Contributions of
Dr. Tuncer Ören
to the Advancement of Modeling and Simulation (M&S)

(A Synopsis and some **citations** from open literature**)**

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Please note: A one page CV can be downloaded

Contributions of Dr. Tuncer Ören to the Advancement of Modeling and Simulation (M&S):

1. On Advancing Simulation Methodology

1.1 Dr. Ören designed (in 1971) the first model specification language (GEST–General System Theory implementor) which was based on a mathematical system theory where he introduced especially:

(1) modular specification of component models based on a mathematical system theory,
(2) their coupling (the concept is later adopted in DEVS models) and time-varying coupling,
(3) automatic generation of simulation programs from model specifications to allow
(4) maintenance of high level specification of models, instead of maintenance of error prone maintenance of simulation programs.

- The dissertation:

  Ören, T.I. (1971). GEST: General System Theory Implementor, A Combined Digital Simulation Language. Ph.D. Dissertation, 265 p. University of Arizona, Tucson, AZ. ACM Portal.

- A first publication was:

  Ören, T.I. (1971). GEST: A Combined Digital Simulation Language for Large-Scale Systems. Proceedings of the Tokyo 1971 AICA (Association Internationale pour le Calcul Analogique) Symposium on Simulation of Complex Systems, Tokyo, Japan, September 3-7, pp. B-1/1 - B-1/4.

Some citations about GEST from open literature follows:

- "A good simulation language should offer the possibility of writing a program in such a way, that the structure of the program is the same as the structure of the real system. As far as the author of this paper knows, there is just one language that offers this possibility in a clear way. This is the GEST '78 language as defined by T.I. Ören [3]." (p. 201).

  Kettenis, D.L. (1979). Combined Simulation with SIMULA '67. In: L. Dekker et al. (Eds.) Preprints of IMACS Congress 1979, Sorrento, Sept. 24-28, 1979, pp. 291-298.

- "The definition of experimental frame as given by Ören and Zeigler (7) is presented. A few of the newly developed simulation softwares have employed this concept such as GEST and SIMAN." (p. 61).

  Tsai, J., Juang, S-Y. (1986). An Experimental Frame Manager for the GASP IV Simulation Language. Proceedings of the 1986 Summer Computer Simulation Conference, July 28-30, 1986, Reno, Nevada, 61-64.

- "GEST [9] typifies the state-of-the-art of component models in continuous simulation language. MAGEST performs checks and certifies GEST programs. Thus any GEST module in a model base can be certified to be correct. Similarly, TESS [18] provides support for module development with SLAM networks." (pp. 113-114).

  Standridge, C.R. (1986). An Approach to Model Composition from Existing Models. In: Modelling and Simulation Methodology in the Artificial Intelligence era, M.S. Elzas et al. (Eds.), North-Holland, Amsterdam, pp. 113-120.

1.2 Dr. Ören published in 1979 –with Dr. B.P. Zeigler
–a paper on advanced simulation methodologies; the article became a seminal work in the field:

- Ören, T.I., Zeigler, B.P. (1979). Concepts for Advanced Simulation Methodologies. Simulation, 32:3, 69-82. SAGE Journals Online
- The article is **still** one of the 50 Most-Frequently Cited Articles in SIMULATION (6/50) as of August 1, 2010 -- updated monthly) Rankings are based on citations to articles on SIMULATION journal site from articles in HighWire-hosted journals.

Some citations about the article from open literature follow:

- "In this paper a comprehensive methodology for system simulation is proposed. The approach bears the stamp of general systems theory, a field to which both authors of this paper have made frequent and significant contributions."

  Karplus, W.J. (1979). Review of the Article by T.I. Ören and B.P. Zeigler (1979), Concepts for Advanced Simulation Methodologies, Simulation 32:3, 69-82.

- "Over the last five years several special purpose simulation systems and general purpose languages have been developed that, either independently or influenced by Oren and Zeigler, have included a functional separation of model development, entity description, scenario specification, and output analysis." (p. 563).

  Ketcham, M.G., Fowler, J.W., Phillips, D.T. (1984). New Directions for the Design of Advanced Simulation Systems. In: Proc. of the 1984 Winter Simulation Conference, S. Sheppard, U. Pooch, and D. Pegden (eds.), Nov. 28-30, Dallas, TX, SCSI, San Diego, CA, 563-568.

- "… Finally, in a very significant paper, Oren and Zeigler (79) pointed out several weaknesses in current languages and proposed developing new languages based on two concepts." (p. 150).

  Shannon, R.E. (1986). Intelligent Simulation Environments. In: Intelligent Simulation Environments. P.A. Luker, H.H. Adelsberger (Eds.). Proceedings of the Conference on Intelligent Simulation Environments., 1986, January 23-25, San Diego, CA.

- "Inspired by Oren and Zeigler's thought-provoking article in the March 1979 issue of Simulation [1], and the work that has taken place at several Universities since then, augmented with experience in Knowledge Engineering has allowed the CM-100 designers to conceive and build a tool that covers the whole trajectory from systems analysis through model construction." (p. 49).

  Elzas, M.S. (1988). Expert Simulation Systems in Practice. In: Proceedings of the 12th World Congress on Scientific Computation, R. Vichnevetsky et al. (Eds.), July 18-22, 1988, Paris, France, Vol. 5, pp. 47-50.

- "In the late 70's, Oren and Zeigler presented the concept of hierarchically modelling and experimental frames (Oren [1] 1979). From then on, the emphasis of simulation software development began to change." (p. 500).

  An, Y., Xiong, G., Xiao, T., Wang, X. (1989). IPSOS -- An Integrated Simulation System for Industrial Processes. In: Proceedings of the 1989 Beijing Simulation Conference. Pergamon Press, London, England, 500-504.

- "In a prominent paper, Ören and Zeigler [25] pointed out three major drawbacks of the traditional simulation languages and simulation environments." (p. 58).

Lin, M.-J. (1990). Automatic Simulation Model Design from a Situation Theory Based Manufacturing System Description. Ph.D. Dissertation, Texas A&M University, College Station, Texas.

- "In the end of 1970s, after Oren et al. presented the concept of advanced simulation methodology (basic conceptual frame for simulation, structured modelling and experimental frame), a new historical period of simulation software began, comparing with conventional simulation language, it has the following remarkable characteristics in structure." (p. 1062).

Wang, Z.-Z., Li, B.-H. (1991). Computer Simulation: The Past, Present and Future. Proc. of the 1991 Summer Computer Simulation Conference, 1991 July 22-24, Baltimore, MD, The Society for Computer Simulation International, San Diego, CA, pp. 1059-1065.

- "On the basis of the ideas of Ören/Zeigler a new approach to definitions will be introduced in this paper. As mentioned, the fundamental demands made on a simulation system originate from T. Ören and B.P. Zeigler in the eighties."

Wittmann, J. (1992). Model and Experiment — A New Approach to Definitions. In: P. Luker (ed.), Proceedings of the 1992 Summer Computer Simulation Conference, 1992 July 27-30, Reno, Nevada, The Society for Computer Simulation International, San Diego, CA, pp. 115-119.

- "In a very significant paper, Oren and Zeigler [1979] pointed out several shortcomings in current languages and proposed developing new languages based on two concepts." (p. 18).

Pegden C.D., Shannon, R.E., Sadowski, R.P. (1995). Introduction to Simulation Using SIMAN. McGraw-Hill, New York, NY.

1.3 Dr. Ören developed detailed categorizations and taxonomies of M&S

- A list of Dr. Ören's publications on categorization and taxonomies of M&S can be accessed by clicking here.

Some citations from open literature follow:

- "Indeed, quoting Tuncer, we are somewhat like 'architects of the future' in establishing categories in which we feel that much future effort will be concentrated." (p. 55).

Zeigler, B.P. (1982). Subject Plan for an Encyclopedia: A Taxonomy for Modelling and Simulation. ACM Simuletter, 13:1-4, 55-62.

- "Oren has produced an admirably detailed classification of computer simulation tools (73-75). Something of this nature is needed for general systems models and tools." (p. 64).

Troncale, L.R. (1985). The Future of General Systems Research: Obstacles, Potentials, Case Studies. Systems Research, 2:1, 43-84.

- "The luncheon speaker on Wednesday was Dr. Tuncer I. Oren of the University of Ottawa. He developed a categorization of simulation technology which clarified concepts even for long-time workers in the field, and which clearly defined regions in which additional effort is needed to meet identified requirements." (p. 5).

Garzia, R.F. (Ed.) (1979). Simulation Week Report. Modelling (IEEE Computer Society Simulation Technical Committee Newsletter), Issue 5 (May 1979), p. 5.

- "No doubt, our own ideas have profited from the published works of Zeigler [4;5], Ören [6;7], Mathewson [9;10], and the DELTA project [11]." (p. 175).

Nance, R.E., Mezaache, A.L., Overstreet, C.M. (1981). Simulation Model Management: Resolving the Technological Gaps. Proceedings of the 1981 Winter Simulation Conference, pp. 173-179.

"Research is currently underway to develop simulation software for conducting an entire simulation study. The design of this software is based on concepts of SDL, of GERT-type networks (12) and of Ören and Zeigler (9)." (p. 362).

Standridge, C.R., Pritsker, A.A.B. (1982). Using Data Base Capabilities in Simulation. In: Progress in Modelling and Simulation, F.E. Cellier (Ed.). Academic Press, London, England, 347-365.

- "One analysis proposed by Oren and Zeigler [1] and amplified by Zeigler [2] and by Oren [3], distinguishes model development, experiment specification, data analysis, and output analysis as four views of simulation. Analyzing a simulation in these terms provides a framework for preparing a taxonomy of expert systems (ES) and Artificial Intelligence (AI) techniques related to simulation studies." (p. 44).

Ketcham, M.G. (1986). Expert Systems and User Decisions in Simulation Studies. In: Languages for Continuous System Simulation, F.E. Cellier (Ed.). SCS, San Diego, CA, pp. 44. 49.

1.4 Dr. Ören promoted model-based M&S

(The concept is later accepted also in software engineering and in systems engineering)

Some citations from open literature follow:

- "Tuncer I. Ören concludes the special section with the most futuristic and methodologically related presentation. He outlines the possibilities for basing information on model bases in addition to data bases. While data base management systems have descriptive power, model base management systems add predictive power: they store knowledge in a form required by the cybernetic society." (p. 144).

Zeigler, B.P. (Ed.) (1984). Introduction. Behavioral Science, 29:3 (July) - Special Section on Simulation Methodology for Human Systems Modelling, pp. 143-144.

- "Our approach towards this goal is to conceive simulation as a special case of a more general and conceptually richer paradigm of model-based activities' (Ören 1984, p.5). It is the aim of this paper to illustrate that the different modeling views simulationists employ are not 'worlds apart' from each other, but they complement each other, and a certain extent may be integrated." (p. 99)

Akkermans, H.A., van Dijkum, C. (1990). Worlds Apart? The Modelling Cycle, Paradigms and the World View in Simulation Modelling. In: Modelling and Simulation, B. Schmidt (ed.), Proc. of the 1990 European Simulation Multiconference, 1990 June 10-13, Nuremberg, Germany, The Society for Computer Simulation International, San Diego, CA, pp. 99-106.

1.5 Dr. Ören's normative views for the advancement of M&S

- Dr. Ören's normative views for the advancement of M&S include *synergies* with artificial intelligence and system theories, as well as need for a *comprehensive and integrative view* of M&S.

- A list has over 170 publications, presentations and other activities on normative views of Dr. Ören for advancements and advanced methodologies. A distribution over the decades is as follows:

	1970s	1980s	1990s	2000s	2010s	total
Publications	14	28	16	51	5	114
Presentations & other activities	8	28	13	13		62
total	22	56	29	63	5	176

1.6 Dr. Ören developed multisimulation

- Multismulation is a powerful simulation methodology to allow simultaneous exploration of several simulation studies. Some references can be found by clicking here.

1.7 Contributions of Dr. Ören to advance the state of the art of simulation methodology are acknowledged by colleagues:

- Dr. Ören has been an invited speaker in international conferences and seminars since 1960s. The following table gives the number of times he has been keynote/plenary/honorary/invited speakers in the 2000s alone:

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	total
keynote/plenary/ honorary/invited	8	5	2	3	4	11	3	6	2	2	2	(1)	**48** (+1)

- Dr. Ören is inducted to Simulation Hall of Fame (Life time achievement award) (2011) SCS
- Dr. Ören received a Distinguished Service Award (2006) from SCS
- Dr. Ören has been an SCS Distinguished Lecturer
- Dr. Ören received a Recognition of Service Award from ACM as a former Chair of the SIGSIM.

Some citations from open literature about his contributions follow:

- "The author has oriented the theory for clarifying the conceptions of system and model, while he does not consider any one of the Czechoslovak group to be able to add more to the results of Mihram [24], Zeigler [35], and Oren [27]."

  Kindler, E. (1981). A Formalization of Some Simulation Language Concepts. Int. J. General Systems. Vol. 6, pp. 183-190.

- This summer (July 26-August 6) Suzy and I participated in the NATO Advanced Study Institute "Simulation and Model-Based Methodologies: An Integrative View" held at the University of Ottawa, Ottawa, Canada; I now know vastly more about modeling and simulation (or the possibilities thereof) than I did before. I also learned that there is a lot more to learn!

  Well, the 58 lecturers and participants from 18 countries at the Institute, organized under the direction of Dr. Tuncer Ören of the University of Ottawa's Computer Science Department, are certainly doing their best to remedy that. In fact, the degree of mathematical abstraction (which seems necessary to develop theory) was so advanced that this writer found it difficult at times to relate it to reality.

  Dr. Ören was the first speaker. After an appropriate greeting he presented a lecture on "Computerization of Model-Based Activities: A Paradigm Shift and New Vistas." Although he covered the "fundamental elements of a simulation study; models and behaviour; elements of a

model-based simulation software system; synergies of simulation, software engineering, artificial intelligence, and general system theories; knowledge-based modeling and simulation systems; and highlights of desirable research in simulation," Tuncer's main thrust, it seemed to me, was "to place simulation in a central position for several scientific disciplines by a shift of paradigm."

In our opinion Dr. Ören made his point, ... The complete papers will be included in a book Simulation and Model-Based Methodologies: An Integrative View which should be available from Springer-Verlag early in 1983.

John McLeod (1982). IF I KNEW THEN ..., Simulation in the Service of Society (S^3), October 1982, pp. IX-X.

- "And a formalization stage: Zeigler and Ören introduced their metaconcepts and explained how earlier languages fit into a formal taxonomy of modeling. They 'classed up' our act something that was sorely needed."

  Kiviat, P.J. (1991). Simulation, Technology, and the Decision Process. ACM Transactions on Modeling and Computer Simulation, 1:2 (April), 89-98. (Commenting on the stages of simulation language evolution)

- "Zeigler [234], Oren [162, 163], Elzas [53, 54], and Nance [156] have advanced the state of the art in simulation methodology." (p. 23)

  Fishwick, P.A. (1995). Simulation Model Design and Execution - Building Digital Worlds. Prentice-Hall, Englewood-Cliffs, NJ.

- "Starting with Zeigler's initial steps in the development of a theory and framework for the practice of modelling and simulation [Zeigler (1976)] and the seminal article by Ören and Zeigler in Simulation [Ören, Zeigler (1979)] a whole series of conferences on Modelling and Simulation Methodology was held in the late seventies and throughout the eighties. The publications that resulted from these, specialized, conferences became mandatory reference texts in M&S at a number of universities the whole world over [Zeigler et al. (1979)] [Ören et al. (1984)] [Elzas et al. (1986)] [Elzas et al. (1989)]."

  Elzas, Maurice S. (2003). The BoK Stops Here! Modeling & Simulation, Volume 2, Number 3, July-September 2003

- "Indeed, many of the ideas that Maurice, Tuncer and I evolved around the ten years from 1975 to 1985 were certainly ahead of their time. Nevertheless, they have started, or are now starting, to emerge as "received truths" or "folklore beliefs" to the current generation. For example, in its High Level Architecture and Simulation Based Acquisition initiatives, the US Department of Defense is requiring standardized, well disciplined, repository-supported, construction of simulation models to foster reusability and interoperability. Often – no, usually – there is no trace back to the first appearances of these ideas in the early M&S symposia books. But the fact that so many of them are entering into the collective unconscious of humanity ought to indicate that the "trio" – Maurice in the jeep driver's seat, Tuncer peering ahead through the binoculars, and myself charting the immediate course – was on the right track in those pioneering days."

  Zeigler, B.P. (1999). Tribute to Maurice Elzas – Some Recollections of Pioneering Days." In: the Book Edited to honor Prof. Ir. M.S. Elzas, University of Wageningen, Dept. of Informatics, Wageningen, the Netherlands, p. 93.

Contributions of Dr. Tuncer Ören to the Advancement of Modeling and Simulation (M&S): 2. On Advancing Modeling Methodology

- Dr. Ören developed a powerful modeling methodology called *multimodeling*. Some references are listed here.

Some citations from open literature on advanced modeling methodologies follow:

- "T.I. Ören introduces a new paradigm of modelling. A Simulation model can be automatically tailored as a piecewise continuous system with a set of discontinuities representing changes in parameters, dynamics etc." (p. 48).

  Rudolph, P. (1991). Book Review: Knowledge-Based Simulation, Methodology and Applications, P.A. Fishwick and R.B. Modjeski (eds.), Advances in Simulation vol. 4, Springer-Verlag, New York, NY.

- "A new paradigm, *structural simulation* (as opposed to conventional 'trajectory' simulation) is needed to avoid having to force structural changes down to the same level as behavioral ones (Ören 1975; Zeigler 1976; Davis 1986; Hogeweg and Hesper1986; Elbert and Salter, 1986; Sampson, 1984.)" (p.13).

  Zeigler, B.P. (1995). Object-Oriented Simulation with Hierarchical, Modular Models - Intelligent Agents and Endomorphic Systems. Academic Press, Harcourt Brace Jovanovich, Publishers.

- "*Variable structure systems* have been introduced as a new system class by Oeren [Oer75]." (p.8).

  Pawletta, T., Lampe, B., Pawletta, S., Drewelow, W. (1996). An Object Oriented Framework for Modeling and Simulation of Variable Structure Systems. Proc. Of the 1996 Summer Computer Simulation Conference, V.W. Ingalls, J. Cynamon, A.V. Saylor (eds.), Portland, Oregon, July 21-25, 1996, pp. 833.

- "In the 1970s a series of more systematic and profound studies aimed at providing a theoretical foundation for modelling. Three names are strongly associated with this theoretical foundation for simulation modelling: Bernard P. Zeigler, Tuncer I. Ören and Maurice S. Elzas. Their series of books (Zeigler, 1976, 1984, Zeigler *et al*. 1979, Ören, 1978, Ören *et al*, 1984, Elzas *et al*., 1986, 1989) was the stage for publication of novel views by many authors whose contributions to the modelling process and its technology are still very relevant today. ... Next to the 'godfathers' of *modelling and simulation*, some of these authors inspired me and have to be mentioned here ..."

  Scholten, H. (2008). Better Modelling Practices: An Ontological Perspective on Multidisciplinary, Model-based Problem Solving. PhD thesis, Wageningen University, Wageningen, The Netherlands. ISBN 978-90-8585-304-6. 320 p.

- "Advances in simulation environments toward support of *hierarchical, modular model construction* are typified by MAGEST (Oren, 1983; Aytac and Oren, this volume) and BORIS (Decker, 1980)." (p. 195). ... "In an early paper (Oren, 1975), and more recently in a taxonomy of models (Oren , 1979, 1985), Tuncer Oren introduced the term "variable structure model" in the sense in which we shall use it here." (p. 196).

  Zeigler, B.P. (1986). Toward a Simulation Methodology for Variable Structure Modelling. In: Modelling and Simulation Methodology in the Artificial Intelligence Era, M.S. Elzas et al. (Eds.), North-Holland, Amsterdam, pp. 195-210.

- "The considerations in this section are strongly influenced by the pioneer work in modeling methodology as performed by Zeigler [7.22] and Oren [7.15, 7.16, 7.17]. These were the first scientists who tried only recently to conceptualize modeling in a methodological manner." (p. 188).

  Cellier, F.E. (1979). Combined Continuous/Discrete System Simulation by use of Digital Computers: Techniques and Tools. Doctoral Diss,, Swiss Federal Institute of Technology, Zürich, Switzerland.

Contributions of Dr. Tuncer Ören to the Advancement of Modeling and Simulation (M&S):

3. On Synergy of Artificial Intelligence and Modeling and Simulation

3.1 Early contributions (1970s-1990s: AI and M&S)

- A list of Dr. Ören's publications, presentations and other activities on simulation and artificial intelligence can be accessed by clicking here.

Some citations from open literature follow:

- "The use of AI in simulation had been proposed already in 1977 by Oren, who discussed how AI could assist simulation. ... Again, the earliest proponent of using AI in simulation was Oren (Oren 1979, 1982, 1986), and he often pointed out how AI could help in model building, including the specification of model components, the interfaces between components, and model parameter values. (p. 115). ... Oren and Zeigler, in the 1987 Annual Report of the Simulation Society, stressed the need for what they termed 'cognizant simulation'. ... Based on this paper, S. Treu made a proposal for the exact requirements of cognizant simulation (Treu 1988). In the past three years there has been much work in creating pieces of such a cognizant simulation language." (p. 116).

  Tsatsoulis, C. (1991). A Review of Artificial Intelligence in Simulation. SIGART (ACM Special Interest Group on Artificial Intelligence, 2:1 (Jan.), 115321.

- "Ören was one of the early proponents of utilizing artificial intelligence techniques (Ören 1977) for computer-assisted model building systems that would include the specification of model components, the interfaces between components, and model parameter values (Ören 1979, Ören 1982)." (p. 112).

  Murray, K.J., Sheppard, S.V. (1988). Knowledge-Based Simulation Model Specification. Simulation, 50:3 (March).

- "The pioneering work of Ören and his associates [9] in the field of knowledge based simulation system building has been reported in the field." (p. 384).

  Jávor, A. (1986). Proposals for the Architecture of Expert Systems. In: The proceedings of the 2nd European Simulation Congress, G.C. Vansteenkiste et al. (Eds.). SCS, San Diego, CA, pp. 384-390.

- "For both simulation researchers and practitioners, this book may be worth buying just for its two chapters (by Oren and Elzas). They provide a unifying view of simulation, artificial intelligence, system theories, software engineering and modelling. … For those in our profession who still consider simulation to be merely a set of techniques for use 'when all else fails' (Wagner, 1975), this book contains an interesting and quite powerful counterview."

Samson, D. (1985). Review of "Simulation and Model-Based Methodologies: An Integrative View, " T.I. Ören, B.P. Zeigler, M.S. Elzas (Ed.). Springer-Verlag, Berlin, 1984, xiii + 651 p., European Journal of Operations Research, 21:3 (Sept. 1985), pp. 411-412.

3.2 Recent contributions (1990s-2000s: Agents and M&S; ADS: Agent-directed Simulation)

- A list of Dr. Ören's publications, presentations and other activities on simulation and software agents can be accessed by clicking here.
- Since 1996, Dr. Ören has been working on ADS which covers four types of synergies of software agents and modeling and simulation that can be discussed two categories:

  (1) contributions of simulation to agents (or *agent simulation*) which covers simulation of systems modeled by software agents and advanced simulation studies initiated by software agents (or *agent-initiated simulation*; and

  (2) contributions of software agents to simulation which consists of agent-supported simulation and agent-based simulation. *Agent-supported simulation* is use of agents in front-end and back-end interfaces of simulation environments to support simulation studies. *Agent-based simulation* is use of agents in and/or during the behavior generation phase of a simulation study; e.g., for dynamic model composition.

  Some citations from open literature follows:

  "The only book to present the synergy between modeling and simulation, systems engineering, and agent technologies expands the notion of agent-based simulation to also deal with agent simulation and agent-supported simulation. Accessible to both practitioners and managers, it systematically addresses designing and building agent systems from a systems engineering perspective."

  Wiley

- "The central thesis of the book is that, while simulation in application to agents is fairly well established, the converse application of agents to the enterprise of modeling and simulation is much less appreciated and as the editors assert, no less important. Indeed, Ören's taxonomy in the opening chapter alone is worth the price of admission. His framework enables one to consider the mutual synergies among modeling and simulation, system theories, systems engineering, software agents, and artificial intelligence. I can see research professors and graduate students being stimulated to explore branches of this tree toward new research directions in proposals or dissertations."

  Zeigler, B.P. (2009). Forward for Agent-Directed Simulation and Systems Engineering, Yilmaz, L. and T.I. Ören (eds.). Wiley Series in Systems Engineering and Management, Wiley-Berlin, Germany. 520 p.

3.3 Cognitive and Emotive Simulations: Personality, Emotions, Perception-Anticipation

- A list of Dr. Ören's publications, presentations and other activities on *cognitive* and *emotive simulations* can be accessed by clicking here.
- A list of Dr. Ören's publications, presentations and other activities on *understanding* can be accessed by clicking here.
  The studies started in developing simulation program understanding systems.

Contributions of Dr. Tuncer Ören
to the Advancement of Modeling and Simulation (M&S):

4. On reliability issues in M&S and artificial intelligence-directed M&S

- Dr. Ören's publications and presentations on M&S reliability and quality assurance (QA), including failure avoidance can be accessed by clicking here.

Some citations from open literature follow:

- "Yet as the complexity of the problems we leave in our wake gets larger, we may find Ören's perspective on model realism more and more attractive in extricating ourselves from what our limited methodologies have wrought." (p. 220).

  Zeigler, B.P. (1983). Respondent's Comments on T.I. Ören. In: Adequate Modelling of Systems, H. Wedde (Ed.). Springer-Verlag, W. Germany, p. 220.

- "This column reviews some of the AI related aspects of the 1988 Summer Computer Simulation Conference in Seattle, July 25-28. - On Tuesday morning Professor Tuncer I. Oren of the University of Ottawa addressed a plenary session on 'Quality Assurance in the AI Era.' - Professor Oren began his talk by asking for a more practical goal that would also be a major step toward proving correctness. He asked how to write programs and to design models that are able to be audited and, in fact, provide automatic audit trails. He first introduced this concept in an article last year in SIMULATION which discussed knowledge base auditing." (p. 207).

  Wildberger, M. (1988). AI and Simulation. Simulation 51:5 (Nov.), 207.

- "Ören (1987a, 1989) has demonstrated the wide variety of ways in which AI and simulation are error prone, a situation which can be alleviated with a corresponding variety of quality assurance techniques. Ören's MAGEST advisor (Ören and Tam, 1988) shows how coupling specifications for GEST can be quality assured. Ören and Sheng (1988) show how to achieve 'built-in' quality assurance within a modelling and simulation environment using semantic knowledge expressed as rules." (p. 345)

  Zeigler, B.P. (1990). Object-Oriented Simulation with Hierarchical, Modular Models. Academic Press, Harcourt Brace Jovanovich Publishers, Boston, Mass. 395 p.

- "In an earlier article Ören (1986a) indicates the relevance of machine learning in simulation .... He also points out that every time there is learning in a knowledge base, the integrity and consistency of the knowledge base need to be assured via relevant syntactic and semantic checks."

  Khoshnevis, B., Parisay, S. (1993). Machine Learning and Simulation: Application in Queuing Systems. Simulation, 61: 5 (Nov.), 295-302.

- "To increase significantly the probability of success in conducting a simulation study, an organization must have a department or group called simulation quality assurance (SQA). The SQA group is responsible for total quality management and works closely with the simulation project managers in planning, preparing, and administering quality assurance activities throughout the simulation study. The SQA is a managerial approach that is critically essential for the success of a simulation study. Ören [1-3] presents concepts, criteria, and paradigms that can be used in establishing an SQA program within an organization."

  Balci, O. (1998). Verification, Validation, and Testing. In: J. Banks, Editor, Handbook of Simulation, Engineering & Management Press (1998), pp. 335–393.

Contributions of Dr. Tuncer Ören to the Advancement of Modeling and Simulation (M&S):

5. On the synergy of software engineering and artificial intelligence

- Dr. Ören developed a taxonomy of about 500 concepts on knowledge and knowledge processing in a book that he edited.

  Ören, T.I. (1990). A Paradigm for Artificial Intelligence in Software Engineering. In: Advances in Artificial Intelligence in Software Engineering - Vol. 1, T.I. Ören (ed.), JAI Press, Greenwich, Connecticut, pp. 1-55.

Some citations from open literature follow:

- "T.I. Ören (University of Ottawa, Canada) proposed a taxonomy of machine intelligence and software. It is mandatory that a sound theoretical basis should be developed as quickly as possible, otherwise, various and de facto standards might emerge soon. Ören's taxonomy would be a good starting point." (p. 247).

  Schoemaker, S. (1985). Artificial Intelligence in Simulation. Future Generations Computer Systems, 1:4 (June 1985), 245-247.

- "We use an example from recent AI literature to demonstrate how certain simulation methods can be reoriented and extended to help AI modelers towards their goal. ... Forbus notes that ... it is difficult to model a pot of boiling water ... or a bouncing ball when expressed within system dynamics. ... Ören [28] developed a concept of multimodel to formalize models containing several submodels, only one of which is put into effect at any given time. "

  Fishwick, P.A. and Zeigler, B.P. (1992). A Multimodel Methodology for Qualitative Model Engineering. ACM Transactions on Modeling and Computer Simulation (TOMACS), 2:1, 52-81.

- "Rendons á César ce qui appartient á César, et au Dr. T.I. Ören, également de l'Université d'Ottawa, la paternité des modèles d'organigrammes utilisés á travers tout ce livre,". (p. X).

  Faroult, S., Simon, D. (1987). Fortran structuré et méthodes numériques, Dunod, Paris, France, 326 p.

Contributions of Dr. Tuncer Ören to the Advancement of Modeling and Simulation (M&S):

6. On promoting ethics in simulation

6.1 Dr. Ören was the lead author of the SCS Code of Ethics

- *As of 2010,* the following Groups have adopted the SCS Code of Ethics

  (In order of adoption)
  - SCS - Society for Modeling and Simulation International (Resolution)
  - MISS - Mcleod Institute of Simulation Sciences (Resolution) (To see: MISS Centers)
  - M&SNet - McLeod Modeling and Simulation Network (Resolution) (To see: Member Organizations)
  - SISO - Simulation Interoperability Standards Organization (Resolution)
  - SISO Canada (Resolution)
  - AMSC - Alabama Modeling and Simulation Council (Resolution)
  - Student Chapters of SCS
  - NMSG - NATO Modeling and Simulation Group (Resolution)
  - DLM - (Resolution) (Members)
  - CMSP - Certification of Modeling and Simulation Professionals.
    By the M&SPCC (Modeling and Simulation Professional Certification Commission)
    (Requirement)
  - Meteksan - Meteksan Defense Industry Inc. (Meteksan Savunma Sanayii A.Ş. - in Turkish)
    (Resolution - in English, in Turkish,

- A list of Dr. Ören's publications, presentations and other activities on simulation and ethics can be accessed by clicking here.

Some citations from open literature follow:

- "Interesting in this third meeting *(in 1986)* is that Tuncer I. Ören, while addressing quality assurance problems in simulation, introduced the concept of normative assessment. And he defines normative assessment of an element of a simulation study as its evaluation with respect to some norms of a value system which can be pragmatic or ethical, and the last one he defines as: 'Ethical assessment of a simulation study is its evaluation with respect to a set of moral codes."

  Smit, W. (1999). A Question of Ethics. In: the Book Edited to honor Prof. Ir. M.S. Elzas, University of Wageningen, Dept. of Informatics, Wageningen, the Netherlands, pp. 30-33.

- "... Ören presents an overview of sources available on the topic of ethics in general. He concludes that ethics has attracted hardly any attention in the simulation community. He strongly advises the development of a code of conduct for people working professionally in the field of simulation. Furthermore, he presents a procedure of how to compose such a code of conduct."

  Kettenis, D.L. (2001). Ethical Issues in Modeling and Simulation. Guest Editor's Introduction to the Special Issue. Transactions of the Society for Modeling and Simulation International, 17:4 (Dec.), 162.

- "For his many years of Outstanding Leadership and Support to the Society, including leading the effort on the M&S Code of Ethics"

  SCS Distinguished Service Award, 2006

6.2 Activities to enlarge the number of institutions accepting the SCS Code of Ethics continue

- Canadian DND (Department of National Defence) is already contacted; they consider adopting it.
- Major M&S Associations, Groups and Centers will soon be contacted

7. Contributions of Dr. Tuncer Ören to Modeling and Simulation Terminology

- A list of Dr. Ören's publications, presentations and other activities on terminology can be accessed by clicking here.
- Details of Dr. Ören's M&S dictionary project can be accessed by clicking here.
- A first M&S dictionary (over 4000 terms all collected by Dr. Ören) is published in 2006.
  The dictionary included English-French-Turkish terms.
  To see the cover of the dictionary, the names of the 14 French colleagues who contributed, as well as the sponsors, please click here.
- Currently, over 90 volunteers are involved for two versions of the dictionary (over 9000 terms)

  Ören, T.I., et al. (In Preparation). Modeling and Simulation Dictionary - English-French-German-Italian-Spanish-Turkish.

  Ören, T.I., BoHu Li, GuangHong Gong et al. (In Preparation). Modeling and Simulation Dictionary - English-Chinese, Chinese-English.

8. Contributions of Dr. Tuncer Ören to Modeling and Simulation Body of Knowledge

- A list of Dr. Ören's publications, presentations and other activities on M&S Body of Knowledge can be accessed by clicking here.
- Dr. Ören's activities in concert with concerned colleagues to finalize an M&S Body of Knowledge (M&S BoK) continues.
- A draft M&S BoK still being developed by Dr. Ören can be accessed by clicking here.

9. Contributions of Dr. Tuncer Ören To Other Aspects of Modeling and Simulation

9.1 Positions at SCS:

- Dr. Ören has been associated with **SCS** since 1966.
  A list of past and current involvement can be accessed by clicking here.
  Currently, he is active in over 10 activities of SCS.

9.2 Positions at ACM SIGSIM: During late 1970s and early 1980s, Dr. Ören was a chairman of ACM SIGSIM and editor of SIMULETTER.

9.3 Positions at NATO: During 1996-2001, Dr. Ören served in several NATO and WEAG groups on M&S.