

Chapter 4

Towards Human-Centered System Design

ABSTRACT

Based on URANOS and its instantiations for human beings, integral thinking and coordination, this chapter presents a model for human-machine collaboration. Nine design principles are presented. They ensure that designing and operating human-centered systems respects human integrity in any human-machine collaboration, i.e. not harmed, or enslaved, reduced, etc. A central component of this model is the conversation between human and machine. It allows humans and machines to enter into an adaptive learning organization, a prerequisite for any mutual beneficial collaboration. Finally, a concrete use case addressing smart industrial machines operating in the context of the fourth industrial revolution is presented.

INTRODUCTION

Human-centered systems (HCSs) put human beings in the center of their design and working processes (Gill, Funston, Thrope, Hijitaka & Gotze, 1993). In this chapter, we show how URANOS can be applied for HCSs, as a complex technical system encompassing human beings and their socio-cultural environment. In this context of designing human-centered systems, the three instantiations presented in chapter “Model Instantiations”, namely body-mind continuum, coordination model and integral thinking, are put together into one model for human-machine collaboration.

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Several design principles are needed to ensure that such systems respect human integrity. Special attention is paid to compliance with human values, in particular preserving of human integrity in any human-machine symbiosis, i.e. not harmed, or slaved, reduced, etc. Based on these principles a design is presented showing how smart machines may converse and collaborate with human beings. In this sense, humans and machines are holistically integrated into a system, allowing them to achieve their common goals through collaboration.

First, in section “Human-Centered Systems: State of the Art” an introduction to HCSs is given, presenting the state of the art of HCSs, and showing how the three instantiations of URANOS are related to HCSs. Section “Design Principles” presents the major design principles that form the base of human-centered design. Section “Model for Human-Machine Collaboration” explains a model for human-machine symbiosis that goes beyond classical human-machine interaction. A concrete design based on that model is presented in section “Designing Smart Industrial Machines: A Case Study”. Some conclusions are given in section “Conclusion”.

HUMAN-CENTERED SYSTEMS: STATE OF THE ART

Designing an HCS is about putting humans in the center of design and system processes (Gill et al., 1993). The term “human-centered” is often mistaken for “user-centered”. User-centered design regards humans as technology users. In contrast to that, human-centered design opens the scope to also include the social and organizational context of users, system designers, engineers, and other persons affected by the system (Gasson, 2003).

This section gives an overview of three important aspects of HCSs. First, an outline of the background and related work of HCS is given. Then, Schwartz’s theory of universal human values is presented in the context of HCSs. Then, human-centered design is brought to light in relation to positive emotions, such as enthusiasm. And finally, some background on bio-cost and stress as quantitative metrics is presented.

Human-Centered Approaches

Human-centered approaches began to evolve in the 1990’s. They emerged from the vision of letting human beings participate in the system processes while taking into account their social and cultural contexts. K.S. Gill (1996) argued, that “human-centredness expounds an emancipatory tradition which

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