

COST Action

Progress Report at 24 months

(24/10/2023 to 24/10/2025)

CA22145: Computational Techniques for Tabletop Games Heritage

The Action was approved by the Committee of Senior Officials (CSO) on 12-5-2023 and has the MoU reference COST 055/23.

This report was submitted on 18-12-2025 by the Action Chair on behalf of the Management Committee in fulfilment of the requirements of the rules for COST Action Management, Monitoring and Final Assessment.

COST Association AISBL

Avenue du Boulevard - Bolwerklaan 21, box 2 | 1210 Brussels, Belgium
T +32 (0)2 533 3800 | office@cost.eu | www.cost.eu

Action leadership and participants

Leadership positions

Position	Name	Contact details	Country*
Chair	Dr Eric Piette	eric.piette@uclouvain.be +33605428914	Belgium

Position	Name	Contact details	Country*
Action Vice-Chair	Dr Walter Crist	wcrist@asu.edu +31433883123	Netherlands

Working groups

#	WG Title	# of participants	WG Leader	Country*
1	Search, Planning, Learning, and Explainability	157	Dr Dennis Soemers dennis.soemers@maastrichtuniversity.nl	Netherlands
2	Cultural Heritage of Games	201	Dr Walter Crist wcrist@asu.edu	Netherlands
3	Automated Game and Puzzle Design	141	Dr Swen Gaudl swen.gaudl@ait.gu.se	Sweden
4	Mathematics in Games	120	Dr Lisa Rougetet lisa.rougetet@univ-brest.fr	France
5	Implementation, Dissemination, and Education	224	Dr Theodora (Dorina) Moullou thmoullou@hotmail.com	Greece

Other key leadership positions

Position	Name	Contact details	Country*
Science Communication Coordinator	Dr Summer Courts	s.l.courts@pgr.reading.ac.uk	United Kingdom
GH Scientific Representative	Eric Piette	eric.piette@uclouvain.be	Belgium

* The country displayed is:

- for the Action Chair, the country that nominated that person to the Management Committee before they were elected Action Chair;
- for the Action Vice-Chair the country that nominated the person as a Management Committee Member,
- for all other leadership positions, if the person is a MC Member the country displayed is the country of nomination, otherwise it is the country of the person's primary work affiliation.

Participants

COST members having accepted the MoU

AL	08/06/2023	AM	08/06/2023	AT	08/06/2023	BE	08/06/2023	BA	08/06/2023
BG	08/06/2023	HR	08/06/2023	CY	08/06/2023	CZ	08/06/2023	DK	08/06/2023
EE	08/06/2023	FI	08/06/2023	FR	08/06/2023	GE	08/06/2023	DE	08/06/2023
EL	08/06/2023	HU	08/06/2023	IS	08/06/2023	IE	08/06/2023	IL	08/06/2023
IT	08/06/2023	LV	08/06/2023	LT	08/06/2023	LU	08/06/2023	MT	08/06/2023
MD	08/06/2023	ME	08/06/2023	NL	08/06/2023	MK	08/06/2023	NO	08/06/2023
PL	08/06/2023	PT	08/06/2023	RO	08/06/2023	RS	08/06/2023	SK	08/06/2023
SI	08/06/2023	ZA	08/06/2023	ES	08/06/2023	SE	08/06/2023	CH	08/06/2023
TR	08/06/2023	UA	08/06/2023	UK	08/06/2023				

Other participants

Institution Name	Country
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Summary

The main aim and objective of the Action is to

explore new ways to study games across diverse fields such as history, archaeology, mathematics, and education, in collaboration with AI researchers. Together, we will design algorithms, methods, and techniques capable of emulating human-like gameplay across a wide range of tabletop games to unlock new insights for research within these disciplines.

During its first two years the Action progressed the achievement of this as described below

During the first half of its implementation, the GameTable Action has made substantial progress toward its overarching aim of creating a multidisciplinary European network capable of transforming the study of games, gameplay, and Game AI while connecting cultural heritage, mathematics, archaeology, history, and computer science. The Action has succeeded in building a robust and active community of more than 340 members from over 40 COST countries, achieving the critical mass and interdisciplinary balance envisioned in the MoU. This network already functions as a long-term collaborative ecosystem that supports innovation, mobility, capacity building, and methodological integration across disciplines.

Scientifically, the Action has made strong progress on several core research directions. Work on imperfect-information games has advanced rapidly, producing new representations such as Belief Stochastic Games and constraint-based formulations that bridge gaps between AI and cultural-game analysis. These developments are being actively compared with other state-of-the-art frameworks through close collaboration within the network and are expected to yield significant impact before the end of the Action. At the same time, work on human-like AI, still emerging but already promising, has generated several methodological foundations and early publications, including cognitively inspired models and exploratory studies in inverse reinforcement learning and strategy imitation. Together, these lines of work enhance our ability to reconstruct ancient games, analyse their tactical depth, and model human decision-making.

In cultural-heritage research, the Action has produced concrete methodologies through STSMs focused on documenting graffiti games, identifying game pieces, and capturing living traditions of play. These contributions demonstrate how cultural processes shape gameplay and rule transmission. An edited volume featuring twenty chapters authored by Action members is currently under review and will constitute the first comprehensive methodological guide to gaming artefacts in archaeology.

Technologically, the Action has highlighted and coordinated innovative digital approaches poised to transform public engagement with heritage games: computer-vision systems for recognising gameboards from photographs, mobile applications for interacting with reconstructed games, high-resolution 3D scans for museum-based experiences, and a digital exhibition designed to outlast the Action. These approaches reinforce the Action's aim of making cultural heritage accessible, interactive, and scientifically grounded.

Educationally, WG5 has produced teacher booklets, glossaries, and AI-based learning tools, and is coordinating the design of museum kits, interdisciplinary educational programmes, and training schools. These efforts support teachers, students, and museum professionals while training the next generation of scholars.

Importantly, the Action has already generated more than 20 scientific publications, an exceptional achievement at the mid-point, alongside many additional manuscripts in preparation. This demonstrates both the productivity and momentum of the network.

Finally, the Action has made strong progress on inclusiveness and gender balance, hosting many events in ITCs, prioritising women for STSMs, maintaining strong female leadership, and fostering collaboration through initiatives such as Connect-Two.

Collectively, these achievements demonstrate clear and impactful progress toward establishing a durable,

interdisciplinary, and innovative research community capable of advancing the scientific and cultural understanding of games across Europe and beyond.

Action website

<https://gametable.network/>

Achievement of MoU objectives, deliverables and additional outputs/ achievements

MoU objectives

The Action reported the following progress in achieving its specific objectives.

MoU objective	Level of progress	Further information (hyperlink or other)
Identify AI techniques that can answer archaeological and historical research questions and facilitate future research on games of the past through the creation of digital tools.	51 - 75%	Over GP1-2 we made strong, coordinated progress on this objective. We convened multiple cross-WG meetings (London, Gothenburg, Wroclaw, Viminacium, Lausanne, ...) bringing together WG1–3 (AI researchers) and WG2 (Cultural Game Heritage researchers) to surface the core historical/archaeological questions behind traditional games and reframe them in AI-amenable terms. The shared terminology that resulted is already aligning methodological choices and steering active research lines across the Action. Substantively, we mapped where specific AI techniques can create value for heritage inquiry: agent-based simulation and reinforcement learning to explore plausible player behaviours and rules-in-use; probabilistic modelling and uncertainty quantification to compare competing reconstructions; supervised learning to recognise boards, pieces, and wear patterns from artefacts. Two cross-cutting tracks are now prioritised: (i) General Human-Like AI that models how people actually play (heuristics, mistakes, learning, social norms), not only how to win, supporting historically grounded reconstructions; and (ii) general models for imperfect-information games to study families of traditional card games with reusable, game-agnostic techniques rather than bespoke solutions. On dissemination and community building, three WG1 AI researchers and three WG2 Cultural Game Heritage researchers, as guest editors, launched the ACM Journal on Computing and Cultural Heritage Special Issue “Computational Techniques for Games Heritage,” explicitly targeting interdisciplinary, use-case-driven submissions. Multiple GameTable collaborations are developing manuscripts for this venue; we will prioritise invitations for these teams to present and refine their work at upcoming Action events ahead of submission. In parallel, we organised a dedicated panel at Board Game Studies 2024, a conference focused on traditional games and their cultural-heritage significance, staffed by four members (including the Chairs, the Science Communication Officer, and a WG4 leader) to present GameTable and, in particular, this AI objective, with the explicit aim of recruiting new partners to collaborate with our AI researchers. We also organised a special session at the 52nd Computer Applications and Quantitative Methods in Archaeology (CAA) 2025 conference in Athens titled “GameTable: Bridging Disciplines for Heritage Games.” This session was highly successful in expanding communication about our ongoing work and sub-projects and in attracting new members to the Action. We accepted 8 submissions, reflecting strong interest from the archaeological and digital-heritage communities. Owing to its success, this initiative will be repeated at the next CAA conference in Vienna in 2026, further strengthening interdisciplinary visibility and network growth. Several groups of members have secured proof of concept funding or are pursuing such opportunities independently, building on the scientific exchanges and mutual understanding fostered through the Action. Next steps include defining shared benchmark tasks and datasets, articulating evaluation criteria meaningful for historians and archaeologists (e.g., plausibility, interpretability, provenance), and maturing these directions into robust digital tools that facilitate future scholarship on games of the past.
Understand the ways that cultural processes can change gameplay,	51 - 75%	This objective has been a central focus of WG2 throughout the Action and will remain a major research priority during GP3–4. Significant progress has been made toward developing methodologies that connect archaeological artefacts to specific forms of gameplay and toward understanding how cultural processes

and explore the ways that games have had an impact on cultural change. Provide methodologies to connect artefacts with specific kinds of gameplay and create innovative techniques for studying gaming cultures of the past.		shape the evolution of games, and, in turn, how games influence cultural change. Involvement in this working group has directly led to significant grant capture and further funding including one doctoral studentship (University of Reading), two postdoctoral fellowships (Swiss National Research Foundation) and a number of smaller projects by members of this Working Group. Several Short-Term Scientific Missions (STSMs) have produced particularly impactful outcomes. Alex de Voogt's STSM has led to the development of an edited volume, <i>Moving Along: Game Pieces in Material Culture</i>, which is under consideration by Oxford University Press. The volume, featuring twenty chapters contributed by GameTable members, will be the first comprehensive publication dedicated to identifying, interpreting, and contextualising gaming pieces within archaeological and historical research, filling a long-standing gap in the academic literature. Tim Penn's STSM produced a rigorous methodology for documenting graffiti games at archaeological sites. This work was further disseminated through the Games Graffiti Training School, where archaeologists, educators, and tour guides were trained in the application of these methods. This ensures that the techniques developed within GameTable will have practical, long-term impact in the field. Walter Crist's STSM provided a field-based example of how to document living traditions of gameplay, resulting in a publication accepted in the <i>American Journal of Play</i>. This research demonstrates how variations in rules across communities provide insight into cultural governance, rule transmission, and the dynamic ways in which gameplay practices evolve over time. Through networking and scientific exchanges within the Action, a team of six GameTable members later secured independent funding from Game in Lab to undertake the first systematic study of evidence for board games in the city of Rome. This collaboration was a result of networking at GameTable meetings and will seek to understand the social and spatial role of games in Europe's first megacity. This is a landmark undertaking because it underlines the momentum that the GameTable community has developed around the study of games and gaming. Additionally, the Action has expanded research into previously underrepresented regions, including Central and Eastern Europe and the Caucasus, these include several publications already accepted or in press, and multiple further publications currently in preparation. These studies will, for the first time, document and analyse traditional games from these areas and offer methodological models for identifying game-related artefacts in diverse archaeological contexts. Together, these achievements demonstrate substantial progress toward developing innovative methodologies for studying past gaming cultures and for understanding the cultural forces that shape and are shaped by gameplay.
Improve standard approaches for the analysis of tabletop games in developing interaction between AI search techniques and the mathematical aspects involved in these techniques.	26 - 50%	During GP1-2 we focused on community building and knowledge exchange for this objective. We organised multiple WG1 and WG3 focused events where GameTable members presented their latest work on AI search (e.g., Monte Carlo and heuristic search, sampling strategies, evaluation functions, reinforcement learning approaches) alongside the mathematical foundations that support them (combinatorial or game-theoretic modelling). They provided a forum to make individual lines of work explicit and to debate, in a formal way, which AI approaches we employ today and how we should improve them for stronger analyses. To catalyse collaboration, several Short-Term Scientific Missions (STSMs) and Young Researchers' Incentives (YRIs) grants were awarded to GameTable members from WG1 and WG3. These supported bilateral visits, joint experiments, and conference presentations, enabling researchers to co-develop ideas, compare methodologies on shared case studies, and receive cross-WG feedback. Early outcomes include reports, and some publications to conferences such as ECAI, IEEE COG, ACG. Reports and papers acknowledging GameTable can be found at https://gametable.network/index-publications.html.

		As these exchanges continue, we expect the emerging practices, shared datasets, evaluation criteria, and method templates, to consolidate into improved, more standardised approaches for analysing tabletop games at the intersection of AI search and mathematical modelling.
Provide explainable approaches for the strategies performed by the AI agents and elements of comparison between tactics and strategies.	0 - 25%	During the first half of the Action, WG1's activities were mainly directed toward developing and refining approaches for imperfect information games, search-based algorithms, and models of human-like AI behavior. These topics emerged as central to the Action's objectives and to the collaborative work of several WGs, thus receiving priority over the explainability-related goal. The initial WG1 meetings included brief discussions about possible directions for implementing explainable approaches to AI strategy interpretation and for comparing tactics and strategies. However, these discussions concluded that dedicated research on this objective should be postponed. No specific models, experiments, or publications have yet been produced in this area. Nevertheless, the conceptual exchanges during these early meetings helped identify where explainability could later complement other strands of work, particularly in analyzing AI decision-making in reconstructed or human-like systems. Depending on the overall progress of the Action, WG1 may return to this theme toward its conclusion, or it may become a focus of follow-up collaborative projects initiated by the group.
Design AIs using a variety of strategies, simulating how humans experience gameplay. Learn from human in-game communication and teach AIs how to interact with AIs and humans.	26 - 50%	Progress on this objective currently stands between 26–50%, with active work underway across WG1 and WG3. Designing human-like AIs is a central theme within the Action, as such systems are expected to improve the study of traditional games, support more realistic simulations, and contribute to the generation of plausible reconstructed rulesets. Early discussions within the WGs have focused on identifying what “human-likeness” means in the context of traditional games, an aspect that can differ from modern games, and members from WG2 and WG5 have been involved to ensure that cultural, historical, and player-experience dimensions are taken into account. Several members of the Action are actively publishing in this area, and some initial results already contribute directly to this objective. Notably, the CogniPlay model presented in a recent work-in-progress paper proposes a cognitively grounded approach for human-like decision-making in General Game Playing, integrating insights from cognitive psychology, selective search, and chunk-based pattern processing. This work also examines how methods such as inverse reinforcement learning, bounded-memory Monte Carlo Tree Search, and dual-process decision frameworks could inform the development of AI systems that mimic human reasoning and selective attention. Current efforts therefore lie at the intersection of AI, cognitive science, and psychology, exploring new forms of knowledge representation that capture human decision biases, limited search depth, and structured pattern recognition. Parallel to these general approaches, more targeted studies are being developed to match human actions in specific games. One ongoing case study focusing on Go aims to compare human move patterns with AI outputs and may lead to a publication in the near future. Overall, while substantial theoretical and exploratory work has begun, the integration of human-in-game communication and AI-human interaction modelling remains a medium-term goal. The foundations laid during the first half of the Action position the consortium well to achieve more concrete outputs during the later phases.
Provide reconstructed games for use by cultural institutions in their educational programs and create accessible	26 - 50%	Progress has been made toward providing reconstructed games for cultural institutions and developing accessible digital tools that engage the public with heritage games. In January 2025, an ancient Senet game housed at the Rijksmuseum van Oudheden will be 3D scanned. This high-resolution model will enable accurate reproduction of the artefact for educational use and will be made available for integration into a museum-oriented video game in which visitors can play a reconstructed version of Senet. This initiative will directly support

digital tools to engage the public with heritage games.		museums in offering interactive, research-informed experiences to their audiences. Discussions within the Action have contributed to identifying innovative digital approaches for the dissemination of heritage games, including mobile applications and computer vision tools. Some GameTable members are pursuing such approaches independently, outside the scope of the COST Action. Reconstructed games will additionally be featured in the Action's forthcoming digital exhibition. While the exhibition's structure and design have been completed, content gathering is ongoing. Once launched, it will serve as an engaging public resource that showcases reconstructed games and their cultural significance. Collectively, these initiatives demonstrate substantial progress toward creating high-quality reconstructions and digital tools that connect the public with gaming heritage in innovative and meaningful ways.
Extend General Game Playing (GGP) research by developing a framework to model imperfect-information games.	51 - 75%	The development of a framework to model imperfect-information games represents one of the core research directions of the Action and has been a central topic of discussion during all WG1 meetings held in Leiden, London, and Wrocław. These discussions will continue during GP3 and subsequent meetings, as this objective lies at the intersection of theoretical modeling, computational representation, and practical applications to traditional and modern games. Imperfect-information games are particularly relevant for studying card games and other traditional games where hidden knowledge plays a key role, but also for broadening the General Game Playing (GGP) paradigm to more complex, realistic environments. Throughout these meetings, significant progress has been made in identifying and formalizing approaches that can generalize to such settings without relying on extensive human knowledge. Close collaboration with experts in the field, including Viliam Lisý, an established researcher in hidden-information games, has been instrumental in guiding the conceptual and methodological development. Several research outputs have already resulted from this work, primarily led by the Chair's team and developed within the context of Achille Morenville's ongoing PhD thesis. These publications introduce innovative representations using constraint programming, notably the Belief Stochastic Games framework, which enables the direct computation of probabilistic reasoning within the game model. This approach is currently being compared to other state-of-the-art systems such as Cardstock, developed by Mark Goadrich (also a member of GameTable), who conducted an STSM at the Chair's host university to strengthen this collaboration. These advancements are paving the way for a robust, general framework for imperfect-information games within the GGP domain. Further publications are already planned as part of the continuation of this research, and experiments applying these models to traditional card games are underway. In this context, close exchanges have taken place with experts such as Thierry Depaulis, whose historical expertise on traditional card games provides valuable cultural and domain-specific insight. Together, these efforts demonstrate steady and meaningful progress toward the objective, combining theoretical innovation, cross-disciplinary collaboration, and applied experimentation that will extend well beyond the lifetime of the Action.
Develop procedural generation techniques of higher quality games and puzzles than are currently being achieved with existing	0 - 25%	The objective of developing procedural generation techniques for higher-quality games and puzzles has seen limited progress so far, with activity estimated at under 25%. This research direction was discussed during WG3 meetings, where members reviewed existing methods for procedural puzzle generation and identified potential areas of application within traditional tabletop games. These exchanges helped clarify the scope and possible research questions related to generative design and automated balancing. However, due to changes in the availability of key contributors who specialize in

approaches and provide automatic evaluation, play testing and balancing of tabletop games.		procedural content generation, many of whom became engaged in other major research projects shortly after the start of the Action, work in this area has advanced more slowly than initially planned. As a result, this objective has not been prioritized compared to other strategic goals more central to the Action, such as human-like AI approaches, imperfect-information modeling, and the reconstruction of ancient games. Nonetheless, some of the techniques being developed for automatic evaluation, playtesting, and balancing of traditional games, particularly within the context of reconstructing ancient rule sets, remain relevant to this objective. These approaches could later inform procedural generation strategies for puzzles and new tabletop game designs. The groundwork laid through these discussions and related projects provides a foundation for potential continuation of this research beyond the lifetime of the Action.
Generate innovative and original high-quality games for commercialisation.	0 - 25%	Although this objective is scheduled for the later phases of the Action, several foundational elements are already being developed to support the eventual generation of innovative, high-quality games suitable for commercialisation. Early progress includes conceptual work on generative AI pipelines, combining content generation, behaviour simulation, and automated evaluation frameworks expected to underpin future game-design toolchains. These discussions have been regularly addressed in WG3 and are aligned with broader research on traditional game modelling within the Action. A significant concrete achievement is the publication of the GAVEL framework at NeurIPS, co-authored by members of the Action. GAVEL introduces a novel combination of evolutionary computation and large language models to generate entirely new board games within the Ludii system, producing playable and original designs that surpass the capabilities of previous automated systems. This work establishes a strong methodological basis for the procedural design of commercially viable games and will be extended during the next phases of the Action to explore more targeted, heritage-inspired, or market-ready game prototypes. In parallel, the Action facilitates reflection on complementary creative pathways, such as the 3D scanning and reconstruction of iconic ancient game materials. These resources could feed into hybrid digital-physical design workflows and inspire innovative new products connected to cultural heritage. Overall, while direct commercialisable outputs have not yet been produced, the scientific and technical foundations, including the GAVEL framework, position the Action to make substantial progress toward this objective in its later stages.
Develop effective educational strategies for teaching Game AI and pedagogical programs and activities among students at all levels of education.	26 - 50%	WG5 has made strong progress in developing innovative educational strategies for teaching Game AI and integrating games into pedagogical programmes at multiple educational levels. The Working Group has created a range of learning tools and materials designed to support teachers, students, and museum professionals in understanding both the cultural significance of games and the computational principles behind AI. A key achievement is the development of teacher booklets tailored to different audiences, including Game On! Unlocking the Power of Play in Teaching, which provides practical guidance for integrating games into classroom activities. WG5 has also compiled a comprehensive glossary to support educators and learners engaging with Game AI and heritage-related terminology. In addition, members are developing an interactive AI-based adventure game aimed at helping educators understand how Game AI functions and how it can be applied as a teaching tool. These resources encourage students to think critically, engage in problem-solving, and explore the cultural, historical, and technological dimensions of games. Looking ahead, WG5 plans to expand these efforts by developing a complete educational programme and a museum kit that can be used in schools,

		museums, and heritage settings to teach about traditional games, computational thinking, and AI. These tools will provide hands-on learning opportunities and foster interdisciplinary understanding. Participation in WG2 and WG5 supported scientific discussion and idea development around Roman and Medieval games. At a later stage, independently of the COST Action, Tim Penn secured funding from the Arts and Humanities Research Council Impact Accelerator Account to develop and deliver related educational sessions in schools across the UK. These sessions, which connect ancient history, historical gaming and the mental health of play, were developed in line with feedback from GameTable Members. As part of the 'testing' and refining process for these sessions, this project has reached more than 900 pupils across the UK as of November 2025. These materials will be rolled out to other countries as appropriate through the life of GameTable, and we will also be seeking to embed them in local and national curricula as part of GameTable's legacy. Collaborations between WG2 and WG5 have also led to the organisation of an international tournament of traditional games involving secondary schools. Supported by dedicated teaching materials and experiential learning activities, this tournament will promote cultural awareness, encourage active participation, and help students engage directly with historical games and their modern interpretations. Together, these initiatives demonstrate substantial progress toward establishing effective educational strategies and pedagogical activities that promote Game AI and traditional game heritage across all levels of education.
Establish a robust network of European researchers, through the organisation and coordination of open and multidisciplinary events, fostering enduring collaborations that extend beyond the duration of the project.	76 - 100%	The Action has made remarkable progress toward establishing a strong and sustainable European research network that will endure well beyond the project's lifetime. GameTable now includes more than 340 members, representing 41 COST countries and 15 international partner countries, demonstrating the Action's exceptional capacity to unite researchers and practitioners across a broad spectrum of disciplines, including archaeology, AI, mathematics, history, education, and cultural heritage. Networking and collaboration have been consistently strengthened through an intensive programme of activities, with 7–8 meetings organised each year. These include Working Group meetings, hybrid scientific workshops, training events, and focused research discussions. Such gatherings have been crucial in building interpersonal trust, enabling interdisciplinary dialogue, and launching new cross-country collaborations. Many of these collaborations are now producing joint publications, prototypes, and methodological advances that contribute directly to the core scientific and communication objectives of the Action. Short-Term Scientific Missions (STSMs) have been particularly impactful in supporting sustained collaboration. They have enabled early-career researchers and senior experts to work together across countries, producing new methods, datasets, and case studies. Several STSM collaborations are continuing independently, demonstrating the long-term strength of the network. The Action plans to further prioritise STSMs in the next periods to reinforce connections in areas where scientific progress is still developing. An innovative and highly successful networking initiative is Connect-Two, a tool developed within the Action that randomly pairs two members each month and invites them to meet online. Through these structured informal exchanges, participants learn about one another's expertise, research interests, and potential areas of collaboration. The programme has exceeded expectations: in just six months, over 350 matches have taken place, significantly strengthening personal connections and directly increasing collaboration rates across WGs. To support knowledge exchange, several Working Groups organise webinars, tutorials, and cross-WG presentations, ensuring that expertise circulates openly across disciplines. Training schools have also been organised to support early-career researchers, offering essential methodological skills and integrating new

		researchers into the international network. The Action supports the coordination and aggregation of existing and future resources into a comprehensive online hub that will serve as a long-term repository for educational materials, tutorials, reconstructed games, datasets, AI tools, and other outputs contributed by network members. The platform is designed to remain accessible beyond the project's end, helping to sustain the network's impact. To enhance visibility and expand the network, GameTable has produced promotional materials such as bookmarks, posters, booknotes, and mugs, which will be distributed at scientific and cultural events to reach new audiences. Looking ahead, the Action focuses on consolidating the scientific community and research themes developed through networking and exchange. Any subsequent pursuit of follow-on funding opportunities will take place independently of the COST Action, contributing to the continuity of collaborations beyond the current funding period. Collectively, these initiatives demonstrate that the Action is successfully building a vibrant, durable, and collaborative international research network with strong prospects for long-term continuation.
Promote a collaborative research agenda aimed at facilitating the inception of new projects that leverage combined expertise, skills, and human resources. This strategic approach will enable the Action to effectively address the challenges posed by the Action.	51 - 75%	The collaborative research agenda within GameTable has developed strongly across the Working Groups, leading to several new interdisciplinary projects that leverage the combined expertise and resources of the network. Within WG2, new collaborations have emerged that have significantly expanded research on traditional games in regions that have historically been underrepresented. These partnerships are producing new datasets, documentation, and analyses that enrich our understanding of cultural gaming practices across diverse geographical areas. Cross-WG collaboration, especially between WG1 and WG2, has been particularly productive. Joint research initiatives have already led to innovative studies, including the analysis of board changes in the Royal Game of Ur using AI-generated game metrics, investigations into the impact of uneven dice on Roman games, explorations of alternative dice types in Greek games, and the use of AI techniques to generate 3D models of games from low-quality photographs. These projects exemplify the Action's collaborative spirit and the synergistic potential of combining archaeological expertise with computational methods. The launch of a special issue for the ACM Journal on Computation and Cultural Heritage (JOCCH) has further stimulated new collaborations and inspired interdisciplinary work both within and beyond the Action. This initiative showcases the main research themes of GameTable and provides a high-profile venue for members to publish joint results. GameTable has also served as a catalyst for new projects. Walter Crist's STSM to Azerbaijan has led to ongoing collaborations with researchers there and facilitated new scholarly connections in neighbouring Georgia, opening further research pathways into regional game traditions. Additionally, the newly funded project 'Play and the City: Investigating the Cultural Heritage of Games of the City of Rome (200 BC–500 AD)' brings together GameTable members to document ancient graffiti games in Rome, with plans to extend this work to the port city of Ostia through collaboration with the OSTIUM team at UCLouvain. Participation in the action also helped young researchers secure major funding packages—Illaria Truzzi leveraged her membership of the GameTable to win a prestigious International Research Studentship (worth >£100,000) at the University of Reading for 'Playing in ancient Iberia: The materiality of games in a multicultural context (c. 800 BCE-800 CE)', and Thomas Daniaux was similarly able to secure a two-year fellowship to Reading via the Swiss National Research Foundation Mobility Postdoc for 'Graffiti on bone, horn and ivory counters in Roman Gaul, Germany and Britain' in part due to participation in the action. Both projects focus on cultural heritage issues around games and gaming in the past. In addition, Barbara's Care has recently obtained multiple funding from the Swiss National

		Science Foundation which also contributes to this objective. Collectively, these achievements demonstrate that the Action is successfully promoting a dynamic and collaborative research agenda. The research collaborations and thematic directions discussed within GameTable have led to independent initiatives pursued outside the framework of the COST Action, illustrating the effectiveness of its interdisciplinary strategy and the durability of its impact beyond the Action's formal duration.
Attract the next generation of young researchers and innovators in games, and support them to learn about the manifold subjects, topics and possibilities in the fields to contribute to the improvement of computer science, mathematics, history, anthropology, and archaeology.	51 - 75%	The Action has made significant progress in attracting and supporting the next generation of young researchers and innovators working on games and their intersections with computer science, mathematics, history, anthropology, and archaeology. GameTable's network already includes a large cohort of early-career scholars, with many beginning their PhD research directly within the thematic scope of the Action. In addition, numerous Master's students have participated in Working Group meetings, workshops, and training schools, using these opportunities to deepen their knowledge of computational and cultural approaches to games and to explore pathways toward doctoral studies. A key mechanism for supporting young researchers has been the deliberate prioritisation of Young Researcher and Innovator (YRI) Grants and Short-Term Scientific Missions (STSMs). These instruments have enabled early-career scholars to travel, collaborate internationally, and obtain mentorship from experienced academics across multiple COST countries. Many STSMs have already resulted in joint publications, ongoing collaborations, and new project proposals, providing strong evidence of the Action's commitment to capacity building. Training schools have also played a vital role in equipping younger members with multidisciplinary skills. These events expose participants to a wide range of topics, including AI techniques, cultural heritage analysis, mathematical modelling, reconstruction methods, and digital humanities approaches, providing them with a uniquely integrated perspective that is rare in existing academic programs. Furthermore, initiatives such as Connect-Two have helped younger participants establish personal connections with senior researchers and peers across countries, reducing barriers to collaboration and fostering a supportive, inclusive research culture. Working Groups routinely organize webinars and tutorials that young members can attend freely, enabling them to broaden their expertise and engage with specialists outside their own discipline. As mentioned under Objective 13, participation in GameTable has generated several doctoral and postdoctoral projects which have already received funding. Our commitment to supporting young researchers is also exemplified by further applications for game-related projects between action members, e.g. Rachael Helen Banes has applied for an MSCA fellowship building on connections established through networking activities within the Action.
Promoting Young Researchers and Investigators (YRI) in increasing their visibility through conferences and workshops.	26 - 50%	In the second Grant Period, we successfully supported 6 Young Researchers and Investigators (YRI) Grants, enabling emerging scholars to advance their research projects and strengthen their academic profiles. Out of 15 funded STSMs, 8 were granted to YRIs. In addition, 11 of the 16 Core Group members are YRIs, who are the primary organizers of our training schools and meetings. This achievement not only highlights our commitment to fostering the next generation of researchers but also reflects the growing impact of our grant scheme in promoting innovative studies and cultivating an international network of early-career academics.
Develop collaborations between YRIs and experts from various fields in supporting	26 - 50%	In alignment with the Action's commitment to fostering collaboration between Young Researchers and Innovators (YRIs) and senior experts, significant progress has been achieved through extensive support for Short-Term Scientific Missions (STSMs) and researcher mobility initiatives. During this second Grant Period, the Action supported 8 STSMs, enabling early-career researchers to work directly with established scholars across Europe, gain specialised expertise, and

researcher mobility by encouraging researchers to participate in training schools and through the intensive use of Short-Term Scientific Missions (STSM). The Action will strive for a fair and diverse membership.		develop interdisciplinary collaborations that extend beyond their home institutions. Overall, 14 STSM proposals were funded, with 8 led by women researchers, demonstrating the Action's strong dedication to fairness, diversity, and inclusive participation. The distribution of successful applicants across Working Groups, 4 in WG1, 4 in WG2, 2 in WG3, 1 in WG4, and 4 in WG5, reflects a balanced and equitable engagement across the network's scientific areas. These mobility initiatives have not only supported skill development among YRIs but have also generated new joint research outputs, strengthened cross-WG collaboration, and created opportunities for long-term partnerships. Combined with the participation of young researchers in training schools and other events, these efforts highlight the Action's commitment to building an open, diverse, and collaborative research community.
Significantly improve gender equality in the Action.	26 - 50%	The Action has made consistent efforts to improve gender equality across its activities, particularly through its funding instruments and leadership structures. A key achievement is the balanced representation within the Core Group, where 7 out of 15 members are women. Importantly, one of these positions is explicitly dedicated to monitoring and promoting gender equality across all Action events, meetings, and funding decisions, ensuring that equity considerations are systematically integrated into the organisation of activities. In practice, the Action has prioritised women applicants for opportunities such as Short-Term Scientific Missions (STSMs), training schools, and other mobility schemes. During the current Grant Period, 14 STSM proposals were funded, 8 of which were led by women, demonstrating a concrete commitment to supporting female researchers and providing them with visibility and mobility opportunities. Similarly, 4 of the 6 YRI Grants and 5 of the 9 Dissemination Grants went to women action members. Women are also actively encouraged to take part in collaborative Working Group initiatives, webinars, and interdisciplinary research discussions. Despite these achievements, one of the Action's most persistent challenges remains the structural gender imbalance in fields such as computer science, artificial intelligence, and computational game research, where female participation is still significantly lower than in the humanities and social sciences. This disparity naturally affects the gender distribution within some Working Groups. Looking ahead, the Action will intensify its efforts in the next Grant Periods by further prioritising women in grant allocation, promoting female leadership roles, and collaborating with gender-equity initiatives in STEM. These measures aim to strengthen gender balance both within GameTable and the broader research communities it engages with.
Disseminate the results of the Action activities to the scientific community and to the public.	51 - 75%	The Action has made significant progress in disseminating its results to both the scientific community and the general public. Members have actively contributed to international visibility by organising dedicated sessions and thematic panels at major conferences, including the European Association of Archaeologists (EAA) and the Computer Applications and Quantitative Methods in Archaeology (CAA) meetings. They have also presented GameTable-related research at numerous third-party conferences such as the Board Game Studies Colloquium, The Interactive Pasts Conference, Play in Antiquity, Playing Antiquity, Computer Games, Advanced Computer Games, the IEEE Conference on Games, the European Conference on Artificial Intelligence (ECAI), and NeurIPS. These contributions have strengthened interdisciplinary dialogue and promoted the Action's scientific objectives worldwide. Public-facing dissemination has likewise been a strong focus. In 2026, GameTable will organise educational events during the European Heritage Days, engaging children, families, and local communities to promote playful learning and awareness of tabletop game heritage. Additionally, GameTable co-organised Games and Gaming in the Ancient World at Wolfson College, Oxford University,

		a day-long public event combining academic lectures with hands-on demonstrations using reconstructed ancient games. Scientific dissemination through publications is also advancing steadily. Several edited volumes and monographs are underway, presenting new findings on traditional games, cultural heritage, and Game AI. Multiple papers have already been published across Working Groups, with WG1 and WG2 having already met their publication targets for the duration of the Action. Working Groups 2, 4, and 5 have established successful webinar series disseminated via the Action's YouTube channel. The WG4 and WG5 sessions were shorter thematic events, while the WG2 webinar runs monthly from September 2024 through September 2026. These recordings provide long-term open-access educational resources and regularly attract international audiences. Digital dissemination continues to expand. GameTable is developing a virtual exhibition that will serve as a major long-lasting dissemination platform, featuring reconstructed games, cultural-historical explanations, and interactive digital tools. The Action is also exploring podcast development and app-based outreach to broaden access to its materials. Social media plays an increasingly important role in amplifying these efforts.- Facebook has grown to 81 followers, with a 50% increase in views and a 25% increase in interactions. It effectively amplifies Instagram content and benefits from broader organic reach.- Instagram and Bluesky, both newly launched, have shown strong early performance. Instagram posts reach an average of 250 users, especially among younger audiences, while Bluesky generates sustained engagement and is currently the main driver of Linktree traffic.- YouTube continues to grow, with 97 subscribers and daily activity through views and shares, positioning it as a core platform for long-form dissemination.- X is being phased out due to minimal engagement, allowing resources to be redirected toward platforms with stronger community impact. A streamlined social-media submission form now facilitates content gathering from members, improving efficiency and consistency across platforms. Future plans include posting short clips from YouTube seminars to enhance cross-platform reach and audience growth. Overall, the Action has built a strong and diverse dissemination ecosystem, ensuring that its scientific, cultural, and educational outputs reach broad and varied audiences.
Achieving geographical and demographical diversity, with special attention to gender balance and COST Inclusiveness Target Countries (ITC), throughout the Action.	51 - 75%	The Action has made strong progress toward achieving broad geographical and demographic diversity, with particular attention to gender balance and representation from COST Inclusiveness Target Countries (ITCs). Within the first two years, the network has expanded to include all but one COST country, with Latvia as the only remaining country not yet represented. Participation has also grown substantially in Near-Neighbor Countries, now including Azerbaijan, Morocco, Tunisia, and Palestine. The Action continues to work toward engaging the remaining NNCs, building on the existing professional networks of GameTable members to facilitate further outreach. Global representation has likewise been a priority, as games are part of human heritage around the world, and the Action has successfully established a community that spans every inhabited continent, demonstrating its broad international appeal and relevance. This diversity is also reflected in the distribution of events and funding. Of the 15 in-person meetings organised so far, 8 have been hosted in ITCs, ensuring visibility, accessibility, and opportunities for researchers in these countries to participate actively in the Action. Regarding financial support mechanisms, 10 out of 31 grants, including STSMs and other mobility instruments, have been awarded to researchers from ITCs or hosted in ITC institutions. While this demonstrates meaningful progress, it is also recognised as an area for continued improvement. Strengthening support for ITC researchers will remain a focus in future Grant Periods, complementing ongoing

		efforts to maintain gender balance and widen demographic participation. Overall, the Action has successfully built a geographically and demographically diverse network and continues to take concrete steps to broaden inclusiveness across all levels of participation.
Identify and interact with stakeholders. Stakeholders will be actively identified among Action members and their networks but also beyond.	26 - 50%	WG5 plays a central role in identifying, engaging, and collaborating with a wide range of stakeholders across education, research, and the cultural heritage sector. These stakeholders include teachers, students, museum professionals, heritage institutions, archaeologists, policymakers, game designers, and members of the public, as well as Action participants and their extended networks. Through initiatives such as the Palamedes museum network and the virtual exhibition, WG5 creates meaningful bridges between researchers and broader audiences, ensuring that GameTable's outputs are accessible, engaging, and relevant to both academic and non-academic communities. Palamedes is the museum-oriented subgroup of WG5, created to coordinate all collaborations with museums, archaeological sites, cultural centres, and heritage institutions that want to engage with the research, reconstructions, and educational outputs of the GameTable Action. To expand the network and foster interdisciplinary dialogue, WG5 and other Action members actively participate in major international conferences and public-facing events, including the Computational Approaches and Quantitative Methods in Archaeology (CAA) annual meeting, the European Association of Archaeologists (EAA) annual meeting, and the TOCATI Festival of Traditional Games. These venues allow the Action to connect with new collaborators, share emerging methods, and showcase developments in historical game research, AI-based reconstruction, and digital heritage dissemination. GameTable has also strengthened its involvement in global cultural heritage initiatives. The Action formally supported the application for the creation of a UNESCO Chair in Traditional Games and Sports, positioning GameTable as an early and committed partner. This endorsement deepens connections with international cultural bodies and creates additional opportunities for long-term collaboration and visibility. Together, these activities ensure that the Action reaches both professional stakeholders and local communities, fostering sustainable partnerships for the preservation, study, and dissemination of game-related heritage. By establishing strong links across institutions, disciplines, and public audiences, WG5 significantly enhances the long-term impact and legacy of the Action.
Form an educational programme to offer training in the different multidisciplinary areas embedded in this Action.	51 - 75%	WG2 and WG5 collaborated to deliver a training school on the recording of graffiti gameboards to an audience of 16 researchers, tour guides and graduate students in Athens in May 2025. This training school provided participants with methods and techniques for recording and interpreting gameboards. One of its key outcomes is that several participants are now preparing scientific publications on gameboards from material in their home countries (including Italy and Türkiye). WG5 has made substantial progress toward developing a comprehensive educational programme that reflects the deeply multidisciplinary nature of the Action. The programme brings together archaeology, computer science, history, mathematics, and education through the study of games as cultural and scientific artefacts. A dedicated training school is currently being prepared, featuring modules on game-based learning, gamification, artificial intelligence, traditional game heritage, and interdisciplinary research methods. This initiative is being developed in close collaboration with WG5's network of museums and heritage practitioners, ensuring that the training remains grounded in real-world cultural contexts and practical pedagogical needs. The programme is designed to serve teachers, students, and museum professionals, and will include a major educational event in Athens during the European Heritage Days to foster public engagement and promote cultural heritage through play. Beyond WG5, other Working Groups are also significantly contributing to the

educational dimension of the Action. WG4 is developing the Handbook on Mathematical Games, conceived as an accessible resource for students, teachers, and general audiences. This handbook integrates mathematical reasoning with historical and cultural perspectives, offering a rich and engaging introduction to traditional game studies.

In parallel, the virtual exhibition currently under development will provide another key educational tool. This interactive platform will allow learners to explore historical games, understand their cultural significance, and engage with the computational and archaeological methods used to analyse and reconstruct them. It is designed to support both formal learning environments and informal public outreach.

Together, these initiatives demonstrate strong and coordinated progress toward establishing a robust educational programme. Multiple components are already underway, and further developments are expected as the Action continues to advance its multidisciplinary vision.

Deliverables

The Action reported the following progress with achieving its deliverables

Deliverable	Month deliverable due	Delivery status	Further information (hyperlink or other)
A system tailored for public and non-computer science researchers, designed to study, analyse, evaluate, and play any tabletop game. It will stand apart from existing platforms and play a crucial role in achieving educational goals by democratizing knowledge creation for the wider audience.	46	Delivered	http://ludii.games/
Release of reconstructed rulesets generated by the approaches developed and validated by the board game research community.	24	Not delivered, but expected within 2 years after the end of the Action	
Release of a book/survey on the mathematics of historical games and its coevolution with history of mathematics.	26	Not delivered, but expected within 2 years after the end of the Action	
Production of educational materials such as booklets (regularly during the third grant period)	36	Not delivered, but expected before end of Action	
Vision Paper on future challenges and avenues for research following all the progress made during the lifetime of the Action	48	Not delivered, but expected before end of Action	
The Action will maintain a public website to coordinate and bundle all dissemination activities. All events planned by the Action will be announced there. Job opportunities, teaching materials, and publications will be available for download.	2	Delivered	https://gametable.network/
Creation of tutorials and videos released on social media channels (YouTube, Facebook, Twitter, etc.) to promote the results and to make the use of the produced AI-based tools easier.	16	Delivered	https://www.youtube.com/@GametableNetwork
White papers from each WG leader after the first two years, to give an overview of the current and projected activities within the Action.	24	Not delivered, but expected before end of Action	
Digital Exhibition to highlight impactful games in world history, and to describe how they can be studied and the motivations people have had for playing. The exhibition will be freely accessible and continue to exist beyond the Action.	44	Not delivered, but expected within 2 years after the end of the Action	
Publications in peer-reviewed journals and conference proceedings. Each WG will produce a minimum of five (open-access) articles/reports/documents, and interdisciplinary collaborations between the WGs will be a priority to present scientific results at conferences.	48	Not delivered, but expected before end of Action	

Organisation of two public events in partnership with museums or other cultural institutions highlighting heritage games and teaching the public about how to play them and how we use AI to research them.	36	Not delivered, but expected before end of Action	
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Additional outputs/ achievements

The Action reported 20 publications on the topic of the Action, co-authored by at least two Action participants from two countries participating in the Action, and for which the Action networking was necessary.

The Action has also produced the outputs/ achievements described below.

Co-authored Action publications - peer-reviewed

1. [doi:10.52202/079017-3515](https://doi.org/10.52202/079017-3515)

Graham Todd, Alexander Padula, Matthew Stephenson, Éric Piette, Dennis J. N. J. Soemers, and Julian Togelius (2024). "GAVEL: Generating Games Via Evolution and Language Models". In Advances in Neural Information Processing Systems 37 (NeurIPS 2024), pp. 110723–110745.

Publication Code: 9798331314385

- 2.

Morenville, A., Piette, E. (2024). Vers une Approche Polyvalente pour les Jeux à Information Imparfaite sans Connaissance de Domaine, Rencontres des Jeunes Chercheurs en Intelligence Artificielle (RJCIA)

3. [doi:10.1007/978-3-031-86585-5_14](https://doi.org/10.1007/978-3-031-86585-5_14)

Morenville A., Piette E. (2024). Belief Stochastic Game: A Model for Imperfect-Information Games with Known Positions, Computers and Games 2024 (CG)

- 4.

Piette, E., Morenville, A., Care, B., Moullou, D., Crist, W. (2025). AI-powered Game Recognition: A Collaborative Dataset for Traditional Games, Computer Applications and Quantitative Methods in Archaeology (CAA). Abstract.

- 5.

Morenville, A., Piette, E. (2025). Modeling Uncertainty: Constraint-Based Belief States in Imperfect-Information Games, IEEE Conference On Games

- 6.

Crist, W., Piette, E., Jeneson, K., Soemers, D.J.N.J., Stephenson, M., van Goor, L., Browne, C. (2025). Ludus Coriovalli: Using Artificial Intelligence-Driven Simulations to Identify Rules for an Ancient Board Game, Antiquity Journal. To appear

7. [doi:10.1109/TG.2025.3614499](https://doi.org/10.1109/TG.2025.3614499)

Eberhardinger, M., Goodman, J., Dockhorn, A., Perez-Liebana, D., Gaina, Raluca D., Çakmak, D., Maghsudi, S. and Lucas, S., "From Code to Play: Benchmarking Program Search for Games Using

Large Language Models," in IEEE Transactions on Games, doi: 10.1109/TG.2025.3614499.

8.

Manuel Eberhadinger, Florian Rupp, Florian Richoux, Johannes Maucher, Setareh Maghsudi. "Towards Cognitive-Plausible Explanations for Board Game Agents with Genetic Programming". Proceedings of the Joint AIIDE Workshops on Experimental AI in Games and Intelligent Narrative Technologies (EXAG-INT 2025) co-located with the 21st AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE 2025)

9. [doi:10.3233/FAIA251406](https://doi.org/10.3233/FAIA251406)

Jakub Kowalski, Dennis J.N.J. Soemers, Szymon Kosakowski, and Mark H. M. Winands (2025). "Generalized Proof-Number Monte-Carlo Tree Search". In I. Lynce, N. Murano, M. Vallati, S. Villata, F. Chesani, M. Milano, A. Omicini, M. Dastani, editors, 2025 European Conference on Artificial Intelligence, Vol. 413 of Frontiers in Artificial Intelligence and Applications, pp. 4945–4952. IOS Press.

10.

Taheri, M., Tan, K., Flaten, O.E., Cyma-Wejchenig, M. (2026). Enhancing Education Training with A Virtual Reality-Based Simulator Integrated Generative AI. In: De Paolis, L.T., Arpaia, P., Sacco, M. (eds) Extended Reality. XR Salento 2025. Lecture Notes in Computer Science, vol 15743. Springer, Cham. https://doi.org/10.1007/978-3-031-97781-7_29

11. [doi:10.1007/978-3-032-07986-2_6](https://doi.org/10.1007/978-3-032-07986-2_6)

Taheri, M., Cyma-Wejchenig, M., Gomes, L., Tan, K. (2026). Adaptive Historical Education through Generative AI and Immersive Game Design. In: Arai, K. (eds) Proceedings of the Future Technologies Conference (FTC) 2025, Volume 1. FTC 2025. Lecture Notes in Networks and Systems, vol 1675. Springer, Cham. https://doi.org/10.1007/978-3-032-07986-2_6

12.

Crist, Walter; Stephenson, Matthew; Piette, Éric; Browne, Cameron (2024). The Ludii Games Database: A Resource for Computational and Cultural Research on Traditional Board Games. Digital Humanities Quarterly, 18(4). ISSN 1938-4122.

13.

T. Penn, B. Kovár, and B. Šebesta (In press, 2025). 'A gameboard from Rusovce in the context of Roman-period gaming finds in the north of the Carpathian Basin.' Slovenská archeológia

Co-authored Action publications - other

1. [doi:10.3233/ICG-240245](https://doi.org/10.3233/ICG-240245)

Éric Piette, Walter Crist, Dennis J.N.J. Soemers, Lisa Rougetet, Summer Courts, Tim Penn, and Achille Morenville (2024). "GameTable COST action: kickoff report". ICGA Journal, vol. 46, no. 1, pp. 11–27. IOS Press.

2. [doi:10.3233/ICG-240251](https://doi.org/10.3233/ICG-240251)

Dennis J.N.J. Soemers, Jakub Kowalski, Éric Piette, Achille Morenville, and Walter Crist (2024). "GameTable Working Group 1 meeting report on search, planning, learning, and explainability". ICGA Journal, vol. 46, no. 1, pp. 28–35. IOS Press.

3.

Moullou, D., Crist, W., Penn, W., Piette, E. (2024). GAMETABLE NETWORK: UNVEILING THE PAST, EMBRACING THE FUTURE THROUGH AI-DRIVEN ARCHAEOLOGICAL RESEARCH, The 30th European Association of Archaeologists (EAA), Abstract.

4.

de Voogt, A., Rougetet, L. (2024). Translation of Étienne de Flacourt's Fifangha Rules (1661)

5.

Dennis J.N.J. Soemers, Jakub Kowalski, Walter Crist, Summer Courts, Tim Penn, and Éric Piette (2025). "Bridging Artificial Intelligence (AI) and Cultural Heritage: Outcomes From the GameTable Working Group 1 (WG1) London Meeting". ICGA Journal. In press. Sage.

6.

Crist, W., Piette, E. (2025) Changing the Game: Measuring Mesopotamian Games With AI-Simulated Play, European Association of Archaeologists (EAA)

7. [doi:10.1177/13896911251384620](https://doi.org/10.1177/13896911251384620)

Dorina Moullou, Barbara Care. ICGA (2025). "Games, Learning, and Digital Heritage: Playable Past and Educational Future in the GameTable COST Action".

Proposals/ projects

The Action reported 9 project(s) and 6 proposal(s) resulting from the Action networking.

Key details of the projects are shown below:

1. Game-Playing Strength of MCTS Variants
(Other)
2. Bridging Past and Present: Modern General AI Approaches without Domain Knowledge Assumptions for Preserving Imperfect-Information Games
(National)
3. Play and the City: Investigating the Cultural Heritage of Games of the City of Rome
(Other)
4. Histoires d'os
(National)
5. Luditech
(National)
6. Graffiti in the shadow of the Acropolis: people, gaming and urban landscapes

- (National)
- 7. Ancient Games in Schools
(National)
- 8. Graffiti on bone, horn and ivory counters in Roman Gaul, Germany and Britain
(National)
- 9. Playing in ancient Iberia: The materiality of games in a multicultural context (c. 800 BCE-800 CE)
(National)

Other outputs / achievements

The following other outputs/ achievements contributing to the COST mission resulted from the Action:

1. All references to tools, projects, or funding opportunities in this report refer to activities pursued independently by participants outside the framework of the COST Action.

Impacts

The Action reported the following impact(s):

Description of the impact, i.e. what will change, and for whom, as a result of what the Action achieved	Type of impact	Timing of impact
Creation of a large, multidisciplinary, and durable European network GameTable has already succeeded in building one of the widest and most diverse research networks ever assembled around the study of games, gameplay, and Game AI. With more than 340 members representing over 40 COST countries and 15 non-COST countries, the Action has brought together experts from archaeology, computer science, mathematics, history, anthropology, education, cultural heritage, and game design. This breadth of participation has significantly reduced fragmentation in the field, connecting researchers who previously worked in disciplinary silos or in geographically isolated contexts. The network's strength lies not only in its size but in the intensity of its interaction. GameTable organises 7–8 meetings per year, numerous cross-WG collaborations, STSMs, training schools, and online initiatives such as Connect-Two, which has already facilitated over 350 researcher pairings. These activities foster long-term interpersonal connections that are expected to persist beyond the Action, generating new joint projects, shared datasets, supervised theses, and interdisciplinary methodologies. The network also increases Europe's global visibility in cultural game studies and Game AI, positioning it as an international reference point in a rapidly growing research area. By creating a critical mass of expertise, GameTable strengthens Europe's competitiveness in future funding bids, including Horizon Europe, ERC consortia, and cross-disciplinary humanities, AI initiatives. Moreover, the inclusion of researchers from COST Inclusiveness Target Countries, Near-Neighbour Countries, and global partners promotes a more equitable and geographically balanced research landscape. This contributes to capacity building in regions where access to international collaborations is typically more limited. In the long term, the network established by GameTable is expected to serve as an enduring platform for research partnerships, training, public engagement, and cultural heritage innovation, continuing to generate impact long after the Action concludes.	• Economic • Societal	Achieved
Development of AI approaches that emulate human play The Action has begun laying strong foundations for future advancements in AI models that emulate human gameplay more closely. Early collaborations between WG1, WG2, and WG3 are identifying the cultural, cognitive, strategic, and social dimensions of human play that current AI systems fail to capture. These insights are already shaping preliminary methodological directions and will guide the creation of more human-centred AI approaches in the coming years. This emerging line of work will ultimately benefit researchers across AI, archaeology, history, anthropology, and game studies by enabling computational tools that better reflect how people actually interpret rules, make decisions, learn, and adapt strategies	• Scientific / Technological	Foreseen within two years of the end of the Action

within different cultural contexts. These models will also **support more realistic simulations** for reconstructing ancient and traditional games, helping scholars generate and test historically plausible hypotheses about how such games may have been played.

To support the longevity and maturation of the research themes discussed within the Action, the network focuses on strengthening interdisciplinary collaboration and shared scientific agendas. While much of the technical work remains at an early stage, the interdisciplinary groundwork established through networking and exchange supports sustained scientific interaction beyond the Action's formal duration.

Reconstructing the missing rules of traditional games

The Action has **begun to pioneer new methodologies for rule reconstruction** by integrating AI reasoning, archaeological evidence, mathematical constraints, and cultural analysis. This will provide historians and museums with **scientifically grounded reconstructions** rather than speculative interpretations. The impact will extend to descendant communities seeking to reclaim intangible heritage, as well as educators who gain playable reconstructions that make cultural heritage accessible to students.

Through direct conversation between AI researchers and archaeologists, we are **developing techniques to evaluate proposed game rules in order to provide more accurate playable versions** of these ancient games. Three research projects have already begun in this line of inquiry, and the goal of GP3 is to further facilitate cross-working group interaction in order to produce more case studies and explore more methodologies for inclusion in our special issue of the ACM Journal on Computing and Cultural Heritage.

- Scientific / Technological

Foreseen within two years of the end of the Action

Models and approaches for imperfect-information games

The Action has already made substantial progress toward developing **new and more general frameworks for modelling imperfect-information games**. Through intensive discussions during multiple WG1 meetings (Leiden, London, Wrocław) and sustained collaborations across Working Groups, several concrete methodologies have already emerged. Notably, the introduction of **Belief Stochastic Games and other constraint-based representations** developed within the Action, primarily through the Chair's team and Achille Morenville's PhD work, demonstrate early breakthroughs in modelling uncertainty directly within the game structure. These approaches are actively being compared against existing state-of-the-art frameworks such as Cardstock, supported by collaborations with its authors within GameTable.

Given the central importance of hidden-information games in many traditional and modern cultures (especially card games and dice games), these developments will offer researchers new analytical tools for understanding how players reason under uncertainty. **AI researchers gain new algorithmic challenges and testbeds; digital humanists obtain models that help reconstruct historically plausible rule sets; and cultural scholars can better analyse how uncertainty shapes gameplay traditions across regions.**

Because this line of research is advancing steadily within the Action, we anticipate that some of its key impacts may begin to materialise before the end of GameTable. Ongoing publications, continued technical development, and the application of these frameworks to traditional games, supported by collaborations with domain experts

- Scientific / Technological

Foreseen by the end of the Action

such as Thierry Depaulis, are likely to contribute meaningfully to the field. While the long-term influence of this work will depend on future research beyond the Action, the foundations being established have the potential to strengthen Europe's role in imperfect-information Game AI and to support the development of methodological tools useful across several academic communities.		
Advancement of digital humanities through Game AI The integration of AI, archaeology, history, and mathematics positions GameTable as a major catalyst for the methodological modernisation of the humanities. By fostering sustained collaboration between humanists and computational scientists, the Action is reshaping how cultural heritage can be analysed, reconstructed, and presented. This growing interdisciplinary confidence is already visible: researchers who would not previously have engaged across disciplinary boundaries are now co-developing ambitious proposals, such as the recent Schmidt Sciences application jointly prepared by humanists and AI specialists. This shift reflects a deeper cultural change within the network, where shared vocabulary, mutual understanding, and methodological exchange have become standard practice. GameTable also promotes the recognition of games as essential elements of cultural heritage. Through digital humanities approaches, it is helping reconstruct, preserve, and publicly showcase traditional tabletop games in ways not previously possible. The Ludii Games Database, already a major repository of knowledge on ancient and historical games, will be further developed in GP3 to become more accessible and to serve as a model for digital humanities infrastructures focused on games. In parallel, the Action supports methodological reflection on innovative digital approaches, including the potential use of computer vision technologies in the study of historical board games. This reflects GameTable's contribution to expanding interdisciplinary perspectives within digital humanities.	• Scientific / Technological	Foreseen by the end of the Action
New tools at the intersection of digital technology and cultural heritage The Action promotes interdisciplinary discussion around innovative digital and computational methods for the study and dissemination of historical games. Related technical developments, including AI-based tools, game systems, and educational applications, are pursued independently by network members outside the framework of the COST Action. A digital exhibition is also being prepared to showcase reconstructed games, artefacts, and interactive demonstrations. This exhibition will serve both educational and public-outreach purposes, offering a lasting digital platform that persists beyond the lifetime of the Action. Together, these tools have the potential to modernise how museums present ancient games, broaden public access to cultural heritage, and create new standards for interactive heritage interpretation supported by digital technologies.	• Scientific / Technological	Foreseen by the end of the Action
Production of new pedagogical tools for multi-disciplinary education The Action is actively developing a wide range of pedagogical tools that support multidisciplinary education across STEM, the humanities, and cultural heritage. These resources are designed to	• Societal	Foreseen by the end of the Action

help teachers, students, and museum professionals engage with historical games, mathematical reasoning, computational thinking, and Game AI in ways that are accessible, creative, and culturally grounded. WG5 has already produced teacher-oriented booklets, glossaries, and introductory materials that demonstrate how games can be incorporated into teaching at different educational levels. These materials are not only being developed but also extensively tested in practice: through repeated classroom sessions, school workshops, and outreach events, such as those piloted in the UK with more than 900 pupils, members are refining activities, adjusting explanations, and validating what works most effectively for learners. The insights from this iterative testing directly inform forthcoming booklets, museum kits, and hands-on activity modules, ensuring that they are pedagogically robust and aligned with real classroom needs. Additional resources under development will support educators in presenting traditional games alongside historical, archaeological, and mathematical narratives, helping learners explore how cultural practices, mathematical structures, and computational techniques intersect in the study of games. The upcoming educational programme and associated training schools will further reinforce these efforts by offering structured learning pathways across archaeology, history, AI, anthropology, and mathematics. Meanwhile, the digital exhibition will support informal learning by providing freely accessible materials that teachers and museums can incorporate into their programmes. Collectively, these efforts are laying the foundations for a new ecosystem of multidisciplinary learning resources, tested, refined, and grounded in real-world educational practice, enabling more engaging and culturally informed teaching across Europe.		
Democratization of advanced AI techniques through game interfaces By embedding complex AI in approachable game-based systems, GameTable enables non-AI specialists, including historians, educators, and museum curators, to use cutting-edge algorithms without technical training. This increases technological literacy across disciplines and enhances interdisciplinary innovation.	• Scientific / Technological	Foreseen by the end of the Action
Increased public awareness of cultural gaming traditions and AI's role in studying them GameTable is significantly contributing to raising public awareness about the cultural importance of games and the innovative ways AI can help study them. By collaborating with museums, cultural heritage organisations, and educators, the Action is making the history, diversity, and social significance of games visible to a much broader audience than traditional academic networks typically reach. A major driver of this impact is the development of digital exhibitions, designed to remain accessible beyond the lifetime of the Action. These exhibitions will showcase reconstructed games, 3D models, historical artefacts, interactive explanations, and demonstrations of AI-driven analyses. They serve not only as educational resources but also as engaging public experiences that highlight how technology and cultural heritage can intersect. Museum-oriented initiatives, for example, the 3D scanning of	• Economic • Societal	Foreseen by the end of the Action

ancient games such as Senet, and the future integration of these reconstructions into museum-based video games, further enhance public engagement. Visitors will be able to explore how historical games were played, how rules are reconstructed, and how AI models help evaluate possible moves or strategies. These experiences demystify AI for the public, presenting it not as an abstract computational tool but as a meaningful method for understanding human creativity and cultural evolution.

Public workshops, educational events such as those planned during European Heritage Days, and school-focused activities including traditional game tournaments also contribute to building cultural awareness. These activities invite children, families, teachers, and community members to experience traditional games firsthand and learn about their history.

By combining cultural heritage with modern AI methods, GameTable is making scientific research more visible, relevant, and enjoyable for society. Over time, this increased awareness is expected to foster appreciation for cultural gaming traditions, stimulate interest in digital heritage, and inspire future generations to explore interdisciplinary fields linking technology and the humanities.

Dissemination and exploitation of Action results

Dissemination and exploitation approach of the Action

The Action's dissemination and exploitation approach as well as all activities undertaken to ensure dissemination and exploitation of Action results and the outcomes of these activities are described below.

The Action's dissemination and exploitation strategy integrates scientific communication, public outreach, and stakeholder engagement to maximise visibility and long-term use of its results. Scientific dissemination is achieved through conference presentations, workshops, webinars, edited volumes, and a dedicated special issue in the ACM Journal on Computation and Cultural Heritage. Publications, tools, and datasets are shared openly, and a comprehensive online resource hub is being developed to host AI tools, educational materials, reconstructed games, and training resources. A key exploitation pathway is the integration of research outputs into widely used platforms. We are currently preparing to add datasets, rule reconstructions, and cultural-information metadata to the Ludii system on an open-access basis, ensuring that the tools and knowledge generated by the Action remain accessible to researchers, educators, and cultural institutions worldwide. Public-facing initiatives include digital exhibitions, mobile apps for heritage games, teacher booklets, museum kits, and AI-based tools such as GameSnap. Collaboration with museums and participation in major events (CAA, EAA, TOCATI, and others) further promote uptake. Engagement through the Palamedes museum network and school-based activities ensures broad impact across sectors.

Dissemination

Dissemination meetings funded by the Action (possible only until 31st October 2021)

The Action did not fund any Dissemination Meetings

Other dissemination activities

The Action also undertook the following dissemination activities:

Activity	At the 2024 Board Game Studies Conference in Tampere, Finland, the GameTable Action organised a panel titled "GameTable: How to Explore Games with AI." This session served as an introduction to the aims, structure, and research directions of the COST Action Computational Techniques for Tabletop Games Heritage. The panel brought together representatives from multiple Working Groups to present the Action's interdisciplinary framework, which integrates computer science, archaeology, history, mathematics, cultural heritage studies, and education. During the panel, the 4 speakers outlined the five Working Groups and their objectives, including human-like AI for gameplay analysis, computational methods for reconstructing historical rulesets, the integration of procedural generation techniques, applications of mathematics to game research, and dissemination and educational outreach strategies. The session highlighted the Action's collaborative tools, such as STSM funding, training schools, and cross-WG networking opportunities, which are designed to accelerate interdisciplinary research and international cooperation. The panel also provided a forum to present upcoming plans, such as developing AI agents that simulate human play, improving digital resources for cultural game heritage, and building an educational ecosystem to support teachers, students, and museum professionals. The activity helped articulate the Action's vision while inviting new pathways for participation and collaboration.
Target	The target audience for this dissemination activity consisted primarily of researchers, practitioners, and students attending the Board Game Studies Conference, one of the major international venues dedicated to the academic study of tabletop games. Participants included historians, archaeologists, anthropologists, computer scientists, mathematicians, educators, museum professionals, game designers, and independent scholars with an interest in traditional and historical games. This audience was particularly well suited for the panel because it included many potential stakeholders already engaged in complementary research areas. Many attendees work with historical game materials, cultural heritage collections, or computational analysis, making them ideal candidates for future collaboration within GameTable. The panel also reached early-career researchers and postgraduate students who could benefit from the Action's mobility grants, training schools, networking opportunities, and interdisciplinary research environment. Furthermore, the event attracted museum representatives and

	cultural heritage specialists, offering an opportunity to connect with institutions interested in game reconstruction, public engagement, and digital heritage tools. By addressing both academic specialists and applied practitioners, the panel ensured that the Action's aims were communicated to individuals capable of using, contributing to, and disseminating its outcomes within their respective communities. This broad and diverse audience helped maximise the visibility and potential impact of the Action.
Outcome	The panel successfully increased awareness of the GameTable Action within the international game-research community and led to several concrete outcomes. Many attendees expressed interest in joining the network, and several later became new members of the Action. The event also stimulated discussions that led to emerging collaborations, including proposals for joint publications, interdisciplinary research topics, and potential STSM visits. Some participants identified opportunities to contribute data, cultural knowledge, or case studies that could enrich the Action's developing resources. The panel helped clarify how AI and computational methods can contribute to the study and reconstruction of tabletop games, which encouraged researchers from the humanities and heritage sectors to engage more actively with the Action's tools and methodologies. Attendees also gained a clearer understanding of how their own expertise, whether archaeological, historical, mathematical, or educational, could fit into GameTable's broader framework. Additionally, feedback from the session informed subsequent planning of Working Group activities and highlighted areas where further outreach would be beneficial, such as museum partnerships and educational applications. Overall, the panel served as an effective dissemination activity, strengthening the network, attracting new collaborators, and demonstrating the relevance of the Action's aims to a broad, multidisciplinary community.
Link	https://gametable.network/news/news-bgs-1.html

Activity	At the "Games, Gaming and the Ancient World" event held at Wolfson College, University of Oxford on 30 May 2025, our GameTable Action ran a 4 simultaneous sessions with a team of four members. We organised three playable games rooted in ancient world themes alongside a dedicated dissemination table aimed at engaging attendees with our research objectives. During the event, participants could explore ancient board games as well as modern video-games that draw inspiration from antiquity, reflecting the event's mission to bridge historical scholarship and contemporary gaming. Our team guided visitors through gameplay, explained historical contexts, and facilitated discussions around how computational and cultural heritage methods can illuminate ancient play. The dissemination table served as a hub for sharing GameTable's research framework, future plans, and opportunities for collaboration.
Target	The activity was designed for a diverse audience including academics in Classics, history, archaeology, and cultural heritage studies; game designers and scholars interested in historical gameplay; and members of the public attending the Oxford event, particularly those with an interest in board games, video gaming, and ancient culture. Given the open but limited-ticket nature of the event and the fact it was held at a college venue, the audience included primarily students, university staff, heritage practitioners, and gaming enthusiasts from Oxford. This audience was especially well suited for our aims: those with a scholarly or practical interest in ancient games could directly engage with the four playable games, while the dissemination table raised awareness of our interdisciplinary research. By interacting with both academic and lay attendees, we aimed to foster collaboration, recruit new participants, and highlight the relevance of GameTable's methods to both heritage and gameplay communities.
Outcome	The event succeeded in raising awareness about the GameTable Action within both academic and gaming-enthusiast circles. Through our game sessions and the dissemination table, we sparked interest in our ongoing research into reconstructing ancient games, applying computational methods, and building educational tools. Several attendees expressed interest in future collaboration, some suggesting joint events, student involvement, and contributing data or historical insight.
Link	https://www.ox.ac.uk/event/games-gaming-and-ancient-world

Activity	Cultural Heritage of Games Webinar The Cultural Heritage of Games Webinar is a monthly webinar series in which GameTable members discuss recent research. Begun in September 2024 and currently scheduled through September 2026, this webinar series highlights completed projects and ongoing work of GameTable members.
Target	The target audience for this dissemination activity are archaeologists, historians, and other cultural heritage researchers who are interested in games. It is intended to inspire future work in the field. While a considerable part of the audience is GameTable members, presenters also encourage the attendance of their colleagues and potential Action members also frequently join the webinar before they become members. The webinar is also recorded (except when there is unpublished material) and disseminated on our YouTube channel.

Outcome	The webinar has been a success in stimulating valuable conversation on the topics presented. It always goes beyond the scheduled one-hour timeslot because of the engaging discussion. Roughly 20–30 people attend each meeting live, with over 250 views on YouTube. We have inspired new research questions and brought to the attention of scholars new evidence for games in parts of the world that are underrepresented in scholarship, to the point where the recorded videos are the only evidence for some of these practices that exist online.
Link	https://gametable.network/news/news-wg2-webinar2.html

Activity	Ostium Collaboration Meeting This meeting took place at UCLouvain between members of GameTable, the Play in the City project, and the ARC-funded Ostium project. GameTable members presented the work of the action as well as planned work and early results on the Play in the City project to Ostium team members and other archaeologists at UCLouvain.
Target	The purpose of this meeting was to increase collaboration between computer scientists and archaeologists within UCLouvain, but also to extend the Play in the City project to include the Roman port city of Ostia, which augments the research goals of Play in the City which focuses on the city of Rome. Ostia is the focus of the Ostium project, and there are multiple points of potential future collaborations between GameTable and this existing project.
Outcome	We were successful in engaging with the Ostium team and will begin pursuing joint collaborations. They are interested in 3D visualizations and virtual reality reconstructions of the city, which is easily amenable to the inclusion of AI-driven gameplay. Furthermore, they have agreed to facilitate and collaborate with the Play in the City project, which is itself a major outcome of GameTable, thus compounding the impact of GameTable on ancient games research to include the two most important Roman cities.
Link	https://gametable.network/news/news-ostium.html

Exploitation activities

The Action undertook the following activities to ensure exploitation (use, in particular in a commercial context) of the Action's achievements:

No input provided by the Action

Action Expenditure

The table below shows the budget allocated to the Action for each Grant Period (funds allocated for the first meeting of the Action and any Final Action Dissemination are not included):

#	Grant Period	Start Date	End Date	Budget allocated to Action (EUR)
1	AGA-CA22145-1	1-11-2023	31-10-2024	154,986.40 (EUR)
2	AGA-CA22145-2	1-11-2024	31-10-2025	223,997.00 (EUR)
3	AGA-CA22145-3	1-11-2025	31-10-2026	249,999.90 (EUR)
4	AGA-CA22145-4	1-11-2026	23-10-2027	217,999.75 (EUR)