Crafting Operational Resilience (CORE)

Jari Laarni[1], Henriikka Kannisto[2], Hannu Karvonen[1], Jussi Korpela[2], Hanna Koskinen[1], Timo Kuula[1], Marja Liinasuo[1], Kristian Lukander[2], Satu Pakarinen[2], Markus Porthin[1], Vuokko Puro[2], Marika Schaupp[2], Laura Seppänen[2], Anna-Maria Teperi[2], Maria Tiikkaja[2], Jari Torniainen[2], Kaupo Viitanen[1], Mikael Wahlström[1]

[1]VTT Technical Research Centre of Finland Ltd

[2]Finnish Institute of Occupational Health (FIOH)

Learning from successes

We examined how learning from successes could be included in nuclear operating experience activities. Successes are often less salient and less likely to trigger intentional learning processes than failures. Facilitating learning from successes is likely to require deliberate effort, such as its formal inclusion into existing practices for collecting or analysis purposes. There was a clear interest in successes, and methods already exist to learn from successes in a more systematic way.

Developing work-based learning

We developed a self-evaluation method that aims to disseminate good practices by the means of guided dialogue among operators. Operator reflections on simulator tasks consisted of more than a half of all discussions. Work practices, collaboration, plant dynamics and stress at emergency situations were major themes addressed in discussions. In order to facilitate the exchange of good practices between crews, new opportunities is needed to witness and exchange the practices with other crews.

Cognitive readiness in operator work

We studied the impact of multitasking on operator work. Perturbations that divert attention away from the task at hand to another task have typically a detrimental effect on performance. Their negative consequences can be mitigated, for example, by better procedure and user interface design, alarm management, and team training. Decision-making heuristics are often useful, but they should be used carefully. Often it is useful to see decision-making as a continuous process which only leads to a sufficiently well solution.

Operator performance in extreme stress

We studied the effect of stress on operator performance in simulated accident scenarios. Increased level of stress was associated with poorer information seeking performance and longer performance time, possibly because of the larger requirement for cognitive processing at the information gathering phase of the task (Figure 1). Psychophysiological measurements of stress and activity can provide valuable information on stress and its association with cognitive performance at work.

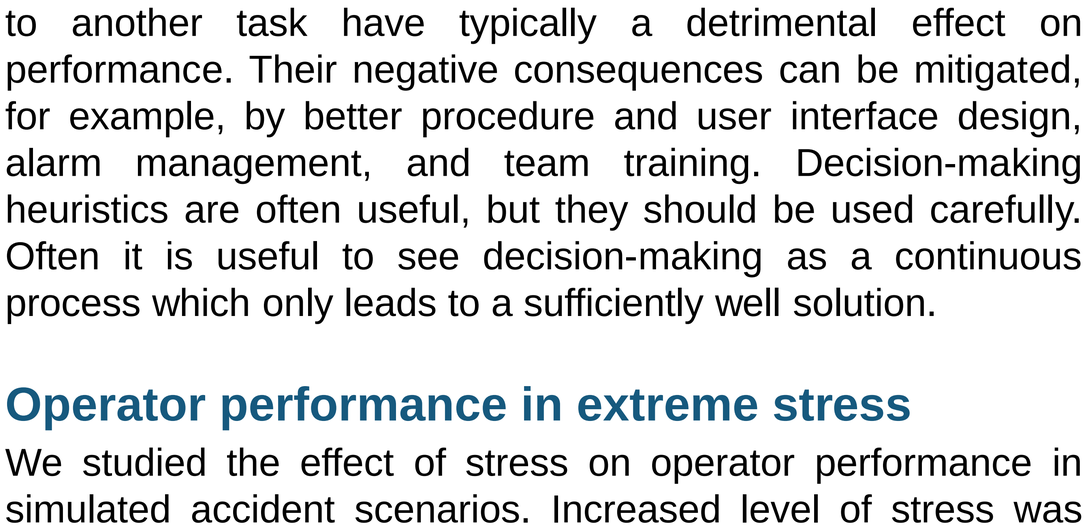

Figure 1. *(a) Predicted stress, (b) self-reported stress, (c) mean heart rate, and e) skin conductance during different parts of a simulator run.*

Resilience in emergency management

We studied emergency exercises from a theoretical (resilience), regulatory (e.g., YVL guides) and practical points of view. Several developmental needs were identified: lack of clearly defined objectives for the exercises and lack of genuine feedback and systematic evaluation as the most influential ones. A step-by-step guide was developed about systematic debriefing, serving as a means to provide feedback and gather lessons learned also from the individual employee's point of view.

HF Tool in safety management

We developed and tested a new HF tool for Operational Event (OE) analyses and evaluated the prerequisites for its implementation in safety management practices (Figure 2). The HF tool was regarded as clear and easy-to-use, and it was considered a useful tool especially in OE analysis, reporting and training as well as for self-evaluation and for monitoring safety trends. It was found to provide a more accurate picture of the analysed OEs and HFs affecting OEs including the success factors, than current analysis methods.

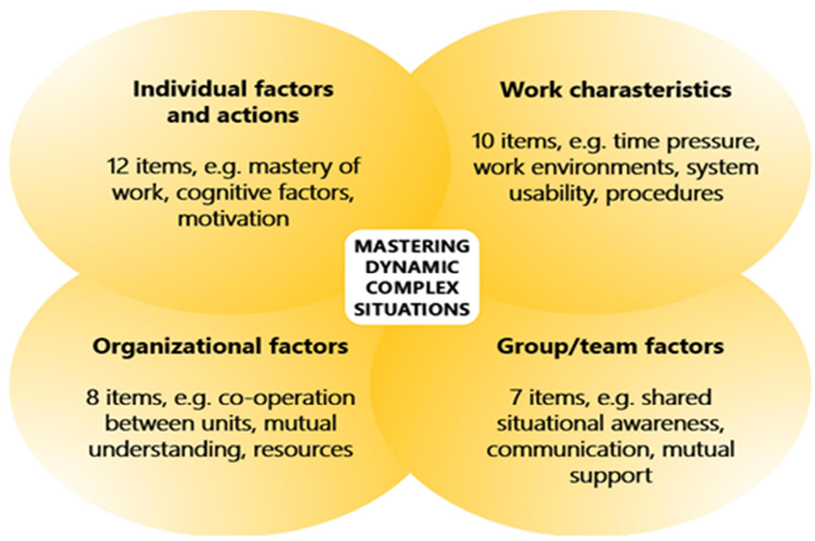

Figure 2. *HF Tool: basic idea and contents.*

Conclusions

- **Promoting deliberate learning from success is important to create new opportunities for learning and development of activities.**
- **Operative personnel need resilience skills to master the increasing amount of perturbations and goal conflicts in their daily work.**
- **Reflective thinking can be trained.**
- **Since stress has an impact on operator performance, simulator training in stressful conditions is useful.**
- **A more systematic approach is needed to support emergency exercises, from objective definition to feedback provision and gathering.**
- **Conceptions and competence regarding human factors has to be improved, as well as concrete tools on how to master them in every-day operations.**

Contacts

Jari Laarni (Jari.Laarni@vtt.fi); **Satu Pakarinen** (Satu.Pakarinen@ttl.fi); **Marja Liinasuo** (Marja.Liinasuo@vtt.fi); **Anna-Maria Teperi** (anna-maria.teperi@ttl.fi); **Mikael Wahlström** (Mikael.Wahlstrom@vtt.fi); **Kaupo Viitanen** (Kaupo.Viitanen@vtt.fi)