Preface

Since its inception in 2007, the conference series on Quantum Interaction is now a tradition in its own right. This year's ninth meeting within the series took place at the Conferene Center Lihn (Filzbach, Switzerland), the same exciting environment as the year before, close to Lake Walensee and the Glarner Alps, during July 15–17, 2015. It was co-hosted by Collegium Helveticum, an interdisciplinary research institute jointly operated by the University of Zurich and the Swiss Federal Institute of Technology (ETH) at Zurich, and by the International Society for Mind-Matter Research.

The title of the conference, Quantum Interaction, refers to the study of cognitive processes using mathematical tools that are inspired by quantum theory, e.g., non-commutative operations, Bell-type inequalities, contextuality, etc. In this sense quantum interaction is not to be understood in terms of interactions between particles or fields as in quantum physics. It is also not intended to address perception, cognition, and consciousness in general at the level of neuronal processes. Quantum interaction attempts to describe cognitive processes at the level at which they actually occur: psychology and cognitive science.

The Quantum Interaction conferences have provided a debating ground for foundational and applied issues and have developed into an emerging interdisciplinary area of science, combining research topics in mathematics, physics, psychology, economics, cognitive science, and computer science. The breadth reflected in this list of disciplines remains a challenge for a coherent framework in which all the different approaches find their systematic place.

The presentations at this year's Quantum Interaction conference covered seven thematic fields: (1) fundamental issues, (2) contextuality and correlations, (3) decision making, (4) complementarity, (5) social and cultural applications, (6) semantic representations, and (7) operators and operator-valued measures. Two distinguished keynote speakers, Alexei Grinbaum (Saclay Research Center, Gif-sur-Yvette) and Ioannis Antoniou (Aristotle University of Thessaloniki) added exciting novel research directions.

Grinbaum's contribution addresses the issue of correlations that apparently violate Bell-type inequalities and yet are of no conclusive quantum origin. The contributions by Dzhafarov and colleagues expand on this theme and suggest a quasi-classical correlation term (due to signaling) that needs to be subtracted from the measured correlations before evidence for nonlocal quantum correlations can be claimed. This development represents a truly novel step toward understanding quantum and post-quantum correlations in non-physical systems.

The work presented by Antoniou is based on decades of previous research on mixing and chaotic systems that started with Gustafson, Misra, and Prigogine in the 1970s. A key point in this approach is a time operator that does not commute with a Liouville operator generating the dynamics of such systems. In an appropriately defined innovation space, this time operator gives rise to an "eigentime" that can be

related to the "age" of a system. In recent work, these topics have been extended to the study of networks.

The 22 papers included in this volume are based on the contributions to the conference. Each one of them was assessed by at least two reviewers and revised according to their comments. We are grateful to all members of the Program Committee for their hard work and timely delivery of reports. In an interdisciplinary area like this one, careful and accurate reviews are certainly not a matter of course.

We are grateful for the splendid hospitality we experienced at the Lihn and thank Hannes Hochuli and his staff for their sensitive cooperation in matters large and small, ensuring the success of the conference. Alfred Hofmann and Anna Kramer at Springer provided helpful advice for the smooth and speedy publication of the proceedings in the Springer series *Lecture Notes in Computer Science*. And, last but not least, we thank Gerd Folkers, director at Collegium Helveticum, for his invaluable support.

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