Worlds of Entanglement Guide

WOE Organizing Committee

29-30 Sept 2017

Abstract

In the following pages you will find information about the sessions, speakers and the program of the symposium Worlds of Entanglement.

Contents

1	Introduction										
	1.1	About the Centre Leo Apostel	2								
	1.2	About the Symposium	2								
2	Sess	ions and Speakers basic information	3								
	2.1	Quantum Foundations	3								
		2.1.1 Speakers	3								
	2.2	Non-classical Probabilistic Structures	3								
		2.2.1 Speakers	3								
	2.3	Frontiers of Quantum Physics	4								
		2.3.1 Speakers	4								
	2.4	Quantum Beyond Physics	4								
		2.4.1 Speakers	4								
	2.5	Entanglement in Social Sciences	4								
		2.5.1 Speakers	4								
	2.6	Complex Systems	4								
		2.6.1 Speakers	5								
	2.7	Quantum Artificial Intelligence	5								
		2.7.1 Speakers	5								
	2.8	Worldview Integration	5								
		2.8.1 Speakers	5								
	2.9	Economic session: Decisions under uncertainty	5								
		2.9.1 Speakers	6								
	2.10	Entanglement and Consciousness	6								
		2.10.1 Speakers	6								
3	Pro	gram	7								
4	Acknowledgments										

1 Introduction

1.1 About the Centre Leo Apostel

The Center Leo Apostel (CLEA) was founded in 1995 as a transdisciplinary research department at the Vrije Universiteit Brussel (VUB). Its scientific council is composed of members of different Flemish universities. It is named after the Belgian philosopher and logician Leo Apostel (1925-1995). Apostel donated the money of the Solvay prize, which he received for his life work in 1985, to the VUB in order to create such a center.

The center's aim is the development of world views that integrate the results of different scientific and cultural disciplines (as elaborated by Apostel and collaborators in their treatise "Worldviews: from fragmentation to integration"). CLEA in particular tries to bridge the gap between the natural sciences and the social sciences and humanities.

CLEA's key objectives were summarized by Apostel as:

- Interdisciplinarity
- Construction of world views
- Broad dissemination of scientific knowledge.

1.2 About the Symposium

The symposium is the natural continuation of past events organized by our centre, in particular the Einstein meets Magritte conference (1995), and the Times of Entanglement symposium (2010), which brought together some of the worlds most renowned thinkers, such as Zygmunt Bauman, Brian Arthur, Ilya Prigogine, Heinz von Foerster, William Calvin, Bas van Fraassen, Bob Edwards, Adolf Grunbaum, Rom Harr, Chris Langton, Constantin Piron, Francisco Varela, Linda Schele, Robert Pirsig, Barbara Hernstein-Smith, John Ziman, among others, to develop an interdisciplinary dialogue about fundamental issues of science and society.

In this event we want to combine two key concepts: Worlds and Entanglement. For the former concept, while the usual understanding of World refers specifically to our planet, by following the ideas of Leo Apostel and lift the notion of World to Worldview, which is incorporates not only what is in the world, but how we perceive it. For the latter concept, entanglement refers to a quantum physical phenomenon where groups of particles behave in a way such that each particle cannot be described independently of the others. In these times of ever-increasing access information, the quantum entanglement of particles conceptually resembles the way our current world and worldviews are shaped. In fact, not only scholars but also society in general is starting to understand the complexity and interwovenness of existential, philosophical, scientific, cultural, social, and global affairs. In Worlds of Entanglement we propose that entanglement is a central notion for a new quantum way of thinking that not only allows to expand the application of quantum theory from the micro-physical to the macro-physical domain, but also brings new perspectives on how we should think about the most fundamental notions conceived by the human intellect, such as information, complexity, life, rationality and consciousness.

The Symposium is organized in sessions that apply the concept of entanglement using different worldviews.

2 Sessions and Speakers basic information

In this section you will find a description of the session and the list of speakers. Keynote speakers are marked with the symbol *.

2.1 Quantum Foundations

In this session we aim at analyzing the conceptual and mathematical structure of quantum theory for a better understanding of the quantum realm.

2.1.1 Speakers

- Marcus Huber* (marcus.huber@univie.ac.at), Vienna (Austria)
- Massimiliano Sassoli de Bianchi^{*} (autoricerca@gmail.com), Lugano (Switzerland)
- Karl Svozil^{*} (svozil@gmail.com), Vienna (Austria)
- Ognyan Oreshkov (ooreshkov@gmail.com), Brussels (Belgium)
- Christian de Ronde (cderonde@gmail.com), Buenos Aires (Argentina)
- Roberto Giuntini* (roberto.giuntini@gmail.com), Cagliari (Italy)

2.2 Non-classical Probabilistic Structures

2.2.1 Speakers

- Claudio Garola^{*} (Claudio.Garola@le.infn.it), Lecce (Italy)
- Rostislav Matveev (rostislav matveev@mis.mpg.de), Leipzig (Germany)
- Gustavo Boznik (gbosyk@gmail.com), Buenos Aires (Argentina)

2.3 Frontiers of Quantum Physics

2.3.1 Speakers

- Jan Naudts* (jan.naudts@uantwerpen.be), Antwerp (Belgium)
- Paul Erker (paul.erker@gmail.com), Vienna (Austria)

2.4 Quantum Beyond Physics

In this session we aim at exploiting the conceptual and mathematical framework of quantum theory to study phenomena outside the quantum realm.

2.4.1 Speakers

- Sandro Sozzo^{*} (ss831@leicester.ac.uk), Leicester (United Kingdom)
- Johnjoe McFadden* (j.mcfadden@surrey.ac.uk), Surrey (United Kingdom)
- Jonito Aerts (jonitoarguelles@gmail.com), Gent (Belgium)

2.5 Entanglement in Social Sciences

In this session we aim at reflecting on the conceptual entanglements at an existential, social, and political levels.

2.5.1 Speakers

- Alexander Wendt* (wendt.23@polisci.osu.edu), Columbus (USA)
- Mathias Albert* (mathias.albert@uni-bielefeld.de), Bielefeld (Germany)
- Luk Van Langehove* (Luk.Van.Langenhove@vub.be), Brussels (Belgium)
- Michaël Bauwens^{*} (michael.bauwens@kuleuven.be), Leuven (Belgium)
- William Lawless (w.lawless@icloud.com), Georgia (USA)

2.6 Complex Systems

In this session we aim at identifying systems in nature and society whose behavior is complex (to the point of resembling entanglement) due to the dependencies, relationships, or interactions between the parts of the system and/or its environment.

2.6.1 Speakers

- Tina Eliasi-Rad^{*} (tina@eliassi.org), Boston (USA)
- Nihat Ay* (nay@mis.mpg.de), Leipzig (Germany)
- Peter Dittrich* (Peter.Dittrich@uni-jena.de), Jena (Germany)
- Francis Heylighen (fheyligh@vub.ac.be), Brussels (Belgium)
- Vasileios Basios (vbasios@ulb.ac.be), Brussels (Belgium)

2.7 Quantum Artificial Intelligence

In this session we aim at describing how quantum theory can be applied as not only a mathematical but also conceptual framework for Artificial Intelligence.

2.7.1 Speakers

- Massimo Melucci^{*} (melo@dei.unipd.it), Padova (Italy)
- Peter Wittek (peter@peterwittek.com), Barcelona (Spain)
- Giuseppe Sergioli (giuseppe.sergioli@gmail.com), Italy (Cagliari)

2.8 Worldview Integration

2.8.1 Speakers

- Norah Bowman (norahbowman@gmail.com), Kelowna (Canada)
- Federica Russo (F.Russo@uva.nl), Amsterdam (Netherlands)
- Karin Verelst (kverelst@vub.ac.be), Brussels (Belgium)
- Kyoko Nakamura (kyoko608@gmail.com), Waseda (Japan)

2.9 Economic session: Decisions under uncertainty

The economic session is focus on the study of decision-making under uncertainty. Hansen and Marinacci (2016) distinguished between sources of uncertainty: (i) *risk within a model*, where uncertainty is about the outcomes that emerges in accordance to a probability model that specifies fully the outcome probabilities. (ii) *Ambiguity among models* where uncertainty is about which alternative model should be used to assign the probabilities. (iii) *Model misspecification* where uncertainty is induced by the approximate nature of the models under consideration to used in assigning probabilities.

Related to the first source of uncertainty *Quantum-Like Influence Diagrams: Incorporating Expected Utility in Quantum-Like Bayesian Networks*, extend the Quantum-Like Bayesian Network model proposed by Moreira and Wichert (2016) incorporating the framework of expected utility and presenting a graphical decision model called Quantum-Like Influence Diagram. In this context, it will be studied how to use influence diagrams to explain the paradoxical findings of the prisoners dilemma game based on expected utilities.

Related to the second and third sources *Decisions under uncertainty on the*ories and facts, present an analysis of decision problems that takes into account the model uncertainty that often arises because of scientific and measurement concerns.

Related to the third source of uncertainty *Robust animal spirits in a small open economy*, extend the Schmitt-Grohé and Uribe (2003) model for an small open economy considering that agents are endowed with robust preferences concerned about model misspecification. In this framework, it will be analyzed the effects of domestic and external shocks when agents take decisions according to the worst case probabilistic scenario.

Finally, *Quantum model of norms compliance in strategic decision-making* shows the nature of social norms and the way in which they influence the reasoning and behavior of the individual actor and, more specifically, the compliance with the norm. The paper is closely related to the theory of rational choice as it uses game theory as the formal model of this interaction, but turns out to be close to the Parsons approach of internalized norms that somehow shape not only the behavior of the actor but also his self-concept.

2.9.1 Speakers

- Massimo Marinacci^{*} (massimo.marinacci@unibocconi.it), Milan (Italy)
- Jocelyn Tapia (jocymagnolia@gmail.com), Santiago (Chile)
- Catarina Moreira (catarina.p.moreira@tecnico.ulisboa.pt), Portugal (Lisboa)
- Jakub Tesař (j.kub.tesar@gmail.com)

2.10 Entanglement and Consciousness

In this session we aim at reflecting on the nature of consciousness, and how the notion of entanglement might enlighten the understanding of some of the most controversial existential notions such as Awareness and Free Will.

2.10.1 Speakers

- Urban Kordes* (Urban.Kordes@pef.uni-lj.si), Ljulbjana (Slovenia)
- Chetan Prakash (CPrakash@csusb.edu), California (USA)
- Yukio Pegio-Gunji (yukio@waseda.jp), Waseda (Japan)

3 Program

Worlds of Entanglement 2017 Program - Room 1

Day	Room	Begin	End		Speaker	Session	Title	Chair	
29	Foyer	0	8:30	08:50	Registration				
29	Q1	0	8:50	09:00	Tomas Veloz	All	Welcoming		
29	Q1	0	9:00	10:00	Marcus Huber	Quantum Foundations	On the role of entanglement in quantum information and beyond	Tomas Veloz	
29	Q1	1	0:00	11:00	Massimiliano Sassoli di Bian	Quantum Foundations	The conceptuality interpretation of quantum and relativity theories	Tomas Veloz	
29	Foyer	1	1:00	11:15	Coffee Break				
29	Q1	1	1:15	12:00	Sandro Sozzo	Quantum Beyond Physics	The "Quantum Cognition" Research Programme	Massimiliano Sassoli de Bianchi	
29	Q1	1	2:00	12:15	Jonito Aerts	Quantum Beyond Physics	Perceiving the whole: a human vision quantum non-summability effect	Massimiliano Sassoli de Bianchi	
29	Q1	1	2:15	13:15	Johnjoe McFadden	Quantum Beyond Physics	Quantum Biology	Massimiliano Sassoli de Bianchi	
29	Foyer	1	3:15	14:30	Lunch				
29	Q1	1	4:30	15:30	Tina Eliassi-Rad	Complex Systems	Learning and Inference in Complex Networks	Peter Dittrich	
29	Q1	1	5:30	16:30	Nihat Ay	Complex Systems	An Information-Geometric Approach to Complexity	Peter Dittrich	
29	Foyer	1	6:30	16:45	Coffee Break				
29	Q1	1	6:45	17:45	Mathias Albert	Quantum Social Science	Quantum World Society	Federica Russo	
29	Q1	1	7:45	18:45	Alexander Wendt	Quantum Social Science	Quantum Mind and Social Science	Federica Russo	
29	Q1	1	8:45	19:00	Tomas Veloz	All	Arrangments for dinner		
29	Hotel	2	0:30	23:30	Dinner				
30	Q1	0	9:00	09:50	Peter Dittrich	Complex Systems	Entanglement through semiosis? Towards measuring a physical media's potential to implement codes	Tina Eliassi-Rad	
30	Q1	0	9:50	10:30	Vasileios Basios	Complex Systems	Quantum Logic, Chaos, Bayesian Inference and Complex Systems	Tina Eliassi-Rad	
30	Q1	1	0:30	11:10	Francis Heilyghen	Complex Systems	Distributed organization in complex adaptive systems	Tina Eliassi-Rad	
30	Foyer	1	1:10	11:30	Coffee Break				
30	Q1	1	1:30	12:20	Roberto Giuntini	Quantum Foundations	The importance of being Toffoli: a logical view on entanglement and quantum correlations	Christian de Ronde	
30	Q1	1	2:20	13:10	Karl Svozil	Quantum Foundations	Breathing in and out of individuality and entanglement	Christian de Ronde	
30	Foyer	1	3:10	14:20	Lunch				
30	Q1	1	4:20	15:10	Massimo Marinacci	Uncertainty in Economics	Decisions under uncertainty on theories and facts	Sandro Sozzo	
30	Q1	1	5:10	15:50	Jocelyn Tapia	Uncertainty in Economics	Robust animal spirits in a small open economy	Sandro Sozzo	
30	Q1	1	5:50	16:30	Catarina Moreira	Uncertainty in Economics	Quantum-Like Influence Diagrams	Sandro Sozzo	
30	Q1	1	6:30	17:00	Jakub Tesar	Uncertainty in Economics	Quantum Model of norms compliance	Sandro Sozzo	
30	Foyer	1	7:00	17:15	Coffee Break	Coffee Break			
30	Q1	1	7:15	18:05	Ognyan Oreshkov	Quantum Foundations	Indefinite causal order in quantum mechanics	Roberto Giuntini	
30	Q1	1	8:05	18:55	Christian de Ronde	Quantum Foundations	Quantum Superpositions and the Representation of Physical Reality Beyond Measurement Outcomes	Roberto Giuntini	
30	Foyer	1	8:55	19:05	Tomas Veloz	All	Closing event	Tomas Veloz	

Day	Room	Begin	End Speaker	Session	litte	Chair	
	29 N/A	08:30	08:50 N/A	N/A	N/A	N/A	
	29 N/A	08:50	09:00 N/A	N/A	N/A	N/A	
	29 N/A	09:00	10:00 N/A	N/A	N/A	N/A	
	29 N/A	10:00	11:00 N/A	N/A	N/A	N/A	
	29 N/A	11:00	11:15 N/A	N/A	N/A	N/A	
	29 N/A	11:15	12:00 N/A	N/A	N/A	N/A	
	29 N/A	12:00	12:15 N/A	N/A	N/A	N/A	
	29 N/A	12:15	13:15 N/A	N/A	N/A	N/A	
	29 N/A	13:15	14:30 N/A	N/A	N/A	N/A	
	29 D1.07	14:30	15:15 Jan Naudts	Frontiers of Quantum Physics	On the emergence of Coulomb Forces	Giuseppe Sergioli	
	29 D1.07	15:15	15:55 TBA	TBA	TBA	Giuseppe Sergioli	
	29 D1.07	15:55	16:30 Paul Erker	Frontiers of Quantum Physics	Autonomous Quantum Clocks	Giuseppe Sergioli	
	29 Foyer	16:30	16:45 Coffee Break				
	29 D1.07	16:45	17:30 Claudio Garola	Non-classical Probabilistic Structures	Recovering non-Kolmogorovian probabilities within a contextual extension of Kolmogorov's probability theory	TBA	
	29 D1.07	17:30	18:05 Rostislav Matveev	Non-classical Probabilistic Structures	Tropical limist of probability spaces	TBA	
	29 D1.07	18:05	18:45 Gustavo Boznik	Non-classical Probabilistic Structures	Majorization Lattice and Entanglement Transformations	TBA	
	29 Foyer	18:45	19:00 Tomas Veloz	All	Arrangments for dinner		
	29 Hotel	20:30	23:30 Dinner				
	30 Q2	09:00	09:50 Luk Van Langenhove	e Quantum Social Science	Entanglement of social realm: Towards a field theory approach social sciences	Norah Bowman	
	30 Q2	09:50	10:35 William Lawless	Quantum Social Science	Social Foundations: The quantum-like physics of interdependence of teams	Norah Bowman	
	30 Q2	10:35	11:15 Michael Bauwens	Quantum Social Science	A bold Metaphysics for the social sciences	Norah Bowman	
	30 Foyer	11:15	11:30 Coffee Break				
	30 Q2	11:30	12:00 Federica Russo	Worldview Integration	Non-violent knowledge building. A proposal for academic writing	Jocelyn Tapia	
	30 Q2	12:00	12:25 Norah Bowman	Worldview Integration	Opportunities in Alternative Epistemologies: Collective, Non-Violent Approaches to Knowledge Construction	Jocelyn Tapia	
	30 Q2	12:25	12:55 Karin Verelst	Worldview Integration	TBA	Jocelyn Tapia	
	30 Q2	12:55	13:15 Kyoko Nakamura	Worldview Integration	Entanglement of 'Art Coefficient', or Creativity	Jocelyn Tapia	
	30 Foyer	13:15	14:20 Lunch				
	30 Q2	14:20	15:10 Massimo Melucci	Quantum Artificial Intelligence	Quantum Theory and AI	Tomas Veloz	
	30 Q2	15:10	15:50 Peter Wittek	Quantum Artificial Intelligence	Quantum-enhanced algorithms in machine learning and Al	Tomas Veloz	
	30 Q2	15:50	16:30 Giuseppe Sergioli	Quantum Artificial Intelligence	Quantum Approach to Pattern Recognition	Tomas Veloz	
	30 Foyer	16:30	16:45 Coffee Break				
	30 Foyer	16:30	16:45 Coffee Break				
	30 Q2	16:45	17:35 Urban Kordes	Consciousness and Free Will	Measure problem in own empiric phenomenology	Massimiliano Sassoli de Bianchi	
	30 Q2	17:35	18:15 Chetan Prakash	Consciousness and Free Will	Interface Theory of Perception and Conscious Realism	Massimiliano Sassoli de Bianchi	
	30 Q2	18:15	18:55 Yukio-Pegio Gunji	Consciousness and Free Will	Entangled Consciousness	Massimiliano Sassoli de Bianchi	
	30 Q2	18:55	19:05 Tomas Veloz	All	Closing event	Tomas Veloz	

4 Acknowledgments

We would like to thank to all our keynote speakers for accepting giving a lecture in our symposium. Next, we thank all the scholars who have sent abstracts. Finally we thank the VUB and other involved institutions (UVA, IFICC, UNIFI), the organizing and scientific committees, and all the attendants for making possible and participating in this event.

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