concern, sign, mistake or opportunity, it indicates reflective thinking as to what has occurred (Weick et al., 2005). Simultaneously, the actor also engages in prospective thinking in an attempt to anticipate events or issues that might require a response. This simultaneous process of retrospective–prospective thinking reflects the iterative cycle of sensemaking and its implications for decision making (Brown, Colville, & Pye, 2015).

The Weickian perspective embodies the social and discursive nature of the sensemaking process. It is argued that there is no objective reality, but a social construction in

which actors interpret and explain sets of cues from the external world (Maitlis, 2005). The social nature of sensemaking raises the importance of communication and interaction. Actors engage in conversational and narrative interactions facilitated by spoken and written, and formal and informal communication. Specifically, they take part in gossip, negotiations, information sharing and seeking and the observation of behaviours and actions to construct meanings (Balogun & Johnson, 2005). Therefore, it is through social interactions that actors are able to engage in social construction and the validation of their perceived realities.

Sensemaking through a cognitive lens.

A number of relevant conceptual frameworks have been purported to explain the mechanisms of sensemaking, including the recognition-primed decision (RPD) model developed by Klein (1998), the data/frame model developed by Klein, Wiggins, & Dominguez (2010), the lens model developed by Brunswik (1955) and the cue utilisation construct by Wiggins (2015a).

The recognition-primed decision (RPD) model (Klein, 1998).

In the RPD model, the recognition of a situation involves four elements: goals, cues, expectations and actions. The process begins when the actor recognises the nature of a situation as either typical or familiar. This triggers a consideration as to whether the existing goals are appropriate and whether and how they should be prioritised given the situation. This process of prioritisation is dependent upon the cues that are most evident, the situations with which they are associated, and the typical responses to these situations.

Based on the RPD Model, sensemaking strategies vary according to different situations. Figure 3.1 illustrates these variations as follows: Variation 1 represents a basic sensemaking strategy. Situations are less complex when they are recognised by actors as typical, and actions are identified that are likely to succeed. This sensemaking strategy operates on the basis of something like an ‘if… then’ rule-based response. Variation 2 corresponds to more complex situations where there might be a need to devote more time to

identifying the cues as the existing information may not present as a typical case. At other times, problems may only be diagnosed later when cues emerge. These situations typically follow the 'if (???)… then' response. In Variation 3, seasoned decision makers are thought to engage in single option evaluations rather than a simultaneous evaluation approach in which they mentally play out the best course of action using 'if… then (???)' logic. If the option is unviable, they proceed to the next option and repeat the process through mental simulation.

From a theoretical standpoint, accurate and efficient sensemaking represents the foundation for recognition-primed decision making (Wiggins, Azar, Hawken, Loveday, & Newman, 2014). The proposition that underscores this model is that sensemaking is enabled by pattern recognition derived from a rich repertoire of cues stored in long-term memory and triggered by particular situations (Wiggins, Azar et al., 2014). Cues are described as environmental stimuli representing a relationship between a feature and an event or object that has been established through repeated association (Wiggins, Azar, et al., 2014; Wiggins, Brouwers, Davies, & Loveday, 2014). The ability to perceive the combination or pattern of relationships among the cues, learned through experience, usually generates an action queue of plausible responses, starting with the most plausible (Klein, 2015).

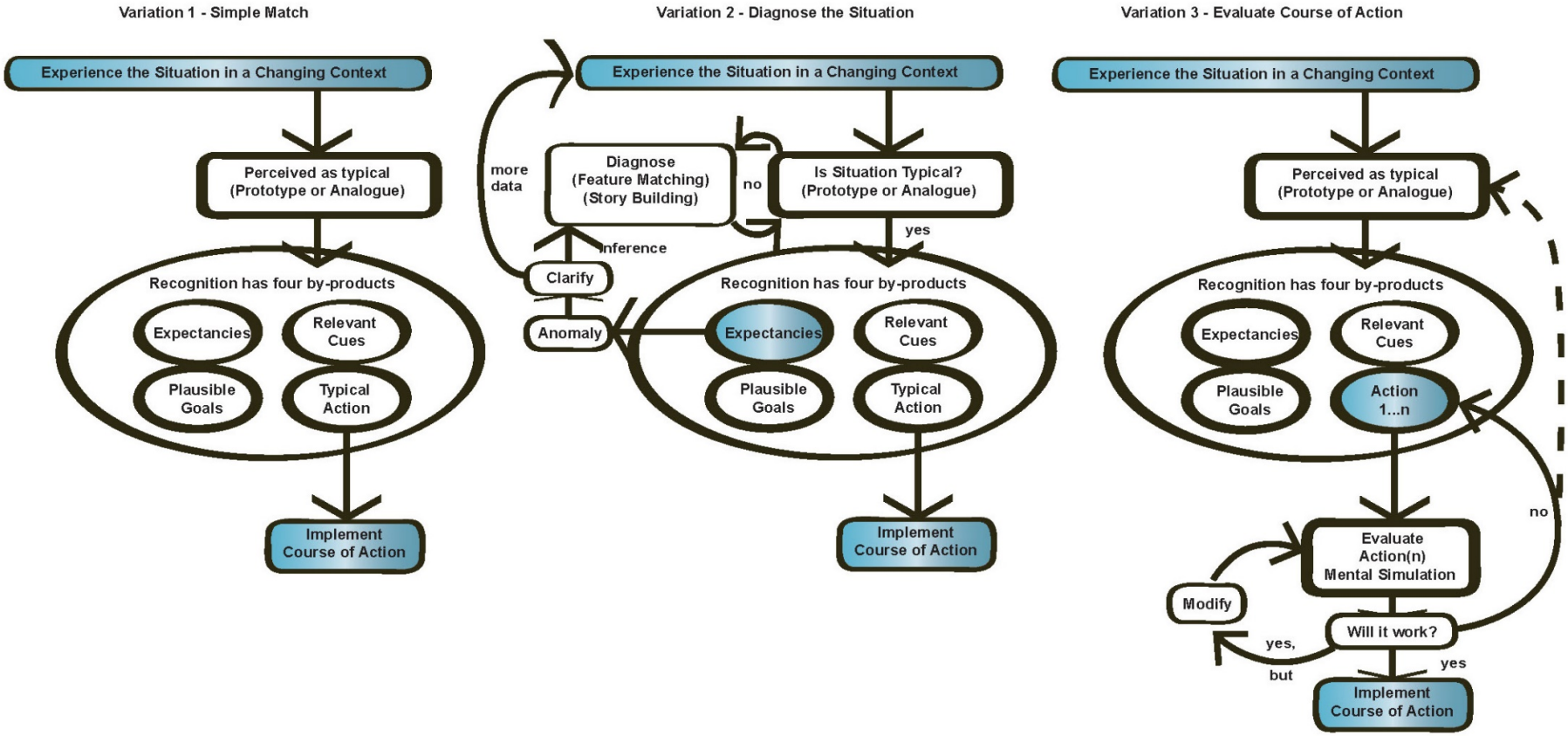


Figure 3.1. The three variants of sensemaking strategies based on the RPD Model (Klein, 1998) ranged from a simple matching strategy (Variation 1) to more complex involving further diagnosis of situations (Variation 2) and the evaluation of options (Variation 3).

Data/frame model.

In the data/frame model, sensemaking is considered in the context of information acquisition processing (Klein, Moon, & Hoffman, 2006a; Klein et al., 2010). When actors attempt to make sense of events they begin with a frame or a perspective, a viewpoint or framework that is expressed in terms of stories, scripts, maps or diagrams. Actors also acquire data or information from the environment. Frames and data form a symbiotic relationship whereby frames shape and define the data, while the data are used to identify the frame.

During complex situations, actors may find that the data and frame do not match or that existing interpretations do not provide sufficient or plausible explanations. In this case, more elaborate sensemaking is invoked that might involve elaborating a frame by adding details, questioning a frame by doubting an explanation or reframing by considering new frames or alternative perspectives (Klein, Moon, & Hoffman, 2006b). Figure 3.2 illustrates an integrated model of data/frame theory from simple data-frame matching to elaborate sensemaking processes.

The data/frame model provides an alternative explanation as to how sensemaking is acquired. In contrast to the cascading model that depicts information acquisition through a linear process of data–information–knowledge–understanding, the data/frame model acknowledges the simultaneous relationship between data and the frame where the end state is the identification of the most suitable frame or the best interpretation of events (Klein et al., 2010).

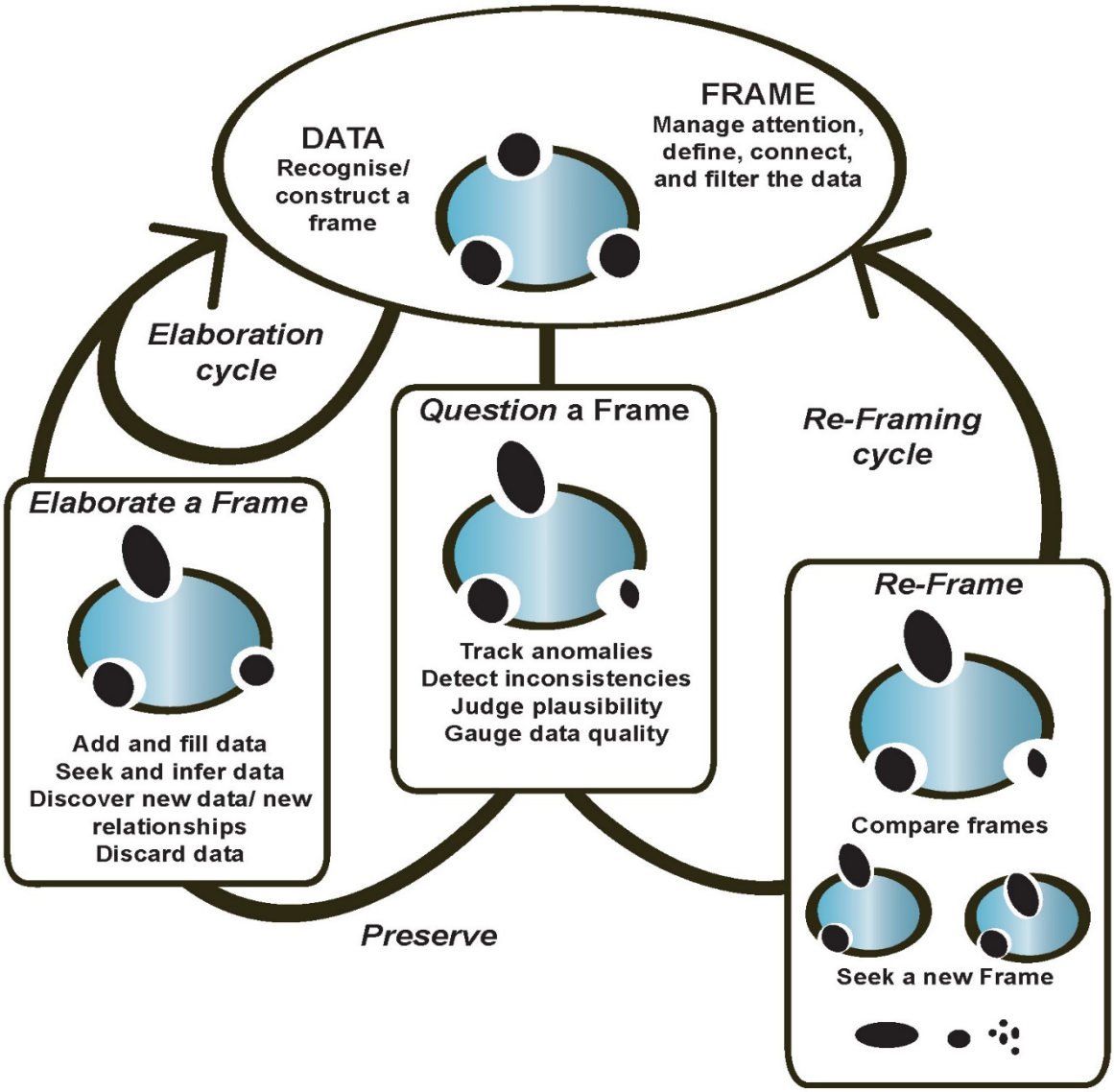


Figure 3.2. An integrated data/frame model (Klein et al., 2010) illustrates sensemaking at the basic level of data/frame matching as compared to the more elaborate sensemaking that occurs when modifications to frame or data are made.

Brunswik's lens model.

Using a conceptual framework similar to that proposed by Klein et al. (2010), Brunswik's (1955) lens model is based on probabilistic functionalism that posits that the relationship between an individual and environmental variables are probabilistically related. Further, the complexity of the structure, the number of cues present, and the time available for

exercising judgement are factors that impact the type of information acquired and the level of processing involved (Thompson, Foster, Cole, & Dowding, 2005).

As part of the lens model, Brunswik distinguishes two characteristics of cues: ecological validity and cue utilisation. Ecological validity is illustrated on the left-hand side of Figure 3.3, and is defined as the correlation between a cue and a criterion (O'Hare, 2015). It is described as the objective value of a feature based on its 'trustworthiness' of representing an object in the environment (Poon, Rubin, & Wilson, 1989). Cue utilisation is represented on the right-hand side of the figure and constitutes the subjective value of a cue or the weight of importance that that an actor ascribes to a cue (Hartwig & Bond, 2001; Thompson et al., 2005). For instance, while a prototype may comprise an important criterion in a product development project, different actors vary in the value or importance that they place on the prototype. Therefore, the relevance or non-relevance of cues is primarily attributable to the perceived utilisation of a cue. The incongruence between the objective and subjective values ascribed to cues is often considered the basis of inaccurate judgements (Connolly, Arkes, & Hammond, 2000).

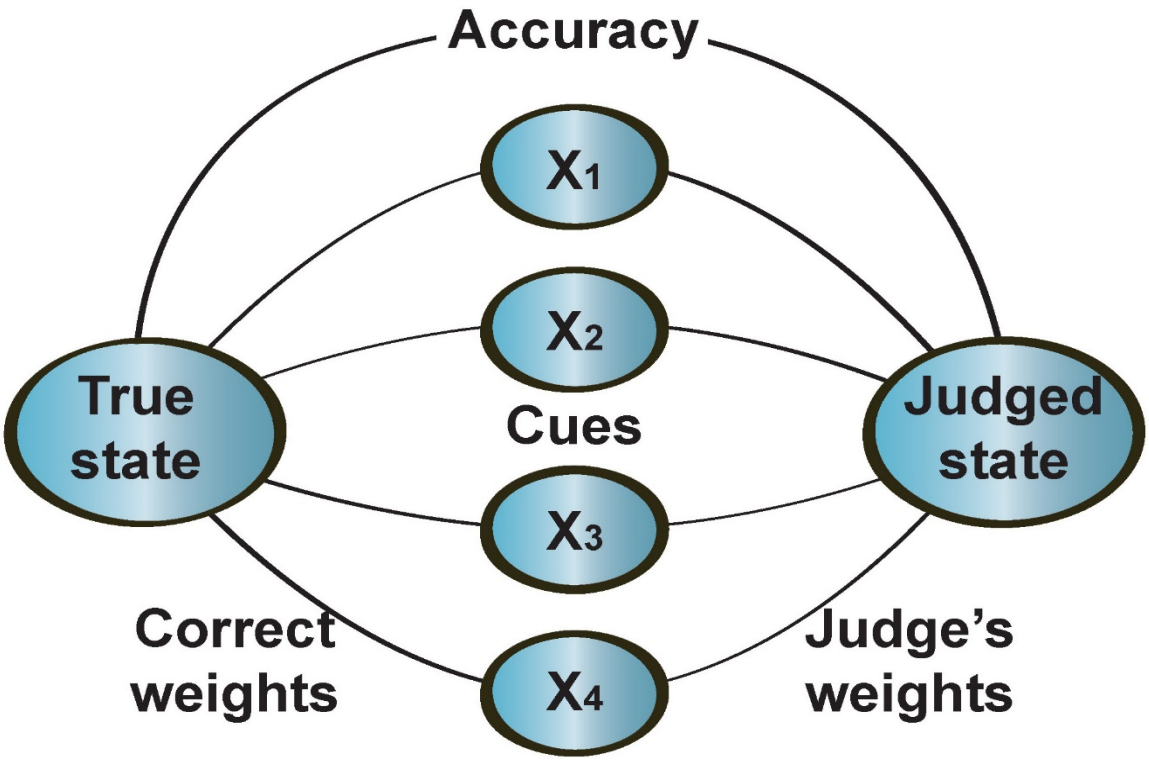


Figure 3.3. A graphical illustration of Brunswik's lens model (Thompson et al., 2005) that depicts an actor's subjective perception as the basis of sensemaking.

Cue and cue utilisation: The basis of sensemaking.

Both the organisational behaviour and cognitive perspectives of sensemaking embody cues and cue-based processing as central to the formation of assessments of situations. To wit, "The situation has provided a cue; this cue has given the expert access to information stored in memory and the information provides the answer" (H. Simon, 1992, p. 155).

Cues constitute highly specialised associations that represent situation-specific relationships between environmental features and events or objects (Brouwers, Wiggins, Helton, O'Hare, & Griffin, 2016). They operate according to cue-based associations in which features associated with a particular environment trigger a memory of a set of feature/object–event relationship/s (Wiggins, 2015b). Cues aid in cognitive processing as they facilitate selective attention, reduce time and effort in information search enabling relatively rapid responses to situations, prompt distinctions between familiar and unfamiliar situations,

facilitate predictions of future states, and reduce anxiety (Einhorn & Hogarth, 1988; Wiggins, 2015a). As demonstrated by several studies, superior or expert performers appear to maximise the benefits of using cues through greater efficiency and accuracy in the search for information (e.g., Loveday, Wiggins, Searle, Festa, & Schell, 2013; Shanteau, 1992).

From an information processing perspective, cue utilisation constitutes a fundamental process involving the recognition of relevant features and the rapid response to situations (Wiggins, 2015a). According to Wiggins, cue utilisation is interwoven with the process of diagnosis whereby accuracy is dependent upon the accuracy and precision of the relationships between the features/objects-events that are retained in memory. Since diagnosis is a construct equivalent to sensemaking, successful performance requires the retention and subsequent recollection of feature–event associations from memory, the integration of feature–event associations into meta-cues, and the capacity to recognise similarities between patterns of cues (Wiggins, 2015a).

Comparison between experienced and inexperienced cohorts.

The acquisition of cognitive skills such as diagnostic reasoning is typically well established from comparative studies of superior and less proficient practitioners (Loveday, Wiggins, Haris, O'Hare, & Smith (2013). Comparative assessments between different levels of performers indicate how the different cohorts make use of information and determine relevant from irrelevant information (Shanteau, 1988; Loveday, Wiggins, Harris, et al., 2013). Although, the comparison spectrum has widened to include the naïve, novice, and competent non-expert performers, that is more reflective of the range of observable organisational performance. The inclusion of these cohorts is important in examining the trajectory of skill acquisition and in developing training systems that support towards expertise progression. Naïve performers, with their lack and/or limited knowledge and background in a domain (Shanteau, 1988), provide baseline information. Novice and competent non-expert

performers, with their considerable knowledge and experience, provide crucial information of stages that precede expertise (Shanteau, 1988; Loveday, Wiggins, Searle, et al., 2013).

Several of the comparative studies in cognition and information processing yield the same conclusion that the distinguishing characteristic between the more advanced performers and their less proficient peers is in their capacity to extract cues in their work domain. Cue activation is the precursor to diagnostic abilities that occurs when a feature in the environment triggers associations in memory (Klein, 2015). This explains the experts' ability to make fine discriminations among environmental cues that may not be visible to the non-experts (Shanteau, 1988; Klein, 2015).

Sensemaking in project management.

The relationship between cue utilisation and sensemaking has yet to be considered explicitly in the context of project management. However, Papadimitriou and Pellegrin (2007) do refer to intermediary objects of design (IODs) as media for the sensemaking process. IODs are objects such as designs, prototypes, documents and pilot implementations produced by the project team that embody cue-based representations of the final deliverable. These cues imbue diagnostic qualities that are useful during the different stages of project implementation since they offer comparative states of 'as–is' and 'to–be'.

The aim of the present study was to test the validity of the sensemaking cues that were identified in Study 1. This involved investigating how groups with and without project management experience responded to project-relevant features in hypothetical scenarios. The intention was to assess the perceived role of these sensemaking features in projects of different levels of complexity and at different stages of a project completion.

A preliminary study.

In Study 1, nine experienced project managers, five from Australia and four from the Philippines, participated in a study that involved the application of the critical incident

technique (CIT). The CIT involves the collection of data through the systematic assessment of incident reports that allows for the examination of individual knowledge, strategies, motivations and decisions in the performance of a task within a complex system (Clark et al., 2012; Crandall, Klein, & Hoffman, 2006). Project managers were asked to recall critical project incidents that posed threats to the progression and outcomes of a project, but where interventions were timely and successful. Based on these incidents, participants were asked to identify the situational features (cues) that guided their diagnoses.

Through content analysis, 63 incidents were identified comprising three categories of cues that were relevant to project management sensemaking, including feedback cues, context cues and tacit knowledge.

Feedback cues were elicited by participants through active engagement with other project actors and were revealed to have a multi-faceted character consisting of form, content and/or the source of feedback—each of which constituted diagnostic cues. Feedback corresponded to narratives, as identified by Alderman et al. (2005), as inputs from various stakeholders shaping the management and the progression of projects from initiation to closing.

Context cues were acquired through sensory observation and comprised boundary objects or project artefacts that were similar to Papadimitriou's and Pellegrin's (2007) concept of the IOD. Boundary objects consisted of primary objects that represented the project in tangible form and instrumental objects that comprised tools related to the achievement of the project goals (Alderman et al., 2005). Further, context cues included social–contextual cues that referred to actors' behaviours and events within the project context.

Tacit knowledge constituted an internal cue that formed the project manager's frame of reference. It comprised experience-drawn knowledge about people management and the nature of project management in general.

The present study.

Informed by the outcomes of Study 1, the present study was designed to test the existence of sensemaking constructs, including feedback cues and context cues, in the context of project management. If cue utilisation constitutes the foundation of sensemaking and, ultimately, project management success, then differences in cue utilisation should be evident between project practitioners and non-project practitioners in a project management sensemaking task. To test this proposition, the present study was conducted using a cross-sectional survey design that included experienced project managers and a comparatively naïve cohort. The participants were asked to respond to hypothetical project scenarios according to a cue utilisation scale wherein they indicated their propensity to use specific project management cues/features. The scale was designed to establish differences in cue utilisation between the experienced project managers and the more naïve group in relation to different levels of project complexity and stages of project management.

Methods.

Participants.

After securing ethics clearance, data collection commenced. A total of 101 participants responded to the online project scenarios assessment survey. Twenty three of the participants were experienced project managers and 78 were naïve participants. The majority of project managers were recruited from an online advertisement that was posted on a project management organisation website and the remainder responded through convenience sampling (1%). The majority of project managers belonged to the 36–45 age range ($\overline{X} = 8$; 35%), and had accumulated between six and ten years of experience ($\overline{X} = 7$, 30%).

The 78 naïve participants in the study were recruited from a pool of university psychology students and each received one course credit for their participation. They reported no formal project management experience in work and non-work organisations (e.g.,

voluntary, not-for-profit and religious organisations). The majority were in the 18–25 age group ($\overline{X}$ = 72, 92%).

Project scenarios assessment survey.

The initial stage of the survey consisted of information pertaining to the study, a consent form and a set of demographic information questions.

The subsequent sections consisted of two hypothetical project management scenarios and a cue utilisation scale to which participants were asked to respond. The survey was administered online through the Qualtrics platform and required approximately 30 minutes to complete. Following their participation, all participants were entitled to enter a raffle to win four AU$50 gift cards.

Study scenarios.

The use of scenarios was designed to enable the presentation of unexpected events as probable events using a set of narratives. Further, it provided a safe and risk-free hypothetical environment within which participants could respond as they would in the operational environnment (Wright, 2005).

In the present study, the two hypothetical scenarios represented different levels of complexity (See Table 3.1 for characteristics of the two project scenarios or see Appendix A for a full description of the scenarios). The differences in the complexity of the project scenarios were designed to enable an assessment of differences in the perceptions of the cognitive demands for each project. However, it also enabled an examination of potential differences in the pattern of cue utilisation between the two cohorts in response to the differences in complexity and across the progression of a project.

As a manipulation check, participants were asked to rate, using a three-point scale (low, moderate, high), the perceived complexity of each project scenario based on two dimensions: (a) multiplicity, or the interrelatedness of project stakeholders and tasks

(Baccarini, 1996; Davies & Mackenzie, 2014), and (b) ambiguity, or the presence or probability of conflicts and uncertainties (Kennedy et al., 2011). This approach was based on McComb et al.'s (2007) factor analysis of a scale of project complexity. Multiple approaches to tasks and multiple end states to satisfy the tasks that commonly relate to interdependencies comprised dimensions that collapsed into a factor labelled 'multiplicity', while conflicts and uncertainties were dimensions that collapsed into a factor labelled 'ambiguity'.

Table 3.1

Characteristics of the Two Hypothetical Project Scenarios

Characteristics	**Low – complexity scenario**	**High – complexity scenario**
Project sponsor	Care Bear's Children's Hospital Foundation (local organisation)	International Federation of Red Cross and Red Crescent Societies (IFRC) (international organisation)
Project deliverable	Coffee-table book for the 50th year anniversary of the children's hospital	Recovery and resettlement village for tsunami victims
Stakeholders	Hospital's local community Hospital board of directors Hospital's finance and supply unit Project team	2,000 households - beneficiaries Local and national government agencies Non-government organisations Local suppliers Technical (construction) experts and specialists Project team
Team size	10	20
Nature of cooperation	Local	Local and international
Project impact	Low stake	High stake
Project condition	Relatively stable	High pressure

Based on the results of the Wilcoxon Signed-Rank test, statistically significant differences were evident in the levels of complexity between the two project scenarios (See Table 3.2). Scenario 1 was perceived as less complex in comparison to Scenario 2 by both the experienced project managers and the naïve participants, in both multiplicity and ambiguity.

Table 3.2

Wilcoxon Signed-Rank Test for Differences in the Complexity Levels between the Two Project Scenarios

Cohorts	**Project scenario 1**	**Project scenario 2**	**Z - value**
	Median (Multiplicity)	Median (Multiplicity)	
Experienced project managers	2	3	3.92****
Naïve participants	2	3	4.18****
	Median (Ambiguity)	Median (Ambiguity)	
Experienced project managers	2	3	3.40***
Naïve participants	2	3	5.48****

*** significant at p=.001; **** extremely significant at p = .000

2 – moderate; 3 – high

Cue utilisation scale.

Each scenario presented hypothetical project management tasks that situated participants within specific project contexts. The hypothetical tasks consisted of short descriptions (e.g. team members' work progress assessment, resource procurement, selection of and coordination with eligible beneficiaries, construction progress and local condition assessment). For each task, participants were provided with a list of information comprising the features that might be used to assist the identification of potential project issues.

The features represented two dimensions in the cue utilisation scale - feedback cues and context cues (See Table 3.3). There were nine items each for feedback cues and context cues in the low-complexity scenario, and 12 items each, for those dimensions in the high-complexity scenario. Participants were asked to rate the likelihood of accessing each feature using a four-point scale (daily, weekly, monthly, not-at-all) across three project management stages – initiation, execution, and closing. A description was provided for the project

management stages. The initiation stage included planning and preparation, while the execution stage involved monitoring and control. Finally, the closing stage constituted the final phase in which the deliverables were achieved (See Study 2 Appendix: Project Scenarios Assessment Survey).

Table 3.3

List of Features Presented in Each Scenario

Feedback cues	Context cues
Emails	Workplace preoccupation/ activities of the team members
Phone calls	Moods of actors
Face-to-face meetings	Personalities of actors
Formal correspondence e.g. letters, memos	Work outputs/ deliverables of the actors/ actual progress in project site
Informal verbal comments	Turn-around time of tasks/ activities
Informal talk	Nonverbal messages e.g. gestures, physical reactions
Word of mouth/ circulated stories	Local event and political news (e.g. election, typhoon, holidays, market inflations)
Unsolicited suggestions/ recommendations	Other ongoing or incoming projects in the organisation
	Reference materials
	Work outputs of external providers
	Project-specific documents (e.g. government-issued documents, proof of identity or community/ residence certificate, curriculum vitae/company profiles)
	PM tool (e.g. project execution plan)

Categorical principal components analysis (CATPCA).

The reliability of the cue utilisation scale was established through CATPCA, a nonlinear principal components analysis (PCA) method that is most appropriate for categorical variables (Starkweather, 2014). Unlike the traditional PCA that tests linear and continuous data, CATPCA involves model estimation and optimal quantification through an iterative algorithm for nonlinear variables. The quantification of the variables results in the same solution yielded by linear PCA but accounts for the variance for each item or a set of variables (Linting, Meulman, Groenen & Kooij, 2007; Starkweather, 2014).

In the present study, a more meaningful analysis was generated through an independent, one-dimension solution CATPCA in which the internal consistency coefficient (Cronbach's Alpha) of each dimension was maximised (IBM SPSS, 2014). Therefore, the scale consisted of 12 dimensions representing the two categories of cues (feedback cues and context cues), distributed across the three project stages (initiation, execution, and closing), based on two varying levels of project complexity (low and high) (See Table 3.4). Through component loadings, the correlation between each item to the principal component (or dimension) was determined with no less than a .3 Pearson *r* coefficient for each item, indicating a moderate to very strong relationship in each case. This suggests that the instrument possessed a reasonably high level of internal reliability.

Table 3.4

Internal Consistency Coefficient of the Cue utilisation Scale

Scale	**Cronbach's alpha**
Low-complexity scenario:	
Feedback Cues (Initiation)	0.734
Context Cues (Initiation)	0.778
Feedback (Execution)	0.700
Context Cues (Execution)	0.792
Feedback (Closing)	0.833
Context Cues (Closing)	0.864
High-complexity scenario:	
Feedback Cues (Initiation)	0.860
Context Cues (Initiation)	0.799
Feedback Cues (Execution)	0.849
Context Cues (Execution)	0.804
Feedback Cues (Closing)	0.907
Context Cues (Closing)	0.875

Results.

Cue utilisation in low complex project scenario.

A Mann-Whitney U test revealed statistically significant differences between experienced project managers and naïve participants during project initiation in the use of feedback cues, $U = 569.50$, $p = .008$, $r = .26$ (See Figure 3.4). The project managers reported a higher median rating of 3.3 (interquartile range = .3) in comparison to the naïve group (median = 2.9, interquartile range = .4) for the inclination to use feedback cues.

It is widely advocated in the project management literature that project initiation is the stage that yields the greatest impact in terms of the direction and outcomes of a project (Heravi, Coffey, & Trigunarsyah, 2015). It is at this stage that project scoping, capabilities assessment, the determination of business requirements, the development of a project plan occurs, and project documents are generated. There is also a relatively greater degree of uncertainty at this stage, due to the limited information available during this phase (Fellows & Liu, 2016). Key to accomplishing the project objectives at this stage is the acquisition of information from various stakeholders.

As expected, project teams seek for inputs and engage in acts of data collection to determine plans, documents, and baselines during the early stages of a project (PMI, 2013). The results appear to reflect this understanding among project managers concerning the temporal requirements of a project, wherein they attached greater importance to feedback cues, including emails, phone calls, face-to-face meetings, formal correspondences, informal verbal comments, word of mouth, and unsolicited comments as sources of information during the initial stages of a project.

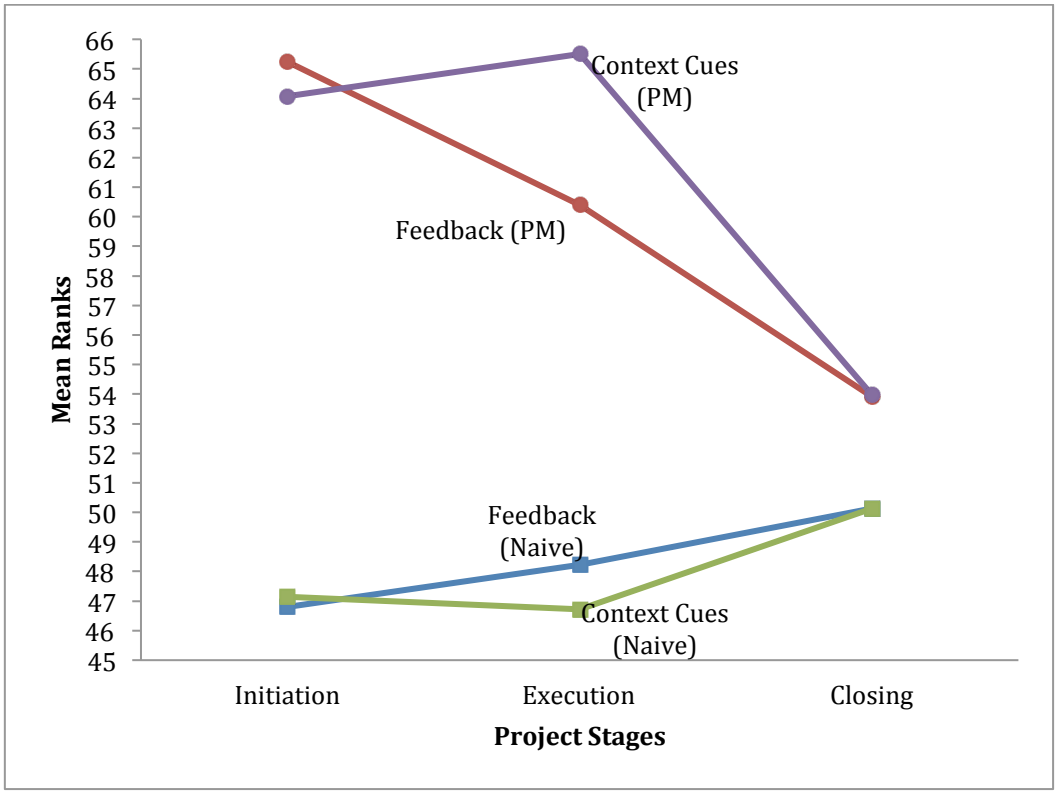


Figure 3.4 Cue utilisation in low-complexity project scenario.

The results also indicated statistically significant differences between the two cohorts in the use of context cues, where project managers consistently reported a greater likelihood of the utilisation of context cues compared to the naïve participants. This occurred in both the initiation, $U = 596.5$, $p = 0.015$, $r = .24$ and the execution stages, $U = 563.5$, $p = 0.007$, $r = .27$ of the lower complexity project. Specifically, project managers recorded a greater median rating (3.2, interquartile range = .5) over the naïve group (median = 2.9, interquartile range = .5) during project initiation. During project execution, project managers' recorded a median rating of 3.2 (interquartile range = .5) in comparison to a median rating of 2.9 (interquartile range = .8) among naïve participants.

The greater utilisation of context cues during low-complexity projects suggests that a project with lesser complexity may permit relatively greater exploration and exploitation of context cues, including project artefacts (e.g. work outputs, deliverables, actual progress, project-specific documents and tools) and social cues (e.g. moods, personalities, bodily

gestures and reactions of project actors, organisational activities and local events). In this case, context cues are availed to provide 'snapshots' of the status of the project (Papadimitriou & Pellegrin, 2007).

Cue utilisation in high complex project scenario.

In the case of the high-complexity scenario, project managers recorded a relatively greater likelihood of accessing feedback cues across all three stages of the project. Specifically, a Mann-Whitney *U* test revealed statistically significant differences between the project managers and naïve participants for perceptions of the importance of feedback during the initiation, $U = 455.5, p = 0.000, r = .36,$ execution, $U = 382.5, p = 0.000, r = .41,$ and closing, $U = 585.5; p=.012, r=.25$ stages of the project. Differences between the project managers and the naïve group were noted based on their median ratings and interquartile ranges as follows: (a) initiation - 3.6, .5 (project managers), 3.1, .6 (naïve); (b) execution - 3.7, .4 (project managers), 3.2, .5 (naïve), (c) closing – 3.2, .7 (project managers), 2.7, .9 (naïve).

The results suggest that when projects are complex, project managers are more reliant on feedback cues, rather than context cues to provide them with the relevant information on the progression of a project towards the goals. Unlike context cues that may require conscious attention and greater cognitive demand for interpretation, feedback cues tend to be advantageous during critical periods, as they represent rich and real-time information. They are derived from project actors' direct engagement of situations and expressed as a personal opinion or a synthesis of various people's perspectives.

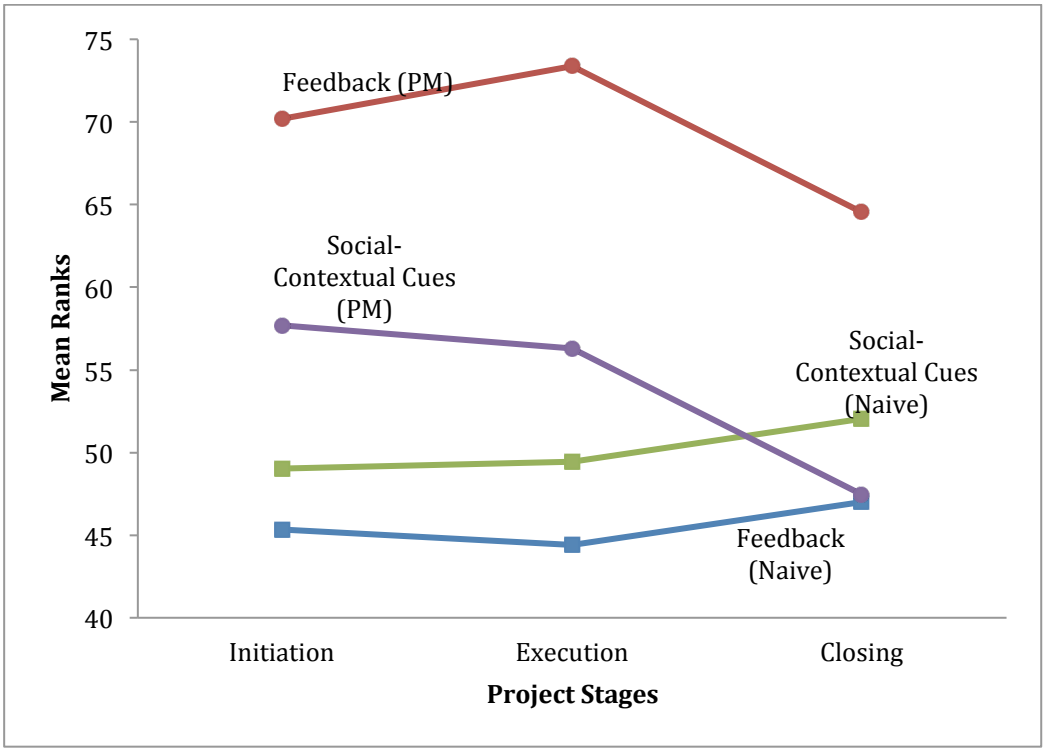


Figure 3.5. Cue utilisation in high-complexity project scenario.

Discussion.

This research builds on earlier work conducted by the authors that identified the categories of cues that are involved in project management sensemaking. In particular, the present study is an investigation of the existence of the sensemaking cues, specifically feedback cues and context cues, in relation to project-specific constructs such as project complexity and stages. Whereas the earlier studies provided only the exploratory/descriptive basis of sensemaking cues (e.g. Alderman et al., 2005; Papadimitriou & Pellegrin, 2007), the present study was designed to examine quantitative responses from groups with varying levels of project management experience to establish how they perceived the utilisation of domain-relevant cues under various, simulated project conditions.

As evident from the outcomes of the present study, sensemaking, examined through the fundamental process of cue utilisation, manifested in different patterns of information prioritisation, depending upon the complexity and stage of the project. In a low-complexity project scenario, both feedback cues and context cues were perceived as equally important

during project initiation, a stage wherein there is limited project knowledge (Midler, 1995) but a greater demand for information to establish the project plan and process requirements (PMI, 2013). Context cues also appeared to be of greater value during the execution stage of a low-complexity project. This may be attributed to the adequacy of context cues to monitor project activities when the operational scope of a project is less complex, as denoted by a less intricate network of systems and people.

During the high complexity project scenario that depicted multi-layered groups of people and systems, a more dynamic and interactive type of cue was preferred. In this case, feedback cues that are naturally derived through active engagement with project actors were preferred over context cues that could be acquired passively or extracted through observation. These results are broadly consistent with Müller (2003) who reported an increase in communication frequency and a preference for face-to-face meetings during higher risk projects. The emphasis on feedback cues during a high-complexity project might be attributed to the efficiency and comprehensiveness of feedback, requiring less effort in interpretation, in comparison to context-related cues.

The results reflect the 'situatedness' of the cues in response to the complexity and temporal nature of the project. This highlights the context-dependent nature of cue utilisation. Cue utilisation is not merely the acquisition of a feature or cue as a source of information, but it represents a difference in the act of 'noticing' and interpreting. In effect, it engages selective attention and/or the censoring of cues where some cues are ignored or neglected in preference to other cues that are accorded relatively greater attention as they are charged with meaningful attributes in particular contexts (Fellows & Liu, 2016; Papadimitriou & Pellegrin, 2007).

As might be expected, the outcomes of the present study suggest that the differences between the experienced project managers and naïve participants relate to how each group

understands and perceives the relevance of different cues in varying situations. Since the project managers generally demonstrated greater and a more discriminating use of feedback and context cues, it provides support for the utilisation of these cues as a fundamental process of sensemaking in project management.

Conclusion.

The results of the present study indicate that indeed feedback cues and context cues comprise sensemaking features in project management, and that the utilisation of these cues is likely to represent a fundamental process in the context of sensemaking. Cue utilisation is the capacity to discriminate between different features in the project environment. As evidenced by the comparative analysis undertaken in the present study, the experienced cohorts demonstrated more judicious use of the project management-related cues relative to the characteristics of a project, including its complexity and the stage of project implementation, in comparison to the naïve cohort.

Feedback cues were regarded as a significant source of information during the initiation of the project, regardless of the level of complexity. This suggests a higher degree and greater frequency of stakeholder engagement at this stage of project management, especially in determining the business requirements and project processes. Further, feedback cues were considered particularly important for a more complex project.

Context cues were accorded greater attention in a lower complexity project compared to a more complex project, and particularly during, the initiation to the execution stages of a project. Although the findings are not conclusive, they point towards the shifting prioritisation of cues in response to the situational characteristics of a project.

Limitations of the present research.

To establish the reliability and existence of the cues identified in Study 1, participants were asked to complete a subjective questionnaire involving hypothetical scenarios. Although this type of approach is not uncommon and accounted for possible differences in participants' experience with particular types of project management scenarios, it remains unclear whether the responses of participants in completing the questionnaire, reflected actual behaviour.

The present study compared experienced and naïve cohorts, rather than experts and novices. Nevertheless, the research derived meaningful insights from the comparison. Naïve participants represent a segment in a project organisation who have little or no knowledge and background of a domain (Shanteau, 1988) but whose participation may be necessary in response to a disaster (Rowlands, 2007). Therefore, the naïve group provide an important basis of comparison in terms of the cognitive skills that emerge with exposure to the domain.

Implications to research and practice.

This research provides both theoretical and applied contributions in the project management field. Firstly, it provides empirical support for the importance of non-technical skills such as sensemaking in the context of project management. More importantly, the present research established the role of cue utilisation as a process that appears to be engaged in sensemaking during project management.

To enhance project management practice, project organisations can potentially incorporate the principles of cue utilisation into their operations. This might be accomplished through the reinforcement of the categories of cues that will serve most effectively during different stages of a project. For example, simulation exercises might be designed where early or uninitiated practitioners can benefit from exposure to a repertoire of project conditions and features that would enable the development and reinforcement of cues.

In addition to training initiatives, existing electronic project management tools can also integrate features to facilitate the flow of more relevant information within the project team. The management of communication within a project can also benefit through the identification of the form and frequency with which information is to be acquired and/or shared among project organisational members.

Study 2 References

Alderman, N., Ivory, C., McLoughlin, I., & Vaughan, R. (2005). Sense-making as a process within complex service-led projects. *International Journal of Project Management, 23*(5), 380–385. doi:10.1016/j.ijproman.2005.01.004

Aubry, M., & Lenfle, S. (2012). Projectification: Midler's footprint in the project management field. *International Journal of Managing Projects in Business, 5*(4), 680–694. doi:10.1108/17538371211268997

Baccarini, D. (1996). The concept of project complexity—a review. *International Journal of Project Management, 14*(4), 201–204. doi:10.1016/0263-7863(95)00093-3

Balogun, J., & Johnson, G. (2005). From intended strategies to unintended outcomes: The impact of change recipient sensemaking. *Organization Studies, 26*(11), 1573–1601. doi:10.1177/0170840605054624

Bosch-Rekveldt, M., Jongkind, Y., Mooi, H., Bakker, H., & Verbraeck, A. (2011). Grasping project complexity in large engineering projects: The TOE (Technical, Organizational and Environmental) framework. *International Journal of Project Management, 29*(6), 728–739. doi:10.1016/j.ijproman.2010.07.008

Brouwers, S., Wiggins, M. W., Helton, W., O'Hare, D., & Griffin, B. (2016). Cue utilisation and cognitive load in novel task performance. *Frontiers in Psychology, 7*. doi:10.3389/fpsyg.2016.00435

Brown, A. D., Colville, I., & Pye, A. (2015). Making sense of sensemaking in organization studies. *Organization Studies, 36*(2), 265–277. doi:10.1177/0170840614559259

Brunswik, E. (1955). Representative design and probabilistic theory in a functional psychology. *Psychological Review, 62*(3), 193–217.

Clark, R. E., Pugh, C. M., Yates, K. A., Inaba, K., Green, D. J., & Sullivan, M. E. (2012). The use of cognitive task analysis to improve instructional descriptions of procedures. *Journal of Surgical Research, 173*(1), e37–e42. doi:10.1016/j.jss.2011.09.003

Connolly, T., Arkes, H. R., & Hammond, K. R. (2000). *Judgment and decision making: An interdisciplinary reader*. Cambridge: Cambridge University Press.

Crandall, B., Klein, G., & Hoffman, R. R. (2006). *Working minds: A practitioner's guide to cognitive task analysis*. Cambridge, Massachusetts The MIT Press.

Davies, A., & Mackenzie, I. (2014). Project complexity and systems integration: Constructing the London 2012 Olympics and Paralympics games. *International Journal of Project Management, 32*(5), 773–790. doi:10.1016/j.ijproman.2013.10.004

Einhorn, H. J., & Hogarth, R. M. (1988). Behavioral decision theory: processes of judgment and choice. In D.E. Bell, H. Raiffa, & A. Tversky (Eds.), *Decision making: Descriptive, normative and prescriptive interactions* (pp. 113–146). Cambridge: Cambridge University Press.

Fellows, R., & Liu, A. (2016). Sensemaking in the cross-cultural contexts of projects. *International Journal of Project Management, 34*(2), 246–257. doi:10.1016/j.ijproman.2015.03.010

Hartwig, M., & Bond, C. F. (2001). Why do lie-catchers fail? A lens model meta-analysis of human lie judgments. *Psychological Bulletin, 137*(4), 643–659.

Havelka, D., & Rajkumar, T. M. (2007). Using the troubled project recovery framework: Problem recognition and decision to recover. *E-Service Journal, 5*(1), 43–73.

Heravi, A., Coffey, V., & Trigunarsyah, B. (2015). Evaluating the level of stakeholder involvement during the project planning processes of building projects. *International Journal of Project Management, 33*(5), 985–997. doi:10.1016/j.ijproman.2014.12.007

IBM SPSS (2014). *Categorical principal components analysis (CATPCA) (Short course module)*. Retrieved from: http://pic.dhe.ibm.com/infocenter/spssstat/v21r0m0/index.jsp?topic=%2Fcom.ibm.spss.statistics.help%2Fidh_cpca.htm

Kärreman, D., & Alvesson, M. (2001). Making newsmakers: Conversational identity at work. *Organization Studies, 22*(1), 59.

Kennedy, D. M., McComb, S. A., & Vozdolska, R. R. (2011). An investigation of project complexity's influence on team communication using Monte Carlo simulation. *Journal of Engineering and Technology Management, 28*(3), 109–127. doi:10.1016/j.jengtecman.2011.03.001

Klein, G. (1998). *Sources of power*. Cambridge, Massachusetts: Massachusetts Institute of Technology.

Klein, G. (2015). A naturalistic decision making perspective on studying intuitive decision making. *Journal of Applied Research in Memory and Cognition*. 4(3), 164–8. doi:10.1016/j.jarmac.2015.07.001

Klein, G., Moon, B., & Hoffman, R. R. (2006a). Making sense of sensemaking 2: A macrocognitive model. *IEEE Intelligent Systems, 21*(5), 88–92.

Klein, G., Moon, B., & Hoffman, R. R. (2006b). Making sense of sensemaking 2: A macrocognitive model. *IEEE Intelligent Systems, 21*(5), 88–92.

Klein, G., Wiggins, S., & Dominguez, C. O. (2010). Team sensemaking. *Theoretical Issues in Ergonomics Science, 11*(4), 304-320. doi:10.1080/14639221003729177

Linting, M., Meulman, J. J., Groenen, P. J. F., & va der Kooij, A. J. (2007). Nonlinear principal component analysis: Introduction and application. *Psychological Methods, 12*(3), 336–358. doi:10.1037/1082-989X.12.3.336

Loveday, T., Wiggins, M. W., Harris, J. M., O'Hare, D., & Smith, N. (2013). An objective approach to identifying diagnostic expertise among power system controllers. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 55*(1), 90–107. doi:10.1177/0018720812450911

Loveday, T., Wiggins, M. W., Searle, B. J., Festa, M., & Schell, D. (2013). The capability of static and dynamic features to distinguish competent from genuinely expert practitioners in pediatric diagnosis. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 55*(1), 125–137. doi:10.1177/0018720812448475

Maitlis, S. (2005). The social processes of organizational sensemaking. *Academy of Management Journal, 48*(1), 21–49. doi:10.5465/AMJ.2005.15993111

Maitlis, S., & Christianson, M. (2014). Sensemaking in organizations: Taking stock and moving forward. *Academy of Management Annals, 8*(1), 57–125. doi:10.1080/19416520.2014.873177

McComb, S.A., Green, S.G., & Dale Compton, W. (2007). Team flexibility's relationship to staffing and performance in complex projects: An empirical analysis. *Journal of Engineering and Technology Management, 24*(4), 293-313. doi: 10.1016/j.jengtecman.2007.09.004

Midler, C. (1995). "Projectification" of the firm: The Renault case. *Scandinavian Journal of Management, 11*(4), 363–375. doi:10.1016/0956-5221(95)00035-T

Morris, P. (2013). Reconstructing project management reprised: A knowledge perspective. *Project Management Journal, 44*(5), 6–23. doi:10.1002/pmj.21369

Müller, R. (2003). Determinants for external communications of IT project managers. *International Journal of Project Management, 21*(5), 345–354. doi:10.1016/S0263-7863(02)00053-4

Musca, G. N., Mellet, C., Simoni, G., Sitri, F., & de Vogüé, S. (2014). "Drop your boat!": The discursive co-construction of project renewal. The case of the Darwin mountaineering expedition in Patagonia. *International Journal of Project Management, 32*(7), 1157–1169. doi:10.1016/j.ijproman.2014.02.006

O'Hare, D. (2015). Situational awareness and diagnosis. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 13–26). Surrey, England: Ashgate Publishing Limited.

Papadimitriou, K., & Pellegrin, C. (2007). Dynamics of a project through intermediary objects of design (IODs): A sensemaking perspective. *International Journal of Project Management, 25*(5), 437–445. doi:10.1016/j.ijproman.2006.11.002

Perminova, O., Gustafsson, M., & Wikström, K. (2008). Defining uncertainty in projects— a new perspective. *International Journal of Project Management, 26*(1), 73–79. doi:10.1016/j.ijproman.2007.08.005

Pich, M. T., Loch, C. H., & De Meyer, A. (2002). On uncertainty, ambiguity, and complexity in project management. *Management Science, 48*(8), 1008–1023.

Poon, L. W., Rubin, D. C., & Wilson, B. A. (1989). *Everyday cognition in adulthood and late life*. Cambridge: Cambridge University Press.

Project Management Institute (2013). *A guide to the project management body of knowledge: PMBOK guide* (5th ed.). Newtown Square, Pennsylvania: Project Management Institute, Incorporated.

Rowlands, A. (2007). Training for disaster recovery. *Journal of Social Work in Disability & Rehabilitation, 5*(3-4), 109–126. doi:10.1300/J198v05n03_07

Sage, D., Dainty, A., & Brookes, N. (2014). A critical argument in favor of theoretical pluralism: Project failure and the many and varied limitations of project management. *International Journal of Project Management, 32*(4), 544–555. doi:10.1016/j.ijproman.2013.08.005

Sampo, T., Kirsi, A., & Mervi, M. (2010). Coping with an unexpected event: Project managers' contrasting sensemaking in a stakeholder conflict in China. *International Journal of Managing Projects in Business, 3*(3), 526–543. doi:10.1108/17538371011056129

Shanteau, J. (1988). Psychological characteristics and strategies of expert decision makers. *Acta Psychologica, 68*(1–3), 203–215. doi:10.1016/0001-6918(88)90056-X

Shanteau, J. (1992). How much information does an expert use? Is it relevant? *Acta Psychologica, 81*(1), 75–86. doi:10.1016/0001-6918(92)90012-3

Simon, H. A. (1992). What is an "explanation" of behavior? *Psychological Science, 3*(3), 150–161.

Starkweather, J.D. (2014). *SPSS short course module 9: Categorical principal components analysis (CATPCA) with optimal scaling*. Retrieved from http://www.unt.edu/rss/class/Jon/SPSS_SC/Module9/M9_CATPCA/SPSS_M9_CATPCA.htm

Thiry, M. (2001). Sensemaking in value management practice. *International Journal of Project Management, 19*(2), 71–77. doi:10.1016/S0263-7863(00)00023-5

Thomas, J., & Mengel, T. (2008). Preparing project managers to deal with complexity—Advanced project management education. *International Journal of Project Management, 26*(3), 304–315. doi:10.1016/j.ijproman.2008.01.001

Thompson, C. A., Foster, A., Cole, I., & Dowding, D. W. (2005). Using social judgement theory to model nurses' use of clinical information in critical care education. *Nurse Education Today, 25*(1), 68-77. doi:10.1016/j.nedt.2004.10.003

Vidal, L.-A., Marle, F., & Bocquet, J.-C. (2011). Measuring project complexity using the analytic hierarchy process. *International Journal of Project Management, 29*(6), 718–727. doi:10.1016/j.ijproman.2010.07.005

Weber, K., & Glynn, M. A. (2006). Making sense with institutions: Context, thought and action in Karl Weick's theory. *Organization Studies, 27*(11), 1639–1660. doi:10.1177/0170840606068343

Weick, K.E. (1979). *The social psychology of organizing* (2nd Ed.). Reading, MA: Addison-Wesley Publishing Company.

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science, 16*(4), 409–421. doi:10.1287/orsc.1050.0133

Wiggins, M. W. (2014). Differences in situation assessments and prospective diagnoses of simulated weather radar returns amongst experienced pilots. *International Journal of Industrial Ergonomics, 44*(1), 18–23. doi:10.1016/j.ergon.2013.08.006

Wiggins, M. W. (2015a). Cues in diagnostic reasoning. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 1–10). Surrey, England: Ashgate Publishing Limited.

Wiggins, M. W. (2015b). Diagnosis and instructional systems design. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 69–80). Surrey, England: Ashgate Publishing Limited.

Wiggins, M. W., Azar, D., Hawken, J., Loveday, T., & Newman, D. (2014). Cue-utilisation typologies and pilots' pre-flight and in-flight weather decision-making. *Safety Science, 65*, 118–124. doi:10.1016/j.ssci.2014.01.006

Wiggins, M. W., Brouwers, S., Davies, J., & Loveday, T. (2014). Trait-based cue utilization and initial skill acquisition: Implications for models of the progression to expertise. *Frontiers in Psychology, 5*, 541. doi:10.3389/fpsyg.2014.00541

Williams, T., Klakegg, O. J., Walker, D. H., Andersen, B., & Magnussen, O. M. (2012). Identifying and acting on early warning signs in complex projects. *Project Management Journal, 43*(2), 37–53. doi:10.1002/pmj.21259

Wright, A. (2005). The role of scenarios as prospective sensemaking devices. *Management Decision, 43*(1), 86–101. doi:10.1108/00251740510572506

Yang, Q., Lu, T., Yao, T., & Zhang, B. (2014). The impact of uncertainty and ambiguity related to iteration and overlapping on schedule of product development projects. *International Journal of Project Management, 32*(5), 827–837. doi:10.1016/j.ijproman.2013.10.010

Study 2 Appendix A: Project Scenarios Assessment Survey

Department of Psychology
Faculty of Human Sciences
Macquarie University NSW 2109 Australia
Phone: +61 (2) 9850 1804
Email: eva-marie.gacasan@students.mq.edu.au

Study Information and Consent Form

Name of Project: Situation Assessment in the Project Context

You are invited to participate in a study of project assessment, the purpose of which is to examine the key situational features that form the basis of early assessment and intervention of projects. The study is being conducted by Eva Marie Gacasan, Department of Psychology, Macquarie University (+612) 9850 1804, eva-marie.gacasan@students.mq.edu.au. This research project is undertaken to meet the requirements of PhD in Psychology under the supervision of Mark Wiggins, Associate Professor, (+612) 9850 9705, mark.wiggins@mq.edu.au of the Department of Psychology.

If you decide to participate, you will be answering a project scenarios assessment survey. The survey consists of a demographic information part and the substantive part that is the Feature Discrimination Task (FDT). In the FDT, you will be presented with two project scenarios to which you would rate their level of complexity and the likelihood of accessing a list of information sources to assess the situations. It will take you 20 - 30 minutes to complete the survey. Any information or personal details acquired during the course of the study are confidential (except as required by law). No individual will be identified in any publication of the results. Access to data is restricted to the research investigators. A summary of the results of the data can be made available to you on request through email.

Participation in this study is entirely voluntary: you are not obliged to participate and if you decide to participate, you are free to withdraw at any time without having to give a reason and without consequence. At the end of the survey, you will find an entry for a raffle draw of 4 $50 Amazon gift cards. Please return the survey form and raffle entry separately to ensure the anonymity of your identity and responses.

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

I agree to participate in this research knowing that I can withdraw from further participation at any time without consequence.

- Yes
- No

Project Scenarios Assessment Survey

Please answer the following demographic questions by ticking (/) the button or providing the information in the space provided.

1. What is your age?

   - o 18-25 years old
   - o 26-35 years old
   - o 36-45 years old
   - o 46-55 years old
   - o 56-65 years old
   - o 66-75 years old
   - o 75 years old or above

2. Where is your country of residence? _____

3. Where is your country of origin (based on ethnic background)?

   _____

4. Are you?

   - o a native English speaker
   - o a non-native English speaker with very good (generally accurate and appropriate) understanding of the language
   - o a non-native English speaker with modest (occasional inaccuracies/ inappropriacies) understanding of the language

5. How many years of project management experience have you had?

   - o less than 3 years
   - o 3 to 5 years
   - o 6-10 years
   - o 11-15 years
   - o 16-20 years
   - o 21-25 years
   - o 26-30 years
   - o 31-35 years
   - o 36-40 years
   - o more than 40 years

6. What is/ was the nature of the latest project that you managed?

- o aerospace
- o architecture
- o community
- o construction
- o disaster response/ recovery
- o education
- o engineering
- o financial services
- o healthcare
- o information and communication technology
- o pharmaceuticals
- o telecommunications
- o others _____

7. How would you describe your role in this latest project?

- o Project Practitioner/ Junior Level
- o Project Manager/ Supervisory Level
- o Project Director/ Executive Level

Project 1 Scenario:

Care Bears Children's Hospital Foundation will be celebrating its 50-year anniversary in 6 months' time. One of the highlights of the anniversary will be the launch of a coffee-table book that tells about the foundation's early history, important milestones, hospital heroes, community impact and its current status. The board of directors has designated you to lead this project and to assume the role of content editor. Your project team comprises 10 people, 9 of whom are contributors who will research and write about their assigned section and 1 as layout editor. All of the team members work full-time in the foundation in different capacities: 4 are nurses, 3 are hospital administrators, 2 are doctors, and 1 is an IT staff member. The procurement process follows the standard procedure of requesting to the supply unit which releases the required resources or coordinates with the finance unit for funds in the acquisition of the resources.

Based on the above scenario, rate the project's level of complexity in terms of:

	High	Moderate	Low
Multiplicity (Interrelatedness of project stakeholders and their tasks)	❍	❍	❍
Ambiguity (Presence or probability of conflicts and uncertainty)	❍	❍	❍

You are provided with information sources to assist you in identifying where potential issues could appear in the project. Rate the likelihood that you would use each information source at different times (D - Daily, W - Weekly, M - Monthly or N - Never) from the initiation (including planning and preparation) to the execution (including monitoring and control), and finally, to the closing of the project.

Sample Response

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Team members' progress report	❍	(/)	❍	❍	(/)	❍	❍	❍	❍	(/)	❍	❍

Task 1.1 Team members' work progress assessment

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Emails from team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Phone calls from team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Face-to-face meetings with the project team	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Workplace preoccupation/ activities of the team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
5. Moods of team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
6. Work outputs/ deliverables of the project team	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
7. Personal affairs/news about team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Task 1.2 Resource procurement

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Formal correspondence (e.g. emails/ memos) from the coordinating units (supply and finance)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Personalities and moods of the key personnel	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Turn-around time for the different offices in acting on the procurement request	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Informal verbal comments from the unit staffs	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
5. Other ongoing or incoming projects in the organization.	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Task 1.3 Product scope and quality management

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Reference materials	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Informal talk with team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Team member's submitted outputs	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Word-of-mouth (circulated stories) about the printing company's status and work progress	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
5. Work output of the printing company	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
6. Correspondence (e.g. email, letter) from the printing company	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
7. Unsolicited suggestions/ recommendations from the board of directors	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

* Please ensure no item has been left unanswered.

Project 2 Scenario:

The International Federation of Red Cross and Red Crescent Societies (IFRC) has commissioned you to lead a 20-member team to oversee a shelter recovery and settlement project in a Pacific island that has been ravaged by a tsunami. This project is expected to be completed in 12 months in which 2,000 households, currently in makeshift camps, will be relocated to 4 government-assigned villages. The project team is responsible in releasing to each household a voucher for construction materials that can be claimed at any approved local construction supplier. The team would also provide the technical expertise and the necessary training for the beneficiaries to build their own homes. As such, the project team needs to properly identify the beneficiaries from the non-eligible actors and to help prevent exploitative business transactions. This project is in partnership with the local and national government, and non-government organisations such as the national Red Cross.

Based on the above scenario, rate the project's level of complexity in terms of:

	High	Moderate	Low
Multiplicity (Interrelatedness of project stakeholders and their tasks)	❍	❍	❍
Ambiguity (Presence or probability of conflicts and uncertainty)	❍	❍	❍

You are provided with information sources to assist you in identifying where potential issues could appear in the project. Rate the likelihood that you would use each information source at different times (D - Daily, W - Weekly, M - Monthly or N - Never) from the initiation (including planning and preparation) to the execution (including monitoring and control), and finally, to the closing of the project.

Task 2.1 Selection of and coordination with eligible beneficiaries

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Government-issued list of beneficiaries	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Proof of identity/ certificate of residence from the beneficiaries	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Non-verbal messages of the beneficiaries e.g. gestures, physical reactions	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Word-of-mouth about the beneficiaries in the community	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
5. Face-to-face meetings with the beneficiaries	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Task 2.2 Third party (e.g. construction experts, construction suppliers, etc.) service management

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Curriculum vitae/ company profiles of third party providers	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Correspondence (e.g. emails/ posted letters) from third party providers	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Phone calls from third party providers	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Word-of-mouth about the performance of the third party providers	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
5. Work outputs/ deliverables of third party providers	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Task 2.3 Interagency coordination

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Correspondence (e.g. emails, posted letters) from other agencies	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Phone calls from other agencies	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Face-to-face meetings with other agency representatives	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Personalities of agencies' representatives ('Who's who')	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
5. 'Feelers' (informal messages sent out by agencies' representatives)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Task 2.4 Project team management

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Work outputs/ deliverables of the project team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Emails from team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Phone calls from team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Face-to-face meetings with the project team	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
5. Workplace activities/ preoccupations of project team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
6. Moods of project team members	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Task 2.5 Construction progress and local condition assessment

	Initiation				Execution				Closing			
	D	W	M	N	D	W	M	N	D	W	M	N
1. Project Execution Plan (Work zone priorities, workload distribution and assignments, schedule, budget, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
2. Circulated stories about community incidents	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
3. Local event and political news (e.g. election, typhoons, holidays, market inflations)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
4. Actual progress in construction sites	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

** Please ensure no item has been left unanswered.*

End of survey. Thank you for your response.

Study 2 Appendix B: Summary of Tests for Differences in Cue Utilisation

Table 3.5

Mann-Whitney U Tests for Differences in Cue Utilisation in Low-Complexity Project Scenario

Project management processes	**Categories of cues**	**Cohorts**	**Mean rank**	**Mann-Whitney U**
Project initiation				
	Feedback cues	Naïve	46.80	569.500**
		Experienced	65.24	
	Context cues	Naïve	47.15	596.500*
		Experienced	64.07	
Project execution				
	Feedback cues	Naïve	48.23	681.000
		Experienced	60.39	
	Context cues	Naïve	46.72	563.500**
		Experienced	65.50	
Project closing				
	Feedback cues	Naïve	50.14	830.000
		Experienced	53.91	
	Context cues	Naïve	50.13	829.000
		Experienced	53.96	

* $P \leq 0.05$, ** $P \leq 0.01$

Table 3.6

Mann-Whitney U Tests for Differences in Cue Utilisation in High-Complexity Project Scenario

Project management processes	**Category of cues**	**Cohorts**	**Mean rank**	**Mann-Whitney U**
Project initiation				
	Feedback cues	Naïve	45.34	455.50***
		Experienced	70.20	
	Context cues	Naïve	49.03	743.00
		Experienced	57.70	
Project execution				
	Feedback cues	Naïve	44.40	382.500***
		Experienced	73.37	
	Context cues	Naïve	49.44	775.000
		Experienced	56.30	
Project closing				
	Feedback cues	Naïve	47.01	585.500*
		Experienced	64.54	
	Context cues	Naïve	52.04	815.500
		Experienced	47.46	

* $P \leq 0.05$, *** $P \leq 0.001$

Chapter 4:

Study 3: Sensemaking through Cue Utilisation in Disaster Recovery Project Management

Aim

Extending the outcomes of Studies 1 and 2, during which cues were identified that enabled sensemaking during project management, Study 3 was designed to test the role of sensemaking cues during project management where the context related to disaster recovery. Participants completed an on-line assessment of cue utilisation that was situated within the context of disaster recovery efforts in the Philippines following Typhoon Haiyan in 2013. The participants were categorised into different groups on the basis of their project management experience in the context of disaster recovery and more generally. The comparative analysis was designed to test whether differences emerged in the context of cue utilisation, depending upon experience.

Publication History

The International Journal for Project Management (IJPM) accepted Study 3 as a journal article on the 5th of July 2016, pending revision. The IJPM has an impact factor of 2.885 and is the premier journal in the project management category according to the Thomson Reuters Journal Citation Reports 2015.

The accepted article was a submission for a special issue in the IJPM on 'Managing Disaster Recovery Projects' in which the general aim was to link project management and post-disaster recovery projects through the identification of tools, methodologies, and best practices that enhance the management and delivery of disaster projects. The author of the

present PhD thesis contributed 80% of the work involved in Paper 3. This publication uses British/ Australian English.

Study 3

Sensemaking through Cue Utilisation in Disaster Recovery Project Management

(Accepted Paper Pending Revision)

Eva Marie Gacasan & Mark Wiggins

Macquarie University, Sydney Australia

Correspondence concerning this article should be addressed to:

Eva Marie Gacasan

Department of Psychology

Macquarie University

New South Wales, Australia 2109

Email: eva-marie.gacasan@students.mq.edu.au

Abstract.

This study examined the role of cue utilisation as a basis for sensemaking in disaster recovery project management. Sensemaking is a critical skill that involves organising and prioritising information to achieve an accurate *sense* of project situations. A mixed between-within groups design was used to test three groups of participants with different project experiences related to disaster recovery. Participants completed a situation judgement test that incorporated assessments of four elements of cue utilisation: cue identification, cue precision, cue discrimination, and cue prioritisation. Statistically significant differences in performance were evident between naïve and non-naïve groups in cue identification, cue precision and cue prioritisation. The study outcomes do provide the basis for training and assessment initiatives that have the potential to enhance performance within disaster recovery project management.

Keywords: *Sensemaking, Cue Utilisation, Disaster Recovery Project Management*

Introduction.

Major disasters, including floods, storms, droughts, landslides, earthquakes and tsunamis leave wide-scale devastations in many parts of the world (Centre for Research on the Epidemiology of Disasters (CRED), 2016). In 2015, there were 346 natural disasters that impacted 113 countries, resulting in 22,773 deaths, with over 98 million people affected, and US$66.5 billion in economic losses (CRED, 2016). During the preceding decade (2005-2014), 376 natural disasters were recorded, with a death toll of 76,424, over 173 million people affected in 116 countries, and a combined economic loss of US$155.8 billion.

The regularity of catastrophic events has resulted in the proliferation of projects for disaster response and recovery (Crawford, Langston, & Bajracharya, 2013). These projects are crucial in the early stage of recovery where the aims include the relief and alleviation of the victims' lives and/or their livelihood and, over the longer-term, the rehabilitation and reconstruction of assets, and the development of community resilience for future disasters (International Federation of Red Cross and Red Crescent Societies (IFRC), 2012).

By and large, the management of disasters is a major contributor to the success of recovery projects (Crawford et al., 2013). Disaster management involves plans, structures, and arrangements that are established for the coordination of efforts among government, voluntary, and private agencies in response to the different phases of disaster recovery (Tun & Pathranarakul, 2006). Understandably, there is the growing scholarly interest and concern in the management of disaster recovery projects, as these undertakings often receive significant governmental and international funding to deliver critical project outcomes.

Disaster management inherently deals with complexities. There tends to be an acute sense of urgency (Walker & Steinfort, 2013) for project implementation, even while there are disruptions in technology, market conditions, and governance. Technical, economic, socio-political, and environmental issues also contribute to heightened levels of uncertainty while

the involvement of various stakeholders – each with different degrees of influence and activities, affects how a project unfolds (Walker & Steinfort, 2013). Together, these pressures of urgency, uncertainty, and the need for integration create different levels of complexity within a project (Turner & Müller, 2003).

The complexity associated with projects becomes apparent in the information processing of disaster project managers where there is often information overload, a lack of information, and/or difficulty in coordination and communication (Preece, Shaw, & Hayashi, 2013). Typically, there is an abundance of both relevant and irrelevant information, making it necessary to filter and manage information judiciously. In some situations, the required information may not be available, immediately shared, nor acted upon collectively, thereby causing feelings of uncertainty and frustration, particularly in the context of time-pressured, high consequence decisions.

Sensemaking is the key to unravelling complex issues such as the emergence of threats and opportunities, the organisation of the required resources, and the recognition of the requirements and relatedness of the different elements within the system (O'Sullivan, Kuziemsky, Toal-Sullivan, & Corneil, 2013). Therefore, skilled sensemaking is crucial in the development of a project plan, and the execution and continued adaptation of the plan according to changes that occur in the project state.

In creating an accurate mental representation of a project state, particularly in conditions of time-constraint, skilled project managers will match the features present in an operational context with features that are stored in memory. The recognition of these feature-event associations constitutes a cue that, in combination with other cues, allows the construction of *sense* surrounding a situation (Kahneman & Klein, 2009; Klein, 2015; Wiggins, 2014). The repeated application of cues reinforces the association between features and events, thereby increasing the likelihood that they will be activated in future encounters

(Wiggins, 2015a). The primary aim of the present research was to establish whether different components of the utilisation of cues are associated with differences in operational experience in managing simulated projects during disaster recovery.

Complexities in disaster recovery projects.

In the context of disaster recovery, skilled project management involves responding effectively and efficiently to complex situations. Complexities are characteristics inherent in disaster-related projects. They constitute the level of multiplicity and ambiguities present in a project and, at greater levels, have the potential challenge the capability of project managers to fully grasp, predict, or control the state of a project and its outcomes (Vidal, Marle, & Bocquet, 2011). .

Multiplicity comprises the number and variety of components and interdependencies within a project state (Davies & Mackenzie, 2014). The dynamic context of disaster recovery involves various actors that connote multiple interactions, agendas and conflicting objectives or interests (Kennedy, McComb, & Vozdolska, 2011). Multiplicity is evident within agent (individuals, families, and disaster responders), organisational (insurance companies, engineering and construction companies, local and national government agencies, international aid agencies), and cross-boundary levels (across jurisdictions) (Kim & Choi, 2013; O'Sullivan et al., 2013).

Ambiguities and uncertainties arise from a lack of knowledge, information, or forecasts concerning different aspects of a project. Technical or scientific uncertainties stem from a limited understanding of the source and nature of events, the required techniques, and/ or the risks that may impact people and/or the environment during disaster recovery (Denis, 1991). Socio-political uncertainties arise from a lack of knowledge concerning the needs, capabilities, culture, and political relationships present in the affected communities (Denis, 1991). However, the most prominent issue confronting many of these practitioners relates to

the uncertainties and challenges in resource and supply that results in cost overruns, deferred deliveries, cost surges, and profiteering (Chang-Richards, Wilkinson, Potangaroa, & Seville, 2013).

The complexities associated with disaster recovery projects relate to the fact that the context exists outside a business-as-usual framework. The multiple interactions of actors and systems that may not be clearly defined and organised (Walker & Steinfort, 2013), and the lack of predictable management processes (Havelka & Rajkumar, 2007) result in several problems, including limited or ineffective planning (Kim & Choi, 2013), inaccurate assessments, design problems and safety neglect (Kim & Choi, 2013), risk management issues (O'Sullivan et al., 2013), and integration/coordination/ communication problems (Ismail, Majid, Roosli, & Samah, 2014).

Sensemaking and cues in disaster recovery project management.

Disaster project situations often appear as emerging and evolving circumstances, such that there is the constant experience of being at the 'edge of chaos' or in the zone between stability and instability (Thomas & Mengel, 2008). Sensemaking enables the identification and labelling of these events (Weick, Sutcliffe, & Obstfeld, 2005), so that they can be visualised clearly and thereby controlled and managed (Maitlis & Christianson, 2014). Therefore, the accuracy and efficiency of this process of identification constitutes a critical precursor to higher-order cognitive strategies such as decision making and problem solving, particularly in complex, time-constrained environments (Klein, 1998).

The identification of familiar contexts is dependent upon a repertoire of cues in memory that relate situational features to objects or events that are triggered in critical, uncertain and complex situations (Wiggins, 2013). At a cognitive level, the application of cues reduces the time and effort in information search and stimulates selective attention, thereby minimising cognitive load (Einhorn & Hogarth, 1988). The capacity to recognise and

respond to situation-specific cues has been associated with differences in operational performance in aviation (Wiggins & O'Hare, 2003), power system control (Loveday, Wiggins, Harris, O'Hare, & Smith, 2013), paediatrics (Loveday, Wiggins, Searle, Festa, & Schell, 2013), and livestock judges (Shanteau, 1992).

In the context of disaster recovery, sensemaking has received relatively little attention. However, Walker and Steinfort (2013) have demonstrated the utility of Soft System Methodology (SSM) to visualise, through the use of pictures and colours, complex situations among disaster project practitioners. They noted that the skill to rapidly and effectively diagnose the project state impacts the capability of management to implement interventions or strategies that ensure that a project will achieve its goals (Havelka & Rajkumar, 2007). However, the acquisition of these skills requires exposure to opportunities where the features and associated events can be applied and tested to form the cues that are then retained in memory. Therefore, it might be anticipated that differences in operational exposure to project management in the context of disaster recovery might be associated with different performance on measures of cue utilisation in this context.

According to Wiggins (2014; 2015a), effective cue utilisation comprises four key components, including the capacity to identify rapidly, meaningful features within a complex array (cue identification), more precise context-related feature–event associations in memory (cue precision), the capacity to discriminate greater from less relevant features during sensemaking (cue discrimination), and the capacity to prioritise the acquisition of feature–event relationships during sensemaking (cue prioritisation). It was hypothesised that participants who reported greater levels of project management experience in the context of disaster recovery would: (a) record a reduced response latency in identifying event-related features; (b) a greater variance in ratings of relatedness of feature–event pairs; (c) a greater variance in ratings of relevance of feature–event pairs in response to a sensemaking scenario,

and (d) a lower ratio of pairs of information screens accessed in the sequence in which they presented during the process of information acquisition. It was also hypothesised that the differences between participants would be greater for disaster recovery scenarios of greater levels of complexity.

Methods.

The study comprised a 3 x 2 mixed-repeated design incorporating three levels of project management experience in disaster recovery (naïve, low experience, high experience) as a between-groups variable, and two levels of complexity (high and low) as a within groups variable. The dependent variables included mean response latency in the context of cue identification, mean variance in the context of cue precision and cue discrimination, and the mean ratio of pairs of information screens accessed in the sequence in which they were presented against the total number of information screens accessed.

Participants.

Following ethics approval, 68 participants were recruited for the study using a snowball sampling technique. The study invitation was disseminated through email or through hard copy to potential individuals or intermediaries of relevant organisations, and particularly amongst humanitarian/ aid and project management organisations. The participants comprised an international sample. They were paid AU$25 as reimbursement for their time in completing the online study that was approximately 30-45 minutes in duration.

Participants' project role experience was categorised into highly experienced, low experience, and naïve groups based on the: (a) project roles that they had assumed and (b) the number of disaster management projects in which they had been involved. The 23 highly experienced participants (34%) were identified on the basis of having indicated middle to high project management roles (e.g. project and/or programme manager, project sponsor, steering committee member, developer of procedures, resource manager, and other special

assignments) and no less than two cases where they undertook a project managerial role. The 29 participants with low experience (43%) held volunteer and/or trainee project roles and/or had only a single or no project management or leadership experience in the context of disaster recovery. The 16 naïve participants (23%) had no project management experience in formal organisations and/or community-based/humanitarian projects. The majority of the high experience (70%) and low experience (96%) participants had been involved in aid/humanitarian projects, while the remainder indicated broader project backgrounds.

The participants ranged in age from 22 – 64 years old (naïve), 18 - 68 years old (low experience), and 26 – 63 years old (high experience). Among the naïve cohort, 87% held tertiary education qualifications, while 48% and 30% held similar qualifications among the low experience and high experience groups respectively.

Materials.

Cue utilisation measures.

A version of the EXPERTise 2.0 programme was created to measure cue utilisation in the context of disaster recovery sensemaking. EXPERTise 2.0 is a situation judgement test platform that comprises scenario-based tasks, each of which assesses different components of the broader construct of cue utilisation. Stimuli are created for different contexts, and the criterion validity of EXPERTise has been established in rail control (Brouwers, Wiggins, Helton, O'Hare, & Griffin, 2016), medicine (McCormack, Wiggins, Loveday, & Festa, 2014), power transmission system (Small, Wiggins, & Loveday, 2014), and aviation (Wiggins, Azar, Hawken, Loveday, & Newman, 2014).

In the present study, the stimuli that comprised EXPERTise 2.0 were developed around disaster recovery project management in the context of the recovery effort following the landfall of Typhoon Haiyan in the Philippines in 2013. The stimuli/ scenarios were based on formal accounts and reports (e.g. International Federation of Red Cross and Red Crescent

Societies (IFRC), 2010; 2012; 2014a; 2014b; 2015a; 2015b; 2015c; 2015d) and on disaster recovery literature describing the experiences of disaster recovery workers and victims. Prior to data collection, the EXPERTise programme for disaster recovery sensemaking was subjected to pilot testing whereby three highly knowledgeable individuals with experience in emergency and/ or humanitarian/aid operations provided their evaluation that formed the basis for the tool refinement. They were specifically asked to comment on the content and structure of the online program.

The EXPERTise programme comprised four tasks. In the cue identification task, participants were asked to identify, as quickly as possible, those features on a series of detailed project management reports that presented greatest concern. For the cue precision task, participants were asked to rate the level of relatedness of a series of feature–event pairs that related to disaster recovery project management. In the case of the cue discrimination task, participants were provided with a scenario in which the details constituted a decision point. They were subsequently asked to select their initial response to the problem and rate the relative importance of a series of task-related features in formulating their response using a 10 point Likert Scale. Finally, in the case of the cue prioritisation task, participants were asked to access, from a list of information sources, a maximum of eight items relating a problem scenario that would most assist the management of a disaster recovery project. (See Study 3 Appendix B: Expertise 2.0 Project Sensemaking Programme for the study tool).

Each of the scenarios comprised cases of lower and higher levels of project complexity that were developed on the basis of the number of pieces of separate information presented. Lower complexity scenarios contained relatively fewer project-related features, and were constrained to the management of one area operation in comparison to the higher complexity scenarios that included a greater frequency of project-related features and multiple

areas of operations. Prior to the EXPERTise tasks, participants were asked to complete a set of demographic questions and measures of emotional intelligence and cognitive flexibility.

Individual differences measures. The study included measures of emotional intelligence and cognitive flexibility to control for individual differences. The Wong & Law's emotional intelligence scale (WLEIS) is designed for leadership and management contexts (Wong & Law, 2002). It consists of four subscales with four items each: self-emotion appraisal, others' emotion appraisal, use of emotion, and regulation of emotion. Participants record their responses on a six point Likert scale. The overall scale has reported reliability coefficients of .86 (Wong & Law, 2002) and .87 (Mazur, Pisarski, Chang, & Ashkanasy, 2014). In the present study, the overall reliability was .89, where the reliability of the four subscales ranged from .87 to .91.

Martin & Rubin's cognitive flexibility inventory (CFI) is a 12-item, seven-point Likert scale test, and has demonstrated good reliability, ranging from 0.76 (Study 1) (Martin & Rubin, 1995) to 0.80 (Malachowski, Martin, & Vallade, 2013). The reliability coefficient in the present study was 0.76. Permission to use the tests was obtained from the authors.

Procedure.

Participants were invited to complete the assessments online using a specific organisational code that was supplied when they indicated their willingness to undertake the study.

Analysis.

Data analysis was undertaken using SPSS version 21.0. Prior to analysis, the data were screened for missing values using Little's missing completely at random (MCAR) test, for outliers, and for final normality. To establish whether the individual difference measures needed to be included as covariates in subsequent analyses, correlations were conducted between scores on the WLEIS and CFI and the dependent variables. Since there were no

statistically significant relationships evident, these variables were excluded from further analysis.

Results.

Cue identification.

For the cue identification task, the 3 x 2 mixed-repeated ANOVA revealed a statistically significant main effect for Experience, $F(2,65) = 13.42$, p = .000, $\eta_p^2 = .29$. Subsequent post-hoc tests using the Bonferroni Correction revealed that response latency for the Naïve cohort was lower than for both the Low Experience cohort, $M_{difference} = -64.36$, *95% CI* [-95.20, -33.53], p = .000, and the High Experience cohort, $M_{difference} = -80.57$, *95%CI* [-112.81, -48.34], p = .000. This effect contradicted the hypothesis in which more experienced participants were expected to record lower response latencies.

A statistically significant main effect was also evident for Complexity, $F(1,65) = 26.84$, p = .000, $\eta_p^2 = .29$, where mean response latency for the more complex task was lower than the mean response latency for the less complex task, $M_{difference} = -33.45$, *95%CI* [-46.34, -20.56], p = .000. There was no statistically significant interaction between Experience and Complexity.

To test whether the results pertaining to experience and response latency were a product of the speed-accuracy trade-off, the mean accuracy of participants was examined using a 3 x 2 mixed-repeated ANOVA. The results revealed a statistically significant main effect for Experience, $F(2,65) = 4.61$, p = .013, $\eta_p^2 = .12$, and post-hoc tests using the Bonferroni Correction, showed that the High Experience cohort achieved greater accuracy than the Naïve cohort, $M_{difference} = .471$, *95%CI* [.147, .795], p = .005. Similarly, the Low Experience cohort showed greater accuracy than the Naïve cohort, $M_{difference} = .386$, 95%*CI* [.076, .695], p = .015. A main effect for Complexity was also evident, $F(1,65) = 43.96$, p = .000, $\eta_p^2 = .40$, with greater accuracy associated with the less complex task (M = 1.06, SE =

0.07) in comparison to the more complex task (M = 0.56, SE 0.07). These results suggest that, in the case of cue identification, greater accuracy was associated with higher response latency and that, in combination, the results differentiated Naïve project managers from the Low and High Experience cohorts, but that no differences were evident between the High Experience cohort and the Low Experience cohort.

Cue precision.

The precision with which features and events/objects are associated is presumed to be determined largely by the frequency of interaction with the operational context. In the present study, cue precision was assessed by asking participants to rate, using a seven-point Likert scale, the relatedness of pairs of features and events. A 3 x 2 mixed-repeated ANOVA revealed a statistically significant main effect for Experience, $F(2,65) = 3.7$, p = .030, η_p^2 = .10. A subsequent comparison using the Bonferroni Correction confirmed the association. The High Experience cohort recorded a greater mean variance compared to the Naïve cohort $M_{difference}$ = .25, *95%CI* [.01, .49], p = .039 and the Low Experience cohort $M_{difference}$ = .26, *95%CI* [.05, .46], p = .014. This suggests that among the groups, the High Experience cohort recorded the greatest precision in feature–event associations.

There was no statistically significant main effect for Complexity, nor was there an interaction between Experience and Complexity.

Cue discrimination.

Cue discrimination was established by comparing the mean variance in the ratings of the perceived importance of features in response to a decision point that had been reached in a disaster-related project management scenario. A 3 x 2 mixed-repeated ANOVA revealed a statistically significant main effect for Complexity, $F(1,65) = 19.63$, p = .000, η_p^2 = .23, with the high-complexity task (M = 1.33, SE = 0.08) associated with a greater mean variance in comparison to the low-complexity task (M = .98, SE = 0.06). No main effect was evident for

Experience and neither was there a statistically significant interaction between Experience and Complexity.

Cue prioritisation.

To establish the prioritisation of cues in response to disaster recovery project management scenarios, participants were asked to select from a list of information items (low-complexity = 12 items; high-complexity = 18 items), the eight that were considered most significant in enabling sense to be drawn from the scenarios. The sequence in which the information was presented was randomised so that the acquisition of information in the sequence in which it was presented would suggest an implicit acceptance of the prioritisation of the features as they were presented. To calculate the extent to which participants were accessing the information in the sequence in which it was presented, the pairs of information screens accessed in sequence were identified and a ratio calculated between the number of pairs that represented information items that were presented in sequence in the list against the total number of pairs of information items accessed.

A 3 x 2 mixed-repeated ANOVA revealed a statistically significant main effect for Experience, $F(2,65) = 3.22$, p = .046, $\eta_p^2 = .09$, and subsequent post-hoc tests using the Bonferroni Correction indicated that the difference lay between the mean performance of the Naïve cohort, (M = .76, SE = .06), and the High Experience cohort (M = .54, SE = .05), $M_{difference} = -.21$, *95%CI* [-.38, -.04], p = .014. There was no main effect for Complexity and nor was an interaction evident between Experience and Complexity.

Discussion and conclusion.

In the present study, sensemaking was conceptualised as a cognitive construct involving the utilisation of context-related cues. According to Wiggins (2015a), cue utilisation comprises four components, including cue identification, cue precision, cue discrimination, and cue prioritisation. It was hypothesised that different levels of task-related

experience would be associated with differences in performance on the four measures. On the basis of their reported experience, participants were delineated into three groups, comprising those with higher levels of project management experience, those with lower experience, and those participants with no experience (naïve).

For cue identification, participants with higher and lower levels of experience were more accurate than naïve participants and recorded greater mean response latency. This speed-accuracy trade-off is broadly consistent with the hypothesis, since naïve participants were likely to have been guessing in the absence of task-related experience, thereby explaining the relatively rapid response latency and concomitant reduced accuracy. For experienced practitioners, the identification of key cues appeared to require a period of search that would explain the relative increase in response latency. This contrasts with other research outcomes concerning cue identification whereby the response latency of more experienced practitioners is typically lower than less experienced practitioners (e.g. Loveday, Wiggins, Harris, et al., 2013; Small et al., 2014; Wiggins et al., 2014).

The differences between previous investigations of cue identification and the outcomes of the present study might be explained by the relative complexity of the scenarios. Previous approaches to cue identification have generally relied on the presentation of information in which there were clear thresholds of performance. For example, in the case of a bedside monitor (Loveday, Wiggins, Searle, et al., 2013) or power control screen (Loveday, Wiggins, Harris, et al., 2013), thresholds are set for normal heart rate or whether or not power is flowing. In the case of the present study, the information presentation was not subject to clear and consistent thresholds. Therefore, participants were required to integrate and process information, rather than simply recognise that a threshold had been breached. As a consequence, a greater level of reasoning was necessary, thereby resulting in an increase in

response latency. This effect is broadly aligned with the principles that underpin dual-process theory (Gonzalez & Thomas, 2008).

Consistent with the results pertaining to cue identification, a main effect for experience was also evident for cue precision where High Experience participants tended to show greater precision in response to pairs of features and events, in comparison to participants with either low or no experience. Cue precision develops from the successive refinements of these associations in the memory as a consequence of experience (Wiggins, 2015a). The result is an increasing repertoire of cue-based associations that are highly tuned to particular nuances associated with situations, thereby improving accuracy (Morrison, Wiggins, Bond, & Tyler, 2013).

While no experience-related main effect was evident in the case of cue discrimination, a main effect was evident for complexity, whereby greater levels of complexity were associated with greater levels of cue discrimination. Since no interaction was evident, it suggests that the level of discrimination occurred irrespective of experience, and may have been insufficiently difficult to differentiate levels of experience in this case. Nevertheless, it is useful to note that greater levels of complexity are associated more broadly with greater levels of cue discrimination, since it suggests that increasing levels of cognitive demand impose a threshold whereby features in the environment are more or less relevant in formulating a response.

Despite the results pertaining to cue discrimination, the outcomes for cue prioritisation were consistent with the hypothesis, with a main effect evident for experience. In comparison to experienced project managers, naïve participants were more likely to acquire information in the sequence in which it was presented. This effect is consistent with the outcomes of previous research where experienced practitioners impose an idiosyncratic framework for information acquisition during the process of sensemaking. Since there was no main effect for

complexity, nor a statistically significant interaction, it suggests that behaviour remained relatively consistent, irrespective of levels of complexity.

Overall, the results confirm the role of cue utilisation in the context of sensemaking in project management disaster recovery scenarios. However, the assessment was insufficiently sensitive to differences in levels of experience in disaster management recovery other than beyond naivety. Although complexity was included as means of potentially differentiating higher from lower levels of project management experience, it was evident that either the conceptualisation of complexity in this case or the presentation of more and less complex cases needs to be either reconsidered and/or refined.

Although cue identification, precision and prioritisation emerged as constructs that are involved in project management in the context of disaster recovery, the role of cue discrimination was less clear. The main effect for complexity suggests that the scenarios in this case may have been insensitive to levels of experience, with experienced and naïve participants equally able to discriminate relevant from less relevant features. Cue discrimination is likely to play a role in sensemaking in disaster recovery, although it may only become evident in expert-novice differences where the features associated with a scenario are less overt and are perhaps more implicit.

Apart from experience, the role of other individual differences, including emotional intelligence and cognitive flexibility, remains unclear, since they bore no relationship to performance on cue utilisation. This is perhaps unsurprising since the scenarios in the present study were oriented towards the technical aspects of project management where performance is less dependent upon non-technical abilities including emotional intelligence.

As a generalisable capability, cognitive flexibility is generally associated with contexts that require a change in cognitive processing, particularly in response to environment demands (Cañas, Quesada, Antolí, & Fajardo, 2003). In the case of the present study, the

scenarios were static, rather than dynamic. Therefore, the demands associated with a given scenario remained consistent, which may have minimised the influence of cognitive flexibility.

Implications to research and practice.

One of the central aims associated with the present research was to establish whether cue utilisation is evident as a construct in the management of projects in disaster recovery. Disaster recovery is a highly dynamic context, with multiple demands arising from multiple agents and stakeholders. While there are likely to be multiple features demanding attention, it was assumed that skilled project managers in this context are capable of quickly and accurately identifying key features, targeting features precisely, discriminating relevant from less relevant features, and prioritising the acquisition of information. These characteristics constitute the broader construct of cue utilisation, the application of which is evident in a wide range of domains, and particularly among experienced practitioners.

Where the preceding efforts to investigate cue utilisation have focused on highly technical domains, the present study examined performance in a domain that is arguably much less procedural. Nevertheless, there remains a reliance on technical skills to draw sense from a complex situation, much as occurs in the cockpit of an aircraft or in the operating theatre. This is the first study to show evidence of cue utilisation in the context of disaster recovery project management. Although there are assumptions relating to project practitioner's exercise of situational judgments in complex situations such as in disaster response, the present research provides concrete measures of cue utilisation. Specifically, cue identification, cue precision, cue, discrimination, and cue prioritisation form the broader constructs of cue utilisation that explain the cognitive processes behind project practitioners' diagnostic abilities (Wiggins, Loveday, & Lyons, 2014). Therefore, it offers an opportunity

for the development of new techniques for both training and assessment that could benefit the disaster project community.

In training for cue utilisation, trainee's attention can be drawn to those specific features that offer predictive information and that are associated with specific consequences (e.g. Wiggins, 2015b; Wiggins & O'Hare, 2003), thereby obviating the requirement to rely on trial and error to identify and then refine more precise feature–event relationships in the form of cues. These are the so-called 'tricks of the trade' that have the potential to improve accuracy and reduce the demands on cognitive processing which enables resources to be devoted to other tasks.

The assessment of cue utilisation clearly requires the development of a repertoire of representative scenarios that have reliability and both criterion and predictive validity. The stimuli developed for the present study provide an important basis for this process. However, further research is necessary, particularly concerning the development of scenarios to assess cue discrimination. Nevertheless, it is possible to envisage the application of a project management disaster recovery assessment tool which would provide feedback to respondents concerning areas of strength and areas of development. Once established, it may be possible to ensure that project managers, who are employed in the critical context, possess the requisite skills to function effectively and efficiently.

Study 3 References

Brouwers, S., Wiggins, M., Helton, W., O'Hare, D., & Griffin, B. (2016). Cue utilisation and cognitive load in novel task performance. *Frontiers in Psychology, 7*, 1–2. doi:10.3389/fpsyg.2016.00435

Cañas, J., Quesada, J., Antolí, A., & Fajardo, I. (2003). Cognitive flexibility and adaptability to environmental changes in dynamic complex problem-solving tasks. *Ergonomics, 46*(5), 482–501. doi:10.1080/0014013031000061640

Centre for Research on the Epidemiology of Disasters. (2016). *Disaster data: A balanced perspective* (CRED Crunch Issue No. 41). Retrieved from http://www.cred.be/

Chang-Richards, Y., Wilkinson, S., Potangaroa, R., & Seville, E. (2013). Resource challenges for housing reconstruction: A longitudinal study of the Australian bushfires. *Disaster Prevention and Management, 22*(2), 172–181. doi:10.1108/09699981211259621

Crawford, L., Langston, C., & Bajracharya, B. (2013). Participatory project management for improved disaster resilience. *International Journal of Disaster Resilience in the Built Environment, 4*(3), 317–333. doi:10.1108/IJDRBE-07-2012-0020

Davies, A., & Mackenzie, I. (2014). Project complexity and systems integration: Constructing the London 2012 Olympics and Paralympics games. *International Journal of Project Management, 32*(5), 773–790. doi:10.1016/j.ijproman.2013.10.004

Denis, H. (1991). The complexity of technological disaster management: technical, sociopolitical and scientific issues. *Organization & Environment, 5*(1), 1–18. doi:10.1177/108602669100500101

Einhorn, H. J., & Hogarth, R. M. (1988). Behavioral decision theory: processes of judgment and choice. *Decision making: Descriptive, normative and prescriptive interactions* (pp. 113–146). Cambridge: Cambridge University Press.

Gonzalez, C., & Thomas, R. P. (2008). Effects of automatic detection on dynamic decision making. *Journal of Cognitive Engineering and Decision Making, 2*(4), 328–348. doi:10.1518/155534308X377810

Havelka, D., & Rajkumar, T. M. (2007). Using the troubled project recovery framework: Problem recognition and decision to recover. *E-service Journal, 5*(1), 43–73.

International Federation of Red Cross and Red Crescent Societies (2010). *Owner-driven reconstruction guidelines.* Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2012). *IFRC recovery programming guidance 2012.* Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2014a). *IFRC real-time evaluation of the Philippines Haiyan response* (February – March 2014a). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2014b). *Philippines: Typhoon Haiyan* (One–year progress report). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2015a). *Emergency appeal operation update Philippines: Typhoon Haiyan* (31 January 2015). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2015b). *Philippines: Typhoon Haiyan* (18 –month progress report). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2015c). *Emergency appeal operation update Philippines: Typhoon Haiyan* (24 June 2015). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2015d). *World disasters report: Focus on local actors, the key to humanitarian effectiveness.* Retrieved from http://www.ifrc.org

Ismail, D., Majid, T. A., Roosli, R., & Samah, N. A. (2014). Project management success for post-disaster reconstruction projects: International NGOs perspectives. *Procedia Economics and Finance, 18*, 120–127. doi:10.1016/S2212-5671(14)00921-6

Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: A failure to disagree. *The American Psychologist, 64*(6), 515–526. doi:10.1037/a0016755

Kennedy, D. M., McComb, S. A., & Vozdolska, R. R. (2011). An investigation of project complexity's influence on team communication using Monte Carlo simulation.

Journal of Engineering and Technology Management, 28(3), 109–127. doi:10.1016/j.jengtecman.2011.03.001

Kim, K. N., & Choi, J.-h. (2013). Breaking the vicious cycle of flood disasters: Goals of project management in post-disaster rebuild projects. *International Journal of Project Management, 31*(1), 147–160. doi:10.1016/j.ijproman.2012.03.001

Klein, G. (1998). *Sources of power*. Cambridge, Massachusetts: Massachusetts Institute of Technology.

Klein, G. (2015). A naturalistic decision making perspective on studying intuitive decision making. *Journal of Applied Research in Memory and Cognition*. *4*(3), 164–168. doi:10.1016/j.jarmac.2015.07.001

Loveday, T., Wiggins, M. W., Harris, J. M., O'Hare, D., & Smith, N. (2013). An objective approach to identifying diagnostic expertise among power system controllers. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 55*(1), 90–107. doi:10.1177/0018720812450911

Loveday, T., Wiggins, M. W., Searle, B. J., Festa, M., & Schell, D. (2013). The capability of static and dynamic features to distinguish competent from genuinely expert practitioners in pediatric diagnosis. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 55*(1), 125–137. doi:10.1177/0018720812448475

Maitlis, S., & Christianson, M. (2014). Sensemaking in organizations: Taking stock and moving forward. *Academy of Management Annals, 8*(1), 57–125. doi:10.1080/19416520.2014.873177

Malachowski, C. C., Martin, M. M., & Vallade, J. I. (2013). An examination of students' adaptation, aggression, and apprehension traits with their instructional feedback orientations. *Communication Education, 62*(2), 127–147. doi:10.1080/03634523.2012.748208

Martin, M. M., & Rubin, R. B. (1995). A new measure of cognitive flexibility. *Psychological Reports, 76*(2), 623–626. doi:10.2466/pr0.1995.76.2.623

Mazur, A., Pisarski, A., Chang, A., & Ashkanasy, N. M. (2014). Rating defence major project success: The role of personal attributes and stakeholder relationships. *International Journal of Project Management, 32*(6), 944–957. doi:10.1016/j.ijproman.2013.10.018

McCormack, C., Wiggins, M. W., Loveday, T., & Festa, M. (2014). Expert and competent non-expert visual cues during simulated diagnosis in intensive care. *Frontiers in Psychology, 5*. doi:10.3389/fpsyg.2014.00949

Morrison, B. W., Wiggins, M. W., Bond, N. W., & Tyler, M. D. (2013). Measuring relative cue strength as a means of validating an inventory of expert offender profiling cues. *Journal of Cognitive Engineering and Decision Making, 7*(2), 211–226. doi:10.1177/1555343412459192

O'Sullivan, T. L., Kuziemsky, C. E., Toal-Sullivan, D., & Corneil, W. (2013). Unraveling the complexities of disaster management: A framework for critical social infrastructure to promote population health and resilience. *Social Science & Medicine, 93*, 238–246. doi:10.1016/j.socscimed.2012.07.040

Preece, G., Shaw, D., & Hayashi, H. (2013). Using the viable system model (VSM) to structure information processing complexity in disaster response. *European Journal of Operational Research, 224*(1), 209–218. doi:10.1016/j.ejor.2012.06.032

Shanteau, J. (1992). How much information does an expert use? Is it relevant? *Acta Psychologica, 81*(1), 75–86. doi:10.1016/0001-6918(92)90012-3

Small, A. J., Wiggins, M. W., & Loveday, T. (2014). Cue-based processing capacity, cognitive load and the completion of simulated short-duration vigilance tasks in power transmission control. *Applied Cognitive Psychology, 28*(4), 481–487. doi:10.1002/acp.3016

Thomas, J., & Mengel, T. (2008). Preparing project managers to deal with complexity — Advanced project management education. *International Journal of Project Management, 26*(3), 304–315. doi:10.1016/j.ijproman.2008.01.001

Tun, L. M., & Pathranarakul, P. (2006). An integrated approach to natural disaster management: Public project management and its critical success factors. *Disaster Prevention and Management: An International Journal, 15*(3), 396–413. doi:10.1108/09653560610669882

Turner, J. R., & Müller, R. (2003). On the nature of the project as a temporary organization. *International Journal of Project Management, 21*(1), 1–8. doi:10.1016/S0263-7863(02)00020-0

Vidal, L.-A., Marle, F., & Bocquet, J.-C. (2011). Measuring project complexity using the Analytic Hierarchy Process. *International Journal of Project Management, 29*(6), 718–727. doi:10.1016/j.ijproman.2010.07.005

Walker, D. H. T., & Steinfort, P. (2013). Using an improved rich pictures approach to improve project situational analysis in complex aid reconstruction development projects. *International Journal of Disaster Resilience in the Built Environment, 4*(2), 182–198. doi:10.1108/IJDRBE-12-2011-0043

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science, 16*(4), 409–421. doi:10.1287/orsc.1050.0133

Wiggins, M. W. (2013). Making sense of sustainability: A cue-based approach to sustainable organisational performance. In G. Avery & B. Hughes (Eds.), *Fresh thoughts in sustainable leadership*. Melbourne, Australia: Tilde University Press.

Wiggins, M. W. (2014). Differences in situation assessments and prospective diagnoses of simulated weather radar returns amongst experienced pilots. *International Journal of Industrial Ergonomics, 44*(1), 18–23. doi:10.1016/j.ergon.2013.08.006

Wiggins, M. W. (2015a). Cues in diagnostic reasoning. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 1–10). Surrey, England: Ashgate Publishing Limited.

Wiggins, M. W. (2015b). Diagnosis and instructional systems design. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 69–80). Surrey, England: Ashgate Publishing Limited.

Wiggins, M. W., Azar, D., Hawken, J., Loveday, T., & Newman, D. (2014). Cue-utilisation typologies and pilots' pre-flight and in-flight weather decision-making. *Safety Science, 65*, 118–124. doi:10.1016/j.ssci.2014.01.006

Wiggins, M. W., Loveday, T., & Lyons, L. (2014). Cue and cue-based processing: Implications for system safety. *Procedia Engineering, 84*, 55–61. doi:10.1016/j.proeng.2014.10.409

Wiggins, M. W., & O'Hare, D. (2003). Expert and novice pilot perceptions of static in-flight images of weather. *The International Journal of Aviation Psychology, 13*(2), 173–187. doi:10.1207/S15327108IJAP1302_05

Wong, C.-S., & Law, K. S. (2002). The effects of leader and follower emotional intelligence on performance and attitude: An exploratory study. *The Leadership Quarterly, 13*(3), 243–274. doi:10.1016/S1048-9843(02)00099-1

Study 3 Appendix A: Measures of Individual Differences Factors

Emotional Intelligence Test (Wong & Law, 2002)

1. I have a good sense of why I have certain feelings most of the time.
2. I have good understanding of my own emotions.
3. I really understand what I feel.
4. I always know whether or not I am happy.
5. I always know my friends' emotions from their behaviour.
6. I am a good observer of others' emotions.
7. I am sensitive to the feelings and emotions of others.
8. I have good understanding of the emotions of people around me.
9. I always set goals for myself and then try my best to achieve them.
10. I always tell myself I am a competent person.
11. I am a self-motivated person.
12. I would always encourage myself to try my best.
13. I am able to control my temper and handle difficulties rationally.
14. I am quite capable of controlling my own emotions.
15. I can always calm down quickly when I am very angry.
16. I have good control of my own emotions.

Cognitive Flexibility Scale (Martin & Rubin, 1995)

1. I can communicate an idea in many different ways.
2. I avoid new and unusual situations.
3. I feel like I never get to make decisions.
4. In any given situation, I am able to act appropriately.
5. I can find workable solutions to seemingly unsolvable problems.
6. I seldom have choices to choose from when deciding how to behave.
7. I am willing to work at creative solutions to problems.
8. My behaviour is a result of conscious decisions that I make.
9. I have many possible ways of behaving in any given situation.
10. I have difficulty using my knowledge on a given topic in real life situations.
11. I am willing to listen and consider alternatives for handling a problem.
12. I have the self-confidence necessary to try different ways of behaviour.

Study 3 Appendix B: Expertise 2.0 Project Sensemaking Programme

Background Information

Typhoon Haiyan was the strongest storm recorded to hit the Philippines. It made its landfall on 8 November 2013 with a reported 6300 deaths and 16 million people or 3.4 million families who were directly affected. The wide scale of devastation was felt across the various islands in the Philippine archipelago that were faced with major challenges in communication, access, and infrastructure.

Project Description

The core shelter assistance project is one of the projects in the recovery programme post-Typhoon Haiyan. The project is carried out within the Red Cross Movement with the Philippine National Red Cross in the leadership role. Based on the owner-driven housing construction approach, the beneficiaries are provided with cash grants and technical training to build their own homes. Cash grants are given in two instalments: as a start-up fund and as the construction progress reaches 50% of the expected work. On average, construction of a housing unit takes a month to complete. The project has a two-year timeframe and is now only 6 months away from the target completion date.

As the project manager, you oversee the operations in 16 project sites that are concentrated in three major islands, Leyte, Panay, and Cebu. Your project team consists of the: (a) community team responsible for the mobilisation and assessment of the community, (b) technical team that provides the technical training, supervision, and monitoring of the construction work and prices, and (c) programme support team that facilitates beneficiary payments, procurement, and quality control. Your work involves coordinating the activities within the movement, the community, and partner government and non-government organisations.

Cue Identification: Failure Identification Task

In the succeeding pages, you are provided with a summary of the status of one or more of your project sites. The columns show the distribution of the core shelter assistance (e.g. technical trainings, and cash instalments) and completed housing units, by beneficiary households.

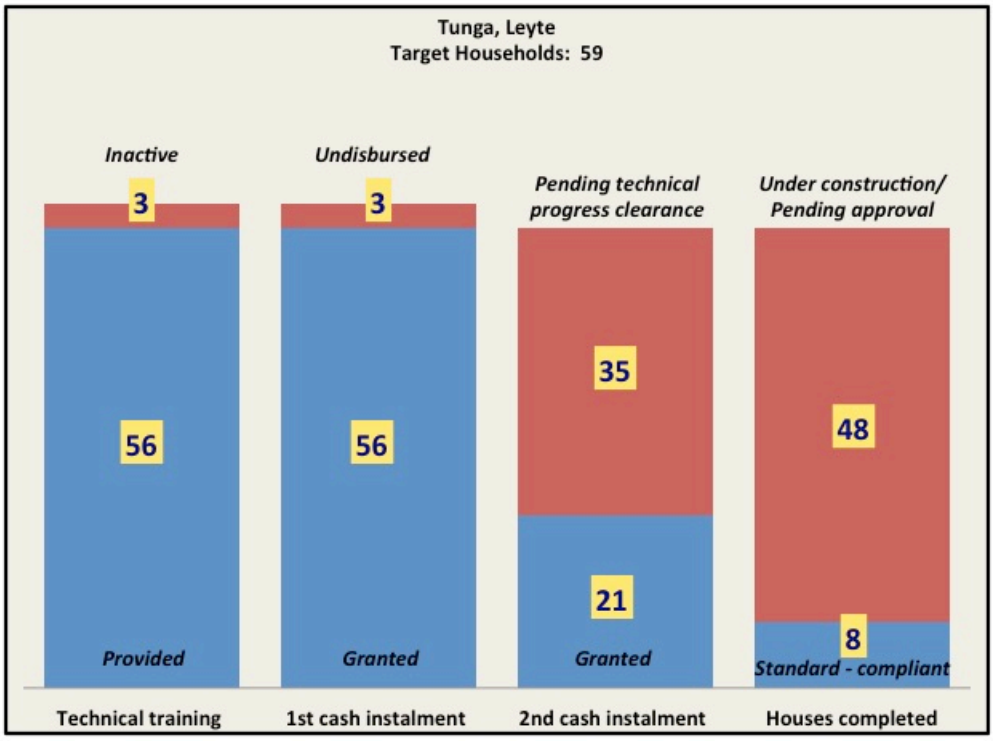
*INACTIVE members are registered beneficiaries who have not received any assistance to date;

*UNDISBURSED payments refer to unreleased funds;

*PENDING CLEARANCE/ APPROVAL indicates that the beneficiaries have yet to comply for certain requirements to be granted payment or full housing approval.

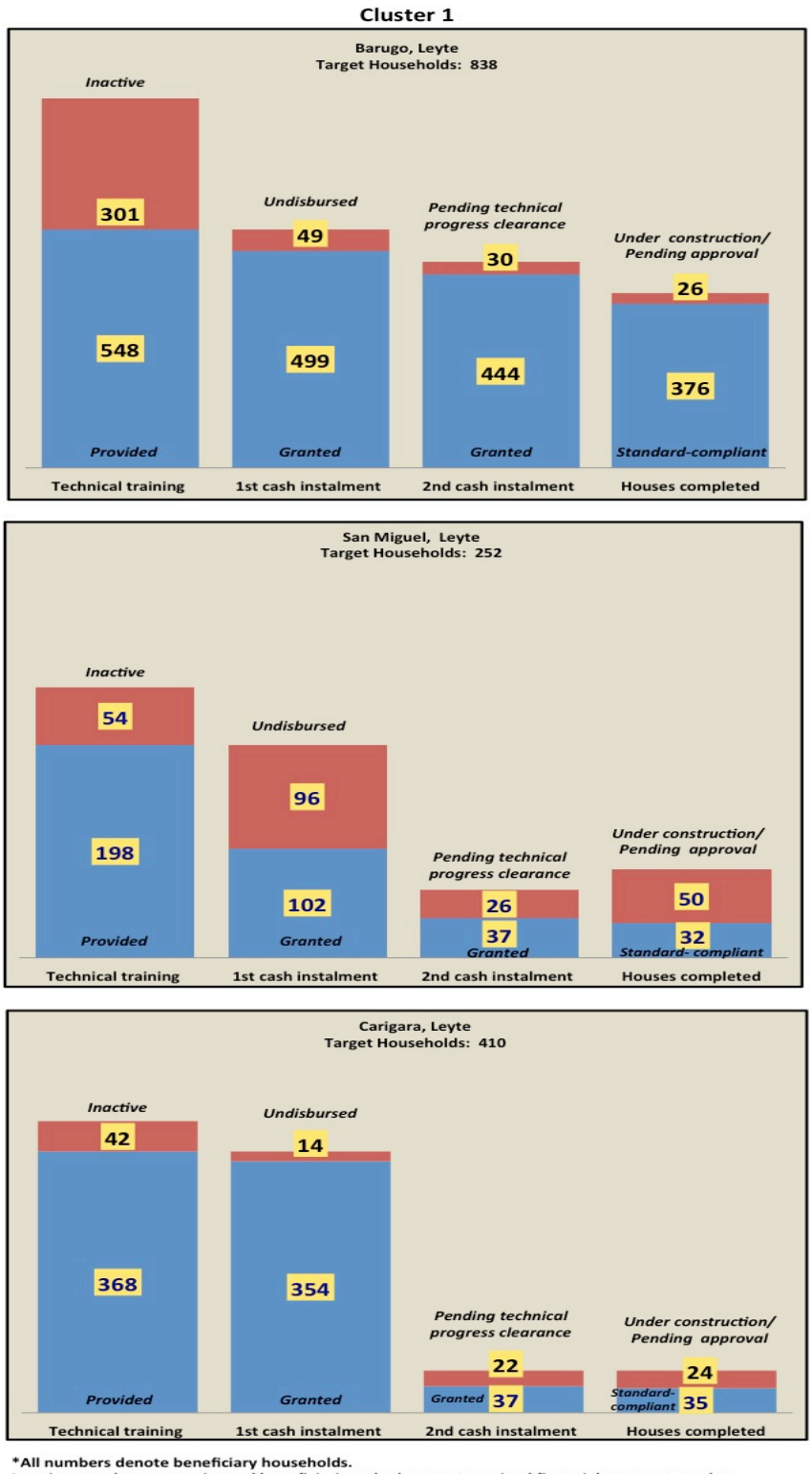
DIRECTIONS: As quickly as possible, identify the area that causes you the greatest concern as the project manager. POINT YOUR CURSOR AND CLICK DIRECTLY ON THE NUMBER WITHIN THE YELLOW BOX CORRESPONDING TO THAT AREA OF CONCERN. There is only one answer for every subtask.

Failure Identification Task – Low Complex Scenario (Sample)



*All numbers denote beneficiary households.
Inactive beneficiaries are registered beneficiaries who have not received financial payments to date.

Failure Identification Task – High Complex Scenario (Sample)



*All numbers denote beneficiary households.
Inactive members are registered beneficiaries who have not received financial payments to date.

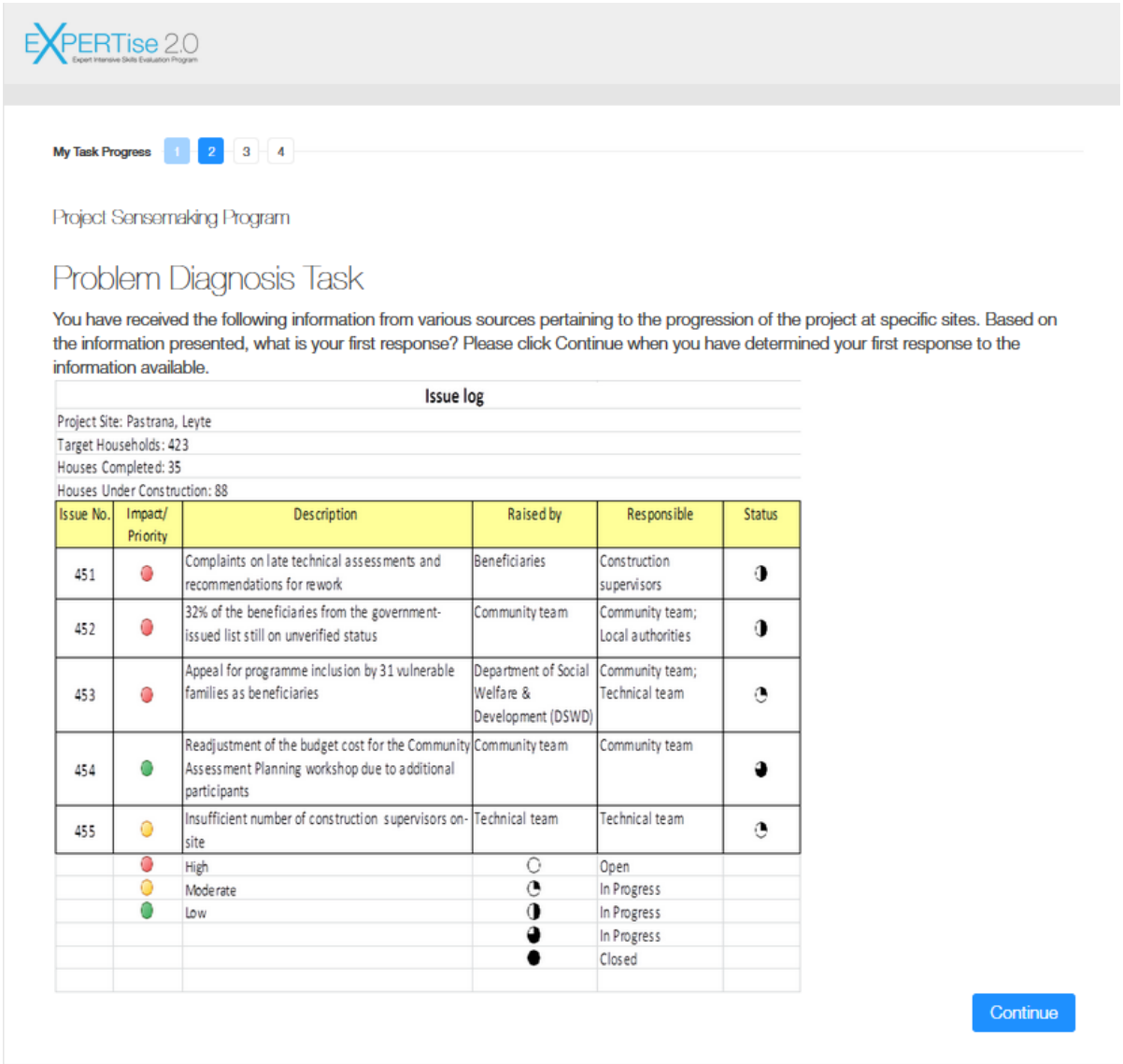
Cue Discrimination: Problem Diagnosis Task

In this task, you are presented with a summary of issues associated with specific sites where the core shelter assistance project is being implemented.

Based on the information presented, you will be asked to assess the current position of the project and determine your first response.

Problem Diagnosis Task – Low Complex Scenario

You have received the following information from various sources pertaining to the progression of the project at specific sites. Based on the information presented, what is your first response? Please click Continue when you have determined your first response to the information available.



From the options below, which most closely matches your preferred immediate response? You may only select one response. If you need to review the scenario again, please click the ‘Back’ button.

When you have made your selection, click ‘Continue’.

- Check the ratio between construction supervisors and households being monitored
- Interview a few beneficiaries about the common challenges encountered in construction
- Speed up the programme inclusion/ verification process for the remaining beneficiaries
- Review the latest expenditures for the Community Assessment Planning workshop
- Meet with the technical team to discuss improvement on quality monitoring efficiency

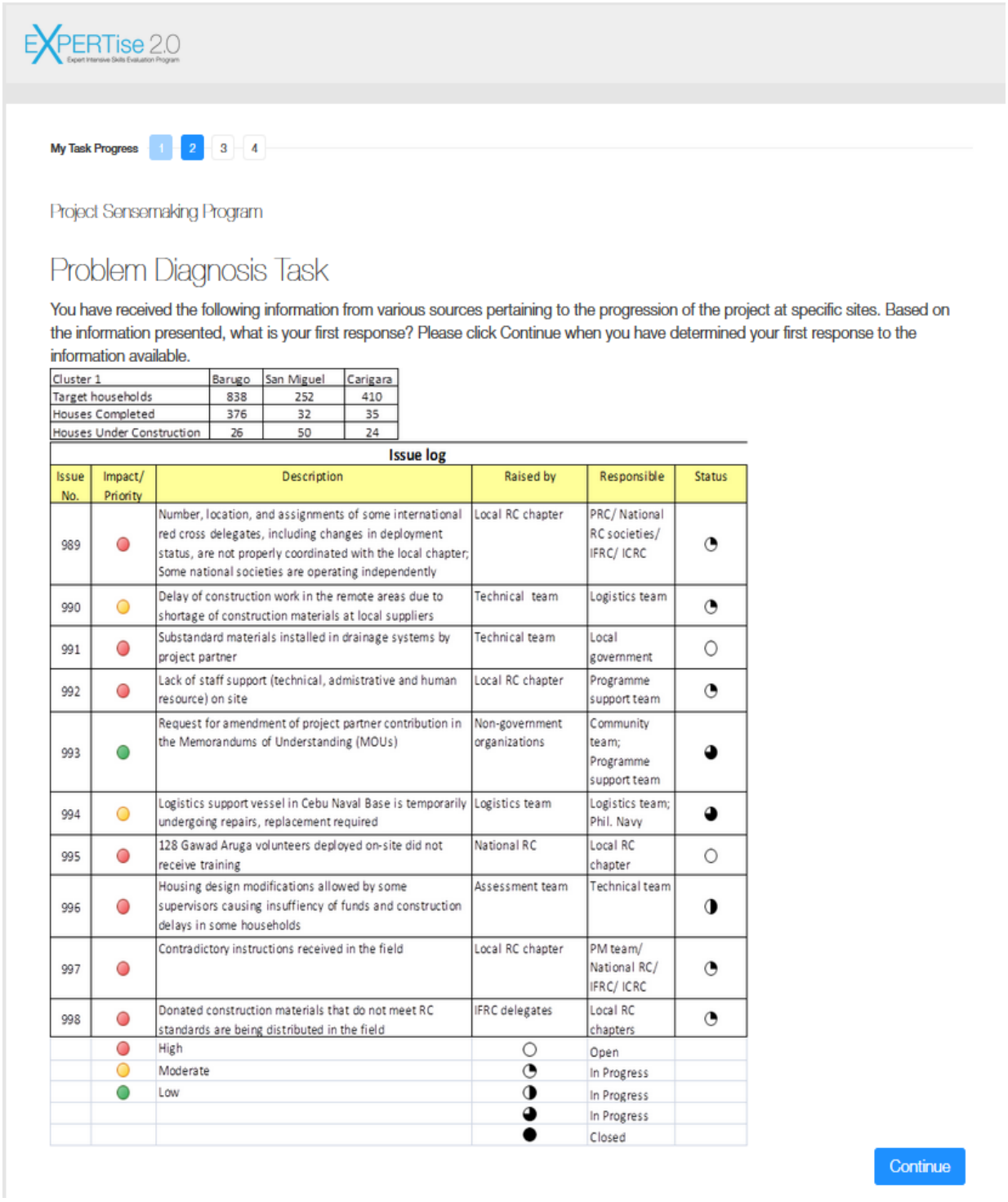
Please rate the importance of the different aspects of this scenario in arriving at your response.

A ‘1’ indicates NOT IMPORTANT AT ALL while a ‘10’ indicates EXTREMELY IMPORTANT.

- Complaints on late technical assessments
- Recommendations for rework
- 32% of beneficiaries on unverified status
- Appeal of 31 vulnerable families
- Impact/ Priority levels of issues
- Status (issue resolution indicator)
- Insufficient number of construction supervisors on-site
- Readjustments in CAP workshop budget cost

PDT – High Complex Scenario

You have received the following information from various sources pertaining to the progression of the project at specific sites. Based on the information presented, what is your first response? Please click Continue when you have determined your first response to the information available.



EXPERTise 2.0

My Task Progress 1 2 3 4

Project Sensemaking Program

Problem Diagnosis Task

You have received the following information from various sources pertaining to the progression of the project at specific sites. Based on the information presented, what is your first response? Please click Continue when you have determined your first response to the information available.

Cluster 1	Barugo	San Miguel	Carigara
Target households	838	252	410
Houses Completed	376	32	35
Houses Under Construction	26	50	24

Issue log

Issue No.	Impact/ Priority	Description	Raised by	Responsible	Status
989		Number, location, and assignments of some international red cross delegates, including changes in deployment status, are not properly coordinated with the local chapter; Some national societies are operating independently	Local RC chapter	PRC/ National RC societies/ IFRC/ ICRC	
990		Delay of construction work in the remote areas due to shortage of construction materials at local suppliers	Technical team	Logistics team	
991		Substandard materials installed in drainage systems by project partner	Technical team	Local government	
992		Lack of staff support (technical, admistrative and human resource) on site	Local RC chapter	Programme support team	
993		Request for amendment of project partner contribution in the Memorandums of Understanding (MOUs)	Non-government organizations	Community team; Programme support team	
994		Logistics support vessel in Cebu Naval Base is temporarily undergoing repairs, replacement required	Logistics team	Logistics team; Phil. Navy	
995		128 Gawad Aruga volunteers deployed on-site did not receive training	National RC	Local RC chapter	
996		Housing design modifications allowed by some supervisors causing insuffiency of funds and construction delays in some households	Assessment team	Technical team	
997		Contradictory instructions received in the field	Local RC chapter	PM team/ National RC/ IFRC/ ICRC	
998		Donated construction materials that do not meet RC standards are being distributed in the field	IFRC delegates	Local RC chapters	
		High		Open	
		Moderate		In Progress	
		Low		In Progress	
				In Progress	
				Closed	

Continue

From the options below, which most closely matches your preferred immediate response? You may only select one response. If you need to review the scenario again, please click the ‘Back’ button.

When you have made your selection, click ‘Continue’.

- Reinforce closer coordination among the project actors and their activities
- Monitor construction of communal facilities provided by project partners
- Adjust the construction timetable of households who encountered procurement problems
- Provide technical experts to guide and support the volunteers on-site
- Issue advice on the allowed extent of housing design modifications

Please rate the importance of the different aspects of this scenario in arriving at your response.

A ‘1’ indicates NOT IMPORTANT AT ALL while a ‘10’ indicates EXTREMELY IMPORTANT.

- Independent operations of other national Red Cross societies
- Unclear deployment status of delegates
- Substandard materials installed by project partner
- Lack of support staff on-site
- Amendment request for Memorandums of Understanding
- Shortage of construction materials
- Under-repair logistics support vessel
- Philippine Navy
- 128 Gawad Aruga volunteers non-trained
- Allowed housing design modifications
- Substandard donated construction materials

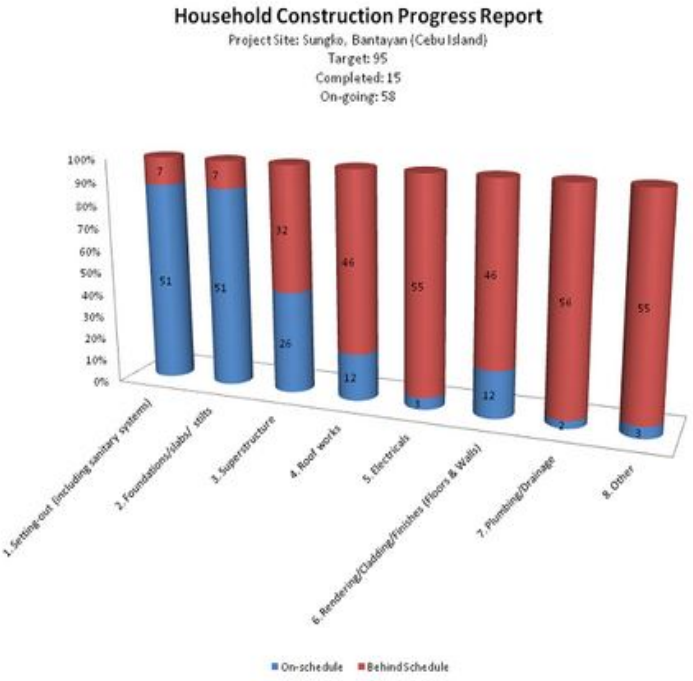
- Contradictory instructions in the field
- Target households
- Houses completed
- Issue no.
- Insufficiency of funds by some households

Cue Prioritisation: Information Acquisition Task

Information Acquisition Task – Low Complex Scenario

Click on the tabs below to access the relevant information

- Acccident Report
- Construction Site Progress Report



- Households' Demographic Background
- Minutes of Community Meeting
- Distribution of Households by Project Phases
- Local News
- Key Project Partners Contacts
- Construction Materials Price Trend
- Email Inbox
- Key Informants' Feedback
- Telephone and Radio Messages
- Post-it-notes on Notice Board

My Decision

Click here only when you are ready to make your final decision

From the options available, what is the most effective, immediate response to resolving the delays? You can only select one response.

- Provide additional technical assistance and available support for the vulnerable families
- Mobilise the community's available manpower resources to address household worker shortage
- Instruct the Technical Team to strictly impose the construction safety regulations in every household
- Monitor regularly the local retail price of construction materials and market transactions
- Solicit support and obtain available resources from the local authorities to the community

Please rate the importance of each information source in assisting you formulate your response, where 1 is low to 7 high.

- Accident Report
- Construction Site Progress Report
- Households' Demographic Background
- Minutes of Community Meeting
- Distribution of Households by Project Phases
- Local News
- Key Project Partners Contacts
- Construction Materials Price Trend
- Email Inbox
- Key Informants' Feedback
- Telephone and Radio Messages

- Post-it-notes on Notice Board

Information Acquisition Task – High Complex Scenario

The project cluster in Panay Island consists of 672, 967, and 1035 families that are in the provinces of Aklan, Antique, and Capiz, respectively. From the total target households in the cluster, houses have been constructed for only 16% of the population. As the new project manager, you have been asked to identify the most effective, immediate response to resolving the delays. From the list below, select a maximum of eight (8) pieces of information to formulate your response.

Click on the tabs below to access the relevant information

- List of Deployed International Delegates
- List of Volunteers
- Recently Completed House
- Deployed Manpower from the Philippine Army
- Email from the PRC Headquarter Manila
- Construction Materials Demand-Supply
- Field Monitoring Feedback
- Technical Team Leader's Feedback
- Livelihood in the Region Pre-Typhoon Haiyan
- Text Message from a Community Leader
- Operation's Map

- Climate Trend
- Construction Supervisors to Households Ratio
- Summary of Beneficiary Payments
- Non-compliance cases
- Calendar of Local Observances
- Field Desk Feedback
- Information from a Humanitarian Agency

My Decision

Click here only when you are ready to make your final decision

From the options available, what is the most effective, immediate response to resolving the delays?

- Allocate more volunteers to assist households that are struggling in construction work
- Provide beneficiary financial management support and make adjustments for realistic timelines
- Set clear reporting lines and decision making responsibility at the various levels
- Address the lack of beneficiary commitment through community follow-up meetings
- Ensure sufficient programme and technical staff support on-site

Please rate the importance of each information source in assisting you make formulate your response, where 1 is low to 7 high.

- List of Deployed International Delegates
- List of Volunteers
- Recently Completed House
- Deployed Manpower from the Philippine Army
- Email from the PRC Headquarter Manila
- Construction Materials Demand-Supply
- Field Monitoring Feedback
- Livelihood in the Region Pre-Typhoon Haiyan
- Text Message from a Community Leader
- Operation's Map
- Climate Trend
- Construction Supervisors to Households Ratio
- Summary of Beneficiary Payments
- Non-compliance cases
- Technical Team Leader's Feedback

- Calendar of Local Observances
- Held Desk Feedback
- Information from a Humanitarian Agency

Cue Association: Background Knowledge Task

In this task, you will see pairs of words appearing together.

You will be asked to indicate, on a scale, the extent to which you think the two words are related.

Word Pairs	
Design Modifications	Cost Adjustment
Project Partners	Organisational Culture
Activity Cost Estimates	Project Schedule
Process Mapping	Role Interdependencies
Request for Information	Procurement
Change Request	Work Breakdown Schedule
Project Sponsorship	Resource Availability
Project Management Plan	Project Performance
Government Standards	Monitor and Control
Collect Data Requirements	Project Objectives
Benchmarking	Risk Categories
Prototype	Feedback
Judgement	Subject Matter Experts
Communication Requirements Analysis	Stakeholders
Vendor Reputation	Delivery Dates
Risk Threshold	Scheduling
Procurement Statement of Work	Market Condition
Acceptance Criteria	Sign-Off
Business Case	Funding
Colocation	Productivity

Chapter 5: Discussion of the Research Presented

Research Outcomes

Sensemaking is an underlying process in project management that consists of collecting, assessing, and organising information based on what is known and/or what occurs in the 'here and now' (Lidskog & Sjödin, 2015). Its role is particularly critical in dynamic and complex operational environments such as disaster recovery. Disaster practitioners must be able to respond promptly to the emerging warning signals in the operational environment, and extract and reproduce information that is specific, relevant, and accurate for it to be meaningful and useful (Kapucu et al., 2008). The way that project practitioners make sense and manage situations in the wake of a disaster or an ongoing recovery operation affects the trajectory of the response and recovery efforts. Accurate and timely sensemaking can result in an early intervention in response to a crisis (Havelka & Rajkumar, 2007). Conversely, erroneous and late diagnoses can lead to risks, the emergence of hazards, or even a new disaster (Lidskog & Sjödin, 2015).

An overarching aim of this research was to broaden the current understanding of sensemaking in project environments such as disaster recovery. In addition, the research was designed to test whether cue utilisation is associated with sensemaking in this context. This was accomplished through a three-stage research process that began with a qualitative study that identified a 'set of cues' that project managers use to interpret and comprehend their operational environment. Subsequently, a confirmatory study established the validity of the project-specific cues and the role of cue utilisation in project management sensemaking. Finally, through an experimental study, cue utilisation was assessed using cue-based tasks within a disaster recovery context.

Figure 5.1 outlines the flow of research based on the three main research questions and the corresponding paper that addresses each enquiry.

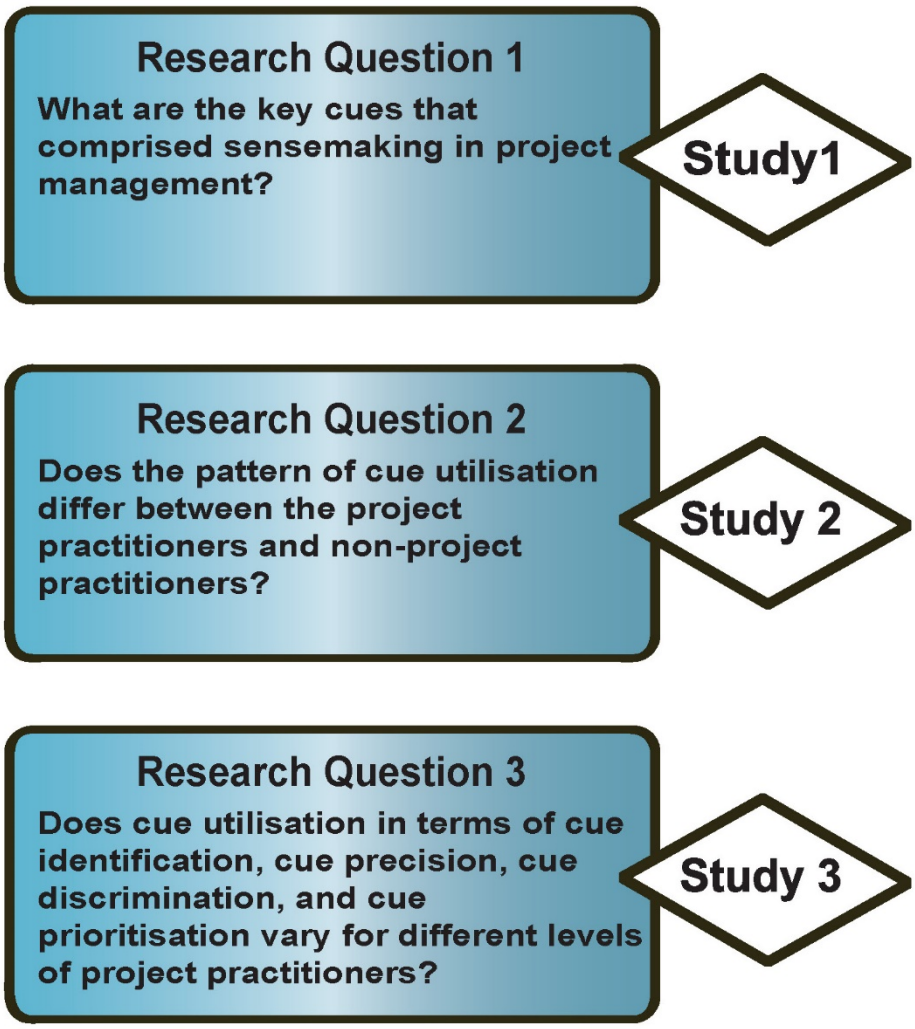


Figure 5.1 The research framework and the associated studies.

Research Question 1: What are the key cues that comprised sensemaking in project management?

The first research question was designed to elicit an in-depth understanding of the features in the operational environment that function as sensemaking cues in project management. The proposition in studying cues is succinctly described as follows: cues are feature/object–event associations in memory that are activated by certain triggers in the environment and forms as basis in diagnostic reasoning (Wiggins, 2015a). If effective project management depends on the proficiency in recognising the diagnostic cues, examining the project management-relevant cues ought to be the first step of this enquiry.

To address the first research question, cognitive interviews were conducted among peer-nominated successful project managers. These participants, five from Australia, and four from the Philippines, provided narrative accounts of actual experiences of critical project incidents that they had skilfully and promptly diagnosed.

Based on the 63 critical incidents that were extracted from the cognitive interviews, three distinct categories of project management-specific cues were identified: feedback cues, context cues, and tacit knowledge. Both the feedback cues and context cues were drawn from the environment as physical stimuli that captured the participants' attention as they appeared discrepant, anomalous, or equivocal cues (Maitlis & Christianson, 2014). Tacit knowledge is a distinct cue as it operated based on the individual's cognitive frames and therefore, was not necessarily triggered by external prompts.

Feedback cues. The findings of Study 1 point to the multi-faceted nature of feedback cues. The actors were drawn to the different characteristics of feedback cues that may be based on the form, content, and source of feedback. The form of feedback refers to the channels/ media in which the information emerged. As substantiated in the narrative accounts of project participants, they highlighted direct or open channels such as meetings, fora, drop-in consultations, one-on-one and group sessions, and casual conversations as information-gathering opportunities whereby issues, concerns, and the status of the project could be brought into awareness. They also identified the utility of physical or technical media such as emails, telephone calls, lodged tickets, and/or fax messages as sources of important information.

The participants were not only cognizant of the form, but they derived signals of concern, issues, crises and/or opportunities through the content of feedback or the message itself. The nature of feedback consisted of various human reactions, including reports of news or information, unsolicited suggestions, requests, complaints, demands, snide comments,

criticisms, concerns, support, praise, and/or arguments. Questions were especially important as they reflected the level of understanding, agreement, or engagement of the enquirer. As a strategy, participants appeared to use questions as a priming cue to extract the required information from other project actors. The nature of the response provided some indication as to the progression of the project.

Further, feedback cues were derived from the source(s) of information. This means that the origin of the feedback, whether from primary or secondary sources, constituted a cue in itself. Notably, the participants regarded both the primary or secondary sources as valuable, based on their trustworthiness and credibility in providing quality information. However, among the source(s) of feedback, participants regarded the key project actors as the most important due to their power and influence in the project organisation.

Overall, feedback comprises a dynamic category of sensemaking features that can occur in different ways. The effective use of feedback cues suggests understanding the nuances in terms of how the feedback emerged (form/ media), what was conveyed (content), and where (source) it was derived.

Context cues. Context cues are embedded in the project management environment. The participants were attentive to the boundary objects including both the primary objects or material artefacts with which the projects were organised, and the secondary or instrumental objects that facilitated the development and/or creation of the primary objects (Alderman et al., 2005). Project deliverables, prototypes, and actual products provide direct assessment of the project-specific requirements, while Gantt charts, process maps, and checklists were considered important indicators of the status of the project.

Observations were also drawn to the wider context within which the project was situated. In particular, the participants paid attention to the greater technical–organisational–environmental milieu. In the process of developing and implementing the project, they

became attuned to the systems, networks, and processes that were operating. The awareness of the elements in the project surroundings enabled the participants to assess the current project state against an ideal state and to anticipate a likely future state.

Further, the social dynamics that were captured by bodily reactions, gestures, voices, and personality formed part of the cues related to context. They were considered a basis for interpreting other peoples' attitudes and emotions. The perceptiveness towards these social cues facilitated social adjustments in subsequent interactions.

The concept of context cues as sensemaking features is consistent with Whiteman and Cooper's (2011) view concerning ecological materiality and the material and physical elements present in the natural environment. They describe ecological sensemaking as noticing and bracketing the subtle ecological cues from a streaming experience, followed by the formation of connections and causal networks between various cues and past enacted environments. They identified ecologically-embedded actors as those who understood the peculiarities and interactive effects of the various cues. Accordingly, these actors are more resilient to surprises than those who are ecologically disembedded and who do not have detailed knowledge or experience with the ecological system or process. As evident from the otucomes of Study 1, the project's ecology comprised both physical and dynamic/ non-tangible cues.

Tacit knowledge. In Study 1, the participants' tacit knowledge was expressed through an understanding of people and project management that guided evaluations and what to 'look for' in situations (Koskinen, Pihlanto, & Vanharanta, 2003). Tacit knowledge was particularly evident in the ability to interpret the meaning of absent or missing features in the operational environment. At times, this tacit knowledge was difficult to explicate or articulate such that the participants used other means of expression, including a form of social validation by raising a question or doubt (Koskinen et al., 2003; Reber, 1989).

In summary, the highlights of Study 1 include the identification of feedback cues, context cues, and tacit knowledge as key sensemaking features in project management. These sensemaking cues were mental representations of problematic or anomalous features that indicate issues related to complexity. Notably, complexity emerged as an important theme that precedes or elicits the project managers' sensemaking. Most importantly, the results of the study suggest that sensemaking cues can be observed and/ or exploited to assist in the management of project complexity. This includes their incorporation into project risk assessment and communication management.

Research Question 2: Do project practitioners and non-project practitioners differ in their perception of the project management sensemaking cues?

Research Question 2 was designed to further examine the project-specific sensemaking cues that were identified in Study 1. In particular, the goal was to compare patterns of sensemaking cue utilisation between project practitioners and non-project practitioners during scenarios of differing complexity and across three stages from project initiation to project completion.

Overall, the results revealed statistically significant differences in the perception of cue utilisation between the two groups. In the less complex project, project practitioners recorded relatively greater utilisation of feedback and context cues during project initiation; and context cues in project execution, in comparison to the naïve cohort. In the more complex project, project practitioners, consistently showed greater utilisation of feedback cues across all stages of the project.

This study presents several important outcomes. Firstly, cues were established as important elements of sensemaking. The differences in the pattern of cue utilisation between project practitioners and non-project practitioners indicates the former's capacity to make fine discriminations between the cues. Most importantly, the differentiation in cue utilisation

reflects the diagnostic qualities of these cues. Indeed, sensemaking is not merely about the presence or absence of cues but differences in the 'acts of noticing' (Weick et al., 2005). To the unseasoned actor, the dynamics of events may appear as an undifferentiated flux where, to the more experienced actor, certain types of features can serve as key cues and signal important information (Whiteman & Cooper, 2011). As evident in the outcomes of Study 2, experienced project practitioners indicated greater flexibility in the perceived utilisation of cues. It is likely that this reflects a more advanced mental model and a more nuanced understanding of the relationship between cues and project characteristics. Lastly, the study provides further evidence of the interaction between sensemaking and project-specific constructs including project complexity and the stage of implementation.

Research Question 3: Does cue utilisation in terms of cue identification, cue precision, cue discrimination, and cue prioritisation vary for different levels of project practitioners?

The third research question was an enquiry that emerged from the outcomes of Studies 1 and 2. Thus far, the sensemaking cues had been identified and, to some extent validated within the project management domain. However, the earlier enquiries were largely subjective assessments that may or may not reflect performance. Therefore, Research Question 3 was oriented towards assessments of performance, particularly in the context of disaster recovery. Cue utilisation was tested using a four-component measurement: cue identification, cue association, cue precision, and cue prioritisation among participants with different levels of project management experience.

It was hypothesised that those participants with greater experience in project management would demonstrate greater cue utilisation in the four-component tasks as demonstrated by: (a) greater speed and accuracy of response in the cue identification task; (b) greater variance in ratings of association between project-concept pairs in cue association

task; (c) greater variance in ratings of relevance of features in cue discrimination task, and (d) a lower ratio of pairs of information screens accessed based on the default order of presentation in cue acquisition task. It was also hypothesised that the complexity of the project scenarios would differentiate the cue utilisation performance of different cohorts.

Three cohorts were examined, ranging from participants with extensive project management experience in disaster recovery to those with less experience in the domain and, finally, to a naïve cohort. While differences were evident between the performance of participants with extensive experience and those participants who were naïve to the domain, the differences were less evident between participants with greater and lesser experience of project management in disaster recovery. It is important to note that Study 3 was designed to test domain-specific cues. These are cues that are recognisable by individuals who are part of, or who are likely to be part of, disaster recovery project operations. Therefore, there is greater confidence in the results that were yielded from the study due to the similarity of the characteristics of the study sample and the likely participants in actual disaster recovery project operations.

Overall, the result provides some support for the role of cue utilisation in project management sensemaking. At an intrinsic level, project practitioners must possess the capacity to comprehend those features in the operating environment that are most significant predictors of the system state, and possess the knowledge and experience to extract the key features from the array of information available.

There was no significant association between complexity and experience suggesting that the experimental scenarios may have lacked sensitivity. As in actual situations, there are often no objective representations for breaches of expectations.

The highlights of Study 3 include the first evidence-based perspective on project management sensemaking in the context of disaster recovery. Sensemaking was examined

through the basic cue utilisation. The experimental study enabled the examination of the differences in cue utilisation strategies among cohorts with different levels of experience in disaster recovery. Consistent with the outcomes of Study 2, more experienced practitioners demonstrated finer cue utilisation among the three cohorts suggesting the application of a more sophisticated mental model. The results have implications for the assessment of, and training interventions for, new recruits in extracting and prioritising information in disaster recovery settings. Pre-deployment training can incorporate cue utilisation strategies to aspects such as risk and communication management.

Table 5.1 provides a summary of the key findings of the present research programme.

Key Findings

Table 5.1

Summary of Key Research Findings

Research Question	Study	Key Findings
1. What are the key cues that comprised sensemaking in project management?	1	Key cues converged into three categories: 1.1 Feedback cues based on: • form/channel • content • source 1.2 Context cues based on: • boundary objects • behavioural/ social cues • contextual (technical–organisational–environmental) cues 1.3 Tacit knowledge based on: • people management • project management The sensemaking cues were mental representations of project managers of important features present in their project environment. Specifically, these cues served as indicators of project complexity issues. Project complexity emerged as a theme that was highly associated with the use of cues.
2. Does the perceived pattern of cue utilisation differ between project practitioners and non-project practitioners under varying levels of project complexity and stages of project management?	2	There were significant differences in the cue utilisation patterns between project practitioners and non-project practitioners in the: 2.1 low complex project Project practitioners indicated greater utilisation of feedback cues and context cues during project initiation, and context cues during project execution, in comparison to the non-project practitioners. 2.2 high complex project Project practitioners indicated greater utilisation of feedback cues throughout the stages of project management, in comparison to the non-project practitioners.

		Comparative assessments between tproject practitioners and non-project practitioners indicated that project practitioners demonstrated a more nuanced understanding of the relative importance of the cues in response to project situations, in comparison to non-project practitioners. The discriminate use of the cues by the project practitioners demonstrated the validity of the cues as sensemaking features in project management. This is the first study to provide evidence of the interrelatedness of the project management realities including project complexity, stages in the project implementation, and sensemaking.
3. Does cue utilisation in terms of cue identification, cue precision, cue discrimination, and cue prioritisation vary for different levels of project practitioners under varying levels of project complexity?	3	Except for cue discrimination, the other three-component processes including cue identification, cue association, and cue prioritisation varied between the more experience cohorts and the naïve cohort. There were no statistically significant interactions between experience and complexity in the four-component processes. This is the first empirical study that measured project management sensemaking, in the disaster recovery context, through the four-component constructs of cue utilisation: cue identification, cue precision, cue discrimination and cue prioritisation. These constructs provide important basis for assessments and training interventions involving disaster project practitioners.

Research Implications

Theoretical implications.

The theoretical perspectives drawn from the present research contribute to the knowledge base of both the disaster management and project management domains. Firstly, the research deconstructs or de-mystifies sensemaking in complex project environments through the identification of a set of cues that appear to be used to guide project practitioners to the potential sources of the problems (Kahneman & Klein, 2009). Generally, project management contexts are complex and this justifies the generation of cues from a range of project settings to understand similar/ global features present in project environments. Project management is also domain-specific which necessitates an understanding as to how cues operate in particular environments. Both global and domain-specific understanding about cues needs to be integrated into the practitioners' mental models (Hodgson & Paton, 2015). This is important for the project practitioners' role as decision makers where, at the beginning of any decision or evaluation process, they distinguish and locate for the most informative type and source of cues (Thiry, 2001).

Secondly, the research outcomes support the notion of project actuality wherein key to understanding project realities such as complexity and coping is the context-dependent nature of actor's cognition and action (Cicmil et al., 2006). As evident from the outcomes of the three studies, the project management sensemaking framework associates the basic process of cue utilisation with project-specific constructs, including project complexity and the project life cycle. The information search, to a greater or lesser extent, is prescribed by the necessities of the situation such that the type of information or knowledge must be available to the individual or organisation at the appropriate time and with minimal effort (Lidskog & Sjödin, 2015). In the present study, project practitioners were able to discern the beneficial cues in response to the complexity demand of the situation.

Finally, for the first time, cue utilisation was established as a construct in the management of projects in highly challenging environments such as disaster recovery. The cue-based theoretical framework comprising cue identification, cue utilisation, cue precision, and cue prioritisation, offers a potential framework by which to understand and assess the sensemaking skills of different project practitioners. This framework provides a clear direction as to how sensemaking, as a diagnostic skill, can potentially be evaluated and developed through training and interventions (Wiggins, Loveday, & Lyons, 2014).

Practical implications.

Cues and cue utilisation play a key role in disaster recovery projects and in project management in general as they facilitate project communication and risk management. Project managers need to be attuned to the different cues and the tools by which these cues can be elucidated (e.g. face-to-face meetings, telephone calls), as they potentially have an impact on the efficiency and performance of a project team (Kennedy, McComb, & Vozdolska, 2011). As Kennedy et al. (2011) stress, there can be no single policy of project management, since this depends on the working conditions. However, project managers must be able to reflexively switch different strategies that obviates confusing, insufficient, or overwhelming information within the project organisation.

Cue-based processing is also relevant to risk management, and particularly in the context of risk identification, response, and control. Cues are used as key indicators for potential negative or positive events (Wiggins, 2015a). Therefore, cue acquisition/ utilisation is a significant component of risk perception and, in turn, risk management.

The recognition of the importance of perceptual skills and expert judgement in risk management is part of the major shift from the traditional focus on quantitative and objective probabilities to the subjective capacities that reflect the actual project attributes (Taroun, 2014). This presents an opportunity for cue-based training. Unlike many training programmes

that develop and assess performance based on the application of standard operating procedures, cue-based training can situate the participants within simulated settings that require them to make choices without clear or complete information (Pullium, Roble, & Raymond, 2014). This type of training is likely to be beneficial in preparing disaster recovery workers for actual operations. Scenario-based training that entails judging and extracting situational features, making decisions, and choosing an action, enables disaster project practitioners to develop and exercise their cue-based processing and sensemaking abilities and receive feedback. In this type of exercise, much as in actual disaster recovery, the right answer is not as important as the process of identifying and formulating a decision (Pullium et al., 2014).

Limitations and Future Directions

The aim of the present thesis was to provide an evidence-based perspective of project management sensemaking through an examination of the construct of cue utilisation. Sensemaking is assessed at the individual cognitive level, and further examined within the context of disaster recovery.

The research investigation specifically included project attributes that play a role in the sensemaking process. Project complexity was included in the present research as a factor that potentially delineates the cue utilisation performance of practitioners. However, the experimental study did not clearly establish the role of complexity in relation to cue utilisation. Nevertheless, the project scenarios provided a basis for the assessment of cue utilisation, particularly in the context of disaster recovery. However, further refinement is likely to be necessary in the presentation of greater and lesser complexity.

The comparative groups in this research involved naïve groups and experienced project practitioners. The comparison between these groups is insightful as it offers a perspective as to the differential abilities among practitioners. However, the inclusion of

expert project managers in future studies is essential as they constitute a key comparative group (Shanteau, 1988). The expert-novice paradigm is a well-established strategy that enables the differentiation of experts from non-experts (Loveday, Wiggins, Harris, et al., 2013).

Research Strengths

The present research is the first to establish empirically, the role of cue utilisation as a process in the context of project management sensemaking. The research outcomes are derived through a programme of research that adopted a mixed-methods approach. The initial study enabled the identification of key sensemaking cues based on the lived experiences of project managers in their encounters and the successful diagnosis of critical and complex project issues. The confirmatory study tested the utilisation of these sensemaking cues through an online survey that incorporated scenarios with important project attributes, including levels of complexity and stages of project progression. Finally, an experimental study examined the construct of cue utilisation in the context of disaster recovery project management. The combination of qualitative and quantitative studies provides both a grounded and empirically-based perspective on the role of cue utilisation in project management.

Secondly, each component study adopted a robust methodology that was appropriate for the context. The participants in Study 1 were identified through peer assessments, while in Study 2, the participants were recruited through relevant professional organisations (e.g. projects management and aid/disaster relief organisations). The stimuli in Studies 2 and 3 were derived from naturalistic settings, and particularly those scenarios that were based on the actual disaster recovery project for Typhoon Haiyan.

General Conclusion

The central aim of the present thesis was to offer an empirically-based perspective on project management sensemaking, targeting the role of cue utilisation. The thesis comprises three studies that address specific research questions.

The identification and description of feedback cues, context cues, and tacit knowledge in Study 1 provided a comprehensive reference that can function as the basis of diagnostic cues in project settings. They reflect the 'global-local knowledge' paradigm in project management that espouses the necessity for both generalisable and domain-specific knowledge in dealing with diverse and complex project environments (Hodgson, & Paton, 2015). Earlier studies provided separate investigations of the importance of feedback, material objects, and implicit knowledge in project management, where the present study demonstrates collectively their role as broad indicators of project complexity. The outcomes form a foundational basis for the examination of sensemaking cues in more specific contexts.

Study 2 established the construct validity of the sensemaking cues and the conceptual link between cue utilisation and project attributes, including complexity and project management stages. For the first time, empirical evidence has been provided that substantiates the relationship between cue utilisation and project-specific constructs. Patterns of cue utilisation varied between project practitioners and non-project practitioners in complex and less complex project cases and stages in the project life cycle. The findings of the study point to the necessity of skilled sensemaking in project management, specifically in the ability to shift emphasis in attention as cues embody varying levels of importance depending on situations. Therefore, project management sensemaking does not merely involve cues. Rather, it is the proficient application of cues.

Finally, Study 3 deconstructed the process of cue utilisation by measuring its component processes. In particular, cue identification, cue association, and cue prioritisation

were evident in project management, although the role of cue discrimination and complexity were not clearly determined. This investigation is the first to establish the role of cue utilisation in project management. Most importantly, through comparative assessments, differences in cognitive processes and strategies were evident with different levels of experience in disaster recovery. This is indicative of sensemaking skills progression in project management and provides a concrete basis for the development of future training initiatives.

The theoretical and practical contributions in the current research serve both the project management and disaster management domains. In particular, cue utilisation is a construct that provides an explanation of the cognitive processes involved in sensemaking. It also has direct application in the management of project communication and risks.

Complete Reference List

Alderman, N., Ivory, C., McLoughlin, I., & Vaughan, R. (2005). Sense-making as a process within complex service-led projects. *International Journal of Project Management, 23*(5), 380–385. doi:10.1016/j.ijproman.2005.01.004

Apte, A., Gonçalves, P., & Yoho, K. (2016). Capabilities and competencies in humanitarian Operations. *Journal of Humanitarian Logistics and Supply Chain Management*, 6(2), 240–258. doi: 10.1108/JHLSCM-04-2015-0020

Aubry, M., & Lenfle, S. (2012). Projectification: Midler's footprint in the project management field. *International Journal of Managing Projects in Business, 5*(4), 680–694. doi:10.1108/17538371211268997

Auton, J. (2014). *Utilisation of prosodic and semantic cues of nonunderstanding during readback/ hearback verbal transactions in technical environments* (Unpublished doctoral dissertation). Macquarie University, NSW, Australia.

Baccarini, D. (1996). The concept of project complexity—a review. *International Journal of Project Management, 14*(4), 201–204. doi:10.1016/0263-7863(95)00093-3

Balogun, J., & Johnson, G. (2004). Organizational restructuring and middle manager sensemaking. *Academy of Management Journal, 47*(4), 523–549. doi:10.2307/20159600

Balogun, J., & Johnson, G. (2005). From intended strategies to unintended outcomes: The impact of change recipient sensemaking. *Organization Studies, 26*(11), 1573–1601. doi:10.1177/0170840605054624

Below, R., Wirtz, A., & Guha-Sapir, D. (2009). *Disaster category classification and peril terminology for operational purposes.* Université Catholique de Louvain: Centre for Research on the Epidemiology of Disasters (CRED) and Munich Reinsurance Company (Munich RE). Retrieved from http://www.cred.be/

Bosch-Rekveldt, M., Jongkind, Y., Mooi, H., Bakker, H., & Verbraeck, A. (2011). Grasping project complexity in large engineering projects: The TOE (Technical, Organizational and Environmental) framework. *International Journal of Project Management, 29*(6), 728–739. doi:10.1016/j.ijproman.2010.07.008

Brouwers, S., Wiggins, M. W., Helton, W., O'Hare, D., & Griffin, B. (2016). Cue utilisation and cognitive load in novel task performance. *Frontiers in Psychology, 7*. doi:10.3389/fpsyg.2016.00435

Brown, A. D., Colville, I., & Pye, A. (2015). Making sense of sensemaking in organization studies. *Organization Studies, 36*(2), 265–277. doi:10.1177/0170840614559259

Brunswik, E. (1955). Representative design and probabilistic theory in a functional psychology. *Psychological Review, 62*(3), 193–217.

Bui, T., Cho, S., Sankaran, S., & Sovereign, M. (2000). A framework for designing a global information network for multinational humanitarian assistance/ disaster relief. *Information Systems Frontiers, 1*(4), 427-442. doi: 10.1023/A:1010074210709

Cañas, J., Quesada, J., Antolí, A., & Fajardo, I. (2003). Cognitive flexibility and adaptability to environmental changes in dynamic complex problem-solving tasks. *Ergonomics, 46*(5), 482–501. doi:10.1080/0014013031000061640

Centre for Research on the Epidemiology of Disasters (2016). *Disaster data: A balanced perspective* (CRED Crunch Issue no. 41). Retrieved from http://www.cred.be/

Chang, Y., Wilkinson, S., Potangaroa, R., & Seville, E. (2012). Managing resources in disaster recovery projects. *Engineering, Construction and Architectural Management, 19*(5), 557–580. doi:10.1108/09699981211259621

Chang-Richards, Y., Rapp, R., Wilkinson, S., von Meding, J., & Haigh, R. (2015). Call for papers: International Journal of Project Management: Special issue 'Managing

Disaster Recovery Projects'. *International Journal of Project Management, 33*(6), 1193–1194. doi:10.1016/j.ijproman.2015.04.002

Chang-Richards, Y., Wilkinson, S., Potangaroa, R., & Seville, E. (2013). Resource challenges for housing reconstruction: A longitudinal study of the Australian bushfires. *Disaster Prevention and Management, 22*(2), 172–181. doi:10.1108/09699981211259621

Cheng, M.-I., Dainty, A. R. J., & Moore, D. R. (2005). What makes a good project manager? *Human Resource Management Journal, 15*(1), 25–37. doi:10.1111/j.1748-8583.2005.tb00138.x

Cicmil, S., Williams, T., Thomas, J., & Hodgson, D. (2006). Rethinking project management: Researching the actuality of projects. *International Journal of Project Management, 24*(8), 675–686. doi:10.1016/j.ijproman.2006.08.006

Clark, R. E., Pugh, C. M., Yates, K. A., Inaba, K., Green, D. J., & Sullivan, M. E. (2012). The use of cognitive task analysis to improve instructional descriptions of procedures. *Journal of Surgical Research, 173*(1), e37–e42. doi:10.1016/j.jss.2011.09.003

Coetzer, A., Redmond, J., & Sharafizad, J. (2012). Decision making regarding access to training and development in medium-sized enterprises: An exploratory study using the critical incident technique. *European Journal of Training and Development, 36*(4), 426–447. doi:10.1108/03090591211220348

Connolly, T., Arkes, H. R., & Hammond, K. R. (2000). *Judgment and decision making: An interdisciplinary reader*. Cambridge: Cambridge University Press.

Cox, R. S., & Danford, T. (2014). The need for a systematic approach to disaster psychosocial response: A suggested competency framework. *Prehospital and Disaster Medicine, 29*(02), 183–189. doi:doi:10.1017/S1049023X14000259

Crandall, B., Klein, G., & Hoffman, R. R. (2006). *Working minds a practitioner's guide to cognitive task analysis* (pp. 69–90). Cambridge, Massachusetts: The MIT Press.

Cranmer, H., & Aschkenasay, M. (2014). Building a professional global disaster response team at an academic health-care institution: The professionalisation of humanitarian health-care workers. *The Lancet Global Health, 2*(1), S8. doi:10.1016/S2214-109X(15)70030-6

Crawford, L., Langston, C., & Bajracharya, B. (2013). Participatory project management for improved disaster resilience. *International Journal of Disaster Resilience in the Built Environment, 4*(3), 317–333. doi:10.1108/IJDRBE-07-2012-0020

Dawes, S.S., Cresswell, A.M., & Cahan, B.B. (2004). Learning from crisis: Lessons in human and information infrastructure from the World Trade Center response. *Social Science Computer Review, 22*(1), 52–66. doi:10.1177/0894439303259887

Davies, A., & Mackenzie, I. (2014). Project complexity and systems integration: Constructing the London 2012 Olympics and Paralympics games. *International Journal of Project Management, 32*(5), 773–790. doi:10.1016/j.ijproman.2013.10.004

Denis, H. (1991). The complexity of technological disaster management: technical, sociopolitical and scientific issues. *Organization & Environment, 5*(1), 1–18. doi:10.1177/108602669100500101

Einhorn, H. J., & Hogarth, R. M. (1988). Behavioral decision theory: Processes of judgment and choice. In D.E. Bell, H. Raiffa, & A. Tversky (Eds.), *Decision making: Descriptive, normative and prescriptive interactions* (pp. 113–146). Cambridge: Cambridge University Press.

Endsley, M. R. (1995). Toward a theory of situation awareness in dynamic systems. *Human Factors, 37*(1), 32–64.

Fellows, R., & Liu, A. (2016). Sensemaking in the cross-cultural contexts of projects. *International Journal of Project Management, 34*(2), 246–257. doi:10.1016/j.ijproman.2015.03.010

Flanagan, J. C. (1954). The critical incident technique. *Psychological Bulletin, 51*(4), 327–358. doi:10.1037/h0061470

Gonzalez, C., & Thomas, R. P. (2008). Effects of automatic detection on dynamic decision making. *Journal of Cognitive Engineering and Decision Making, 2*(4), 328–348. doi:10.1518/155534308X377810

Gremler, D. D. (2004). The critical incident technique in service research. *Journal of Service Research, 7*(1), 65–89. doi:10.1177/1094670504266138

Gunawan, L. T., Alers, H., Brinkman, W.-P., & Neerincx, M. A. (2011). Distributed collaborative situation-map making for disaster response. *Interacting with Computers, 23*(4), 308–316. doi:10.1016/j.intcom.2011.04.003

Haigh, R., & Sutton, R. (2012). Strategies for the effective engagement of multi-national construction enterprises in post-disaster building and infrastructure projects. *International Journal of Disaster Resilience in the Built Environment, 3*(3), 270–282. doi:10.1108/17595901211263657

Hartwig, M., & Bond, C. F. (2001). Why do lie-catchers fail? A lens model meta-analysis of human lie judgments. *Psychological Bulletin, 137*(4), 643–659.

Harvey, P. (2010). The role of national governments in international humanitarian response to disasters. *26th Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP) Meeting, Kuala Lumpur.* Retrieved from http://www.alnap.org/resource/5966

Havelka, D., & Rajkumar, T. M. (2007). Using the troubled project recovery framework: Problem recognition and decision to recover. *E-Service Journal, 5*(1), 43–73.

Hayes, P. E., & Hammons, A. (2002). Picking up the pieces: Utilizing disaster recovery project management to improve readiness and response time. *Industry Applications Magazine, IEEE, 8*(6), 27–36. doi:10.1109/MIA.2002.1044203

Heravi, A., Coffey, V., & Trigunarsyah, B. (2015). Evaluating the level of stakeholder involvement during the project planning processes of building projects. *International Journal of Project Management, 33*(5), 985–997. doi:10.1016/j.ijproman.2014.12.007

Hodgson, D. E., & Paton, S. (2015). Understanding the professional project manager: Cosmopolitans, locals and identity work. *International Journal of Project Management* (In Press). doi:10.1016/j.ijproman.2015.03.003

Houston, J.B., Hawthorne, J., Perreault, M.F., Park, E.H., Goldstein Hode, M., Halliwell, M.R.,…Griffith, S.A. (2015). Social media and disasters: A functional framework for social media use in disaster planning, response, and research. *Disaster. 39*(1), 1–22. doi: 10.1111/disa.12092

IBM SPSS (2014). *Categorical principal components analysis (CATPCA) (Short course module)*. Retrieved from http://pic.dhe.ibm.com/infocenter/spssstat/v21r0m0/index.jsp?topic=%2Fcom.ibm.spss.statistics.help%2Fidh_cpca.htm

International Federation of Red Cross and Red Crescent Societies (2010). *Owner –driven reconstruction guidelines.* Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2012). *IFRC recovery programming guidance 2012.* Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2014a). *IFRC real-time evaluation of the Philippines Haiyan response* (February – March 2014a). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2014b). *Philippines: Typhoon Haiyan* (One–year progress report). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2015a). *Emergency appeal operation update Philippines: Typhoon Haiyan* (31 January 2015). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2015b). *Philippines: Typhoon Haiyan* (18–month progress report). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2015c). *Emergency appeal operation update Philippines: Typhoon Haiyan* (24 June 2015). Retrieved from http://www.ifrc.org

International Federation of Red Cross and Red Crescent Societies (2015d). *World disasters report: Focus on local actors, the key to humanitarian effectiveness.* Retrieved from http://www.ifrc.org

Ismail, D., Majid, T. A., Roosli, R., & Samah, N. A. (2014). Project management success for post-disaster reconstruction projects: International NGOs perspectives. *Procedia Economics and Finance, 18*, 120–127. doi:10.1016/S2212-5671(14)00921-6

Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: A failure to disagree. *The American Psychologist, 64*(6), 515–526. doi:10.1037/a0016755

Kapucu, N., Berman, E. M., & Wang, X. H. (2008). Emergency information management and public disaster preparedness: Lessons from the 2004 Florida hurricane season. *International Journal of Mass Emergencies and Disasters, 26*(3), 169–196.

Kärreman, D., & Alvesson, M. (2001). Making newsmakers: Conversational identity at work. *Organization Studies, 22*(1), 59.

Kaulio, M.A. (2008). Project leadership in multi-project settings: Findings from a critical incident study. *International Journal of Project Management, 26*(4), 338–347. doi:10.1016/j.ijproman.2007.06.005

Kelman, I., & Glantz, M.H. (2015). Analyzing the Sendai Framework for Disaster Risk Reduction. *International Journal of Disaster Risk Science, 6,* 105–106. doi: 10.1007/s13753-015-0056-3

Kennedy, D. M., McComb, S. A., & Vozdolska, R. R. (2011). An investigation of project complexity's influence on team communication using Monte Carlo simulation. *Journal of Engineering and Technology Management, 28*(3), 109–127. doi:10.1016/j.jengtecman.2011.03.001

Kim, K. N., & Choi, J.-h. (2013). Breaking the vicious cycle of flood disasters: Goals of project management in post-disaster rebuild projects. *International Journal of Project Management, 31*(1), 147–160. doi:10.1016/j.ijproman.2012.03.001

Klein, G. (1998). *Sources of power*. Cambridge, Massachusetts: Massachusetts Institute of Technology.

Klein, G. (2015). A naturalistic decision making perspective on studying intuitive decision making. *Journal of Applied Research in Memory and Cognition*. *4*(3) 164-168. doi:10.1016/j.jarmac.2015.07.001

Klein, G., Moon, B., & Hoffman, R. R. (2006a). Making sense of sensemaking 1: Alternative perspectives. *IIEE Intelligent Systems, 21*(4), 70–73.

Klein, G., Moon, B., & Hoffman, R. R. (2006b). Making sense of sensemaking 2: A macrocognitive model. *IEEE Intelligent Systems, 21*(5), 88–92.

Klein, G., Wiggins, S., & Dominguez, C. O. (2010). Team sensemaking. *Theoretical Issues in Ergonomics Science, 11*(4), 304–320. doi:10.1080/14639221003729177

Koskinen, K. U. (2012). Organizational learning in project-based companies: A process thinking approach. *Project Management Journal, 43*(3), 40–49. doi:10.1002/pmj.21266

Koskinen, K. U., Pihlanto, P., & Vanharanta, H. (2003). Tacit knowledge acquisition and sharing in a project work context. *International Journal of Project Management, 21*(4), 281–290. doi:10.1016/S0263-7863(02)00030-3

Laine, T., Korhonen, T., & Martinsuo, M. (2016). Managing program impacts in new product development: An exploratory case study on overcoming uncertainties. *International Journal of Project Management, 34*(4), 717–733. doi:10.1016/j.ijproman.2016.02.011

Lalonde, P.-L., Bourgault, M., & Findeli, A. (2012). An empirical investigation of the project situation: PM practice as an inquiry process. *International Journal of Project Management, 30*(4), 418–431. doi:10.1016/j.ijproman.2011.09.005

Lejano, R., & Tan, J. M. (2015). Learning from Typhoon Haiyan. *Nature, 518*, 35.

Lidskog, R., & Sjödin, D. (2015). Time, knowledge, and risk: Decision making in the aftermath of storm disasters. *International Journal of Mass Emergencies and Disasters, 33*(3), 341–359.

Linting, M., Meulman, J.J., Groenen, P.J.F. & va der Kooij, A.J. (2007). Nonlinear principal component analysis: Introduction and application. *Psychological Methods, 12*(3), 336–358. doi:10.1037/1082-989X.12.3.336

Loufrani-Fedida, S., & Missonier, S. (2015). The project manager cannot be a hero anymore! Understanding critical competencies in project-based organizations from a multilevel approach. *International Journal of Project Management, 33*(6), 1220–1235. doi:10.1016/j.ijproman.2015.02.010

Loveday, T., Wiggins, M. W., & Searle, B. J. (2014). Cue utilization and broad indicators of workplace expertise. *Journal of Cognitive Engineering and Decision Making, 8*(1), 98–113. doi: 10.1177/1555343413497019

Loveday, T., Wiggins, M. W., Harris, J. M., O'Hare, D., & Smith, N. (2013). An objective approach to identifying diagnostic expertise among power system controllers. *Human*

Factors: The Journal of the Human Factors and Ergonomics Society, 55(1), 90–107. doi:10.1177/0018720812450911

Loveday, T., Wiggins, M. W., Searle, B. J., Festa, M., & Schell, D. (2013). The capability of static and dynamic features to distinguish competent from genuinely expert practitioners in pediatric diagnosis. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 55*(1), 125–137. doi:10.1177/0018720812448475

Lu, Y., Luo, L., Wang, H., Le, Y., & Shi, Q. (2015). Measurement model of project complexity for large-scale projects from task and organization perspective. *International Journal of Project Management, 33*(3), 610–622. doi:10.1016/j.ijproman.2014.12.005

Maiers, C., Reynolds, M., & Haselkorn, M. (2005). Challenges to effective information and communication systems in humanitarian relief organizations. *2005 IEEE International Professional Communication Conference Proceedings, Ireland,* 82–91. doi:10.1109/IPCC.2005.1494163

Maitlis, S. (2005). The social processes of organizational sensemaking. *Academy of Management Journal, 48*(1), 21–49. doi:10.5465/AMJ.2005.15993111

Maitlis, S., & Christianson, M. (2014). Sensemaking in organizations: Taking stock and moving forward. *Academy of Management Annals, 8*(1), 57–125. doi:10.1080/19416520.2014.873177

Malachowski, C. C., Martin, M. M., & Vallade, J. I. (2013). An examination of students' adaptation, aggression, and apprehension traits with their instructional feedback orientations. *Communication Education, 62*(2), 127–147. doi:10.1080/03634523.2012.748208

Martin, M. M., & Rubin, R. B. (1995). A new measure of cognitive flexibility. *Psychological Reports, 76*(2), 623–626. doi:10.2466/pr0.1995.76.2.623

Mazur, A., Pisarski, A., Chang, A., & Ashkanasy, N. M. (2014). Rating defence major project success: The role of personal attributes and stakeholder relationships. *International Journal of Project Management, 32*(6), 944-957. doi:10.1016/j.ijproman.2013.10.018

McComb, S.A., Green, S.G., & Dale Compton, W. (2007). Team flexibility's relationship to staffing and performance in complex projects: An empirical analysis. *Journal of Engineering and Technology Management, 24*(4), 293-313. doi: 10.1016/j.jengtecman.2007.09.004

McCormack, C., Wiggins, M. W., Loveday, T., & Festa, M. (2014). Expert and competent non-expert visual cues during simulated diagnosis in intensive care. *Frontiers in Psychology, 5*. doi:10.3389/fpsyg.2014.00949

Metcalfe, M., & Sastrowardoyo, S. (2013). Complex project conceptualisation and argument mapping. *International Journal of Project Management, 31*(8), 1129–1138. doi:10.1016/j.ijproman.2013.01.004

Midler, C. (1995). "Projectification" of the firm: The Renault case. *Scandinavian Journal of Management, 11*(4), pp.363–375. doi: 10.1016/0956-5221(95)00035-T

Morris, P. (2013). Reconstructing project management reprised: A knowledge perspective. *Project Management Journal, 44*(5), 6–23. doi:10.1002/pmj.21369

Morrison, B., & Morrison, N. (2015). Diagnostic cues in major crime investigation. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 91–98). Surrey, England: Ashgate Publishing Limited.

Morrison, B. W., Wiggins, M. W., Bond, N. W., & Tyler, M. D. (2013). Measuring relative cue strength as a means of validating an inventory of expert offender profiling cues. *Journal of Cognitive Engineering and Decision Making, 7*(2), 211–226. doi: 10.1177/1555343412459192

Müller, R. (2003). Determinants for external communications of IT project managers. *International Journal of Project Management, 21*(5), 345–354. doi:10.1016/S0263-7863(02)00053-4

Musca, G. N., Mellet, C., Simoni, G., Sitri, F., & de Vogüé, S. (2014). "Drop your boat!": The discursive co-construction of project renewal. The case of the Darwin mountaineering expedition in Patagonia. *International Journal of Project Management, 32*(7), 1157–1169. doi:10.1016/j.ijproman.2014.02.006

Mutasa, M. (2013). Investigating the significance of disaster information management. *Jàmbá: Journal of Disaster Risk Studies* 5(2), 1–6. doi:10.4102/jamba.v5i2.73

O'Hare, D. (2015). Situational awareness and diagnosis. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 13–26). Surrey, England: Ashgate Publishing Limited.

O'Sullivan, T. L., Kuziemsky, C. E., Toal-Sullivan, D., & Corneil, W. (2013). Unraveling the complexities of disaster management: A framework for critical social infrastructure to promote population health and resilience. *Social Science & Medicine, 93*, 238–246. doi:10.1016/j.socscimed.2012.07.040

Othman, S. H., & Beydoun, G. (2013). Model-driven disaster management. *Information & Management, 50*(5), 218–228. doi:10.1016/j.im.2013.04.002

Packendorff, J. (1995). Inquiring into the temporary organization: New directions for project management research. *Scandinavian Journal of Management, 11*(4), 319–333. doi:10.1016/0956-5221(95)00018-Q

Papadimitriou, K., & Pellegrin, C. (2007). Dynamics of a project through intermediary objects of design (IODs): A sensemaking perspective. *International Journal of Project Management, 25*(5), 437–445. doi:10.1016/j.ijproman.2006.11.002

Pellegrinelli, S., & Webster, R. M. (2011). Multi-paradigmatic perspectives on a business transformation program. *Project Management Journal, 42*(6), 4–19. doi:10.1002/pmj.20275

Peller, J., Schwartz, B., & Kitto, S. (2013). Nonclinical core competencies and effects of interprofessional teamwork in disaster and emergency response training and practice: A pilot study. *Disaster Medicine and Public Health Preparedness, 7*(04), 395–402. doi:10.1017/dmp.2013.39

Perminova, O., Gustafsson, M., & Wikström, K. (2008). Defining uncertainty in projects — a new perspective. *International Journal of Project Management, 26*(1), 73–79. doi:10.1016/j.ijproman.2007.08.005

Pich, M. T., Loch, C. H., & De Meyer, A. (2002). On uncertainty, ambiguity, and complexity in project management. *Management Science, 48*(8), 1008–1023.

Pilbeam, C. (2013). Coordinating temporary organizations in international development through social and temporal embeddedness. *International Journal of Project Management, 31*(2), 190–199. doi:10.1016/j.ijproman.2012.06.004

Pollack, J., Costello, K., & Sankaran, S. (2013). Applying actor–network theory as a sensemaking framework for complex organisational change programs. *International Journal of Project Management, 31*(8), 1118–1128. doi:10.1016/j.ijproman.2012.12.007

Poon, L. W., Rubin, D. C., & Wilson, B. A. (1989). *Everyday cognition in adulthood and late life*. Cambridge: Cambridge University Press.

Preece, G., Shaw, D., & Hayashi, H. (2013). Using the viable system model (VSM) to structure information processing complexity in disaster response. *European Journal of Operational Research, 224*(1), 209–218. doi:10.1016/j.ejor.2012.06.032

Project Management Institute testifies on disaster relief project management. (2011, November). *Information Technology Newsweekly*. Retrieved from http://search.proquest.com/docview/900518023?rfr_id=info%3Axri%2Fsid%3Aprimo

Project Management Institute (2013). *A guide to the project management body of knowledge: PMBOK guide* (5th Ed.). Newtown Square, Pennsylvania: Project Management Institute, Incorporated.

Pullium, J.K., Roble, G.S., & Raymond, M.A. (2014). Be prepared. *Nature*, *514*, 430.

Reber, A. S. (1989). Implicit learning and tacit knowledge. *Journal of Experimental Psychology: General, 118*(3), 219–235.

Rowlands, A. (2007). Training for disaster recovery. *Journal of Social Work in Disability & Rehabilitation, 5*(3-4), 109–126. doi:10.1300/J198v05n03_07

Sage, D., Dainty, A., & Brookes, N. (2014). A critical argument in favor of theoretical pluralism: Project failure and the many and varied limitations of project management. *International Journal of Project Management, 32*(4), 544–555. doi:10.1016/j.ijproman.2013.08.005

Sampo, T., Kirsi, A., & Mervi, M. (2010). Coping with an unexpected event: Project managers' contrasting sensemaking in a stakeholder conflict in China. *International Journal of Managing Projects in Business, 3*(3), 526–543. doi:10.1108/17538371011056129

Seppänen, H., & Virrantaus, K. (2015). Shared situational awareness and information quality in disaster management. *Safety Science, 77*, 112–122. doi:10.1016/j.ssci.2015.03.018

Shanteau, J. (1988). Psychological characteristics and strategies of expert decision makers. *Acta Psychologica, 68*(1–3), 203–215. doi:10.1016/0001-6918(88)90056-X

Shanteau, J. (1992). How much information does an expert use? Is it relevant? *Acta Psychologica, 81*(1), 75-86. doi:10.1016/0001-6918(92)90012-3

Simon, H. A. (1992). What is an "explanation" of behavior? *Psychological Science, 3*(3), 150–161.

Simon, L. (2006). Managing creative projects: An empirical synthesis of activities. *International Journal of Project Management, 24*(2), 116-126. doi:10.1016/j.ijproman.2005.09.002

Small, A. J., Wiggins, M. W., & Loveday, T. (2014). Cue-based processing capacity, cognitive load and the completion of simulated short-duration vigilance tasks in power transmission control. *Applied Cognitive Psychology, 28*(4), 481–487. doi:10.1002/acp.3016

Söderholm, A. (2008). Project management of unexpected events. *International Journal of Project Management, 26*(1), 80–86. doi:10.1016/j.ijproman.2007.08.016

Söderlund, J. (2004). Building theories of project management: Past research, questions for the future. *International Journal of Project Management, 22*(3), 183–191. doi:10.1016/S0263-7863(03)00070-X

Starkweather, J.D. (2014). *SPSS short course module 9: Categorical principal components analysis (CATPCA) with optimal scaling*. Retrieved from http://www.unt.edu/rss/class/Jon/SPSS_SC/Module9/M9_CATPCA/SPSS_M9_CATPCA.htm

Suhaimi, A. W., Marzuki, N. A., & Mustaffa, C. S. (2014). The relationship between emotional intelligence and interpersonal communication skills in disaster management context: A proposed framework. *Procedia - Social and Behavioral Sciences, 155*, 110–114. doi:10.1016/j.sbspro.2014.10.265

Takagi, H., Esteban, M., Shibayama, T., Mikami, T., Matsumaru, R., De Leon, M., . . . Nakamura, R. (2015). Track analysis, simulation, and field survey of the 2013

Typhoon Haiyan storm surge. *Journal of Flood Risk Management*. doi:10.1111/jfr3.12136

Taroun, A. (2014). Towards a better modelling and assessment of construction risk: Insights from a literature review. *International Journal of Project Management, 32*(1), 101–115. doi:10.1016/j.ijproman.2013.03.004

Tatham, P., Kovács, G. & Larson, P. (2010). What skills and attributes are needed by humanitarian logisticians - a perspective drawn from international disaster relief agencies. *Production and Operations Management (POMS) 21st Annual Conference. Canada*. Retrieved from https://www.pomsmeetings.org/confproceedings/015/fullpapers/015-0179.pdf

The United Nations Office for Disaster Risk Reduction (2015). *Sendai Framework for Disaster Risk Reduction 2015-2030.* Retrieved from www.wcdrr.org

Thiry, M. (2001). Sensemaking in value management practice. *International Journal of Project Management, 19*(2), 71–77. doi:10.1016/S0263-7863(00)00023-5

Thomas, J., & Mengel, T. (2008). Preparing project managers to deal with complexity—Advanced project management education. *International Journal of Project Management, 26*(3), 304–315. doi:10.1016/j.ijproman.2008.01.001

Thompson, C. A., Foster, A., Cole, I., & Dowding, D. W. (2005). Using social judgement theory to model nurses' use of clinical information in critical care education. *Nurse Education Today, 25*(1), 68–77. doi:10.1016/j.nedt.2004.10.003

Trivedi, A., & Singh, A. (2016). A hybrid multi-objective decision model for emergency shelter location-relocation projects using fuzzy analytic hierarchy process and goal programming approach. *International Journal of Project Management.* (In Press). doi:10.1016/j.ijproman.2016.12.004

Tun, L. M., & Pathranarakul, P. (2006). An integrated approach to natural disaster management: Public project management and its critical success factors. *Disaster Prevention and Management: An International Journal, 15*(3), 396–413. doi:10.1108/09653560610669882

Turner, J. R., & Müller, R. (2003). On the nature of the project as a temporary organization. *International Journal of Project Management, 21*(1), 1–8. doi:10.1016/S0263-7863(02)00020-0

Vidal, L.-A., Marle, F., & Bocquet, J.-C. (2011). Measuring project complexity using the analytic hierarchy process. *International Journal of Project Management, 29*(6), 718–727. doi:10.1016/j.ijproman.2010.07.005

Walker, D. H. T., & Steinfort, P. (2013). Using an improved rich pictures approach to improve project situational analysis in complex aid reconstruction development projects. *International Journal of Disaster Resilience in the Built Environment, 4*(2), 182–198. doi:10.1108/IJDRBE-12-2011-0043

Wang, M., Li, Q., Hu, Q., & Zhou, M. (2013). Quality analysis of open street map data. 8th *International Symposium on Spatial Data Quality*, *Hong Kong*, *XL-2/W1*, 155–158 Doi: 10.5194/isprsarchives-XL-2-W1-155-2013

Weber, K., & Glynn, M. A. (2006). Making sense with institutions: Context, thought and action in Karl Weick's theory. *Organization Studies, 27*(11), 1639–1660. doi:10.1177/0170840606068343

Weeks, M.R. (2007). Organizing for disaster: Lessons from the Military. *Business Horizons, 50*(6), 479–489. doi:10.1016/j.bushor.2007.07.003

Weick, K. E. (1979). *The social psychology of organizing* (2nd ed.). Reading, MA: Addison-Wesley Publishing Company.

Weick, K. E. (2010). Reflections on enacted sensemaking in the Bhopal disaster. *Journal of Management Studies, 47*(3), 537–550. doi:10.1111/j.1467-6486.2010.00900.x

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science, 16*(4), 409–421. doi:10.1287/orsc.1050.0133

White, D., & Fortune, J. (2002). Current practice in project management—an empirical study. *International Journal of Project Management, 20*(1), 1–11. doi:10.1016/S0263-7863(00)00029-6

Whiteman, G., & Cooper, W. H. (2011). Ecological sensemaking. *Academy of Management Journal, 54*(5), 889–911. doi:10.5465/amj.2008.0843

Wickens, C. D., & Hollands, J. (2002). *Engineering psychology and human performance* (3rd ed.). New Jersey: Prentice Hall.

Wideman, R. M. (1989). Successful project control and execution. *International Journal of Project Management, 7*(2), 109–113. doi:10.1016/0263-7863(89)90024-0

Wiederhold, B.K. (2013). In a disaster, social media has the power to save lives. *Cyberpsychology, Behavior, and Social Networking. 16*(11), 781-782. doi: 10.1089/cyber.2013.1532

Wiggins, M. W. (2013). Making sense of sustainability: A cue-based approach to sustainable organisational performance. In G. Avery & B. Hughes (Eds.), *Fresh thoughts in sustainable leadership*. Melbourne, Australia: Tilde University Press.

Wiggins, M. W. (2014). Differences in situation assessments and prospective diagnoses of simulated weather radar returns amongst experienced pilots. *International Journal of Industrial Ergonomics, 44*(1), 18–23. doi:10.1016/j.ergon.2013.08.006

Wiggins, M. W. (2015a). Cues in diagnostic reasoning. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 1–10). Surrey, England: Ashgate Publishing Limited.

Wiggins, M. W. (2015b). Diagnosis and instructional systems design. In M. W. Wiggins & T. Loveday (Eds.), *Diagnostic expertise in organizational environments* (pp. 69–80). Surrey, England: Ashgate Publishing Limited.

Wiggins, M. W., Azar, D., Hawken, J., Loveday, T., & Newman, D. (2014). Cue-utilisation typologies and pilots' pre-flight and in-flight weather decision-making. *Safety Science, 65*, 118–124. doi:10.1016/j.ssci.2014.01.006

Wiggins, M. W., Brouwers, S., Davies, J., & Loveday, T. (2014). Trait-based cue utilization and initial skill acquisition: Implications for models of the progression to expertise. *Frontiers in Psychology, 5*, 541. doi:10.3389/fpsyg.2014.00541

Wiggins, M. W., Loveday, T., & Lyons, L. (2014). Cue and cue-based processing: Implications for system safety. *Procedia Engineering, 84*, 55–61. doi:10.1016/j.proeng.2014.10.409

Wiggins, M. W., & O'Hare, D. (2003). Expert and novice pilot perceptions of static in-flight images of weather. *The International Journal of Aviation Psychology, 13*(2), 173–187. doi:10.1207/S15327108IJAP1302_05

Willems, A., Waxman, B., Bacon, A. K., Smith, J., & Kitto, S. (2013). Interprofessional non-technical skills for surgeons in disaster response: A literature review. *Journal of Interprofessional Care, 27*(5), 380–386. doi:10.3109/13561820.2013.791670

Williams, J., Nocera, M., & Casteel, C. (2008). The effectiveness of disaster training for health care workers: A systematic review. *Annals of Emergency Medicine, 52*(3), 211–222.e212. doi:10.1016/j.annemergmed.2007.09.030

Williams, T., Klakegg, O. J., Walker, D. H., Andersen, B., & Magnussen, O. M. (2012). Identifying and acting on early warning signs in complex projects. *Project Management Journal, 43*(2), 37–53. doi:10.1002/pmj.21259

Winter, M., Smith, C., Morris, P., & Cicmil, S. (2006). Directions for future research in project management: The main findings of a UK government-funded research network. *International Journal of Project Management, 24*(8), 638–649. doi:10.1016/j.ijproman.2006.08.009

Wong, C.-S., & Law, K. S. (2002). The effects of leader and follower emotional intelligence on performance and attitude: An exploratory study. *The Leadership Quarterly, 13*(3), 243–274. doi:10.1016/S1048-9843(02)00099-1

Wright, A. (2005). The role of scenarios as prospective sensemaking devices. *Management Decision, 43*(1), 86–101. doi:10.1108/00251740510572506

Yang, Q., Lu, T., Yao, T., & Zhang, B. (2014). The impact of uncertainty and ambiguity related to iteration and overlapping on schedule of product development projects. *International Journal of Project Management, 32*(5), 827–837. doi:10.1016/j.ijproman.2013.10.010

Zhang, D., Zhou, L., & Nunamaker Jr, F.J. (2002). A knowledge management framework for the support of decision making in humanitarian assistance/ disaster relief. *Knowledge and Information Systems, 4*(3), 370–385.

Zhang, L. (2013). Managing project changes: Case studies on stage iteration and functional interaction. *International Journal of Project Management, 31*(7), 958-970. doi:10.1016/j.ijproman.2012.11.014

Appendices

Appendix A: Construction Management and Economics (2016) Publication

(Removed for copyright purposes)

Appendix B: Ethics Approval Letters

Study 1

MACQUARIE University

RE: HS Ethics Final Approval (5201200812)(Condition met)

Fhs Ethics <fhs.ethics@mq.edu.au> Thu, Nov 15, 2012 at 10:10 AM

To: A/Prof Mark Wiggins <mark.wiggins@mq.edu.au>

Cc: Ms Eva Marie Gacasan <eva-marie.gacasan@students.mq.edu.au>

Dear A/Prof Wiggins,
Re: "University Project Management Assessment"(5201200812)
Thank you for your recent correspondence. Your response has addressed the issues raised by the Faculty of Human Sciences Human Research Ethics Sub-Committee and you may now commence your research.
This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:
http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.
The following personnel are authorised to conduct this research:
A/Prof Mark Wiggins
Ms Eva Marie Gacasan

Please note the following standard requirements of approval:
1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).
2. Approval will be for a period of five (5) years subject to the provision of annual reports.
Progress Report 1 Due: 15th November 2013
Progress Report 2 Due: 15th November 2014
Progress Report 3 Due: 15th November 2015
Progress Report 4 Due: 15th November 2016
Final Report Due: 15th November 2017
NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.
Progress reports and Final Reports are available at the following website:
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/

human_research_ethics/forms
3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Sub-Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).
4. All amendments to the project must be reviewed and approved by the Sub-Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms
5. Please notify the Sub-Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.
6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:
http://www.mq.edu.au/policy
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy
If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have final approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.
If you need to provide a hard copy letter of Final Approval to an external organisation as evidence that you have Final Approval, please do not hesitate to contact the Ethics Secretariat at the address below.
Please retain a copy of this email as this is your official notification of final ethics approval.

Yours sincerely,

Dr Peter Roger
Chair
Faculty of Human Sciences Ethics Review Sub-Committee
Human Research Ethics Committee
****
Faculty of Human Sciences - Ethics
Research Office
Level 3, Research HUB, Building C5C
Macquarie University
NSW 2109
Ph: +61 2 9850 4197
Fax: +61 2 9850 4465

Email: fhs.ethics@mq.edu.au
http://www.research.mq.edu.au/

Study 2

RE: HS Ethics Application - Approved (5201300800)(Subject to Condition/s)

Fhs Ethics <fhs.ethics@mq.edu.au> Wed, Jan 29, 2014 at 2:08 PM

To: Associate Professor Mark Wiggins <mark.wiggins@mq.edu.au>

Cc: Ms Eva Marie Gacasan <eva-marie.gacasan@students.mq.edu.au>

Dear A/Prof Wiggins,
Re: "Situation Assessment in the Context of Project Management"(5201300800)
Thank you for your recent correspondence. Your response has addressed the issues raised by the Faculty of Human Sciences Human Research Ethics Sub-Committee, effective 29th January 2014. This email constitutes ethical approval only.
This approval is subject to the following condition/s:
1. Please forward consent of the intermediaries to the Sub-Committee once obtained;
2. Please provide a copy of the advertisement and the link to the online assessment tool when they are available.
This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:
http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.
The following personnel are authorised to conduct this research:
A/Prof Mark Wiggins
Ms Eva Marie Gacasan
NB. STUDENTS: IT IS YOUR RESPONSIBILITY TO KEEP A COPY OF THIS APPROVAL
EMAIL TO SUBMIT WITH YOUR THESIS.
Please note the following standard requirements of approval:
1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).
2. Approval will be for a period of five (5) years subject to the provision of annual reports.
Progress Report 1 Due: 29th January 2015
Progress Report 2 Due: 29th January 2016
Progress Report 3 Due: 29th January 2017
Progress Report 4 Due: 29th January 2018

Final Report Due: 29th January 2019
NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.
Progress reports and Final Reports are available at the following website:
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms
3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).
4. All amendments to the project must be reviewed and approved by the Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms
5. Please notify the Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.
6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:
http://www.mq.edu.au/policy/
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy
If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.
If you need to provide a hard copy letter of approval to an external organisation as evidence that you have approval, please do not hesitate to contact the FHS Ethics at the address below.
Please retain a copy of this email as this is your official notification of ethics approval.

Yours sincerely,

Dr Peter Whiteman
Deputy Chair
Faculty of Human Sciences
Human Research Ethics Sub-Committee

Faculty of Human Sciences - Ethics
Research Office
Level 3, Research HUB, Building C5C
Macquarie University
NSW 2109
Ph: +61 2 9850 4197
Fax: +61 2 9850 4465
Email: fhs.ethics@mq.edu.au
http://www.research.mq.edu.au/

Study 3

MACQUARIE University

RE: HS Ethics Application - Approved (5201401123)(Con/Met)

Fhs Ethics <fhs.ethics@mq.edu.au> Mon, Feb 16, 2015 at 12:32 PM

To: Professor Mark Wiggins <mark.wiggins@mq.edu.au>

Cc: Ms Eva Marie Gacasan <eva-marie.gacasan@students.mq.edu.au>

Dear Professor Wiggins,
Re: "Sensemaking in Project Management"(5201401123)
Thank you very much for your response. Your response has addressed the issues raised by the Faculty of Human Sciences Human Research Ethics Sub-Committee and approval has been granted, effective 16th February 2015.
This email constitutes ethical approval only.
This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:
http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.
The following personnel is authorised to conduct this research:
Ms Eva Marie Gacasan
Professor Mark Wiggins
Please note the following standard requirements of approval:
1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).
2. Approval will be for a period of five (5) years subject to the provision of annual reports.
Progress Report 1 Due: 16th February 2016
Progress Report 2 Due: 16th February 2017
Progress Report 3 Due: 16th February 2018
Progress Report 4 Due: 16th February 2019
Final Report Due: 16th February 2020
NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.
Progress reports and Final Reports are available at the following website:
http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms
3. If the project has run for more than five (5) years you cannot renew

approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Sub-Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Sub-Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website: http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5. Please notify the Sub-Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites: http://www.mq.edu.au/policy http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

If you need to provide a hard copy letter of approval to an external organisation as evidence that you have approval, please do not hesitate to contact the Ethics Secretariat at the address below.

Please retain a copy of this email as this is your official notification of ethics approval.

Yours sincerely,

Dr Anthony Miller
Chair
Faculty of Human Sciences
Human Research Ethics Sub-Committee

Faculty of Human Sciences - Ethics
Research Office
Level 3, Research HUB, Building C5C
Macquarie University
NSW 2109
Ph: +61 2 9850 4197
Fax: +61 2 9850 4465
Email: fhs.ethics@mq.edu.au
http://www.research.mq.edu.au/

Appendix C: Inventory of Sensemaking Studies in Project Management Publications

Table 1

Inventory of Sensemaking Studies in Project Management

Author	Aspects of Sensemaking	Nature of Study
Fellows and Liu (2016)	Identified the links between individual and collective sensemaking, and cultural sensemaking in cross-cultural context of projects	Review of sensemaking literature
Laine, Korhonen, and Martinsuo (2016)	Identified sensemaking as a social process that enhances program impact management practice; Observed a process of collective sensemaking through different expressions of ideas and opinions relating to uncertainty and ambiguity	Case study
Musca, Mellet, Simoni, Sitri, & de Vogüé (2014)	Described sensemaking based on four discursive practices: re-wording, reframing, focusing attention, and reaffirming team cohesiveness to construct and accept project renewal	Case study
Metcalfe and Sastrowardoyo (2013)	Illustrated sensemaking through an argument mapping method to make complexity and conflicts explicit Argument mapping uses "warrants and rebuttals as well as dialectic, providing a creative, rigorous and auditable, mutable mobile." (p. 1134)	Case illustration/ theoretical paper
Pollack, Costello, and Sankaran (2013)	Identified actor-network theory (ANT) as a framework to study sensemaking As a research methodology, "ANT primarily focuses on tracing networks of associations between actors, building understanding of interaction and organisation without imposing pre-determined structure." (p. 119)	Case studies
Koskinen (2012)	Sensemaking as a process in organisational learning: "Sensemaking and negotiation of meaning are ongoing processes in project-based companies. Their roles are particularly strong within the projects in which the organizational learning takes place through problem solving activities." (p. 44)	Theoretical Paper
Pellegrinelli and Webster (2011)	Illustrated sensemaking of a business transformation program through multi-paradigmatic perspectives including radical humanist, radical structuralist, interpretive, and functionalist paradigms	Case study
Sampo, Kirsi, and Mervi (2010)	Illustrated how sensemaking processes between project managers within the same team but from different cultural backgrounds yielded highly divergent responses to the same unexpected event	Case study

Papadimitriou and Pellegrin (2007)	Identified intermediary objects of design (IOD) as media for the sensemaking process in projects. IODs "include all objects such as designs, prototypes, descriptive documents, and pilot implementation produced by the project team and enclosing an intermediary representation of the final deliverable." (p. 437)	Case study/ participant observation
L. Simon (2006)	Discussed sensemaking in terms of the project manager's roles: as sense-maker, a web-weaver, a game-master and a flow-balancer	Case studies
Alderman et al. (2005)	Illustrated how sensemaking was framed by the different narratives employed by different communities, stakeholders, and other interest groups, during the different project phases including seeding, negotiation, and accomplishment	Case study
Thiry (2001)	Identified sensemaking as a first step in value management (VM) intervention; Functional analysis ('How-Why' relationship of functions), or its equivalent, including an information- communication phase, is the basis of the VM intervention's sensemaking process.	Theoretical paper