

**Book review of: Modeling Human–System Interaction: Philosophical and Methodological Considerations, With Examples By Thomas B. Sheridan**

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## books

### Modeling Human–System Interaction: Philosophical and Methodological Considerations, With Examples

By Thomas B. Sheridan

2017, 192 pages, \$110.00

Hoboken, NJ: John Wiley & Sons, Inc.

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#### —Reviewed by Joost de Winter

Thomas B. Sheridan is a well-known scientist who has written a large number of influential articles and books on topics such as teleoperation, automation, and supervisory control. His latest book, *Modeling Human–System Interaction: Philosophical and Methodological Considerations, With Examples*, has, in his words, “evolved from a professional lifetime of thinking about models and, more generally, thinking about thinking” (p. xi).

I have mixed feelings about this book. On the positive side, it contains an accessible overview of classical human–machine system models, including “borrowed engineering models” and qualitative human–automation interaction models. The book has a logical structure, and the core chapters are devoted to the four human information-processing stages (acquiring information, analyzing the information, deciding on action, and implementing and evaluating the action). The models are described in a dense, no-nonsense style.

For example, chapter 8, “Implementing and Evaluating the Action,” describes Hick’s law and information theory, Fitts’s law of human movement, open-loop versus closed-loop manual control, McRuer’s crossover model, time delays and preview, internal representation, modeling of response times, human error, and Reason’s Swiss cheese model. It is impressive that all these topics are covered in only

10 pages with quite a sparse layout. I believe that Sheridan has been successful in bringing forward the essence of the selected models. If a reader wishes to learn more about topics such as detection theory, preview control, manual control theory, or Kalman filtering, the 30 pages of appendices provide a useful, mathematically oriented addition.

The book also contains a good deal of discussion on what models are. For example, in chapter 2, Sheridan introduces a set of criteria that allow one to classify models: applicability to observables, dimensionality, metricity, robustness, social penetration, and conciseness, each of which can be coded from 1 (least) to 3 (most). I find this an interesting taxonomy, as it differs from existing model-appraising techniques (e.g., Jacobs & Grainger, 1994).

I also have a few critical remarks to make. First, although it is clear that this book aims to review classical models, the writing appears to be outdated. Sheridan explains in the preface that “the reader may feel that some models are dated and no longer in fashion . . . , though I would maintain that all those included have passed the test of time and continue to have relevance.” But it is still peculiar that, for example, fuzzy logic is described as a “new analytical tool” (p. 48) while Sheridan cites a reference from 1965.

I cannot escape the impression that this book is primarily a compilation of well-known models and drawings and that no attention has been devoted to relating to modern technology or to adding up-to-date reflection, insight, or integration. For example, chapter 9, “Human–Automaton Interaction,” contains a figure from 1967 about supervisory control (Ferrell & Sheridan, 1967) and a table with levels of

automation from 1978 (Sheridan & Verplank, 1978). A reader cannot have more than respect that Sheridan was much ahead of his time. However, it is not explained that/how these models have passed the test of time and continue to have relevance. For example, no reference is made to (levels of) automated driving, an important topic for many human factors researchers nowadays. It would have been interesting to hear Sheridan’s opinion about the validity and impact of supervisory control in modern times.

Admittedly, chapter 11, “Can Cognitive Engineering Modeling Contribute to Modeling Large-Scale Socio-Technical Systems?” does reflect on the bigger picture, such as inequality between rich and poor, privacy, population growth, the Internet, virtual reality, and massive open online courses (MOOCs). However, it does so in a descriptive and dated fashion. For example, a section is devoted to the 1972 report “The Limits to Growth” (Meadows, Meadows, Randers, & Behrens, 1972). Although it is undeniable that this report includes predictions that continue to be relevant, chapter 11 does not offer new data or viewpoints on this matter.

Similarly, it is explained that models can now be made available to a broader audience as “MOOCs are now reaching thousands of users worldwide,” “the Internet is currently in the process of making publicly available many sorts of data sets,” and “[virtual reality] technology allows the viewer to be ‘immersed’ in virtual worlds” (p. 126). These are not precise or enlightening observations.

A second point of critique is that parts of the book appear to lack depth and rigor. For example, chapter 1 describes how new knowledge is gained and covers topics such as scientific methods of acquiring knowledge,

evidence, objectivity, and bias. Unfortunately, the text in this chapter seems a pale reflection of standard textbook information about epistemology, scientific methodology, and philosophy of science. It is stated that “one’s brain can acquire knowledge during the evolutionary process by successive modifications to the genes. That finally results in fertilization of egg by sperm and the gestation process in the mother” (p. 5). Although the point is well taken that one’s knowledge is a function not only of one’s lifetime experience but also of past experiences of the species as a whole (see, e.g., Purves, Wojtach, & Lotto, 2011), this topic of evolution of knowledge could have been explained in more detail.

In chapter 1, important topics are treated, such as learning and intelligence, but in rather superficial ways. For example, Sheridan highlights Gardner’s theory of multiple intelligences, a theory that is not accepted by

mainstream intelligence researchers (Ritchie, 2015), while not citing any other research on intelligence. This is an omission, because information-processing skills can be useful for modeling individual differences in human-machine interaction and would have been in line with the information-processing models treated elsewhere in the book.

In summary, this book will be useful for scientists who want to have an accessible overview of classical human factors models. However, it is not recommended if the goal is to be inspired by rigor and timely reflections.

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