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EDITORIAL

Robotics, Virtual Reality, and Agents and their Body: A Special Issue in Memory of Marco Somalvico

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1 The Context of the Initiative

On 17 November 2002, Prof. Marco Somalvico passed away suddenly and prematurely. We are past the fifth anniversary, but Marco has never ceased to be a major influence, indeed a cherished human presence as well in one's memories, for his disciples, collaborators, and colleagues who knew him. Some of these have undertaken the initiative of several commemorative issues, hosted in a number of journals, and covering research in both artificial intelligence, and robotics. This involved a painstaking refereeing process; still, for every article in these special issues, at least one of the authors knew Marco Somalvico.

The special issue you are holding in your hands stands out, within this initiative, in that it is focused on robotics. In 1998, Marco Somalvico was awarded the Joseph F. Engelberger Robotics Award for Education, and he also was among the founders of the Società Italiana di Robotica Industriale. His group started research in robotics at the Technical University of Milan since 1971. Moreover, he was one of the first two scholars who introduced research in artificial intelligence into Italian academia.

Several international scholarly journals are participating in this memorial endeavour: the issues in the *Journal of Intelligent and Fuzzy Systems* and in the *International Journal on*

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Artificial Intelligence Tools have already appeared, and concomitantly with this special issue, one in *Cybernetics and Systems* is also in press. All in all, seven journals (also including *Computational Intelligence* and *Annals of Mathematics and Artificial Intelligence*, as well as *Applied Artificial Intelligence*) will have hosted this initiative. A large, shared pool of referees proved extremely valuable.

Our thanks go to former Editor-in-Chief, Prof. Spyros Tzafestas, and the current Editor-in-Chief, Prof. Kimon Valavanis, for playing host. We are also grateful to Joey Francis Magnata, of Springer, and to the referees who made this multi-journal initiative feasible; they are all listed alphabetically in the following (even though only part of them were involved in this particular special issue): Francesco Amigoni, Silvana Badaloni, Mirko Bordignon, Andrea Bonarini, Will Browne, Vincenzo Caglioti, Stefano Cagnoni, Riccardo Cassinis, Aldo Franco Dragoni, Susi Dulli, Efstratios (Stratis) Gallopoulos, Giuseppina Gini, Maria Gini, Moshe Goldstein, Janis Jefferies, Rodger Kibble, Jacob Kogan, Jixin Ma, Vittorio Maniezzo, Emanuele Menegatti, Richard Mitchell, Ephraim Nissan, Corrado Petrucco, Matteo Roffilli, Daniel Stamate, Jin Tian.

2 An Introduction to the Articles

The first article is from Karlsruhe. Knoop, Pardowitz and Dillmann are concerned with robots' ability to learn from humans, and in particular with robots' ability to transform gathered abstract task knowledge "into their own representation and dimensionality", as opposed to programming-by-demonstration approaches, where knowledge "is defined in the workspace of the human demonstrator". The Karlsruhe team "presents a new approach for mapping abstract human-centered task knowledge to a robot execution system based on the target system properties", such that "the required background knowledge about the target system is examined and defined explicitly".

The second article in this special issue is from Minneapolis. Rybski, Larson, Veeraraghavan, LaPoint, and M. Gini discuss a set of experiments that were performed with a swarm of small and simple robots in order to test their overall performance in a foraging task, when operating with different communication and sensing systems.

The third article is by D'Angelo (in Udine, Italy) and Pagello (in Padua), and pays tribute to the late Hideo Yuasa of Tokyo, because the project stemmed from earlier collaboration with him. Autonomous roboticles's survival "is better accomplished if they are open systems, interacting with the environment by exchanging matter, energy, information, and so on". The model of how the autonomous robot control unit works "borrows from living systems the idea that sensing and acting on the environment can be recognized as a mechanism exchanging energy with the environment in order to maintain an highly organized internal control structure to resist to external applied perturbations. The necessary energy balancing is provided by an autopoietic loop which is fed by the energy entering the robot through its sensor devices and it is dissipated by its effectors for properly acting in the environment".

Francesco Amigoni's paper is concerned with the potential of multirobot systems exploiting mobile code technologies, presenting (albeit in a rather preliminary way) such "architectural and technological solutions that enable both the mobility of code in a network of robots and the interfacing between robotic platforms and mobile code".

The next article, too, is from Milan. Caglioti and Gasparini's application is in a Robocup context, such that robots are expected to play with a flying ball; therefore, "reliable methods to localize a sphere in the 3D space are needed". Whereas if "the radius of the sphere is

known, it can be localized by analyzing a single, perspective image of it", this is not the case if the radius is unknown. Caglioti and Gasparini "consider axial-symmetric catadioptric cameras, i.e. devices consisting of an axial-symmetric mirror plus a perspective camera, whose viewpoint is on the symmetry axis". They "show that, using a noncentral axial-symmetric catadioptric camera, a single image is sufficient to determine both the position of a sphere and its radius". Noncentrality of this camera means that "the viewing rays are not all concurrent at a single point".

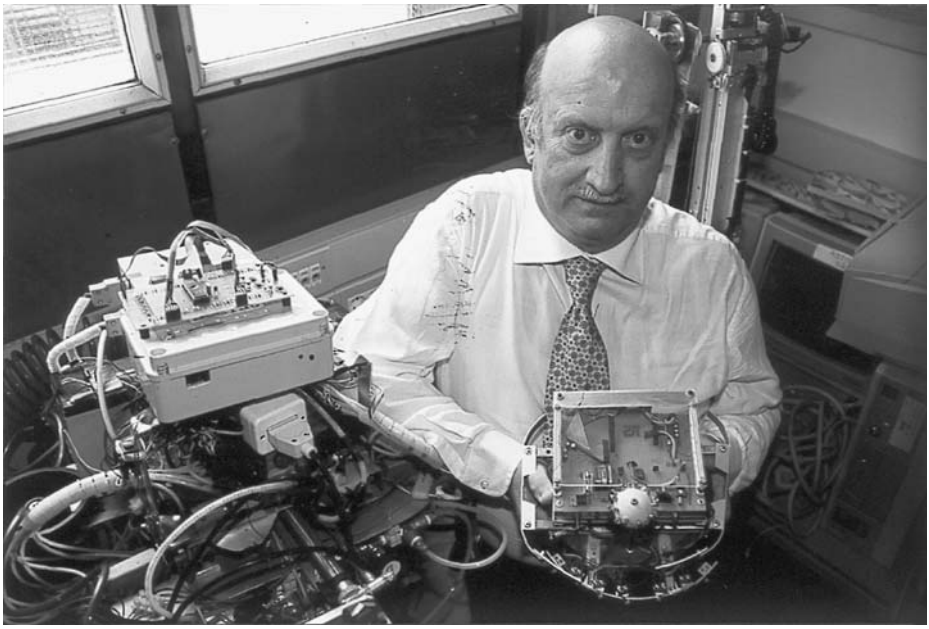
The article by Folgheraiter, G. Gini and Vercesi, from Milan, is titled "A New Haptic Device for Applications in Virtual Reality and Humanoid Robotics". The device "combines the electro-tactile stimulation with the force and visual feedbacks in order to improve the perception of a virtual world". Tbe user wears a glove with sensors and actuators, connected to a PC. Tactile and kinesthetic sensations are recreated by integrating cutaneous stimulation with 3D modelling techniques. One application is as an interface to intelligent robots.

The last two papers in this issue are from London. In the fist one, Nissan overviews embodied agents reasoning about the body (e.g., self-reconfiguring robots), recognition of a body part as belonging to one's own body, and virtual models of the human body. In the last article, Nissan applies episodic formulae by exemplifying them on an anecdote, in which human characters (rational, emotional, hierarchically positioned embodied agents) must reason about each other's bodies, and ascribe to each other beliefs within such reasoning. "This article develops two threads. The first thread argues that the narrative dimension of social interaction is important to societies of embodied agents", even "in societies of robots, because categories of patterns of action can arguably be usefully captured by modifications of levels of abstraction originally developed" in formal approaches to narratives, and roles within these. The second thread "is to analyze a story of interaction among characters with different social positioning, such that reasoning on the body of one of them is central", and punishment is meted to such agents who are not astute enough not to antagonise the most powerful agents in the course of satisfying the goals assigned to them.

3 Marco Somalvico (1941–2002)

Marco Somalvico was born in Como (the famous lakeside resort), on 10 October 1941, the son of a professional musician, and in fact he inherited a passion for music, being a skilled organ player. A prized high school leaver in 1960, in the same town of Como he was to start his career as a high school teacher. In 1965, he earned the *Dottore Ingegnere* Degree in Electronics Engineering at the prestigious Technical University (Politecnico) of Milano, and this came along with the *Medaglia D'Oro* (golden medal) award of the Politecnico di Milano Alumni Association as that year's best graduate in electronics engineering. A research associateship at the Politecnico followed. After three years spent at the Artificial Intelligence Laboratory of the Computer Science Department at Stanford University (a stay which deeply influenced him), in 1971 Marco Somalvico returned to Milan, to the Computer Engineering Section of the Electronics and Information Department at Technical University, and took an assistant professor post.

In Stanford he also spent some time in 1977 and 1989, and in Edinburgh, a few months in 1972 (at the Department of Computational Logic of the School of Artificial Intelligence). As early as 1971, Marco established the Artificial Intelligence and Robotics Project of the Politecnico di Milano, where he directed the team since then. In 1974, he became associate professor locally; then, in 1980, full professor. He also was member of the Istituto di Studi Superiori dell'Insubria Gerolamo Cardano, an *Institut de France*-type prestigious (though young) institution.



Marco Somalvico in his robotics laboratory

At the start of the 1970s, he was the man who, at about the same time as Ugo Montanari, first introduced artificial intelligence into Italian academia. He soon brought in a robot prototype, obtained from Olivetti, which his team at the prestigious Technical University of Milan radically modified. He was among the founders of the Società Italiana di Robotica Industriale (the Tenth International Symposium of Industrial Robotics was held in Italy, in 1983), as well as of the Associazione Italiana per l'Intelligenza Artificiale. In 1987, Marco Somalvico hosted in Milan the International Joint Conference on Artificial Intelligence (IJCAI). The team carried out disparate research, with a focus on AI or robotics, but touching upon a great number of subjects. One of the projects which Marco especially cherished was applied to the assistance to people with disability, and for that reason Marco was awarded an award, the *Ambrogino d'Oro*, by the City of Milan. In 1998, he was awarded the Joseph F. Engelberger Robotics Award for Education (of the USA Robotic Industries Association), the equivalent of the Nobel prize for academics in robotics. These are but a few of the honours he received.

His output of scholarly publications includes 5 books, and over 150 articles. Apart from robotics, his research has included automated problem solving, parallel problem solving (especially using cellular automata), automated program synthesis, natural-language processing, machine vision, multi-agent systems, computer-aided design, expert systems, home and urban automation (home automation he used to call *domotica* in Italian), virtual museums, man-machine interaction, and AI systems of assistance to the disabled. He concerned himself as well with philosophy, and (jointly with two of his students) authored the entry 'Intelligenza Artificiale' for the *Enciclopedia Italiana*. Marco Somalvico is survived by his wife, linguist Graziella Tonfoni.

In his last several years, Marco had been constantly very tired, yet always very active. An intensely honest and deeply religious man, he also used to be combative for his convictions. There is no room to tell anecdotes about Marco's remarkable personality, blunt candour, and sometimes rather impolitic courage to stand by his conscience. He was a

protagonist, and knew that. His attitude to the academic profession and to his fellow humans was very personal. He had been ill in late 2002. In a phone conversation to his house in Lesmo (midway between Como and Milan), he had mentioned a recent pleural extravasation, but expected to be soon back to work. Then in the evening of 17 November, in Milan, he suffered a fatal heart failure. Italian newspapers commemorated him for the general public, at various lengths; unsurprisingly, the most showy newspaper cuts are from his native Como, whose university he co-founded. His contribution to artificial intelligence research and education was important, yet, for all of his scholarly stature, it is his personality that stands out even more. His positive personal impact on those who had the opportunity to know him and work with him was immense.

4 The Structure of the Articles

In order to facilitate going through the various topics, in the following we consider the structure of all articles by section and subsection.

From Abstract Task Knowledge to Executable Robot Programs, by Steffen Knoop, Michael Pardowitz and Rüdiger Dillmann.

1. Introduction
2. State of the Art
    - 2.1. Programming by Demonstration
    - 2.2. Task Description Languages
3. Basis
    - 3.1. Macrooperators
    - 3.2. Flexible Programs
    - 3.3. Problem Statement
4. Mapping Approach
    - 4.1. Structure Mapping
    - 4.2. Elementary Operator Mapping
    - 4.3. Rule-Based Tree Manipulation
    - 4.4. Parallelization
5. Target System Properties
6. Experiments and Results
    - 6.1. Mapping Evaluation
    - 6.2. FP Execution and Evaluation
7. Discussion and Conclusion

Acknowledgements
References

Performance Evaluation of a Multi-Robot Search, and Retrieval System: Experiences with MinDART, by Paul E. Rybski, Amy Larson, Harini Veeraraghavan, Monica Anderson, and Maria Gini.

Issues on Autonomous Agents from a Roboticle Perspective, by Antonio D'Angelo, Enrico Pagello and Hideo Yuasa.

A Multi Modal Haptic Interface for Virtual Reality and Robotics, by Michele Folgheraiter, Giuseppina Gini and Dario Vercesi.

1. Introduction
2. Haptics: Open Problems
3. Skin Physiology from a Functional Point of View
4. The Haptic Device
   - 4.1. The Force Feedback Systems and its Connection to the Virtual Object Model
   - 4.2. Electro-Cutaneous Stimulation System
   - 4.3. Waveform Features and Multi-Electrode System Architecture
   - 4.4. Acquisition and Control Systems
5. The Qualitative Haptic Sensation Generated
   - 5.1. Role Played by the Stimulation Intensity and Frequency
   - 5.2. Role Played by the Duty-Cycle of the Wave
   - 5.3. Integration of Tactile, Force and Visual Feedbacks
6. Conclusions and Future Work

References

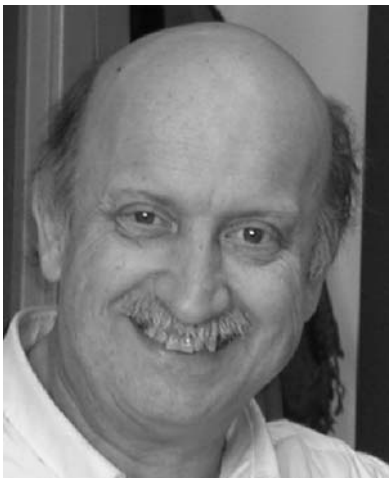
From Embodied Agents or Their Environments Reasoning About the Body, to Virtual Models of the Human Body: A Quick Overview, by Ephraim Nissan.

1. Introduction
2. Same-Kind Embodied Agents, yet with Individual or Subcategory Differences
3. Recognition of One's Own Body
4. Embodied Agents Imitating Human Body Movements
5. On Some Virtual Models of the Human Body, for Intended Ultimate Use on the Human Body
6. Robots Reconfiguring Their Own Body
7. Artificial Muscles, and Animatronics
8. Concluding Remarks

Acknowledgements
References

Nested Beliefs, Goals, Duties, and Agents Reasoning About Their Own or Each Other's Body in the TIMUR Model: A Formalism for the Narrative of Tamerlane and the Three Painters, by Ephraim Nissan

1. Introduction
2. An Anecdote About Timur, and Relevant Considerations
   - 2.1. The Narrative Analyzed
   - 2.2. The Folklore Approach to Narratives
   - 2.3. Computer Modelling of Narratives of the Folklore Kind
   - 2.4. Non-Classical Logics of Fiction
   - 2.5. Feeding Narratives to Embodied Agents
   - 2.6. Parallel Anecdotes, as Real and Fictional Anecdotes



Marco Somalvico