

## ACG 2021 conference report

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The 17<sup>th</sup> *Advances in Computer Games* conference (ACG 2021) was held online in 2021 for the first time in its 47 year history, due to the COVID pandemic and resulting travel restrictions. The conference took place during 23–25 November 2021.

The *Advances in Computer Games* conference series is a major international forum for researchers and developers interested in all aspects of artificial intelligence and computer game playing. Earlier conferences took place in London (1975), Edinburgh (1978), London (1981, 1984), Noordwijkerhout (1987), London (1990), Maastricht (1993, 1996), Paderborn (1999), Graz (2003), Taipei (2005), Pamplona (2009), Tilburg (2011), Leiden (2015, 2017) and Macao (2019). For the past 20 years, the conference has been held every second year, alternating with the *Computer and Games* conference.

A total of 34 papers were submitted to this conference. One was later withdrawn and the remaining 33 papers were each reviewed by three reviewers. A total of 22 papers were accepted for presentation at the conference. All accepted papers will appear in the conference proceedings, to be published by Springer in their *Lecture Notes in Computer Science* (LNCS) series.

The online nature of this year's conference offered some benefits in that conference registration could be made free for the first time, resulting in a record participation for this event with 399 registered participants. The attendance figures for the sessions peaked at around 100 viewees at any given time. Another benefit is that all talks were recorded and are available online. We would like to thank Dr Nicolás Arnáez from the University of Alberta's AI4Society initiative for setting up the conference's Zoom stream – which ran without incident throughout – and for preparing the presentation videos.

A key challenge for running the conference online was to devise a schedule that worked for as many attendees as possible over a wide range of time zones. Unfortunately, our Japanese and Taiwanese colleagues had to contend with conference sessions lasting into the early hours of the morning (local time), which will be addressed in future online events.

The themes for this year's ACG conference were specifically widened to include video game research in addition to the usual traditional/mathematical games research. The goal was to broaden the conference focus to encourage new researchers to participate in ICGA events. The four papers presented in Session 5 *Player Modelling* represent the results of this initiative.

The ACG 2021 programme consisted of three keynote speeches and six regular paper sessions. We were delighted to hear keynote talks from world-class researchers David Silver and Michael Bowling, and veteran computer chess program creators Larry Kaufman and Mark Lefler. In addition, Opening

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and Closing remarks were given by ICGA President Jonathan Schaeffer. All papers and presentation videos can be accessed at the ACG 2021 web site.<sup>1</sup>

### 1. SESSION 1: LEARNING IN GAMES

The opening session, chaired by Todd Neller, collected three papers focussed on machine learning – especially deep learning – for specific games. These included C. Yi and T. Kaneko on “Improving Counterfactual Regret Minimization Agents Training in the Card Game Cheat”, B. Doux, B. Negrevergne and T. Cazenave on “Deep Reinforcement Learning for Morpion Solitaire” and L. G. Heredia and T. Cazenave on “Expert Iteration for Risk”.

### 2. SESSION 2: SEARCH IN GAMES

This session, chaired by Michael Hartisch, presented new search methods and enhancements of existing search methods for a range of games. The papers presented were N. Fabiano and T. Cazenave on “Sequential Halving Using Scores”, T. Cazenave, J. Sentuc and M. Videau on “Cosine Annealing, Mixnet and Swish Activation for Computer Go”, G. Moskowitz and V. Ponomarenko on “A Heuristic Approach to the Game of Sylver Coinage” and A. Pálsson and Y. Björnsson on “Evaluating Interpretability Methods for DNNs in Game-Playing Agents”.

### 3. KEYNOTE: MICHAEL BOWLING *Artificial Intelligence Goes All-In: Computers Playing Poker*

The first keynote speaker, Professor Michael Bowling from the University of Alberta’s Computer Poker Research Group and Google DeepMind, was introduced by Jonathan Schaeffer. This talk described the development of the world’s first superhuman Poker bots.

### 4. SESSION 3: SOLVING GAMES

Kazuki Yoshizoe chaired this session on solving, or at least providing more complete complexity analyses, of some simple games. This included S. Tanaka, F. Bonnet, S. Tixeuil and Y. Tamura on “Quixo is Solved”, J. Uiterwijk on “Solving Bicoloring-Graph Games on Rectangular Boards – Part 1: Partisan Col and Snort” and “Part 2: Impartial Col and Snort” and R. Hayward, R.A. Hearn and M. Jamshidian on “BoxOff is NP-Complete”.

### 5. KEYNOTE: LARRY KAUFMAN AND MARK LEFLER *54 Years of Progress in Computer Chess*

Larry Kaufman and Mark Lefler, introduced by Jaap van den Herik, presented a personal account of key developments in Computer Chess over the last half century, through their own experiences in the field.

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<sup>1</sup>[https://icga.org/?page\\_id=3328](https://icga.org/?page_id=3328)

## 6. SESSION 4: CHESS PATTERNS

This session on *Chess Patterns*, chaired by Tristan Cazenave, explored effective representations of Chess for AI search. The papers included M. Bizjak and M. Guid on “Automatic Recognition of Similar Chess Motifs”, R. Haque, T.H. Wei and M. Müller on “On the Road to Perfection? Evaluating LeelaChess Zero Against Endgame Tablebases” and D. Gomboc and C. Shelton on “Chess Endgame Compression via Logic Minimization”.

## 7. KEYNOTE: DAVID SILVER *AlphaZero Fundamentals*

The third keynote speaker was David Silver, leader of Google DeepMind’s machine learning group and lead researcher on the successful AlphaGo, AlphaZero and AlphaStar programs. Dr Silver described the inner workings of AlphaZero, and how existing search methods were adapted to produce the spectacular results obtained. Martin Müller introduced David Silver.

## 8. SESSION 5: PLAYER MODELLING

Matthew Stephenson chaired Session 5 on *Player Modelling* which collected the video games papers accepted for the conference. These included K. Fujihira, C.-H. Hsueh and K. Ikeda on “Procedural Maze Generation with Difficulty from Human Players’ Perspectives”, H.-J. Chang, C. Yueh, G.-Y. Fan, T.-Y. Lin and T.-S. Hsu on “Opponent Model Selection Using Deep Learning”, G. Guglielmo, I.F. Peradajordi and M. Klincewicz on “Deep Learning to Detect Facial Markers of Complex Decision Making” and A. Gunes, F. Kavum and S. Sariel on “Player Modeling Using Event-Trait Mapping Supported by PCA”.

## 9. SESSION 6: GAME SYSTEMS

This session, chaired by Spyridon Samothrakis, featured four papers on game systems, especially the Ludii general game system. The papers included M. Stephenson, E. Piette, D.J.N.J. Soemers and C. Browne on “Automatic Generation of Board Game Manuals”, “Optimised Payout Implementations for the Ludii GGS” and “General Board Geometry” (in various order of authorship) in addition to M. Goadrich and C. Shaddox on “Quantifying the Space of Hearts Variants”.

## 10. REFLECTIONS

In the past, a typical *Advances in Computer Games* conference attracted roughly 15-20 papers and 30-40 in-person attendees. The move to an online venue did not increase the number of papers submitted or accepted, but led to a dramatic increase in the number of registrants (399). This is important for the future of the ICGA, as some of these people may become ICGA members and even authors of ACG papers.

The online event had several important advantages over the traditional in-person conference. First, the logistics were much simpler – no local arrangements needed (e.g., finding space). Second, it was easier to attract excellent keynote speakers (no travel time required). Finally, no money changed

hands: registration was free, there were no local costs, and there was no travel for the keynote speakers and organisers. Of course, there was still the significant volunteer time given by many people to help make the conference a success. A sincere thank you to everyone involved in ACG!

The disadvantage of an online conference is the reduced interaction between participants. Texting a colleague is not the same quality interaction as having a face-to-face discussion. We will explore the use of tools to help enhance the online experience,

*Advances in Computer Games* is offered every second year, alternating with the *Computers and Games* conference. CG will be offered online in 2022. It is our expectation that for 2023 we will be able to organise a conference whose program is a combination of in-person and online content.

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