
Safety-related improvisation in led outdoor activities: An exploratory investigation into its occurrence and influencing factors

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Abstract

The dynamic nature of led outdoor activities means that, despite activity providers' best efforts, activity leaders can be exposed to unanticipated situations for which no procedures exist. Improvisation, the spontaneous, real-time conception and execution of a novel response, has been identified as a potential means of maintaining safety in such situations in other safety critical domains. This study examines improvisation in the led outdoor activity context with the intention of adding to the body of knowledge around activity leader decision making. In this exploratory investigation a survey study was undertaken in order to determine whether safety-related improvisation occurs during led outdoor activities, and also to identify the circumstances in which it occurs, the form it takes, and to establish by what factors it is influenced. Over 50% of respondents reported improvising in at least half of their activities, commonly as the result of unanticipated environmental conditions and/or the need for easier procedures. Respondents identified a range of factors that influenced their ability to improvise, many of which overlap with those found in other safety critical domains, but some that appear to be unique to led outdoor activities.

Keywords: Improvisation, safety critical situations, led outdoor activities

Introduction

Led outdoor activities (LOA), defined here as instructed activities taking place in an outdoor setting that have an educational goal associated with them, can involve a degree of uncertainty and risk. Participating in LOA activities that involve an acceptable level of risk can be beneficial as they provide an opportunity for participants to engage with risk, to test their capabilities, and to learn from mistakes (Cline, 2007; Dickson, 2012). Despite LOA organisations' best efforts to keep levels of risk acceptable, the dynamic environment in which many LOAs take place means that LOA leaders and their participants can sometimes find themselves in situations that their organisation has not anticipated, and hence are outside their organisation's procedures or their own experiences or knowledge. These situations may have the potential to negatively impact the safety of the activity leaders and participants. Research from other domains has shown that one means of devising solutions to such unplanned for safety critical situations is through improvisation (e.g. Weick, 1993; Mendonça, 2007; Grøtan, Størseth, Rø, & Skjerve, 2008). This study considers safety-related improvisation in LOAs.

Improvisation is an ambiguous concept in relation to safety. Inappropriately devised or poorly executed improvisation has contributed to adverse outcomes for activity leaders and participants. Examples include the Mangatepopo Gorge incident in 2008, in which six students and their teacher were swept over a spill weir and drowned after following

their LOA leader's improvised plan to exit the flooded Mangatepopo gorge in New Zealand (Brookes, Smith, & Corkill, 2009), and the Ptarmigan Peak incident in Alaska, in which two students died after the failure of the improvised roping and anchoring system devised by the activity leaders led to all four roped climbing groups becoming detached from the slope and falling into a boulder field (Williamson, Ratz & Miller, 1997). To the contrary, evidence from other safety critical domains such as firefighting and emergency response services (e.g. Klein, 1999, pp.19-20; Bigley & Roberts, 2001; Roux-Dufort and Vidiallet, 2003), and aviation (e.g. National Transportation Safety Board, 2010) indicates that appropriate, effective improvisation can save lives. This suggests that improvisation by LOA leaders and their organisations, if appropriate and effective, may also have the potential to impact positively on the safety of participants and leaders in the event that they find themselves in an unanticipated, safety critical situation. An improved understanding of improvisation in relation to LOAs may, therefore, provide new insights into safety for LOA organisations. As a first step in this line of inquiry, research is required to understand the nature of improvisation during LOAs.

This article presents the findings from an exploratory study that was undertaken as part of a wider research program examining improvisation by LOA leaders. Specifically, a survey study was undertaken to provide broader evidence that improvisation takes place in safety critical situations within the LOA domain. The aims of this study were to identify the circumstances in which safety-related

improvisation occurs, the forms in which it manifests, and to establish what factors influence safety-related improvisation by LOA leaders.

What is improvisation?

Improvisation, as it is referred to in this study, is an adaptive strategy used when faced with situations for which no procedures exist, or where circumstances prevent known procedures from being deployed. It is not considered as a replacement for well designed emergency procedures. Various definitions of improvisation exist in the literature. For example, it is defined as “creative and spontaneous behaviour of managing an unexpected event” (Magni, Proserpio, Hoegl, & Provera, 2009, p. 1045), and an unplanned response that takes place in a turbulent, rapidly changing environment (Chelariu, Johnston, & Young, 2002). The definitions tend to converge on three elements (Størseth et al. 2009): first, improvisation involves a behavioural or cognitive time-constraining activity to meet certain objectives; second, a close proximity in time between planning and execution of an action; and third, a deviation from existing practices or knowledge. These three elements form the basis of the definition adopted in this study: improvisation represents the spontaneous and real-time conception and execution of a novel solution to an event that is beyond the boundaries for which an organisation has anticipated or prepared.

The boundaries of the concept of improvisation are unclear. Improvisation is by no means the only purposeful response to unplanned events; innovation, creativity, adaptation and bricolage all overlap to an extent. It is a temporal element, the convergence between the conception of a response and its execution that is considered a key factor in distinguishing improvisation from these concepts (Moorman and Miner 1998; Chelariu et al. 2002). The exact timeframe of this convergence, however, has yet to be clarified, hence the phrase “close proximity” adopted by Størseth et al. (2009).

The inclusion of “novelty” or “deviation” in the definition also contributes to the ambiguity surrounding the concept. Historically, novel responses have been categorised as falling into discrete categories (e.g. Weick, 1998). In more recent literature, however, improvisation has been described as a continuum of novelty (e.g. Vera and Crossan 2005), with behaviours described as interpretations, embellishments and variations (originally excluded from the definition of improvisation by Weick 1998) all included as improvisations occurring at varying points on the continuum. This study adopts the latter approach so that all instances of interpretation, embellishment and variation, so long they have not previously been performed or known of by the improviser, are

considered improvisations. In adopting this approach it is acknowledged that much of what LOA leaders do routinely in relation to educating their participants, such as making use of teachable moments, could be said to involve some degree of improvisation. This study, however, focuses on improvisation as it relates to maintaining participant safety during LOAs.

Safety-related improvisation in led outdoor activities

Decision making is an essential component of improvisation (Mendonça, 2007) and there is a wide body of literature surrounding decision making by LOA leaders. Literature focusing on LOA decision making, problem solving, and judgement in safety critical situations in LOAs can, therefore, shed important light on the factors that influence improvisation in these situations. The following discussion draws together the studies from this literature that are of most relevance to improvisation decision making.

With reference to the components of the definition of improvisation adopted in this study, of particular relevance is LOA literature that examines decisions that: must be made and then performed almost simultaneously; are required before information and desired end goals of a situation can necessarily be established, and where the performance of the responses must constantly be updated as actions reveal more information about the situation and determine new goals (see flexecution in Klein, 2007a, 2007b); and/or involve deciding on a novel course of action rather than weighing known alternatives (see discussion of the continuum of novelty above). Improvised decisions involve devising a response that is different to anything the improviser has been trained to do, has experience with, or has heard of before.

Judgement, problem solving and decision making are considered to be core skills of LOA leaders, which can be enhanced through experience, practice, networking and commitment to continuous improvement through education (Green, 1990). Shooter, Sibthorp & Paisley (2009) view judgement and decision making as a mediator between program specific components, such as course goals, the natural environment and the group size, technical skills (e.g. planning and logistics and wilderness medicine), and interpersonal skills (e.g. relationship building and facilitation). These factors are similar to a number of factors that have been found to influence safety-related improvisation in other domains: experience and expertise (Klein, 1999; Vera & Crossan, 2005; Grøtan et al., 2008; Kahneman & Klein, 2009), education (Kontogiannis & Linou, 2000; Hockey, Sauer & Wastell, 2007), and teamwork (Vera & Crossan, 2005).

The remaining factors – networking and interpersonal skills and the natural environment – are also likely to influence improvisation but may be specific to the LOA domain.

Tozer, Fazey and Fazey (2007) examined adaptive expertise, defined as the “ability to perform flexibly and innovatively in novel and unstructured situations” (p.55). Adaptive experts are capable of “drawing on their knowledge to invent new procedures for solving unique or fresh problems, rather than simply applying already mastered procedures” (pg.60). While this lacks the temporal element inherent in the definition of improvisation, the concepts are very similar. Tozer et al. describe four factors that assist the development of adaptive expertise: Practice, variation in practice, reflection, and good thinking. Practice variation is particularly relevant given that improvisation is a means of varying performance in novel situations. Tozer et al. identify five aspects of practice that can be varied: (1) the intended outcome; (2) the criteria by which the outcome is judged; (3) the way a task is carried out or experienced; (4) the reason for which the learning or task is undertaken; and (5) the perspective a person can take. These have implications for how training could enhance LOA leaders’ ability to improvise when faced with safety critical situations.

Studies examining heuristics used in LOA decision making tend to involve contexts that do not require improvisation, for example a decision as to whether or not to take a group skiing on a particular slope does not require simultaneous conception and execution nor does it necessarily require a novel response. Despite this, some of these heuristics may also influence improvisation, particularly the component of improvised decision making in which the LOA leader decides when an improvised response is necessary. For example, ignoring red flags, force fitting information to the situation, sticking rigidly to schedules (Ewert, Shellman & Glenn, 2006), or continuing to work to a commitment (Furman, Shooter & Schumann, 2010) may mean that a leader continues with a procedure or activity when the circumstances have changed sufficiently so that the procedure or activity can no longer be deployed as specified and hence improvisation would be required.

Studies that have examined LOA decision making from a naturalistic decision making perspective have also identified influencing factors similar to those found to influence improvisation in other domains. Boyes and O’Hare (2003) used Cognitive Task Analysis methods to produce a model of decision making involving three components: Leader’s situation awareness, (environment, people and task factors); situation assessment of challenge level; and resource management. In a subsequent study the researchers used computer simulations to examine the impact of

these components on the decision making processes of expert versus proficient leaders (Boyes & O’Hare, 2011). Overall, the information categories accessed the most by the leaders were intentions, hazards and shelter. Expert leaders accessed and spent more time looking at information screens pertaining to environment and people factors than did proficient leaders. Experts also demonstrated more serial-based processing in their decision making, with familiarity with the venue found to be a significant covariate. Situation awareness and sensemaking have been shown to influence improvisation in other safety critical domains (e.g. Weick, 1993; Mendonça, 2007). Boyes and O’Hare’s (2003; 2011) studies indicate that in the LOA field, increased knowledge of the environment (particularly the specific area in which an activity is taking place) and the students and other leaders involved in the situation may help leaders obtain more accurate levels of situation awareness, thereby enhancing their ability to improvise.

Along with individual level factors, LOA decision making studies have also revealed the influence of team level factors, such as participant factors and group dynamics factors, as well as the impact of the environmental factors. For example, Galloway (2007) used hierarchical liner modelling to examine the factors that influenced leaders’ decisions to evacuate in response to medical emergency scenarios described in vignettes. Individual level factors were found to be the most significant predictors of the decision to evacuate: the level of student injury was the most significant predictor, followed by the degree of isolation. Leaders were more likely to decide to evacuate when students were more severely injured and more likely to push on when more isolated. Group cohesion was also a significant predictor, with greater cohesion making leaders more likely to push on. More experienced leaders were less likely to be influenced by group cohesiveness than less experienced leaders. Less experienced leaders were also more likely to focus on the structural and procedural aspects of the medical decision, leaving them with diminished capacity to attend to and develop more advanced problem-solving options (Galloway, 2007).

Martin, Schmid and Parker (2009) also identified group cohesion as a factor influencing judgement and decision making, along with participant readiness, physical safety, environmental impact, and educational mindset. Their data was obtained using a qualitative methodology involving the triangulation of data from interviews, observations and artefacts. Team level factors have been shown to influence improvisation in other domains and these studies demonstrate they may also do so in the LOA field.

The LOA literature discussed above goes some way toward identifying factors that may influence improvisation in the LOA domain, however, because these studies do not examine improvisation situations specifically, there are important gaps in the knowledge base surrounding improvisation. These include how common safety-related improvisation is in LOAs, what activities it might occur in, and what it might look like. Also, with the exception of some team level factors identified in naturalistic decision making studies, the factors identified above reside mainly at the individual level of the system (i.e. instructor-related factors e.g. experience, expertise, training, education, situation awareness). Studies of improvisation have identified other influencing factors at the team and organisational levels, such as team work quality, information flow, communication, organisational culture, organisational memory, organisational structure (Trotter, Salmon, & Lenné, 2012). The gaps in knowledge existing around the relevance of these, and other higher level factors to safety-related improvisation in LOAs, require investigation. This survey represents an initial attempt to address these gaps.

Method

Respondents

Respondents were 157 employees (112 Male, 45 Female) of Australian LOA providers aged from 19 to 67 years old. All respondents were currently employed by LOA providers either as activity leaders, supervisors or managers. Participation was voluntary. This study was approved by the Monash University Human Research Ethics Committee.

Participant recruitment and response rate

Recruitment initially involved the distribution of hard copies of the survey to two Victorian outdoor activity organisations who had agreed to participate in the study. The first of these organisations is one of the largest in Australia and offers both centre-based and journey-based programs to schools. The second organisation is a smaller, Victorian organisation that offers camp-based, single-day and journey-based programs to both schools and corporate clients. The surveys were distributed at the organisations' annual staff days. A member of the research team attended the staff days and gave a presentation to staff introducing the project and describing and giving examples of the safety-related improvisations relevant to the survey. Ninety surveys were distributed at the organisations' annual staff days and 35 were completed and returned either at the staff day or by mail in prepaid envelopes, giving a response rate of 39%.

In order to increase the number of respondents an online survey was used. This involved distributing the link to the online version through Australian outdoor activity providers' networks. Organisations in these networks include both journey-based and camp-based providers. Providers who received the link were encouraged to advertise it to their staff via newsletters, meetings, notice boards and other forms of staff communication. 181 respondents initiated the online survey. Of these, 56 were excluded as they went no further than the two compulsory entry questions (41) or no further than the initial demographic questions (15). Another three were excluded as they were not currently employed. In total 122 people completed the online survey, a completion rate of 67%. Data from the 122 online respondents were combined with 35 hard copy respondents, giving a total of 157 for analysis.

Survey tool

A self-report, pen and paper survey was developed to gather information on when, where and in what form LOA employees might improvise in relation to safety and what factors influence their ability to improvise in safety critical situations. The questions were developed based on an extensive literature review of improvisation in safety critical situations (Trotter et al., 2012). Questions were included to ensure information was collected about all the factors identified in the literature as potentially influencing improvisation. Lists of LOAs and Outdoor Recreation qualifications were obtained through review of documents and discussion with members of a participating LOA organisation. After an initial draft was developed by the authors, the survey was reviewed and piloted by six Human Factors experts to ensure the questions were unambiguous and easy to complete.

Both the hard copy and online versions of the survey began with an explanation of improvisation and how it might occur in safety critical situations. A number of LOA specific examples were given and respondents were instructed to think about improvisations that they have performed in the course of their work in order to maintain the safety of their participants. In the online version the definition of improvisation was placed at the top of every page on which respondents were asked about improvisation.

The survey consisted of 37 questions in total, with several comprising multiple items. Questions 1 to 13 collected demographic, employment and qualifications data, questions 14 to 21 asked about the occurrence and nature of safety-related improvisation in LOAs, and questions 22 to 37 examined factors influencing improvisation in safety critical situations in LOAs. Questions 23 onward asked respondents

specifically about each of the factors identified in the literature (Trotter et al., 2012) as potentially influencing improvisation in safety critical situations. These factors were: organisational culture – the organisation’s underlying beliefs, attitudes and values; organisational structure – the organisation’s hierarchy and role system; organisational memory – the information retained and made accessible by the organisation; organisational learning – how the organisation learns from incidents; information flows and communications – how information gets from one person to another within the organisation; teamwork quality – how well team members are able to work together; team leadership – style and competency of team leaders; situation awareness – the ability to identify, interpret and understand a situation; experience – including both LOA specific and non LOA experience; skill and expertise – technical competencies of leaders; training and education – practical and theoretical knowledge gain through formal means; and systemic knowledge – knowledge of the entire system, the roles each member of the system plays and how an individual’s actions will affect different parts of the system.

Following the distribution of the hard copy version, the survey was transformed into an online version which was run using the online software tool SurveyMonkey™ and was live for six months from April to September 2012.

Data entry and analysis

The completed hard copy surveys were entered into a Microsoft Excel spreadsheet. Data from the online version was downloaded from Survey Monkey™ in Microsoft Excel format upon closure of the survey, and both sets of data were merged into a master Microsoft Excel spreadsheet.

Respondents’ answers to each question were collated, with responses to most questions summarised using descriptive statistics (frequencies, averages). Responses to open ended questions were imported into NVivo 9™, a qualitative data analysis software package, and coded for themes. One human

factors analyst performed the initial coding. Identified themes were then reviewed by a second analyst upon completion. Any discrepancies or disagreements between the two analysts were resolved through discussion until consensus was reached.

Results

Participant characteristics

Table 1 presents a summary of respondents’ demographic data and involvement in the LOA field. Half of the respondents were leaders, with the other half identifying as either managers or supervisors. Respondents had been employed in the LOA field between 1 and 45 years (mean = 12 years, SD 9.5) and spent on average 99 days per year leading LOA in the field.

The majority of respondents were employed in Victoria (31.8%), followed by Queensland (24.8%), Western Australia (23.6%), New South Wales (12.7%), and South Australia (5.7%). The remaining states represented less than 1% each. Respondents held a range of outdoor education qualifications, with over 95% of respondents reporting that they obtained these in Australia. 40% of respondents had a Bachelors degree or higher in an outdoor education related field (e.g. sport and outdoor recreation, leisure studies, exercise science, physical health and education); 26% had a diploma or post-graduate diploma in an outdoor education related field (e.g. education, physical education and outdoor education, outdoor recreation, or outdoor instruction); 47% had Certificate III or IV in outdoor recreation; and 50% had Wilderness First Aid/First Responder/Emergency Medical Technician qualifications.

Online respondents were employed by a range of organisations including schools and universities (23), church and youth groups (17), and other larger multi-activity outdoor/adventure organisations running journey-based programs (14). Although respondents were not asked directly, an examination of the websites and other available information about

Table 1. Summary of demographic and LOA involvement data

Variable	Overall (n=157)	Instructors (n=79)	Supervisors (n=22)	Managers (n=56)
Proportion	100%	50%	14%	36%
Mean age (years) [SD]	38 [12.9]	36 [13.3]	38 [11.7]	41 [9.8]
Male (%)	115 (71%)	52 (66%)	17 (77%)	43 (77%)
Mean no. years in field [SD]	12 [9.5]	10 [9.7]	12 [8.5]	14 [9.3]
Mean days leading per annum [SD]	99 [82.1]	115 [81.0]	99 [85.0]	78 [81.0]

each of the companies that respondents listed as their current employers indicates that the majority of their clients are school aged or university students. For all respondents, the most commonly led activities were bushwalking, followed by canoeing, abseiling and rock climbing.

Improvisation characteristics

All but two respondents (98.7%) reported having to improvise in relation to safety. Almost half (43.9%) reported that they improvised in “a few” of the activities that they led, 11.5% reported they improvised in “about half”, 31.2% in “most” and 12.1% in “every” activity they led. Most respondents believed the amount they improvised reflected the norm in their organisation with just over half (54%) reporting that they thought other employees improvised about as often as they did. The activities in which respondents reported being most likely to improvise reflected the activities most commonly led, with bushwalking and canoeing the activities in which improvisation was most common.

As shown in Figure 1, respondents were most likely to have to improvise as the result of unanticipated environmental conditions, for example, rain in a catchment area that causes a rapid, unexpected rise in river level during a canyoning activity. The next most common reason was participants requiring an easier procedure, for example, midway through a full day hike an asthmatic participant is unable to complete the route despite having initially felt up to the challenge.

This was followed by broken/missing equipment, for example, participants reveal they have forgotten the required equipment for a river crossing that must take place to complete a hiking route.

Figure 2 shows that respondents’ improvisations most commonly involved novel emphasis or embellishments to procedures, for example, extending the period between scheduled communications with base so as not to delay participants in completion of a hike in cold wet weather. Fewer improvisations involved responses with greater novelty such as adding new parts to procedures or coming up with entirely new procedures, such as devising a new way of bringing a capsized kayaking participant back to shore after standard rescue techniques failed. Over 64% believed their improvisation succeeded in making the situation safer for their clients, and a further 31% believed their improvisations did not adversely impact on client safety. No respondents believed their improvisations made the situation less safe. Other impacts of improvisations reported were that their improvisations made the situation/activity more accessible or appropriate to the abilities of their clients and/or made the situation or activity more enjoyable for their clients.

Factors influencing improvisation

Respondents were first asked in an open-ended format what factors they felt influenced their ability to improvise in safety critical circumstances. This question was asked before the factor specific questions

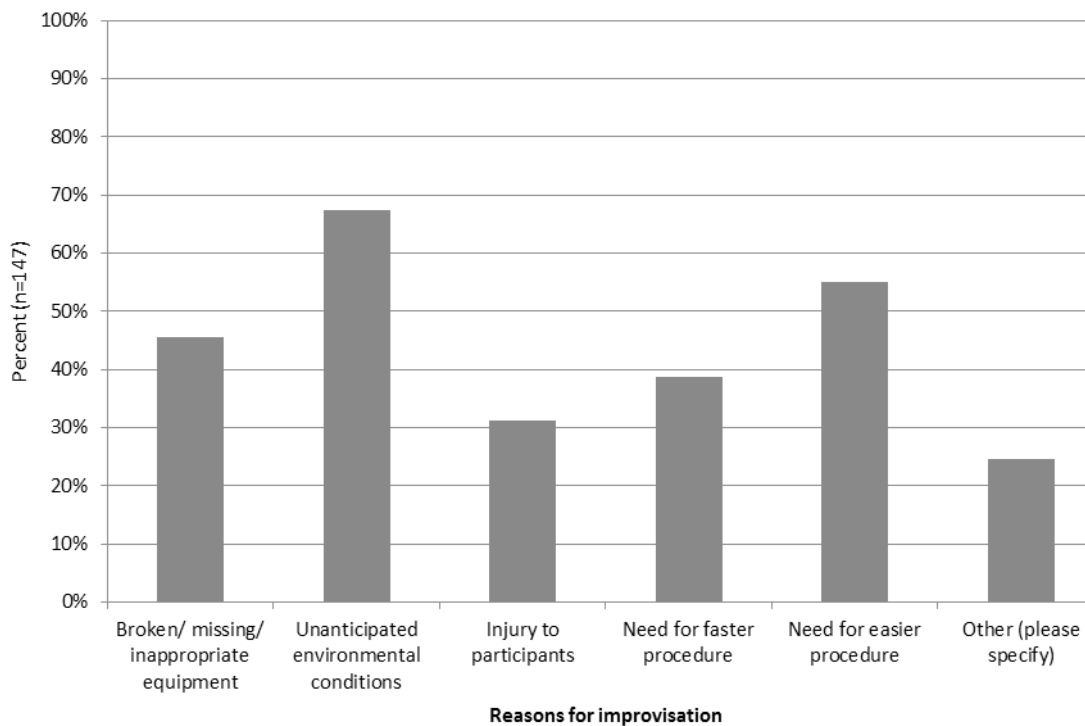


Figure 1. Responses to “What are the main reasons you would improvise?”

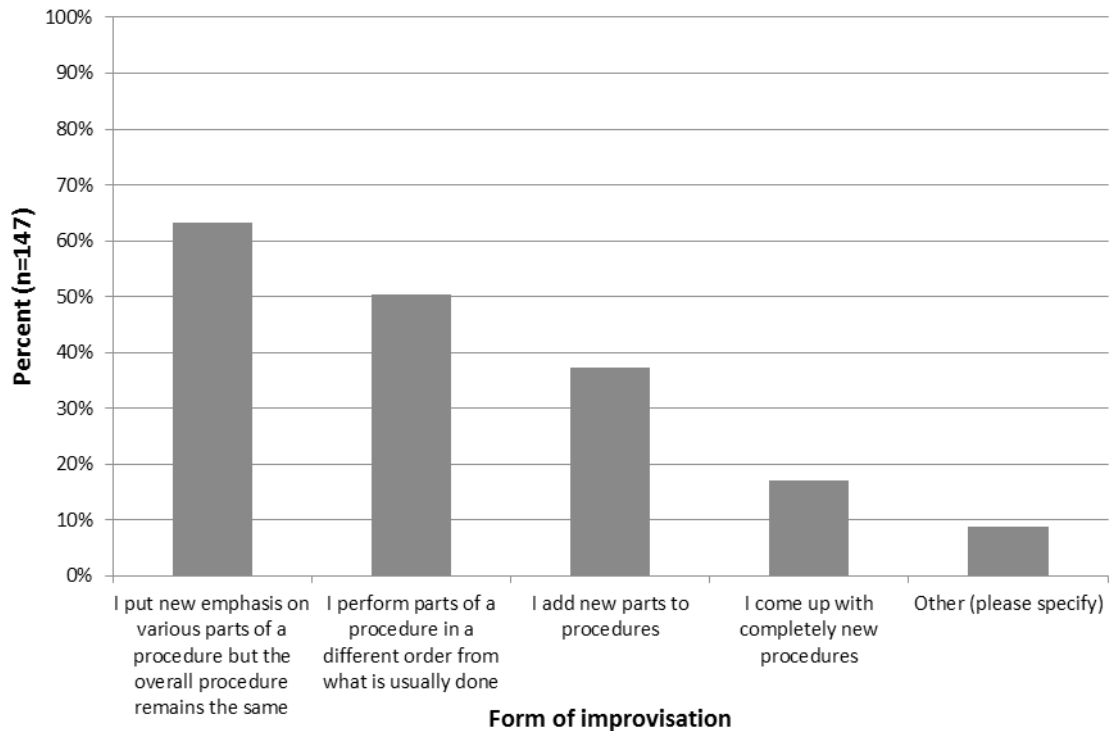


Figure 2. Responses to “How would you describe most of your improvisations?”

so that respondents’ answers were not guided towards specific factors. A content analysis of the responses revealed the factors shown in Table 2. As can be seen, “Experience and knowledge” was the most commonly identified factor influencing respondents’ ability to improvise. Sublevels of this factor included experience in a broad range of other activities (both in the LOA field and outside it), as well as in the specific activity being led at the time improvisation was required (Note, “Not Elsewhere Classified” [NEC] sub-categories are where respondents have only identified the keyword and not provided further detail, e.g. a participant might list “Experience, knowledge”). The second most commonly identified factor was the respondents themselves. Common sublevels of this factor included respondents’ own physical capabilities, skills, cognitive processes (e.g. reflection, creative thinking), and situation awareness. The potential outcomes of the improvisation (particularly in relation to safety); features of the participants being led in the LOA; and features of the environment completed the list of the five most commonly identified factors identified as influencing improvisation.

Next, respondents were asked specifically about each of the factors identified by Trotter et al (2012) as influencing improvisation in other safety critical domains. For each factor, respondents were asked if they felt that at their current LOA employment this factor supported their ability to improvise. Responses of *Strongly agree*, *Agree*, *Disagree* or *Strongly*

disagree were counted as an indication that this factor influenced the respondent’s improvisation (Responses of *Neither agree nor disagree*; *Don’t know*; *This factor does not influence improvisation* were not counted as such). Respondents selecting these options were then asked to complete open-ended questions for each factor, outlining what it was within their organisations that was particularly supportive or unsupportive of their improvisation.

The factors were presented in three sections: organisational level factors, team level factors, and individual level factors. Table 3 presents the proportion of respondents who felt that the factors influenced their improvisation either positively or negatively. In general, a greater proportion of respondents felt individual level factors influenced their ability to improvise, particularly their situation awareness and experience. The exception to this was the factor “systemic knowledge” which had the third lowest percentage overall. A lower proportion of respondents felt organisational factors influenced their ability to improvise, particularly organisational memory and information flows within the organisation. Nevertheless, even for these factors with the lowest proportions, over 50% of respondents felt that the factors influenced their ability to improvise. After each section of factors (organisational, team, individual), respondents were given the opportunity to identify any other factors that they felt influenced their ability to improvise. Additional factors identified

Table 2. Factors identified by respondents as influencing their ability to improvise in safety critical situations in LOA (from open-ended question)

Factors High level - Sublevel	Mentions (n=119)	Percent	Factors High level - Sublevel	Mentions (n=119)	Percent
Experience and knowledge	55	46.2%	Time	23	19.3%
– Experience NEC	27	22.6%	– Time NEC	11	9.2%
– Experience in broad range of activities/environments	8	6.7%	– Constraints	10	8.4%
– Knowledge NEC	7	5.9%	– Of day	2	1.7%
– Experience in the specific activity	5	4.2%	Resources	19	16.0%
– Knowledge of location	3	2.5%	– Equipment	14	11.8%
– Knowledge of risk management	2	1.7%	– Resources NEC	3	2.5%
– Knowledge of unanticipated situations	2	1.7%	– External assistance	2	1.7%
– Knowledge of procedures	1	0.8%	Other staff	15	12.6%
Leaders (respondents)	44	40.0%	– Available assistance	9	7.6%
– Capabilities	13	10.9%	– Capabilities	5	4.2%
– Cognitive processes	12	10.2%	– Influence	1	0.8%
– Situation awareness	8	6.7%	Organisation	15	12.6%
– Confidence	6	5.0%	– Policy and procedure	7	5.9%
– Stress level	5	4.2%	– Support	7	5.9%
Outcomes	41	34.5%	– Finance	1	0.8%
– Safety/Risk	36	30.3%	Training	10	8.4%
– Educational	4	3.4%	– Training NEC	8	6.7%
– Impact on others	1	0.8%	– In broad range of activities/environments	1	0.8%
Participants	37	31.1%	– In risk management	1	0.8%
– Capabilities	21	17.6%	Communications	7	5.9%
– Group characteristics	8	6.7%	Alternatives	2	1.7%
– Injury	3	2.5%	Role responsibilities	2	1.7%
– Participants NEC	5	4.2%	Does not identify factors	6	5.0%
Environment	37	31.1%			
– Weather	15	12.6%			
– Environmental conditions NEC	13	10.9%			
– Location	8	6.7%			
– Impact on environment	1	0.8%			

are also described in Table 3 and included external standards and regulations and resource availability and mobilisation at the organisational level, group dynamics at the team level, and confidence and positivity at the individual level.

Content analysis of the open ended questions pertaining to each factor revealed what respondents found particularly supportive or unsupportive when improvising. At the organisational level, respondents identified incident reviews, debriefings, formal staff communications as aspects of organisational learning particularly supportive of their improvisation. The lack of these communications, and of management interest

in learning from incidents, were identified as aspects that were unsupportive. Organisational structures in which ultimate decision making power lies with the leader in the field, management responsibilities are distributed across systems, and where the structure can change with circumstances were seen as supportive of improvisation. Top down structure and lack of cohesion between management levels was seen as unsupportive. Trusting and supportive management that values diversity and creativity and understands the need to modify procedures in a dynamic environment was identified as an aspect of organisational culture that was supportive of improvisation. A culture in which management are overly focused on prescriptive

Table 3. Percentage of respondents who believe factors identified in the literature influence their improvisation in safety critical situations in LOA and other factors that respondents identified outside of those identified in the literature.

Factor	Influence %	Other factors influencing improvisation
Organisational Factors		
Organisational Learning	79.8%	Mobilisation/availability of resources
Organisational Structure	78.9%	External standards and considerations
Organisational Culture	77.2%	Finances
Organisational Information flow	66.4%	Design of LOA programs/activities/ training
Organisational Memory	51.2%	
Team Factors		
Teamwork	82.7%	Group dynamics
Team Leadership	80.2%	
Individual Factors		
Situation Awareness	96.2%	Positivity/optimism
Experience	95.3%	Self-belief/confidence
Skill	91.5%	Calm under pressure/stress
Training	91.5%	Physical condition
Systemic Knowledge	74.0%	

documentation and are not trusting or supportive was identified as unsupportive. Organisations in which communication lines and brief/debrief processes are clear, where leaders have access to senior staff and are able to receive rapid performance feedback were seen as supportive of improvisation, while lack of clear communication and slow feedback were seen as unsupportive. Aspects of organisational memory that the respondents felt supported their improvisation included incident reporting systems, documentation processes for changes to procedures, and debriefs, while lack of these systems and processes was felt to be unsupportive.

At the team level, respondents identified clear communication, the support and trust of teammates, shared schemas and previous experience working with teammates as aspects of teamwork supportive of improvisation. No unsupportive aspects were identified. A team leader who trusts and supports team members, has a positive relationship with team members, is flexible and listens well was seen as supportive of improvisation, while a rigid, inflexible leader was seen as unsupportive.

At the individual level, respondents felt that first aid and risk management training, practical 'hands on' training, training in a broad range of activities/situations, and training that includes unpractised scenarios and problem solving enhanced their situation awareness, supporting their improvisation. Training that focused on prescriptive processes was seen as negatively affecting respondents' situation awareness and thus as being unsupportive of improvisation. Work and personal outdoor experience

of a broad range of activities, conditions and situations was seen as supportive of improvisation, as was greater life experience in general. Having highly practiced and continuously improving technical skills, both specific to particular activity in which improvisation is required and in a range of different activities, was seen as supportive of improvisation. Respondents identified training in risk management and first aid, training that includes unanticipated scenarios, and that covers a broad range of activities/approaches/techniques as supportive of improvisation. Highly prescriptive, theoretical training and education that does not include critical thinking was identified as unsupportive. Understanding the interactions between different parts of the organisation, the support systems that are in place and the consequences of decisions on other parts of the organisation were aspects of systemic knowledge that were identified as supportive of improvisation, while lack of/poor communications between areas of the organisation was an aspect that was seen as unsupportive.

Discussion

The study presented aimed to explore whether improvisation takes place in safety critical situations within the LOA domain, and if so, to identify in what circumstances, in what forms it occurs and to establish by what factors it is influenced. The results indicate that improvisation does indeed occur in safety critical situations in the LOA domain, most commonly as a result of unanticipated environmental conditions, broken, missing or inappropriate equipment or the need to make a procedure easier for participants. This improvisation takes a range of

forms across the continuum of novelty from relative minor embellishments to procedures, to completely new solutions and according to respondents does not impact negatively on the safety of their participants.

The latter is of interest because incidents such as the Mangatepopo Gorge incident (Brookes et al., 2009) demonstrate that improvisation can, and does, have a negative impact on safety in the LOA domain when it is not appropriate and effective. It is possible that despite the assurance of confidentiality, respondents may have been hesitant to report that on the occasions they have had to improvise, their improvisations have tended to make the situations less safe for participants. Respondents may have been wary of potential repercussions of any such admission from their organisations or their clients. If respondents had not been asked to provide the name of their employers, they may have felt more comfortable responding to this question.

Another possibility is that a proportion of respondents were in fact “freelancing” – performing inappropriate improvisations that do not fit with the extant goals of their organisations and were likely to cause harm to themselves or others (Bigley & Roberts, 2001) – but, because these situations did not result in actual injuries or reportable near misses, are unaware that their improvisations reduced the safety of their participants. This relates to the idea that people with limited knowledge in a domain lack the metacognitive skills necessary to accurately estimate their abilities and in fact hold overly optimistic views of their competency while being unaware of it (Kruger & Dunning, 1999). Increasing the skill level, knowledge and experience of activity leaders is one way LOA organisations could increase the likelihood that leaders’ improvisation would be appropriate.

LOA organisations do not always have the option to employ experienced staff. Where this is the case it is appropriate that organisations modify activity programs to suit the experience level of the staff available. Even in such modified programs however, there is still potential that staff could find themselves in unanticipated safety critical situations. Organisations with relatively inexperienced staff could enhance the likelihood of leaders being able to distinguish appropriate improvisation from inappropriate improvisation in such situations, by ensuring that the organisations’ goals, objectives and expectations around safety are communicated clearly and consistently through all forms of organisational documentation and communication, including mission statements, policies, briefings and informal communications from supervisors and managers. These goals and expectations can then form the limits of what Bigley and Roberts (2001)

describe as “constrained improvisation”: appropriate improvisation can be tolerated within clear boundaries, but anything that crosses the established boundaries is not acceptable. This demonstrates how organisational level factors, such as organisational policy and culture, could interact with the lower level factors mentioned most often by participants, such as experience, knowledge, capabilities and situation awareness to impact on improvisation.

Team level factors could also interact with individual level factors. For example, respondents identified group dynamics as a factor influencing their ability to improvise. While participants did not elaborate extensively on this factor (self-generated responses tended to consist of one or two words only), this fits with Galloway’s (2007) and Martin et al.’s (2009) findings that group cohesion influenced decision making in naturalistic settings. More cohesive groups were less likely to choose to evacuate in a medical emergency (Galloway, 2007). This may mean leaders of more cohesive groups are more likely to attempt improvised solutions before resorting to evacuation, however, the effect of group cohesion was more pronounced for novice leaders than experts. Given that experience was considered one of the most important factors influencing leaders’ ability to improvise, the influence of group cohesion may not necessarily be a positive one. In order to improvise effectively, less experienced leaders may have to overcome the pressures of highly cohesive groups. Organisations could assist leaders in doing so by educating them in the influence of group cohesion on their decision making and performance; making them aware of the relationship so they can take it into account when moving toward an improvised solution.

The impact of higher level factors, particularly factors beyond the organisational level, such as external standards and regulations that participants identified in this study, has been considered less often than individual level factors in the LOA decision making literature. A notable exception is Adams (2005; 2006) who uses a systems approach to examine avalanche decision making and identifies factors at the team, client, organisational and socio-political levels. Given the identification of organisational and regulatory level factors in this study, a similar approach may be useful in describing and modelling the factors influencing improvisation in LOAs. This “systems” way of thinking is not entirely unfamiliar in the LOA field – as well as Adams, LOA accident causation models by Davidson (2007) and Jackson (2010) include higher level factors. Dickson (2012) also includes the social and political context in her whole-of-organisation risk management approach.

Modelling the factors influencing improvisation could be useful in determining how LOA organisations can support appropriate, effective safety-related improvisation, while preventing inappropriate, ineffective improvisation. Any improvisation model specific to LOAs would need to include all the LOA specific factors identified in this study as well as those identified in other safety critical domains and confirmed in this study. It would also need to identify the relationships and interactions between the factors. Such a model is beyond the scope of this study. The survey methodology employed here allowed the identification of factors, an important first step toward understanding improvisation, but could not be used to determine the relationships and interactions between factors. A future study is underway to obtain the data required to determine these interactions and then to create a systems model using data from critical decision method interviews (Klein, Calderwood, & MacGregor, 1989) focusing on improvisation events.

This study also has some other notable limitations. The sample size (157) is reasonably small as a representation of the Australian LOA field, but given the difficulties in accessing respondents due to the remote locations in which many operate, a total of over 100 responses was considered a substantial achievement. The self-selective nature of survey is also a limitation as there is the potential that only those who felt particularly strongly about improvisation will have responded and that this sample may not be representative of employees of the Australian LOA field as a whole. This was not felt to be a concern with this study in particular because the study was exploratory and aimed to identify factors rather than determine conclusively any ranking or order of factors. This being the case, it was felt that it was more important to use a method that would allow data collection from the largest number of respondents, including those in remote areas. Even if it had been desirable to collect a representative sample, the data about the field necessary to allow stratification or determine representativeness of the sample does not exist within the field in Australia.

It should be noted that according to the limited statistics available, the respondents in this study have been working in the LOA industry for longer than average (9.5 years compared to 5.75 years for full-time employment and 1.75 year for part time employment in the Queensland Outdoor Industry Survey, (2008)). The respondents in this study therefore have greater levels of LOA experience. As experience was identified as one of the most important factors influencing respondents' ability to improvise, the higher level of experience of the respondents may have led to this figure being somewhat inflated. It is not possible, however, to calculate the extent of any inflation.

In discussing improvisation in relation to LOAs, it is important to sound a note of caution. In general, LOA organisations work to prevent their activity leaders being placed in situations that are outside of their knowledge, experience and/or the organisations procedures. This research in no way advocates that safety-related improvisation be encouraged in situations where an organisation has appropriate procedures in place, or where staff have relevant experience in, or knowledge of, effective techniques. Improvisation in such situations, or when it is not directed towards the extant safety-related goals of the organisation, is described in the literature as inappropriate improvisation or "freelancing" (Bigley & Roberts, 2001, p. 1289). In relation to safety in LOA, improvisation is potentially beneficial only in situations beyond those anticipated by organisations in their procedures or training, or where circumstances prevent known procedures from being deployed. The latter is particularly important when improvised responses involve violations of standard operating procedures - in any other circumstances such violations would be unacceptable. Improvisation should be viewed as an addition to robust safety and risk management procedures, and not as an alternative. Organisations that can enhance the ability of its leaders to improvise appropriately and effectively will add to their overall ability to maintain the safety of its staff and clients in the unfortunate event they are faced with such unprepared for safety critical situations.

Conclusion

This survey represents a first step in exploring the concept of safety-related improvisation in LOAs. The survey determined that safety-related improvisation is relatively common in the LOAs and is most likely to occur as the result of unanticipated environmental conditions, broken or missing equipment or the need for an easier procedure. Factors identified in the literature as influencing improvisation in other safety critical domains were found to be relevant to the LOA domain, however, there were also a number of factors specific to the LOA domain that were identified. The most commonly identified factors were individual focused, although a number of higher level factors were also identified. Future studies will investigate the interactions between factors in order to develop a systems-based model of improvisation from which it will be possible to develop guidelines on how organisations can best support effective, appropriate improvisation while discouraging ineffective, inappropriate improvisation. This will allow LOA organisations to reap the potential safety benefits and increased resilience afforded by appropriate, effective improvisation.

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