

REPORT ON THE ACADEMIA EUROPAEA INFORMATICS SECTION WORKSHOP “GRAND CHALLENGES OF UNCONVENTIONAL COMPUTATION”

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The Academia Europaea Informatics Section Workshop on Grand Challenges of Unconventional Computation was organized by Prof. Cristian Calude and Prof. Dines Bjorner in Liverpool, UK. The workshop was held at the University of Liverpool on September 17, 2008 in conjunction with the 2nd Workshop on Reachability Problems, 15-17 September 2008.

The workshop attracted more than thirty participants and had the outstanding list of speakers including Prof. Cristian S. Calude (U. Auckland), Prof. Jose Felix Costa (U. Wales Swansea), Prof. Dines Bjorner (Technical U. Denmark), Prof. Barry Cooper (U. Leeds), Prof. Mark Hogarth (U. Cambridge), Prof. Oscar Ibarra (UC. Santa Barbara) and Prof. John Tucker (U. Wales Swansea).

The workshop was opened by Prof. Cristian S. Calude, welcoming the participants and giving an interesting talk about the present and the future of Unconventional Computation discipline. The second talk was given by Prof. Dines Bjorner, the Chair of Informatics sections in The Academia Europaea. He also welcomed us, and spoke briefly on the history of Academia Europaea, recent initiatives of the organization and importance of the workshop’s subject for scientific community.

The first part of the workshop programme was continued by talks of Prof. Jose Felix Costa “The Misconception of Hyper-Computation” and Prof. Barry Cooper “Incomputability, Emergence, and the Turing Universe”. Prof. Jose Felix Costa started by discussing a procedure to locate the Equator by using a pendulum and pointing out that finding the absolute zero latitude is in this setting undecidable. The lesson taught by the “Gedanken experiment” is more general: information in Nature is degradable by measurements limitations. In the next talk Prof. Barry Cooper’s proposed to use computability as a key concept for understanding missing links between emergent higher mental functionality and algorithmic design. He also presented several arguments supporting the idea of a close relationship between emergence, the nature of phase transitions, and mathematical definability.

The second part of the programme was immediately started after the short refreshment break. The second part contained another three excellent talks, which

topics were ranging from concrete to very abstract by Prof. Mark Hogarth “A New Problem for Rule Following”, Prof. Oscar Ibarra “Computing with Cells: Membrane Systems” and Prof. John Tucker “Computing by Experiments with Physical Systems”.

Prof. Mark Hogarth started his talk highlighting many analogies between developments in geometry and computability. There are many effects in non-classical computations that are similar to what we can observe in non-Euclidean geometries. One of the key points here is that “running” the same algorithm first on the Turing machine and then on the relativistic computers will, in general, produce two different results. Prof. Oscar Ibarra gave a nice brief overview of membrane computing and reported on recent results and challenging open problems in the field. He also discussed computational power and complexity of the recently introduced neural-like systems, called spiking neural P systems. The last talk of the workshop was given by Prof. John Tucker. In his talk he discussed the fundamental question: “What can we compute by experiments with a class of physical systems with or without using algorithms?” He proposed to explore experimental computation systematically and precisely starting from examples based on kinematics, possibly the simplest physical theory which offer insights into experimental computation, and pose interesting and difficult theoretical problems.

The workshop was very informative for most participants. It was very well organized and stimulated many fruitful discussions between the participants related to computability, mathematics and philosophy.