Cognition and Safety: An Integrated Approach to Systems Design and Assessment

By Oliver Sträter

Safety is a genuine concern in human-machine systems. The human behavior and decision-making process is an important aspect of this safety in numerous daily activities in industry. Investigation of human behavior at the cognitive level has resulted in many theories and models, just to design and assess the safest operational system, for instance, for air traffic control.

A book review by Amrita Bose

Ingenious technologies and systems are designed, assessed and innovated throughout time. Sträter addresses the gap between the design of safety systems, on the one hand, and operation, on the other. Methods and models for human behavior in design focus on system workload or situational awareness, while operation relates to human error. A homogeneous approach towards notions like human error, workload and situational awareness is aimed at being integrated in this book by making use of existing knowledge of human cognition without, as the author claims, 'reinventing the wheel'.

The preface promises the reader to supply general perspectives of cognitive issues that could than be easily adjusted to their own problem. This book will most likely fulfill that promise for the specialist readership of professionals, scientists and regulators in the safety and cognitive field – in particular, but not exclusively, for the air traffic management, nuclear industry, ground-transportation and occupational safety sector, as the integrated model is based on research in these sectors. The cognitive theories in the safety management area could surely be interesting for those of you with a broad interest in human cognition, and, for instance, working in change management in general. But do expect to plough through lots of theory though. The book, for example, gives backing on communication and the importance of the context in which it takes place, to prevent errors and to assess errors as well as possible. Some organizational measures could be counterproductive. Some errors cannot just be 'trained away' as training takes place at a certain cognitive level while the mistake was made at a different point of the decision-making process (a less rational point). This is useful information for any work environment that contains a system in which operators have to adhere to certain procedures. The examples of car driving research that are used to illustrate assessment of cognitive performance remind us that a general cognitive model might be useful in more sectors than the highly demanding environments of air traffic control or nuclear power plants.

Part I, "concerns", discusses mainly the existing techno-morphologic theories (psychological models that try to equalize technical models) and their shortcomings.

Part II, "integration", explicates how the description and possible assessment of human behavior in an integrative cognitive model could serve to include the imperative dynamic concepts, while not neglecting techno-morphologic notions. The cognitive processing loop approach is unfolded in two chapters.

Part III, "application", is the more practical part of the book. The Cognitive Processing Loop is assessed and validated in this part.

In conclusion, Oliver Sträter makes it clear that valuable knowledge gets lost. An error in a certain measure might have failed in one industry, another industry might happily think to improve by implementing the same measure facing the same error to occur. An interdisciplinary model like the Cognitive Processing Loop can act as a knowledge management tool for any industry to learn from.

About the Author

Dr. Oliver Sträter currently develops a long-term safety strategy with EUROCONTROL and is a member of the German Reactor Safety Commission. In the past he has been an advisor to various nuclear organizations throughout the world (IAEA, NRC, HSK, and OECD).

About the Reviewer

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