Preface

The international conference *Philosophy, Mathematics, Linguistics: Aspects of Interaction 2012* (PhML-2012) was held on May 22–25, 2012 at the Euler International Mathematical Institute (EIMI), which is a part of the St. Petersburg Department of Steklov Mathematical Institute (PDMI). This conference was the second sequel in the PhML series of conferences intended to provide a forum for the presentation of current researches, and to stimulate an interdisciplinary dialogue between philosophers, mathematicians, logicians, computer scientists and linguists.

The first PhML conference was held in 2009 and was initially conceived as a part of the *World Philosophy Day in Russia* proclaimed for 2009 by UNESCO. The first conference clearly revealed the need for the scientific community in a broad dialogue between representatives of natural sciences and humanities because of the increasing mathematisation of scientific knowledge. The project was successfully continued with PhML conferences in 2012 and 2014.

As it often happens in science, similar tendencies appear almost simultaneously in different research centers. It is noteworthy that in recent years, numerous international conferences with interdisciplinary topics are organized in many countries. Apparently, the reason for this lies in the fact that the contemporary social development is characterized by intensive contacts between different cultures, in which the understanding of human phenomena and the knowledge of the world are achieved in the interaction of various forms of collective consciousness and professional scientific activity – in art and literature, in humanities and natural sciences.

It is generally recognized that the globalization is a characteristic feature of the contemporary stage of civilization development. In the field of material production, the globalization manifests itself in the international division of labour, in which the most of high-tech products include components made in several countries. In the field of culture, the globalization manifests itself in the free availability of works of literature, music, fine arts, cinema, no matter where they were created. But in sciences, the globalization is manifested not only in the free availability of scientific research results offered in open access publications on the Internet, but also in the wide development of interdisciplinary researches, in which previously isolated sciences fruitfully interact, and where fundamental research and applied research are complementary.

The most important sign of this phenomenon becomes the increasing mathematisation of all sciences, which began in the Modern Ages. In this regard,

in the preface to his *Metaphysical Foundations of Natural Science*, I. Kant asserted in 1786 that "in any special doctrine of nature there can be only as much proper science as there is mathematics therein."[1]

The process of mathematisation is obviously manifested in the constant expansion of application areas of mathematics invading today not only in the natural and technical sciences, but also in the humanities. Now, the scientists, who are working in the humanities, and mathematicians, who are interested in the expansion of the field of applications of mathematics, have a serious need for interdisciplinary dialogue and personal contacts to discuss various aspects of interplay between mathematics and humanities. That is why in 2011, the Scientific Council of the EIMI decided to hold on May 22–25, 2012 the international interdisciplinary conference PhML-2012, the subject of which would constitute different aspects of interaction of philosophy, mathematics, linguistics, and the main goal would be to broaden the dialogue between mathematicians, logicians, computer scientists, philosophers and linguists.

The PhML series of conferences was organized with the intention to reveal that the "effectiveness of mathematics in the natural sciences",[2] pointed out in 1960 by Eugene Wigner, is also manifested in such humanities as philosophy and linguistics. Following Wigner: "The miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve."[3] A possible way to explain the applicability of mathematics was suggested by Alain Connes in reflections on the nature of mathematics he expressed during the talk *Espace-temps, nombres premiers, deux défis pour la géométrie*[4] given on November 12, 2010 at the Institut Henri Poincaré, Paris, where he said in particular:

> C'est qu'il faut essayer de comprendre quand les gens vous posent la question : « À quoi les mathématiques sont-elles utiles ? » En fait, les mathématiques, c'est sans doute l'usine la plus performante pour fabriquer des concepts, et des concepts, après, qui servent partout.[5] (03:42 – 03:59)

Concerning the universality of concepts, Émile Durkheim wrote in 1912: "conversation and intellectual dealings among men consist in an exchange of

[1] Metaphysical Foundations of Natural Science. In H. Allison and P. Heath, eds., *Immanuel Kant. Theoretical Philosophy after 1781,* p. 185. Cambridge University Press, UK, 2002.

[2] E. P. Wigner. The Unreasonable Effectiveness of Mathematics in the Natural Sciences. *Communications in Pure and Applied Mathematics*, 13(1):1–14, 1960.

[3] Ibid., p. 14.

[4] Watch this talk on Vimeo at `https://vimeo.com/24504403`, on the page maintained by the Société Mathématique de France.

[5] Our translation of this quotation is: "It is that you should try to understand when people ask you the question: 'For what mathematics is useful?' In fact, the mathematics is probably the most efficient factory to produce concepts, and such concepts that, afterwards, serve everywhere."

concepts. The concept is, in essence, an impersonal representation. By means of it, human intelligences communicate."[6]

For such an exchange of concepts, the PhML conferences provide a forum for philosophers, linguists, and especially for working mathematicians and logicians who are interested in philosophy and linguistics, and who have something to say in these domains of knowledge on the basis of their own professional practice where mathematics intervenes in philosophy/linguistics as a factory of concepts and/or as a factory of structures. And this is done for the purpose to analyze the philosophical/linguistic problems in mathematical terms, to draw philosophical/linguistic conclusions from philosophical/linguistic hypotheses by a mathematical proof, and to construct mathematical models in which one can study philosophical/linguistic problems. This means that the conferences of PhML series aim to promote mathematical methods in philosophy and linguistics. But the conferences of PhML series are not limited in this issue; they are interested in the philosophy of mathematics and logic, as well as they are interested in other related issues mentioned on their CfP webpages.

Moreover, the organizers considered as important to invite for participation in the conference PhML-2012 the scientists of the last wave of Russian emigration. As a result of extensive preparatory work, the conference PhML-2012 had brought together 37 registered participants from 11 countries. Apart from plenary sessions intended to present invited papers, there were also parallel sessions of thematic sections to present contributed papers. In addition, the conference featured a panel discussion entitled *The Heritage of Kant and Contemporary Formal Logic*.

It is worth noting that the conference PhML-2012 aroused great interest among researches of the PDMI, graduate students, faculty and staff members of the St. Petersburg State University, members of the St. Petersburg Mathematical Society, members of the St. Petersburg Philosophical Society, and among the wide scientific community of St. Petersburg. Some talks had gathered such an audience that the EIMI conference-hall was overcrowded. Following to the general opinion of organizers and to numerous comments of participants, this second conference in the series PhML was highly successful.

The conference PhML-2012 is presented on the website of the Euler International Mathematical Institute at `http://www.pdmi.ras.ru/EIMI/2012/PhML/index.htm`. The working languages of the conference were Russian and English, but for a better understanding between the participants, when giving a talk or speaking in discussions, all used English. With this in mind, in printed

[6] É. Durkheim. *The Elementary Forms of Religious Life*, p. 435. The Free Press, NY, 1995.

announcements about the schedule and the program, and in announcements on the Internet about the conference, organizers used the spelling of personal names and titles of talks in English.

At the conference PhML-2012, there were presented 23 invited talks in plenary sessions and 6 contributed talks in parallel sessions of two thematic sections *Mathematics and Language* and *Logic and Semantics*. The contents of most of the papers are outlined in brief abstracts presented on the EIMI website at `http://www.pdmi.ras.ru/EIMI/2012/PhML/index_files/abstracts_PhML_2012.htm`. This table of abstracts lists all the talks given at the conference. The actual volume of the Proceedings of PhML-2012 provides an opportunity for readers to acquaint with a selection of expanded papers those were presented during the PhML-2012 conference.

Since the *Studies in Logic* is a reviewed series, all the papers have had to be passed through the peer reviewing process of the type "Single Blind Review", that is, a paper is sent to reviewers in such a form as it is prepared for publication by the author(s), but the names of reviewers are hidden from the author(s). In result, all papers of the present Proceedings were peer reviewed, in most cases by more than one referee, and sometimes by four referees. The published versions of original talks given at the conference have benefited greatly due to the cooperative work of authors and reviewers during such an editorial process. I am very grateful to all reviewers, without whose work the present Proceedings of PhML-2012 would not have been possible to realize in its actual form.

The only papers being kept intact in the editorial process are the papers of Jaakko Hintikka and Grigori Mints, who were passed away while these Proceedings were been prepared. Their original papers are accompanied by detailed—however indispensable—commentaries written for this volume by Gabriel Sandu, Roy Dyckhoff and Sara Negri, to whom I am very grateful.

The project to publish the Proceedings of PhML-2012 dates back to the August 2013 when Grigori Mints accepted my proposal to head the prospective editorial board. We planned to start editorial work after the next conference PhML-2014 were completed in April 2014. To my deepest sorrow and regret, he suddenly died on May 29, 2014, and the work could not start as planned. One year later, I had returned to the project. Now, after two years of intensive editorial work, I propose the present volume to the attention of researchers who are interested in those aspects of the interaction of philosophy, mathematics, and linguistics that were discussed during the conference PhML-2012.

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