Habilitation Board Decision on the Nomination for Appointment to Associate Professor

Masaryk University	
Faculty	Faculty of Science
Procedure field	Mathematics - Algebra and Theory of Numbers
Applicant	John Denis Bourke
Applicant's home unit, institution	Faculty of Science, Masaryk University
Habilitation thesis	Categorical structures for higher-dimensional universal algebra
Board members	
Chair	prof. RNDr. Jiří Rosický, DrSc. *Faculty of Science, Masaryk University*
Members	prof. RNDr. Jan Paseka, CSc. *Faculty of Science, Masaryk University* doc. RNDr. Jan Šťovíček, Ph.D. *MFF UK Praha* Prof. Maria Manuel Clementino, PhD *University of Coimbra, Portugalsko* Prof. Walter Tholen, PhD. *York University, Toronto, Kanada*

Evaluation of the applicant's scholarly/artistic qualifications

Bourke's research is devoted to category theory, a relatively young branch of pure mathematics that arose from the work of Mac Lane and Eilenberg in algebraic topology in the mid 1940s. Bourke's work focuses on what may be called higher-dimensional category theory – a notoriously challenging research area with significant applications within category theory itself, to algebraic topology, as well as mathematical logic and theoretical computer science. Bourke was trained in this area by the Australian school in Sydney where he did his PhD studies under the supervision of S. Lack. Since then, he has developed into a distinguished researcher in the area. He has published 17 research papers, all in reputable international journals, including the top journals like Advances in Mathematics and Mathematische Zeitschrift. 10 of them were written with a collaborator (mostly S. Lack or R. Garner). His most important results include the 2-dimensional monadicity theorem, the understanding of the role of double categories in the theory of algebraic weak factorization systems (with R. Garner), the decisive understanding of the connection between monads and theories (with R. Garner) and the breakthrough result applying skew monoidal categories to homotopy theory. In 2016, he was an invited speaker at the annual Category Theory conference. He was also invited to give seminar talks in universities in Regensburg, Sheffield and Cambridge. Following WoS, he has 48 citations (without self citations), which is appropriate for a researcher 10 years after PhD in algebra. This year, he succeeded to obtain MASH Junior grant of MU.

Conclusion: The applicant's scholarly/artistic capabilities **meet** the requirements expected of applicants participating in a habilitation appointment procedure in the field of Mathematics - Algebra and Theory of Numbers.

Evaluation of the applicant's pedagogical experience

In the period 2011-2016, being on a postdoctoral position, Bourke taught an advanced course "Topics in category theory" and run exercises for courses "Category theory", "Rings and modules" and "Topology". At Macquarie university in Sydney, he taught the course "Logic and set theory". Returning to the Department of Mathematics and Statistics as an Assistant Professor, he resumed teaching "Topics in category theory" and has started to teach the course "Geometric algorithms" for the Faculty of Informatics and has taught the course "Representation theory" for bachelor's and master's students of Mathematics. Then he has started to teach the new courses "Algebra III" and "Algebra IV" for bachelor's students of Mathematics. He supervised three master's theses, two of them were successfully defended and one is in progress. Currently, he has two PhD students. He turned out to be a very enthusiastic teacher and the students simply like him and want to continue with him.

Conclusion: The applicant's pedagogical capabilities **meet** the requirements expected of applicants participating in a habilitation appointment procedure in the field of Mathematics - Algebra and Theory of Numbers.

Habilitation thesis evaluation

The contents of Bourke's thesis provide ample evidence of his ability, hard work and creativity as a mathematician: of the 5 papers in the thesis, two are published in the highly prestigious journal "Advances in Mathematics" and two in the well-regarded specialist journals "Journal of Pure and Applied Algebra" and "Journal of Homotopy and Related Structures". The contributions in these papers are important, original, technically very challenging and cover a very broad range of topics. The thesis was evaluated by distinguished experts: R. Street is a current leader of the Australian school, N. Gambino is a reputable specialist in category theory and mathematical logic, and E. Riehl is one of leading researchers in higher category theory. The first paper deals with 2-dimensional universal algebra and proves the 2-dimensional monadicity theorem. Following N. Gambino, it has all the marks of a classical result. The second paper is about algebraic weak factorisation systems and, following E. Riehl, it forms the definite treatise of the subject, which has already received a large number of citations. R. Street considers the third paper dealing with skew monoidal categories as a vital step in understanding the symbiosis between category theory and homotopy theory. The fourth paper is about monads and theories and N. Gambino considers it as the culmination of a long line of research that began

in the '60s. Finally, the fifth paper studies homotopically enriched categories and the adjoint function theorem there, as claimed by E. Riehl, unifies nearly every strict, weak and enriched version known to the literature. She calls it really lovely and is excited by the new notion of an accessible infinity-cosmos introduced there.

Conclusion: The applicant's habilitation thesis **meet** the requirements expected of habilitation theses in the field of Mathematics - Algebra and Theory of Numbers.

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Secret vote results

Voting took place: electronically

Number of board members		5
Number of votes cast		5
of which	in favour	5
	against	0

Board decision

Based on the outcome of the secret vote and following an evaluation of the applicant's scholarly or artistic qualifications, pedagogical experience and habilitation thesis,the board hereby submits a proposal to the scientific board of the Faculty of Faculty of Science of Masaryk University to **appoint the applicant associate professor** of Mathematics - Algebra and Theory of Numbers.

In Brno on 06.05.2021

prof. RNDr. Jiří Rosický, DrSc.