Requirements of crisis situations -an action psychology perspective

Robert Zinke, Gesine Hofinger, & Stefan Strohschneider
Friedrich-Schiller-University Jena
Germany

Abstract

Crisis situations in different domains demand varying types of reactions, depending on the type of work, the situational dynamics, risk, etc. In addition, organisational and cultural contexts define the conditions under which individuals will act intuitively and based on their "best-practice" experiences. On the other hand, the sources of human error seem to be similar in different complex work environments. Therefore, we argue that more substantial knowledge of basic characteristics of (dynamic) crisis situations and of the "human condition" will contribute to more appropriate action. Complex problem-solving, effective decision-making and taking command in crisis situations are influenced by emotional and physical conditions and by basic psychological mechanisms of self-regulation and action. At the same time, these mechanisms are the sources for "human-error". The aim of this presentation is to explain basic psychological requirements of crisis situations. Situated requirements meeting psychological and cognitive human characteristics are presented as a main source of insufficient behaviour. We illustrate our arguments with observations of behaviour in critical situations in the domain of public transportation, as found in the federal German research project OrGaMIR.

What is human error and (how) can it be prevented?

"Human Factors: a system view of human, technology and organization" was the central theme of the 2009 Annual Meeting of the HFES Europe Chapter in Linköping, Sweden. In the keynote: "In the systems view of Human Factors: Who is accountable for failure and success?" Sidney Dekker highlighted the complex interactions and relationships of human individuals and machines. He also referred to critical incidents, which are most often the trigger for investigations of responsibility and causes of failure.

The human being is but one element in a complex system of many interdependent factors, but it is arguably one of the more versatile, which could potentially compensate system weaknesses if enabled to do so. Most often large sums of money are spent on technical response capability or on the development of emergency

In D. de Waard, A. Axelsson, M. Berglund, B. Peters, and C. Weikert (Eds.) (2010). *Human Factors: A system view of human, technology and organisation* (pp. 1 - 10). Maastricht, the Netherlands: Shaker Publishing.

response plans. Attention is hardly given to the strain on crisis responders or to the mechanisms regulating their actions.

What causes failure or success? Why do people fail to act or react appropriately in the face of an emerging crisis? In order to highlight possible causes, the authors of this article approach crisis situations from an action psychology perspective, based on the action regulation theory of Dietrich Dörner. Hereby, more general requirements are distinguished which a crisis situation imposes on human individuals or teams, respectively. Even though a study on crisis preparedness of German public transportation agencies was conducted, which also investigated strengths and weaknesses of crisis response staff acting in exercises, no hard facts are presented here. Instead, this article aims at identifying basic psychological requirements of crisis situations in order to formulate consequences for preparing crisis response staff.

Imagine for a moment that you are a supervisor in an oil refinery. Due to a defective valve the rising pressure causes a pipe to burst. Not only are several construction units affected instantly, but the large amount of gasoline, quickly seeping away into the ground, also threatens to heavily contaminate the groundwater and thus the large population of a nearby town. How would *you* react? What would *you* do first? Or imagine a dark and dusty tunnel. You are in an underground railway system, facing the sight of a derailed train. You can easily identify the muffled cries of passengers in agony. On-site you are responsible for coordinating the rapid reaction teams, trying to rescue the wounded. Vision is impaired by smoke of an unknown source. Due to technical problems with the radio communication you are the interface for communicating with staff on the surface. Down in the tunnel, you collect and coordinate all the information.

You repeat your call to a team leader for a status report via walkie-talkie – no response. Worried if he and his team might be injured, you decide to look after him yourself. This brings you away from your position and the passengers. Upon arrival, you find the squad leader heavily involved in giving orders to his team, all of them being in good health. His uncomprehending reaction to your question "why in the world did you not answer my call" is: "I had more important things to do." How would **you** feel in this situation?

At first sight, considering the variety of these examples, you might agree with us that crisis situations in different domains demand varying types of reactions. And yes, quite logically: what is appropriate or not, among other factors, depends on the type of work, the situational dynamics, specific risks, etc. In addition, organisational and cultural contexts define the conditions under which individuals will act *intuitively* and based on their *"best-practice"* experiences. Also, the degree of appropriateness will be judged differently depending on the commentator: be it a passenger, a regional politician or the representative from the organization affected.

On the other hand, the sources of human error seem to be similar in different complex work environments. Therefore, as the authors would argue, more substantial *knowledge* of basic characteristics of (dynamic) crisis situations and of the "human

condition", leads to an *understanding* resulting in more *efficient training* and *systemic changes* of the framework, which in the end will contribute to *more appropriate action*. Of course, this is not to be seen as a "stimulus and response equation of telling them how to do things right in return improving their action. Academic knowledge of critical aspects has to be transferred into appropriate training methods. Experience has taught us, that experienced practitioners and decision makers are to the most part resistant to lectures. Instead of spoon-feeding them, they must experience the consequences of often made mistakes in action in a controlled environment; the method of mid-fidelity computer simulations for this purpose can only be named here (Brehmer & Dörner, 1993). Keeping in mind the great array of possible settings and complications beyond the initial examples, it comes down to complex problem-solving, effective decision-making and taking command, as most critical aspects in crisis situations and successful crisis management. These are influenced by emotional and physical conditions and by basic psychological mechanisms of self-regulation and action, identified as the source for "human-error". Situational requirements meeting psychological and cognitive human characteristics are apparently a main source of, so called, "insufficient" behaviour (cf. Badke-Schaub et al., 2008).

If you recall the second example, we witnessed a situation like this; however it was only an exercise. There was no real threat, so the rescue staff (who knew it was an exercise) experienced a stress level far below the one expected in a real crisis. Despite all of them being trained rescue staff, several members of the team behaved in a way that would threaten the life and health of passengers and staff in a real disaster.

Professional staff involved in an exercise who are unable to manage the crisis is something often seen in major exercises (and, of course, in real disasters). This shows that professional training alone does not prepare staff sufficiently to adequately respond to a crisis. In a system perspective, psychological requirements of the situations have to be taken into account as well.

What are the general demands put on the emergency staff from the perspective of Human Factors psychology? Before exploring that question, a short definition of the term crisis is given as the authors use it.

In contrast to an incident, mostly a technical malfunction, or an emergency - with an inherent threat to human lives or severe threat to material, but limited to a single location - a crisis is of larger scope. Whereas a crisis includes elements from an incident or emergency, it usually requires a centralized crisis management unit at a higher level in order to coordinate reaction and to improve substantial judgment in a given situation. In related literature you often find the defining element of a threat to the continued existence of an organisation, for example. A catastrophe is usually defined as the uncontrollable development and expansion of an emergency or crisis with an inherent threat to a large number or a given loss of human lives.

Crisis management in different types of disasters follows different rules. The command staff in an accident in underground transportation systems cannot easily be

replaced by the teams who normally respond to airplane accidents, floods, or disaster sites discovered after a terrorist attack. Yet, the events the authors focus on from a psychological perspective share some features: They start suddenly and often due to some external event, they are highly dynamical, and are a severe threat to life or the health of many people - emergency responders on-site and adjacent personnel alike.

The challenges of such situations are known from research on complex problem solving under time pressure (Dörner, 1996; Frensch & Funke, 1995, Dörner & Schaub, 1994; Strohschneider, 2003). Most importantly, in addition to being a complex problem, this kind of event also puts emotional and sometimes ethical burdens on those dealing with it.

Situational characteristics and psychological consequences of crisis

In the following step, general characteristics of crisis are outlined together with the psychological consequences for the acting individual exposed to a crisis. The first characteristic to mention is the threat to life, health, the environment, or other important goods. The importance for action is high –while not acting is usually not an option. A high level of importance increases the stress level because of the anticipated consequences of wrong decisions. The second aspect is the high dynamics of crisis situations leading to time pressure. Decisions have to be made quickly and the situation may change while responders are busy thinking. Time pressure easily leads to a lack of action control and adds to the individual stress level (Dörner, 1996). Even with the best emergency plans there will always be features of the situation that have not been planned for. This uniqueness brings a need for problem-solving and decision-making, but these cognitive activities are slow and easily impaired by stress and anxiety. Another factor is uncertainty. Not all aspects of the situation are known. This may be due to a lack of data or due to lack of time for processing the data available. Also, the reliability of information is often disputable. Decisions have to be taken without an adequate basis of information. But, not knowing enough contradicts the human need for control and thus leads to uncertainty (Dörner, 1996; Langer, 1983; Glasser, 1986). A last feature to mention here is the Information overflow. While basic features of the situation may still be uncertain, messages, status reports and other bits of information keep coming in while the individual's ability to take in new information is diminished due to stress. Information must be prioritized and evaluated constantly.

All these features of disasters add to stress due to the threat to the individual's life, health, or feeling of competence (Lazarus, 1999; Dörner 1996). The typical stress reaction is a "fight or flight" tendency, which means that the organism is prepared for quick and strong action. This tendency impairs the rather slow processes of conscious thinking and problem-solving. Analysis – of weighing different options for action, asking critical questions - is nearly impossible, while a strong tendency towards "ad-hocism" (Dörner, 1996) – a type of "acting now just to do something" - can be observed.

Behaviour observed in critical situations

In the federal German research project OrGaMIR, the authors from Jena investigate questions of individual actions in critical situations in the domain of public transportation. While one focus is on inter-organisational cooperation, the second one is on crisis management in major accidents and acts of terrorism involving toxic substances. Data were collected in several German public-transportation companies running underground railway systems. A combination of document analysis, expert interviews, and observations allows insights in emergency procedures, plans for crisis management, action requirements, and behaviour. Some of the findings and psychological constraints will be discussed now.

According to experts´ knowledge in theory (e.g. Heath and O´Hair, 2009; Bojn, 2008), the authors filtered for negative examples here. So, apart from the usually acceptable performance in the professional skills, the following enumeration of inadequate behaviour was found in observations:

- wrong assessment, often the underestimation of the scope of the event
- blind actionism without gaining an overall picture or paying attention to changes
- difficulty/ inability to prioritize and abiding by various or conflicting tasks (e.g. due to insufficient training)
- insufficient knowledge of internal and external support to be informed
- conflicting procedures and overlapping responsibilities for various classifications of events cause uncertainty and delay
- insufficient or incomplete information is delivered
- difficulty to communicate with other organizations in a meaningful way (giving the right amount of information, mutual misunderstanding of "vocabulary"/ parlance)

In addition to these findings from observation, additional potential sources of employee´s shortcomings and divergence from rules were identified based on interviews and document analysis:

- shift of superior- and subordination, after handing over responsibility
- knowledge about structure, strategies and requirements for information and modes of communication of external organizations on site (Hofinger, 2009)
- technical limitations for wireless communication with other organizations
- being accepted as an authority and individual´s ability to lead
- extent of knowledge of the general site and the general strategy
- force to violate constraints in existing SOPs, inappropriate for the situation confronted with

On top of all the elements identified above, additional individual constraints determine the performance of personnel: What are their physical conditions? Are they able to handle uncertainty? Are they able to switch from following daily routines into acting in accordance to special procedures? Are they capable of

handling stress and being confronted with wounded and corpses on-site? People´s fear to make mistakes and the fear of one´s own death does not correspond with immediately helping other people.

Consequences

If a disaster management staff is to meet those challenges, they need skills beyond their technical knowledge about fire, floods, injuries, etc. The necessary skills are known as "non-technical skills" (e.g. Flin et al., 2008; Taylor-Adams et al., 2008). In aviation, their importance has been acknowledged for more than 20 years under the label of Crew Resource Management (e.g. Salas et al., 2006).

Non-technical skills in disaster management are generic competencies in the fields of problem-solving, strategic thinking, and communication and team management (Strohschneider, 2008). In contrast to domain-specific skills (*first-order techniques*, Borodzicz, 2004) that can be drilled in exercises and applied nearly without conscious thinking, the non-technical skills (*second-order techniques)* involve higher cognitive activities and are needed whenever a situation could not be foreseen. Some of the most important are:

I. Problem-solving and strategic thinking
   - Building strategic and tactical goals - weighing importance and identifying what can be achieved in a given situation
   - Prioritizing the large number of tasks
   - Maintaining situation awareness (e.g. Endsley, 1995)
   - Flexibility to adapt emergency plans and procedures the actual situation (McMaster and Barber, 2009; Borodzicz, 2004)
   - Information management, as the ability to take information in quickly, to distribute it correctly if necessary, to keep track of status changes and to decide quickly if and how to react.
   - Insight in one's own reaction to stress and an ability to cope with emotion and pressure.

II. Communication and team management
   - Shared mental Models, regularly updated among all involved staff (e.g.Lim & Klein, 2004; Stout et al., 1999; Cannon-Bowers & Salas, 2001).
   - Clear and explicit communication (e.g. Horn & Strohschneider, 2005; Hofinger, 2005).
   - Leadership and delegation in collaborative work processes including the ability to self reflect workload distribution and dealing with uncertainty (e.g. Buerschaper & Starke, 2008; Paris, 2000)
   - Assigning and taking responsibility and a „unity of command (Sloper, 2004)
   - Ensuring cooperation, also across organizational borders (e.g. McMaster & Baber, 2009; Kapucu, 2008)

In both categories, complex problem-solving and in team management, a constantly shared and common mental representation of the situation is the basis for any target-oriented action. To maintain situation awareness means to know the elements of the

situation, understand their meaning and being able to anticipate their development – in short "knowing what's going on so you can figure out what to do" (Endsley 1995). Closely linked to that is the concept of shared mental model - knowledge and interpretations of the tasks, the environment, available resources, and the team itself. This is especially necessary if continuous communication is not possible and when every team member acts alone for some time (e.g., Lim & Klein, 2004; Stout et al., 1999).

If you combine these accumulated general requirements for crisis responders with the findings from document analysis, interviews and observations in crisis exercises, you will receive role-specific demands. For each position within an organization the relevant data can be transferred into a chart like in Table 1

	Demands for special action committee staff
Knowledge	- solid knowledge of exact reporting channels, procedures, regulations, responsibilities and limiting specifics of the present situation - ability to determine and distinguish incident, emergency, crisis and catastrophe
Cognitive Processes	- rapid knowledge transfer from training of the present situation - decision making must follow standard principles, which have to be anticipated by subordinates/ team members and result in identical action
Action	- standardized reporting of behaviour - reliable/ secure action taking acquired through drills - double assurance by means of SOPs - planning of sufficient turn taking
Self regulation	- self-confidence and following directives/ regulations - emotional distance for professional and rational action with respect to the requirements of the present situation, regardless of one's own preferences - role-switching between super- and subordination
Physical challenges	- capable of acting under stress, smoke, heat, … - prone to sensory overload at night, in long-lasting operations, under physically challenging conditions - compensate through qualified control mechanisms, team support and training

This example gives you an overview of the demands for each individual in the special action unit. In consequence, based on this list of psychologically relevant demands in case of a crisis, all personnel can be trained more efficiently for their specific task.

Conclusion

To sum it all up, situational demands are different depending on the role and task of the individual. For example, emergency responders need more first-order or technical skills and must be willing to adhere to procedures, while crisis management

teams need to be able to decide flexibly according to the development of the situation.

While individual and team skills are decisive for disaster management, we want to point out the role of the organisation for those skills: Is the organization prepared for emergencies and a crisis? For example, does it have emergency procedures that reduce stress for the individuals by giving them an outline for their actions? Are teams allowed to decide according to their insight on-site (local allocation of competence, e.g. Weick and Sutcliffe, 2007) or do hierarchies overrule sense? Does the organization allow flexible restructuring if planned structures are not sufficient (McMaster and Baber, 2009)? Are there periodic trainings for emergency staff?

Taken together, the skills listed above lead to resilience (e.g. Hollnagel et al., 2006; Reich, 2006) in the face of disaster. Resilience implies the "ability to bounce back and even to grow in the face of threats" (Reich, 2006). Three core principles of resilience have been described: (Reich, 2006*): control, coherence, and connectedness* – theses three C's summarize the non-technical skills described above. This can be achieved by training generic competencies. Especially the training of crew resource management skills in aviation has been an area of focus for the last 15 years. (Salas et al., 2006). Yet, to this day it seems unclear if all of the skills listed above can be learned (by adults) or which kind of training method is most appropriate.

Within the research project OrGaMIR one of our tasks is the conception of a training setup for civil crisis management staff. The training by means of alternating feedback sessions and mid-fidelity simulations appears to be a promising path to travel. At the same time the organizational frame has to be adjusted to offer individuals the flexibility needed to react adaptively to the crisis they are confronted with.

References

Badke-Schaub, P., Hofinger, G., & Lauche, K. (Eds.) (2008), *Human Factors: Psychologie sicheren Handelns in Risikobranchen* [Human Factors. Psychology of safety in high-risk domains], Heidelberg, Springer.

Borodzicz, E.P. (2004). The missing ingredient is the value of flexibility, *Simulation & Gaming, 35*, 414-426.

Bojn, A. (Ed.) (2008). *Crisis Management*. Volume II. Los Angeles: Sage Publications Ltd..

Brehmer, B. & Dörner, D. (1993). Experiments with computer-simulated microworlds: Escaping both the narrow straits of the laboratory and the deep blue sea of the field study. *Computers in Human Behavior, 9*, 171-184.

Buerschaper, C. & Starke, S. (Eds.) (2008), *Führung und Teamarbeit in kritischen Situationen [Leadership and team work in critical situations]*, Frankfurt am Main, Germany: Verlag für Polizeiwissenschaft.

Cannon-Bowers, J. A. & Salas, E. (2001), Reflections on shared cognition, *Journal of Organizational Behavior, 22*, 195-202.

Dörner, D. (1996), *The logic of failure: Recognizing and Avoiding Error in Complex Situations*, New York: Metropolitan Books.

Dörner, D. & Schaub, H. (1994), Errors in planning and decision making and the nature of human information processing. *Applied Psychology: An International Review*, 433-453.

Endsley, M.R. (1995), Toward a Theory of Situation Awareness in Dynamic Systems, *Human Factors, 37*, 32-64.

Flin, R, O'Connor, P., & Crichton, M. (Eds.) (2008), *Safety at the Sharp End. A Guide to Non-technical Skills.* Aldershot: Ashgate.

Frensch, P.A. & Funke, J. (Eds.) (1995*), Complex Problem Solving. The european Perspevtive.* Hillsdale NJ: Lawrence Erlbaum Associates.

Glasser, W. (1986), *Control theory in the classroom*, New York:, Harper and Row.

Heath, R.L. & O`Hair D. (Eds.) (2009). *Handbook of risk and crisis communication.* London: Routledge.

Hofinger, G. (2009), Kritische Faktoren der interorganisationalen Zusammenarbeit [critical factors of inter-organizational co-operation]. In S. Strohschneider and ?initials? Heimann, *Kultur und Handeln.* (pp. 189-203). Frankfurt am Main, Germany: Verlag für Polizeiwissenschaft.

Hofinger, G. (Ed.) (2005), *Kommunikation in kritischen Situationen. [Communication in critical situations]* . Frankfurt am Main, Germany: Verlag für Polizeiwissenschaft.

Horn, G. & Strohschneider, S. (2005) Kommunikation im Krisenstab [Communication in the crisis management group]. In G. Hofinger (Ed.), *Kommunikation in kritischen Situationen* (pp. 101-120). Frankfurt am Main, Germany: Verlag für Polizeiwissenschaft.

Hollnagel, E.,Woods, D., & Leveson, N. (Eds.) (2006) *Resilience engineering, concepts and precepts*, Aldershot, UK: Ashgate.

Kapucu, N. (2008) Collaborative emergency management: better community organizing, better public preparedness and response. *Disasters, 32*, 239-262.

Langer, J.E. (1983), *The Psychology of Control*, Beverly Hills, CA: Sage Publications.

Lazarus, R.S. (1999), *Stress and Emotion*, London: Free Association Books.

Lim, B.-C. & Klein, K.J. (2004) Team Mental Models and Team Performance: A Field Study of the Effects of Team Mental Model Similarity and Accuracy, Pennsylvania/ Singapore, University of Pennsylvania/ Ministry of Defense Singapore.

McMaster, R. & Baber, C. (2009), Multi-Agency Operations: Cooperation during flooding. In D. De Waard, J. Godthelp, F. Kooi, and K.A. Brookhuis. (Eds.), *Human Factors, Security and Safety* (pp. 13-27), Maastricht, The Netherlands: Shaker.

Paris, C.R., Salas, E., & Cannon-Bowers, J. A. (2000), Teamwork in multi-person systems: a review and analysis, *Ergonomics, 43*, 1052-1075.

Reich, J.W. (2006), Three psychological principles of resilience in natural disasters, *Disaster Prevention and Management, 15*, 5, 793- 798.

Salas, E., Wilson, K.A, Burke, C.S., & Wightman, D.C (2006), Does Crew Resource Management Training Work? An Update, an Extension, and Some Critical Needs, *Human Factors, 48*, 392-412.

Sloper, P. (2004), Facilitators and barriers for co-ordinated multi-agency services, *Child: Care, Health & Development, 30*, 571-580.

Strohschneider, S. (2008), Human Factors Training, in: Badke-Schaub, P, Hofinger, H, and Lauche, K (Eds.), *Human Factors: Psychologie sicheren Handelns in Hochrisikobranchen [Human Factors: psychology of safe behaviour in high-risk domains*] (pp. 289-306), Heidelberg, Germany: Springer Verlag.

Strohschneider, S. (Ed.) (2003). *Entscheiden in kritischen Situationen [Decision-making in critical situations]*. Frankfurt am Main: Verlag für Polizeiwissenschaft.

Stout, R.J., Cannon-Bowers, J.A., Salas, E., & Milanovich, D.M. (1999). Planning, shared mental models, and coordinated performance: An empirical link is established. *Human Factors, 41*, 61-71.

Taylor-Adams, S. Brodie, A., & Vincent, C. (2008). Safety Skills for Clinicians: An Essential Component of Patient Safety, *Journal of Patient Safety*, *4*, 141-147.

Weick, K. & Sutcliffe, K.M. (2007), *Managing the unexpected. Resilient Performance in an Age of Uncertainty*. 2nd edition. San Francisco: John Wiley & Sons Inc.