

Game Table WG4 | First Online Meeting

Minutes

Below you find a collaborative document.

Working Group 4, “Mathematics in Games” first meeting was held online, on Zoom. It was held on Wednesday the 24th of January 2024. We’ll meet at 9:00 CET (you can check your time [here](#)).

The meeting link was: <https://univ-nantes-fr.zoom.us/j/82400841220>

No recording was made due to objections from the audience.

The scheduled program was:

9:00 – Opening of the Meeting

9:10 – Welcoming, short presentations of Lisa and Tiago

9:20 – Introductory presentations

11:00 – Short break to get a coffee ☺

11:15 – Organisational Discussion

12:30 – Closure

The first session was a round of short presentations. Participants were asked to prepare 3 to 5-minutes-talk about themselves (their work, research interests, institution, etc.).

20 participants + 1 video

Introductions

- **Lisa Rougetet**, co-leader of WG4, Université de Bretagne Occidentale (Brest, France)
Centre François Viète (<https://cfv.univ-nantes.fr/>)
Contact: lisa.rougetet@univ-brest.fr

Master Degree in Mathematics - Master Degree in Epistemology, History of Sciences and Techniques - Ph.D in History of Mathematics, untitled "From Mathematical Recreations to the Ordered Field of Surreal Numbers and the Victory of a Chess Program. A (Hi)Story of Combinatorial Game Theory in the 20th Century"

Since 2017, lecturer and researcher in history of games and their mathematical theories (courses for MD students in history of science) + teacher trainer for future primary and secondary school teachers (in maths, using mathematical games and their history)

Webpage: <https://nouveau.univ-brest.fr/fr/membre/lisa-rougetet>

- **Tiago Hirth**, co-leader of WG4, University Lisbon, Inter University Centre for the History of Science, Portugal
ludicum.org, thirth@campus.ul.pt

I'm trained in mathematics and a PhD student in the History and Philosophy of Science. My main focus is Recreational Mathematics and its affine fields (mathematics, history, popularization and pedagogy).

I've been part of the Board Game Studies network and co-organizer of the Board Game Studies Colloquium for two meetings, being a regular for the last decade. I've studied games in their historical, mathematical and pedagogical context. I promote mathematics using games workshops and have helped volunteering at the mathematical games tournament in Portugal since 2011.

- **Eric Piette**, UCLouvain, Belgium, eric.piette@uclouvain.be

Is an Assistant Professor at UCLouvain's ICTEAM institute and INGI department, specialising in Game Artificial Intelligence (AI), this individual's research spans Machine Learning, Explainable AI, Constraint Satisfaction Problem, and Knowledge Representation and Reasoning within General Game Playing. Renowned as the main proposer and Chair of the GameTable COST Action CA22145, they lead an international network exploring the use of game AI to preserve the intangible cultural heritage of games. A pivotal contributor to the Digital Ludeme Project, an ERC-funded initiative, they co-developed the Ludii General Game System for studying traditional strategy games across human history. Their Ph.D. thesis, "A Stochastic Constraint-Based Approach to General Game Playing," introduced innovative methods, exemplified by WoodStock, a winner of the International General Game Playing Competition 2016. As an expert in game AI and computational studies, they continue to shape the field with impactful research and collaborative initiatives.

More information at <https://piette.info/eric/>

Related projects:

- WoodStock: <https://www.cril.univ-artois.fr/woodstock/>
- Digital Ludeme Project (DLP): <http://ludeme.eu/index.html>
- GameTable: <http://gametable.network/>

Game Types I am interested in:

- Any kind of tabletop games, including puzzles. Games studied with Ludii: <http://ludii.games/>

- [Walter Crist](#), Leiden University, The Netherlands

Digital Ludeme Project: ludeme.eu, wcrist@asu.edu

I am an archaeologist focusing on the prehistory of board games in the eastern Mediterranean. I've written about games in ancient Egypt, Cyprus, Azerbaijan, the Roman Empire, and the Netherlands. My work with the Digital Ludeme Project explored case studies for the application of AI playout simulations to the archaeological evidence for games, including to assess the applicability of rules documented from texts on different sizes of boards, as well as exploring rulesets that replicate behavior that would produce use-wear on a given board. I also am interested in social theory on games, and have written about how games function as social lubricants and how this helps to bring people together to form social and economic relationships.

- **Ori Davidov**, University of Haifa, Israel

E-mail: davidov@stat.haifa.ac.il

Homepage: <https://davidov842.wixsite.com/proforidavidov>

I am a professor of statistics with a love for games. If you are interested in my background see my homepage. My research is on the interphase of methodological and theoretical statistics. My primary interests for the past few years have been on: (1) statistical methods that involve constraints (known as order restricted inference); (2) the application of game theory to experimental design (where infinite games play an important role); (3) statistical methods for ranking and rating where I focus on paired comparison data which is the type of data obtained when a group of K agents participate in tournament. These days I am looking into intransitivity and cyclicity in such settings. This is a long-standing and vexing problem related to voting paradoxes and impossibility theorems (e.g., Arrows theorem).

I am open to collaborate on projects which involve a statistical analysis of games.

- **Miloš Stojaković**, University of Novi Sad, Serbia.

homepage: <https://people.dmi.uns.ac.rs/%7Emilosst/>

email: milosst@dmj.uns.ac.rs

I'm a professor at University of Novi Sad, one of my primary interests is Positional Games, and all kinds of related topics. I've been scientifically active in this field for more than 20 years.

Positional Games is a subclass of Combinatorial Games, it includes popular recreational games like Tic-Tac-Toe, Hex, Sim, etc. The field has experienced tremendous growth in recent years. Together with Dan Hefetz, Michael Krivelevich and Tibor Szabo, we wrote a book about Positional Games in 2014 (if you want me to send you a PDF, send me a short email): <https://link.springer.com/book/10.1007/978-3-0348-0825-5>

I've been teaching about positional games and related topics on other institutions, including masters and PhD courses in University of Buenos Aires (on two occasions), Eötvös University Budapest, University of Groningen, TU Graz, Oberwolfach Research Institute for Mathematics, University of Szeged, etc. I've also been involved in popularisation programs on school level on various topics related to games.

My broader background is in mathematics and computer science, besides games I work in discrete random structures, combinatorial algorithms, discrete and computational geometry, and graph theory.

- Igor Nedelkovski

<https://igor-nedelkovski.info>

I am a professor at the Faculty of Information and Communication Technologies, University "St. Kliment Ohridski" in Bitola, North Macedonia. 30+ years experience in higher education, starting from teaching and research assistant, assistant professor, associate professor to professor. Currently, I am the Rector of the University (from 2022); before that, I was Vice-Rector and before that Dean of the Faculty of ICT.

I have an educational background in Mechanical Engineering and in Computer Simulations. I am teaching Mathematical Modeling and Computational Simulations, Virtual Engineering, Computer Graphics. My research interests related to this COST action are closely related to these areas: Physics/ Mathematical modelling in computer games, Real-time simulations in computer games, Physically based rendering + Video games production. I am also experienced project manager (50+ projects managed) and a serial entrepreneur (now mostly a consultant and investor) who has worked on more than 600 short video games (from simple flash games to advanced simulation-based games).

- Jess Enright

- Mirjana Mikalački, University of Novi Sad, Serbia.

homepage: <https://people.dmi.uns.ac.rs/~mima/>

email: mima@dm.uns.ac.rs

I am an associate professor at the Department of Mathematics and Informatics, at the Faculty of Sciences, University of Novi Sad, Serbia. I graduated Computer Science, and did my PhD about Positional Games, with prof. Miloš Stojaković in 2014. I am interested in graph theory, positional games on graphs, algorithms and complexity. I teach at the University but also to High School students that are talented for mathematics. I am involved in popularisation of games and theoretical computer science on school and preschool level.

- Ekrem BAHÇEKAPILI

ekrem.bahcekapili@ktu.edu.tr

I am an Associate Professor in the Department of Management Information Systems at Karadeniz Technical University, Türkiye. I received my PhD in 2015 from Atatürk University

in the field of Computer and Instructional Technologies. My main areas of study are distance education, assistive technologies for the hearing impaired, and human-computer interaction. In recent years, I have developed an interest in artificial intelligence and immersive reality. Apart from this action, I am a Management Committee (MC) member in CA21131 - Enabling multilingual eye-tracking data collection for human and machine language processing research (MultiPEYE), and a Working Group (WG) member in CA19142 - Leading Platform for European Citizens, Industries, Academia and Policymakers in Media Accessibility (LEAD-ME). Below are my works and projects related to this action:

- Examination of Children' Playing Game Tendencies and Digital Game Preferences Based on Gender, <https://doi.org/10.53506/egitim.1076103>
- Development of Animated Virtual Sign Language Translator TİD3b for Turkish Sign Language Dictionary, <https://tid3b.com/>
- Developing a Game-Based Adaptive Environment for Teaching Programming for Secondary School Students and Examining its Effect on Students' Computational Thinking Skills, <https://kodlarobo.com/>

- Carla Cardoso

carla.g.cardoso@gmail.com

I'm a high school mathematics teacher in Portugal, since 2000. Currently, I'm a PhD student in History and Philosophy of Sciences at the University of Lisbon, focusing on the development of probability theory and its relationship with games of chance.

- Hüseyin ÖZDEMİR

ozdemirmaths@gmail.com

I am a mathematics teacher in high school in Türkiye. My undergraduate education was Master of Science in Secondary School Science and Mathematics Education (Integrated Bs & Ms Programme in Mathematics Education), Bogazici University, Istanbul. I got my PhD degree from the Department of Mathematics Education, Institute of Educational Sciences, Bursa Uludag University, Türkiye. My academic interests are STEM (Science, Technology, Engineering and Mathematics) education, CLIL (Content and Language Integrated Learning) approach, Distance education, Teaching maths with games. I think this action will be very useful and enlightening for me and my students because I will use the experience and knowledge I will gain from here for their education. It is a great chance for me to meet new people and improve myself in a field that I am interested in.

- Hrachya Kocharyan

I am an Assistant Professor at the American University of Armenia. I am a materials scientist. I have research interests in various fields, and involvement in this action is a good chance for me to learn new things, meet new people, and work on something interesting and maybe fun.

- Emin Durmishi, University of Tetovo, North Macedonia.

homepage: <https://sites.google.com/view/emin-durmishi>

email: emin.durmishi@unite.edu.mk or emindurmishi@gmail.com

I am an Assistant Professor at the Faculty of Natural Sciences and Mathematics of the University of Tetova. I completed my PhD at St. Cyril and Methodius University in Skopje in June 2022.

My primary research interests lie in the fields of general topology and intrinsic shape theory. I study topological notions related to connectedness and their inheritance under some classes of transformations by using coverings of topological spaces. I apply these findings to intrinsic shape theory - an alternative approach to standard shape theory.

I expect to give my modest contribution here by applying digital topology to board games and possibly the notion of continuity up to a covering for describing stages of games.

- **Georg Grasegger**

georg.grasegger@ricam.oeaw.ac.at

Affiliation: Johann Radon Institute for Computational and Applied Mathematics (RICAM), Austrian Academy of Sciences

I have a PhD in Computer Mathematics and a Teaching Degree for Math and Computer Science.

Currently I am working in Symbolic Computation and Graph Theory, in particular Rigidity Theory. My current work is not directly related to board games but I am interested in hidden mathematics in games and the interplay of maths and games.

- **Karolina Drabent**

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I am a PhD student at Czech Technical University in Prague, working with reinforcement learning in games. Specifically big imperfect information games. I am interested in game theory and its application in games. Also I'm interested in Fairness in AI, graph theory and agent-based modelling.

I have Masters in Artificial Intelligence from the University of Amsterdam, my thesis was on "Program synthesis and graph representation". I have bachelors in computer science from Warsaw University of Technology.

- **Timur Koparan**

timurkoparan@gmail.com

I am a professor in the field of mathematics education at Zonguldak Bülent Ecevit University Ereğli Faculty of Education.

Master's Degree - Applied Mathematics - Scalar Wave Modeling with Numerical Methods - Pamukkale University

PhD- Mathematics Education- The Effect of Project Based Learning Approach on the Statistical Literacy Levels and Attitude towards Statistics of Student- Karadeniz Technical University

Mathematics teacher in high schools between 1998 and 2013. Lecturer and researcher in the field of mathematics education at Zonguldak Bülent Ecevit University since 2013.

Courses: Probability, Teaching Probability and Statistics, Teaching Mathematics with Games, Computer Aided Mathematics, History of Mathematics, Philosophy of Mathematics, Material Development

Efforts to make teaching probability more enjoyable led me to use simulation. Later, I also included probability games in the lesson. Thus, I designed game and simulation-based learning environments and observed the process. Later, the course on teaching mathematics through games was included in the university curriculum. I have been teaching this course for 5 years. We play various games individually, in pairs or as a class, such as number games, nim games, probability games, geometry games, match games, dice games, money games, intelligence games, topological games, card games, sudoku-style games, puzzles. I am interested in all games that have mathematics behind them.

I am open to collaboration in studies on game-based learning environments, didactic processes for playing games, analysis of games, and the effectiveness and impact of educational games.

My research articles can be found here <https://www.researchgate.net/profile/Timur-Koparan>

- **Younès Rabii (they/them)**, Queen Mary University of London, yrabii.eggs@gmail.com

Profiles: [Academic](#) | [Game Development](#)

I'm an awarded indie game designer, and currently a PhD student in Procedural Generation and Automated Game Design. I'm very interested in developing mathematical tools to assist automated game design, and this problem in particular: When an algorithm generates a new set of rules, how can we know if it's possible to achieve the game's win condition? Could the algorithm know if the game is "playable"?

- **Dolantina Hyka**

Holds a "Doctor of Sciences" degree in Analysis and Algebra with a specialisation in Cryptography from the University of Tirana. Currently serving as the Head of the Information Technology Department and Deputy Dean for Academic Affairs at the Faculty of Informatics, Mediterranean University of Albania, I bring over a decade of experience in academia and leadership roles. As an accomplished mathematician, I've lectured at esteemed institutions and contributed to diverse research areas, including Cryptography, Information Security, and Artificial Intelligence. With a robust publication record of over 25 articles and active participation in conferences, I also edited the book "Mathematics for Economics." Engaging with various scientific councils and organising committees, I continue to foster innovation and knowledge exchange in my field.

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Working web: www.umsh.edu.al

-**Daniel Velinov**

Contact: velinov.daniel@gmail.com

As a researcher with a PhD in Mathematics and expertise in Functional Analysis, Generalised Functions, Semigroup Theory, and Mathematical Modeling, my academic journey has equipped me with a robust foundation. Through my role as an Associate Professor at the Faculty of Civil Engineering, Ss. Cyril and Methodius University, I've delved into the intricacies of mathematical theories and their real-world applications.

I see an opportunity to apply mathematical models to enhance the study of games, creating a symbiosis between mathematical rigour and game AI techniques. This involvement aligns with my passion for interdisciplinary research and the potential to address challenges in preserving the global heritage of games.

Also part of the workgroup - who couldn't attend online:

Alfie Davies

Memorial University of Newfoundland
Canada
alfied@mun.ca

I'm a PhD student in Combinatorial Game Theory. I am most interested in misère theory; I study how to lose games. The algebra of misère play is surprisingly more complicated than that of normal play—you could say that losing is harder than winning.

Musa AKBULUT

Igor Sikorsky Kyiv Polytechnic Institute
Ukraine
<https://kpi.ua/en>
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I am studying aerospace engineering and also rocket engineering in Ukraine. I have worked in different companies before. I am improving myself in the field of artificial intelligence. I have an artificial intelligence robot that I built as part of the course. Since I love playing games, I want to specialize in making games in the background.

Yannick Rochat

Department of Linguistics and Information Studies
Faculty of Arts
University of Lausanne
Switzerland
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I pursued my undergraduate studies in mathematics at the Swiss Federal School Technologies in Lausanne. Subsequently, I successfully my doctoral thesis in digital humanities, focusing on character networks within fiction. In 2016, I co-founded a study group dedicated to games and video games at the University of Lausanne. Since 2021, I have held the position of assistant professor in game studies within the faculty of Arts at the University of Lausanne. My research encompasses the historical exploration of local games and the examination of past practices in video game development. Additionally, I conduct a course titled “Playful mathematics” on the study of intersection between mathematics and games, including the analysis of mathematical games. Other courses I offer cover topics such as game preservation, platform studies, and game design aimed at conveying scientific knowledge.

Manuel Hohmann

Institution: University of Tartu

Country: Estonia

Website: <http://geomgrav.fi.ut.ee/people/manuel/>

Projects: <https://github.com/xenos1984>

I am a mathematical physicist primarily working in geometry and gravity. I developed an interest in games and their mathematics as a student more than 20 years ago, with a particular interest in geometry in games. At that time I have implemented a few chess variants on boards like cylinder or torus using Zillions of Games, and I am trying to implement those in Ludii and / or GDL. I am also interested in general game playing algorithms for playing these games.

Rebecca Y. Bayeck, assistant Professor of instructional technology and learning science; Utah State University, USA rebecca.bayeck@usu.edu

My research interest are various and it's a privilege to join this group given my growing interest in mathematics and board games

Dorđe Baralić, Mathematical Institute SANU, Belgrade, Serbia

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I am a research associate professor at the Mathematical Institute SANU. I obtained my PhD in algebraic topology from the Faculty of Mathematics, University of Belgrade in 2013. I am interested in toric topology and its applications, combinatorics, discrete geometry and algebraic topology. Currently, I serve as Assistant Director of the [Mathematical Institute SANU](#) in charge of international collaboration, work with gifted students and science promotion. I'm an enthusiastic person, passionate about my work and new collaborations. In my free time, I love travelling and reading. Besides my native Serbian, I speak English and Spanish.

My research concerns applications of algebraic topology and combinatorial methods to Hex Games, triangulations, polyomino puzzles and recreational mathematics. You can contact me for more information.

Since 2017, I have been a co-organizer of May Month of Mathematics, the biggest science popularisation event in Serbia. I am involved in many projects of maths training for students, teachers and STEM in the Balkans and other countries.

References related to Games (in broader context)

1. Dj. Baralić and L. Milenković: [The Magic Permutohedron](#), published online in [The Mathematical Intelligencer](#)
2. E. Liđan and Dj. Baralić: [Homology of polyomino tilings on flat surfaces](#), [Applicable Analysis and Discrete Mathematics](#), 16 (2022), 001–022

3. Dj. Baralić and V. Limić: [The law of large numbers for the bigraded Betti numbers of a random simplicial complex](#), *Russian Mathematical Surveys*, (2021) 76(1) 186-189
4. Dj. Baralić, J. Ivanović and Z. Petrić: [A simple permutoassociahedron](#), *Discrete Mathematics*, (2019) 342(12) 111591
5. Dj. Baralić and R. Živaljević: [Colorful versions of the Lebesgue and KKM theorem](#), *Journal of Combinatorial Theory*, Series A, Volume 146 (2017), 295-311.

The second part of the meeting was used to discuss organisation and how to collaborate among each other (which common tools we could use, subgroups of work, etc.)

Organisational Aspects

Platform for general conversation and topical discussion - Discord (but the project as a whole might be covered, discussion to follow in Leiden)

Publication linked to COST

RMM is making a dedicated yearly issue on Mathematics and Games

Summer Schools on specific topics

Have Subgroups in our maths groups:

- History of Mathematical Games
- Mathematical Didactics in Games
- Solvability and "Playability" of games (connections with WG1 and WG2 and WG3) → write a paper on that!

Question of playability across history and geographical areas (with WG2, cf. Walter's remark)

- Topology in Games
- Fairness in Games

→ Create a survey to define all (if possible!) types of approaching games from a mathematical point of view. (Direct link with WG1 and AI approach).

This survey could be a first start to define subgroups of persons working on different topics.

→ For the next meeting: have several specialised talks to better understand what you are doing concerning games and maths (what data do you work with, what are your questions, etc.). + sharing the slides to other groups.

→ Organise online sessions for these presentations

Common Literature / Reading Recommendations in/for/about Mathematics & Games:

Mathematical games

20th Century

- *Theory of Games and Economic Behavior* (Princeton University Press, 1944) by John Von Neumann and Oskar Morgenstern
- Blaquière, Austin, Françoise Gérard, and George Leitmann. *Quantitative and Qualitative Games*. Vol. 58. Mathematics in Science and Engineering. New York and London: Academic Press, 1969.
- Hájek, Otomar. *Pursuit Games: An Introduction to the Theory and Applications of Differential Games of Pursuit and Evasion*. Mathematics in Science and Engineering, v. 120. New York: Academic Press, 1975.
- *Winning Ways for Your Mathematical Plays* (Academic Press, 1982) by Elwyn R. Berlekamp, John H. Conway, and Richard K. Guy
- Beasley, John D. *The Mathematics of Games*. [2.] repr. Recreations in Mathematics 5. Oxford: Oxford University Press, 1990.

21st Century

- Conway, John Horton. *On Numbers and Games*. 2nd ed. Natick, Mass: A.K. Peters, 2001.
- Hirsch, Robin, and Ian Hodkinson. *Relation Algebras by Games*. 1st ed. Studies in Logic and the Foundations of Mathematics, v. 147. Amsterdam Boston: North Holland/Elsevier, 2002.
- Beck, József. *Combinatorial Games: Tic-Tac-Toe Theory*. Encyclopedia of Mathematics and Its Applications, v. 114. Cambridge ; New York: Cambridge University Press, 2008.
- *Combinatorial Game Theory* (American Mathematical Soc. 2013) by Aaron Siegel
- Lowrie, Tom, and Robyn Jorgensen, eds. *Digital Games and Mathematics Learning*. Vol. 4. Mathematics Education in the Digital Era. Dordrecht: Springer Netherlands, 2015. <https://doi.org/10.1007/978-94-017-9517-3>.
- Posamentier, Alfred S., and Stephen Krulik. *Strategy Games to Enhance Problem-Solving Ability in Mathematics*. Problem Solving in Mathematics and Beyond, volume 5. New Jersey: World Scientific, 2017.
- Bewersdorff, Jörg. *Luck, Logic, and White Lies: The Mathematics of Games*. CRC Press, 2021.
- Koparan, T. (2019). Teaching Game and Simulation Based Probability. *International Journal of Assessment Tools in Education*, 6 (2), 235-258. DOI: 10.21449/ijate.566563

General public

- Cottanceau, Jérôme. *Le choix du meilleur urinoir*. Belin, 2016.
<https://www.belin-editeur.com/le-choix-du-meilleur-urinoir> (in French)
- Devlin, Keith J. *Mathematics Education for a New Era: Video Games as a Medium for Learning*. Natick, Mass: A K Peters, 2011.
- Gould, Ronald J. *Mathematics in Games, Sports, and Gambling: The Games People Play, Second Edition*. Boca Raton, London, New York: CRC Press, 2010. <https://www.routledge.com/Mathematics-in-Games-Sports-and-Gambling-The-Games-People-Play-Second/Gould/p/book/9781498719520>.
- Lane, Matthew. *Power-Up: Unlocking the Hidden Mathematics in Video Games*. Princeton: Princeton University Press, 2017.
- Stewart, Ian. *Math Hysteria: Fun and Games with Mathematics*. Oxford University Press, 2004.
- Taylor, David G. *The Mathematics of Games*. Textbooks in Mathematics. Boca Raton, London, New York: CRC Press, 2015.

Other

- *Puck: A Slow and Personal Automated Game Designer*, Michael Cook
Downloadable at <https://www.puck.games/>
- Journal of Recreational Mathematics (1968-2014).
- Recreational Mathematics Magazine - <https://sciendo.com/journal/RMM>