Preface

First International Interdisciplinary Workshop on Requirements Engineering for Sociotechnical Systems (RESOSY 2021)

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These days, using a computer is not any more equivalent to sitting behind a screen. Computing has become ubiquitous and has been embedded everywhere: in one's TV screen, washing machine, car, streetlamps, and maybe even in one's body. Computing does not just enhance social processes but in many cases, it also constructs social phenomena and processes. Let us bring two examples. First, Facebook constructs social phenomena in an unprecedented scale, ranging from enabling couples to meet each other to creating "echo chambers" believing in fake news or conspiracy theories. Second, an organisation where business processes have been automated is essentially not the same organisation anymore because introducing information technology effectively redefines social relationships.

The author has found through his numerous interactions with industry that many big companies seem to be interested more in *humans* rather than in technology as such. For example, Mitsubishi is interested in further augmentation of the driver capabilities by information technology; the Estonian company Bolt is working towards self-driving taxis; Boeing is funding research in how humans behave within a complex sociotechnical system, such as an Airline Operations Control Centre; and Hitachi is working on more precise embedding of smart cities in a social context.

The notion of a *sociotechnical system* was coined in the 1950s [1], after it had been shown in the context of coalmining that changes of the social subsystem are more relevant and impactful compared to changes of the technical subsystem [2]. A *sociotechnical system* has defined operational processes followed by human actors and operates within an overall organizational and social context [3]. A sociotechnical system can be viewed as entailing work systems in which human participants and/or machines perform work – processes and activities – using information, technology, and other resources to produce specific products or services for internal and/or external customers [4]. In the current era of interconnectedness, it is important to consider humans in a sociotechnical system as forming a network within the system rather than being external users of the system [5]. In other words, sociotechnical systems have *participants* rather than users. Naturally, sociotechnical systems are *open systems* where any new participants may join, or any existing participants may opt-out at any time.

The sociotechnical approach to systems design [6] suggests giving equal weight to social and technical aspects when work systems are being designed. The heyday of sociotechnical systems' design methods was in the 1970s and the early part of the 1980s, and the low point in the latter part of the 1980s and the 1990s [7]. The 21st century has seen a revival of interest in sociotechnical design approaches [7], probably because of increasingly ubiquitous computing that facilitates interactions between the participants. The ideas of sociotechnical systems design appear in participatory methods, where end users are involved during the design process, as well as in agile methods of software development [7]. Some of the important keywords concerned with designing modern sociotechnical systems are *equifinality* and *accountability*. Equifinality means that systems goals can be achieved by more than one means [8]. Accountability involves identifying who can call whom to account and who must provide an accounting of what and when [9]. Some of the contemporary approaches of designing

sociotechnical systems [10-11] cater for both equifinality and accountability by using the abstraction metaphors of *goals* and *agents* (*actors*), where the goals of a sociotechnical system that can be achieved by different means by human and man-made agents playing different participant roles of the system.

A crucial part of designing a sociotechnical system is requirements elicitation and representation, which has so far received little attention as a separate discipline. To further enhance this discipline, the purpose of the First International Interdisciplinary Workshop on Requirements Engineering for Sociotechnical Systems (RESOSY 2021) was to present dedicated and holistic methods of engineering requirements for both social and technical aspects of sociotechnical systems. To that end, the workshop brought together researchers and practitioners from the fields of information systems, human-computer interaction, requirements engineering, and digital product design.

The first paper included by these proceedings elaborates the contents of the keynote talk of the workshop that was given by Professor Mārīte Kirikova from Riga Technical University in Latvia. In her paper, Mārīte Kirikova discusses the challenges of continuous requirements engineering for sociotechnical systems that originate from diverse and fast changes in systems contexts, project-based issues, and the multi-systems nature of sociotechnical systems. She argues for the necessity of flexible frameworks and new ways of knowledge management in the development of sociotechnical systems. She proposes to achieve a holistic view on sociotechnical systems and requirements engineering for them by means of methods for fractal knowledge representation.

The paper by Steven Alter from the University of San Francisco, USA is dedicated to treating sociotechnical systems as work systems. The paper proposes to elicit and represent requirements for sociotechnical systems as work systems in terms of portrayals and characteristics of work systems and work system elements, performance variables, facets of work, functions performed by subsystems, work system design principles, division of responsibilities, interaction patterns, and the characterization of smartness in devices and systems. The paper explains how these aspects are useful for identifying requirements for sociotechnical systems in general and for their smaller subset – mixed initiative systems.

The paper by Mohamad Gharib and Ishaya Peni Gambo focuses on how to complement business process modelling with social and organizational aspects. The paper puts forward a two-stage approach that begins with capturing the social and organizational context of the business process by means of Tropos goal models of the actors and Tropos models of goal dependencies between the actors. This is followed by capturing the control flow of the activities corresponding to the goals by applying the Workflow-net with Actors (WFA-net) approach earlier proposed earlier by Gharib, Giorgini, and Mylopoulos.

The paper by Syazwanie Filzah Binti Zulkifli, Cheah Wai Shiang, and Nurfauza Binti Jali proposes to elicit emotional requirements by employing the Human Oriented Method for Eliciting Requirements (HOMER) proposed earlier by Willmann and Sterling. The paper also demonstrates how emotional requirements can be represented by different kinds of models employing the metaphor of agent: goal models by Sterling and Taveter and Tropos goal models enhanced by emotional goals, as well as emotion-oriented role models, domain knowledge models, scenario models, interaction models, behavior models, and agent knowledge models by Sterling and Taveter.

The paper by Kerli Mooses reports on *do/be/feel* workshops for requirements elicitation and co-design that were carried out with 38 adults with the purpose to find out what would be an ideal app supporting physical activities by adults. The workshops sought answers to the questions (1) what should such app do? (2) what should such app be like, i.e., what should be the quality characteristics of such app? (3) how should such app make one feel? (4) which roles are associated with the app? The results of the questions (1)-(4) were combined into a goal model consisting of the corresponding functional goals, quality goals, emotional goals, and roles.

The paper by Leon Sterling, James George Marshall, Sonja Pedell, and Steven Murdoch discusses how interdisciplinary interactions produced outcomes that would not have been achieved if the researchers had stayed within discipline boundaries. Innovation from a software engineering perspective was the identification of emotional goals, the use of more engaging terminology and images, and improved requirements elicitation. Innovation from a design perspective was the introduction of clearcut, repeatable and agile software engineering methods. The argumentation is reinforced by examples of using motivational goal modelling in interdisciplinary projects of designing serious games.

The paper by Nico Zimmer and Kuldar Taveter is concerned with requirements engineering for sociotechnical systems. The paper systematically describes and analyses the requirements for the complex real-life sociotechnical system of the Airline Operations Control Centre (AOCC). The requirements are mapped to the viewpoint framework for holistic requirements elicitation and representation at different abstraction layers and from three complementary perspectives. The purpose of the requirements engineering was studying the social part of the AOCC by means of agent-based simulation of AOCC employees with different personality profiles. The latter along with applying the viewpoint framework are the main novelties of the approach.

Finally, the paper by Eduardo A. Oliveira, Varsha Maram, and Leon Sterling discusses how motivational goal models could be elaborated with the help of more fine-grained requirements artefacts such as user stories and personas. This paper describes a method enabling to generate from a motivational goal model a collection of user stories consistent with the model. The generated user stories are checked by users and developers to ensure their readability and clarity. The method has been partially automated within an extension to an editing tool.

In addition to the presentations, the workshop included many inspiring discussions on the nature of sociotechnical systems, methods of requirements engineering for such systems, and particularly about the importance of emotion-oriented requirements for sociotechnical systems and the relevant methods.

Finally, I would like to thank Tahira Iqbal for proposing the workshop idea, Kerli Mooses and Tahira Iqbal for editing these proceedings, and Tahira Iqbal, Kerli Mooses and Ishaya Peni Gambo for preparing and conducting the workshop. I am also grateful to other members of the Research Group of Human-Centric Information Systems at the University of Tartu and volunteering PhD students for participating in the workshop organization.

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