



CLIMATE GEOGAMES: A NEW PARADIGM TO GAMES AS CIVIC ENGAGEMENT TOOLS FOR URBAN HERITAGE SUSTAINABILITY

GEOGAMES CLIMÁTICOS: UM NOVO PARADIGMA DOS JOGOS COMO FERRAMENTAS DE ENGAJAMENTO CÍVICO PARA A SUSTENTABILIDADE DO PATRIMÔNIO URBANO

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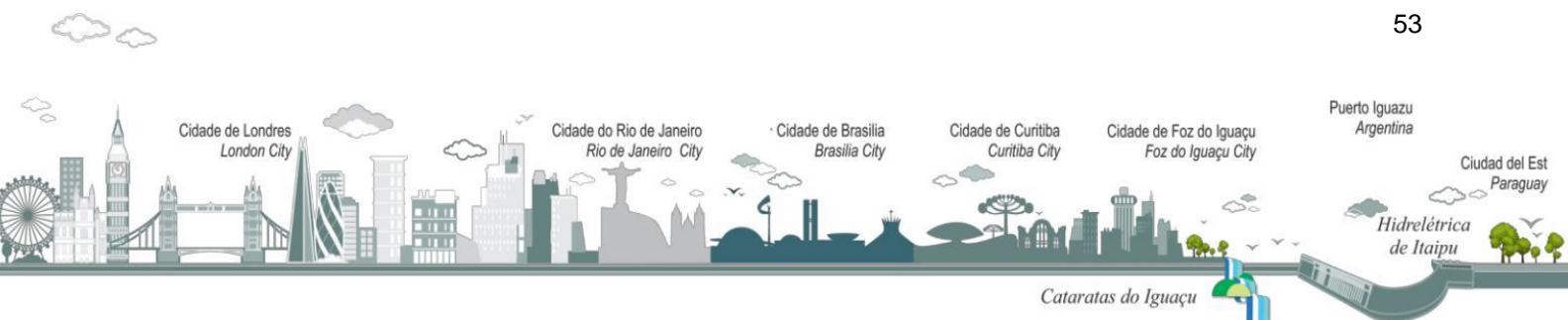
Resumo: Apenas recentemente os estudos sobre criação e implementação de jogos sérios (educacionais) digitais e não digitais começaram a se concentrar nas questões das mudanças climáticas. Os problemas das mudanças climáticas e das emissões de gases de efeito estufa forçaram muitas cidades em todo o mundo a mudar a maneira pela qual elas (re)projetam áreas de patrimônio urbano, especialmente aquelas afetadas por questões como erosão costeira e inundações. Os atores sociais locais interessados desempenham um papel importante na construção de resiliência nas cidades por meio de mudanças comportamentais de mitigação e adaptação. Todavia, há uma falta de métodos inovadores para aprimorar essas habilidades de conscientização climática e projeto colaborativo de modo a manter o envolvimento dos cidadãos durante todo o processo. A combinação entre patrimônio urbano, mudança climática, jogos sérios e engajamento cívico é o que defendemos como a abordagem "Geojogos climáticos". Os geojogos climáticos são jogos criados para um novo clima, cujo objetivo é acelerar o processo de projeto urbano por meio de aprendizado, diálogo e ação sobre riscos e impactos climáticos. Nossa proposta é que os geojogos climáticos sejam um método e instrumento descentralizados, em que os participantes possam rapidamente projetar e gerir futuros resilientes à mudança do clima. Assim, o objetivo deste artigo é discutir como jogos sérios podem ser aplicados para redesenhar cidades afetadas pelos impactos das mudanças climáticas, com um interesse particular em áreas urbanas costeiras. Os resultados externam as lições aprendidas com a revisão do estado da arte e abrem questões para estudos adicionais sobre o tópico dos geojogos climáticos.

Palavras Chave: Geojogos climáticos. Mudanças climáticas. Projeto urbano. Engajamento cidadão.

Abstract: Studies on digital and non-digital serious (educational) games design and implementation have only recently started to focus on climate change issues. Climate change and greenhouse gas emissions problems have forced many cities throughout the world to change the manner in which they (re)design urban heritage areas, especially those affected by issue such as coastal erosion and flooding. The behavioural change of stakeholders plays an important role in building resilience, mitigation and adaptation strategies in cities. However, there is a lack of innovative methods to raise climate awareness and collaborative design skills as tools to keep citizen engaged throughout the process. The 'Climate

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Geogames' approach combines urban heritage, climate change, serious games and civic engagement. Climate geogames are games meant for a new climate, whose goal is to speed up the design process through learning, dialogue, and action on climate risks and impacts. Our proposed approach is intended as a decentralized method where stakeholders can rapidly design and manage climate resilient scenarios. The goal of this paper is to discuss how serious games can be applied to redesign cities affected by the impacts of climate change, with a particular interest in urban areas at the coast. The results inform lessons learned from the state-of-the-art review and open questions for further studies on the topic of climate geogames.

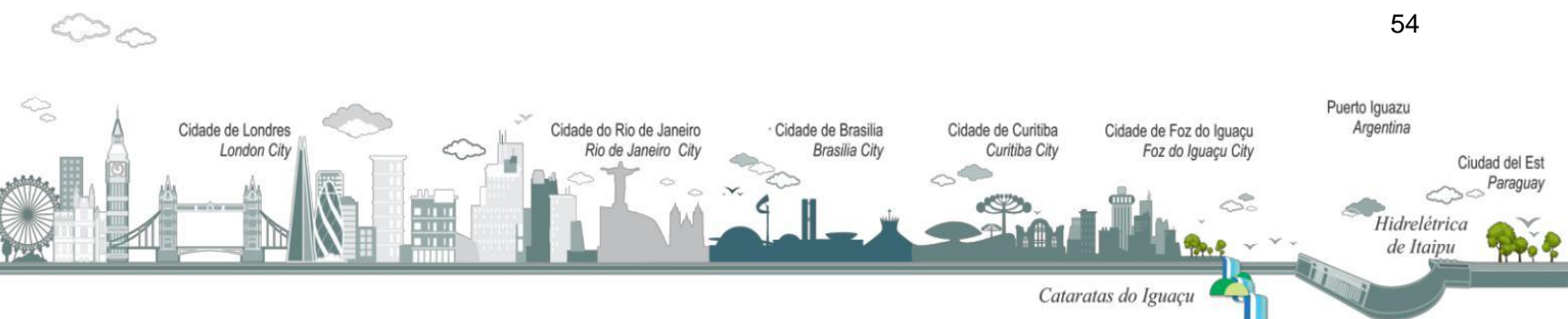
Key Words: Climate geogames. Climate change. Urban design. Civic engagement.

INTRODUCTION

Climate change and greenhouse gas emissions problems have forced many cities throughout the world to change the manner in which they (re)design urban heritage areas, especially those having adverse impacts through higher temperatures, prolonged droughts, and coastal erosion and flooding.

A gap remains between common sense and scientific knowledge, in other words, the awareness needed to encourage behavioral change to effect mitigation and adaptation. 'Climate Geogames' - games meant for a new climate, whose goal is to speed up the design process through learning, dialogue, and action on climate risks and impacts - are one way to reduce this gap by enhancing opportunities for education and cooperation. Such games can provide communities with the opportunity to interactively explore different climate resilient scenarios - building a collective adaptive capability to change through design.

Studies on digital and non-digital serious (educational) games have only recently begun focusing on climate change issues (BACHOFEN; SUAREZ; STEENBERGEN; GRIST, 2012; HARTEVELD; SUAREZ, 2015; JUHOLA; DRISCOLL; DE SUAREZ; SUAREZ, 2013; PARKER; CORNFORTH; SUAREZ; ALLEN *ET AL.*, 2016; SUAREZ; BACHOFEN, 2013; SUAREZ; MENDLER DE SUAREZ; KOELLE; BOYKOFF, 2014; SUAREZ; OTTO; KALRA; BACHOFEN *et al.*, 2014) as the





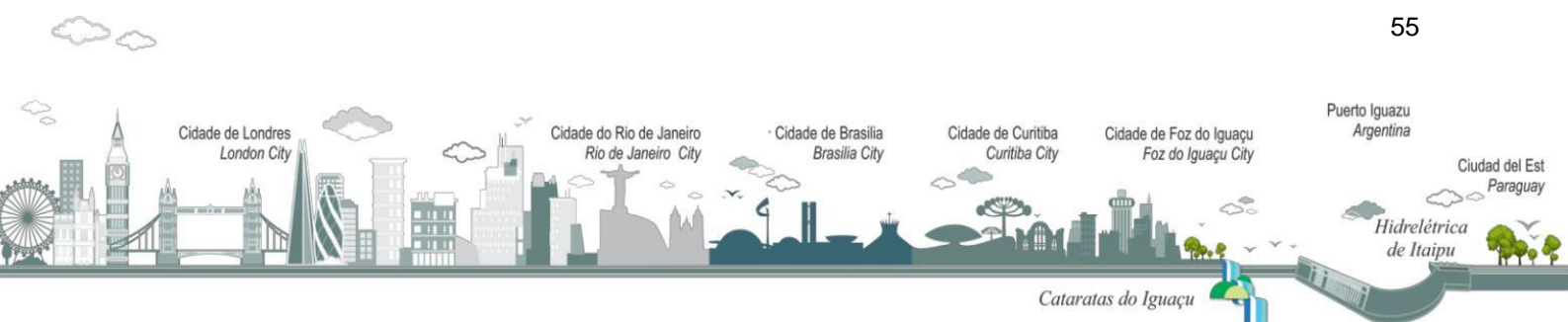
emblematic “Games for a New Climate: Experiencing the Complexity of Future Risks” (MENDLER DE SUAREZ; SUAREZ; BACHOFEN; FORTUGNO *et al.*, 2012). Janot Mendler de Suarez and Pablo Suarez have been the frontrunner authors on this topic due to their research as part of the ‘Games for a New Climate Task Force’ of Red Cross.

Climate Geogames are a method of engaging different people and communities in climate change related issues from impacts and adaptation, to equity and power dynamics. Such games are a fun but serious way of helping humanity tackle the complexities, volatilities and uncertainties that could be hallmarks of the “new normal” for the global climate. Hence, the transection of urban heritage, climate change, serious games and civic engagement, is what we defend as the “Climate Geogames” approach. This proposed approach is intended to be a decentralized method where stakeholders can rapidly design and manage climate resilient scenarios.

How can serious games be applied to redesign and manage cities affected by climate change impacts, especially the ones in a more critical state of vulnerability in coastal areas? How can digital and non-digital games raise climate awareness and citizenship with inhabitants?

This contribution also addresses stakeholders’ understanding of climate issues such as younger cohorts and older people by focusing on communication strategies to enhance knowledge of and commitment to a coordinated managed policy for climate change adaptation planning. The goal is to gather knowledge to further creating climate geogames with the participation of the community to enhance resilience on climate change related to the United Nations Sustainable Development Goal 11 – Sustainable Cities and Communities.

Making coastal cities sustainable means: 1) creating career and business opportunities such as green and blue industries; 2) safe, well located, and affordable housing; and building adaptation awareness among inhabitants. It involves 3) investment in safe and carbon zero transportation, creating and increasing green





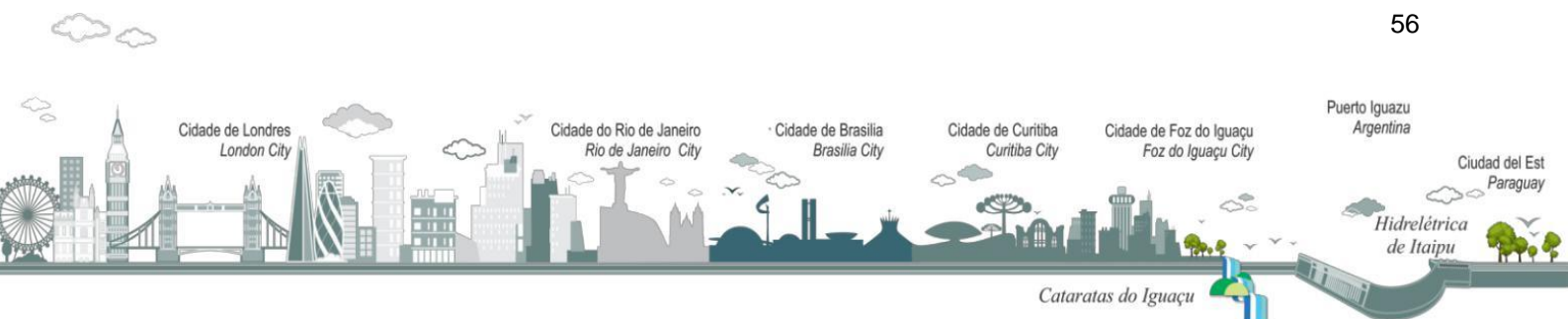
public spaces; and 4) improving urban design, planning and management in participatory and inclusive ways.

Lastly, this paper is a response from the participation of the author at UK-Brazil workshop "Financing urban climate-resilient development" for Early Career Researchers, a part of his Postdoctoral role under the Coastal Communities Adapting Together (CCAT) project, funded by the EU Ireland-Wales Programme. The workshop took place in Foz do Iguaçu, Brazil, between 9 to 12 September 2019

The rest of the paper is organized as follows: In the next section "A State of Reflection: Climate Geogames" we describe the evolution of the geogames concept and our argumentation of the relevance of climate geogames. In section 3 "Recent Experiences: A Gamepedia", we provide an overview and a list of digital and non-digital climate related games. In section 4 "Conclusion and Unfoldings", we provide directions for future work.

A STATE OF REFLECTION: CLIMATE GEOGAMES

The climate geogames concept is evolving alongside the rising interest on city building games, whether they are physical bricks such as Lego or computer games such as the classic Metropolis (1966), SimCity (1989), and PlastiCity (2004), Urban Plans, City Creator (2002), and Super City (2011). These games established the role of games as a laboratory for simulating urban planning and management issues. The most recent version of SimCity was launched in 2014 for mobile phones with the support of Facebook. The "SimCity BuildIt" version combined traditional elements of SimCity with innovations on collaboration with other players on Facebook in real time. This is a case when gaming merged with social media proved to have a huge potential for reaching a wider audience and foster digital social interactions.



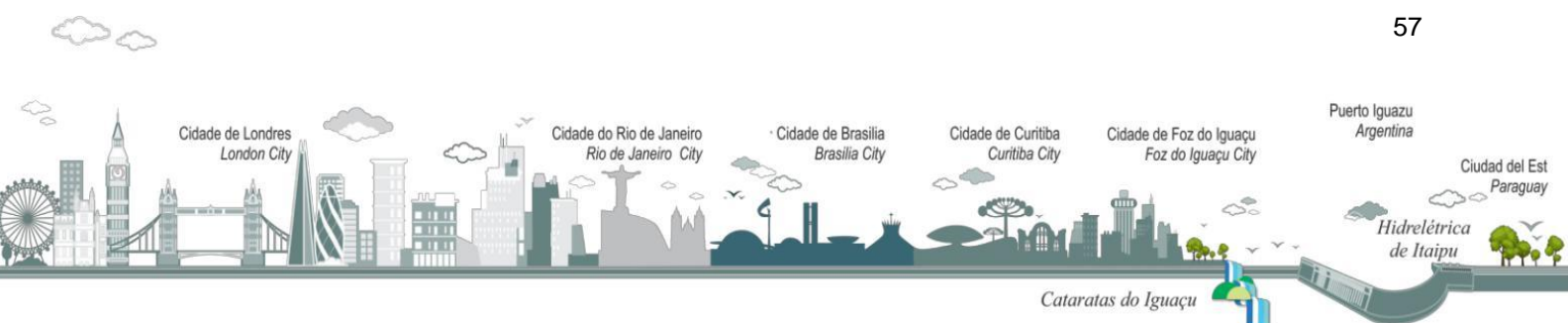


For urban planning, these types of games can be categorized in three groups: non digital / traditional, digital and pervasive (REINART; POPLIN, 2014). Non digital / traditional one includes Broken Cities, CLUG, Ginkgopolis, Masterplan, Neue Heimat, Pop-up Pest, Stadtspieler e The Harbour Game. Digital one includes Anno, City One, Civilization, Community PlanIt, Green Sight City, Minecraft/Block by block, Plasticity, Securing Sydney's Urban Planning, SimCity e Surfing Global Change. Pervasive one includes Mogi, PacManhattan e REXplorer.

During the 1970s, the first serious games related to urban issues were created with the goals of instructing and informing as well as giving pleasure (ABT, 1970). "Corridor" was developed to explore technological, economic, and political limitations on transportation projects for the Northeast Corridor Transportation. "Politica" was developed to explore pre-revolutionary crisis in the Latin American context. "Simpolis", probably an inspiration for SimCity, was developed to investigate the role of decision-making to crises responses in cities.

According to Abt (1970, p. 6) games involve "(...) two or more independent decision-makers seeking to achieve their objectives in some limiting context". It is "(...) a context with rules among adversaries trying to win objectives". The difference of serious games is its serious other than casual character. Serious games "(...) have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement". This does not mean that serious games should not be entertaining.

Serious games are the application of games and technological simulations to non-entertainment domains. Serious games differs from computer games because they are made by more elements than just narrative, art and software (ZYDA, 2005). Serious games add pedagogy with the aim of educating and instructing, but the pedagogy must be subordinated to the narrative while the entertainment aspect must not be forgotten. Zyda (2005, p. 25-26) distinguishes game, video-game and serious games:





1) Game is a “physical or mental contest, played according to specific rules, with the goal of amusing or rewarding the participant”;

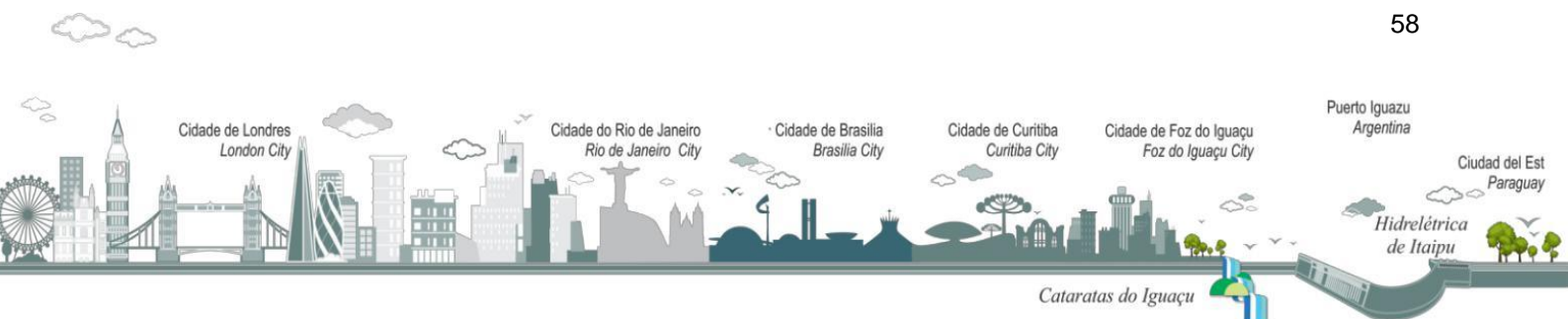
2) Video-game is a “mental contest, played with a computer according to certain rules for amusement, recreation, or winning a stake”;

3) Serious games is a “mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives”.

Although the phrase ‘serious games’ could be considered an oxymoron (words that exclude themselves mutually), it is the personification of the antagonist legacy between education and entertainment. Serious games use the artistic dimension of games to deliver a message, teach a lesson or emulate an experience (MICHAEL; CHEN, 2005).

Alenka Poplin researched serious games applications for civic engagement in urban planning (POPLIN, 2011; 2012; 2014). She investigated its potential to inform citizens about their built environments while bringing them pleasure in the process of playing the game. She focused on searching for appropriate narratives and how to attract more citizens to the urban planning process. She cites educational games created by schools to teach about the history of the city and planning with ecological principles, such as “Londoner”, “SCAPE”, and “Urban Science”.

“Second Life”, a first of a kind digital gaming environment merged with social media, was used as a tool for civic engagement in urban planning and design processes. In the “Hub2” game players explored and redesigned a neighborhood in Boston, Massachusetts, USA, by moving objects, interacting with other players, and experimenting diverse spatial configuration settings such as new structures, green areas, streets, and pavements (GORDON; MANOSEVITCH, 2011). In the “Participatory Chinatown” the goal of the 3D multiplayer game was to engage residents of Chinatown, Boston, in the process of decision-making for the neighborhood’s master plan (GORDON; SCHIRRA, 2011).



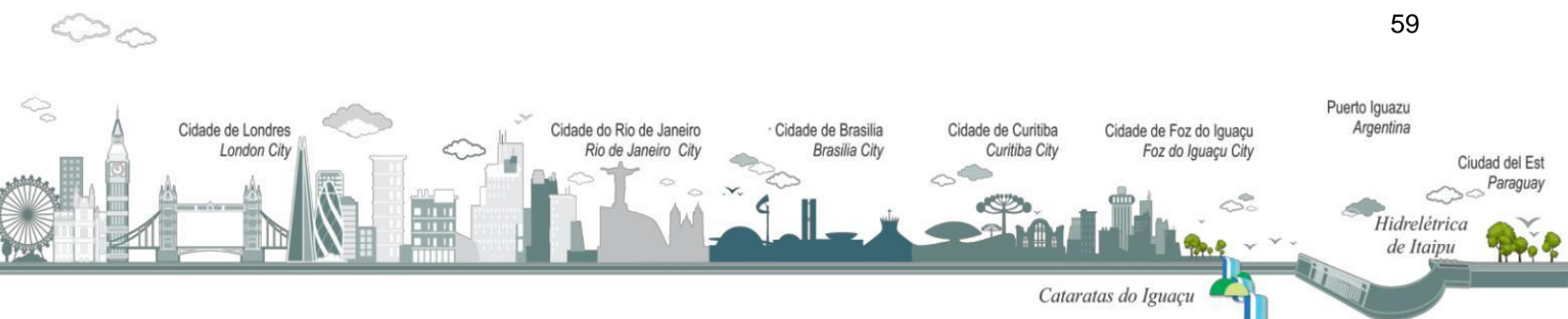


Schlieder and colleagues were the precursors of the geogames concept (SCHLIEDER, 2014a; SCHLIEDER; KIEFER; MATYAS, 2005), a sub-section of serious games that focuses on geographic location and locomotion in the city. Hence, the natural evolution of geogames comes from location-based games (SCHLIEDER; KIEFER; MATYAS, 2006) in which players use an electronic device such as a GPS or a mobile phone to play card or board games in a specific urban setting. It's about transforming the city into a playfield where groups of people can engage in games such as "City Poker", "Neocartographer", and "GeoTicTacToe", enriched with quiz questions in a certain topic.

The state-of-the-art concepts and types of Geogames are:

- 1) Christoph Schlieder develops the concept under the Geoinformation and Urban Geography domains. Definition:

"Geogames constitute a subclass of location-based and mobile games which can be played on mobile devices using positioning technology (like GPS) and integrate the players' position and motion track into the game flow. Through a specific mapping of existing board games into geographical space Geogames combine the strategic aspect of board games with locomotion typical for sportive activities. (...) In order to prevent the possibility of winning the game by just being faster than your opponent Geogames integrate special synchronization mechanisms using quests/tasks. In game-based learning, these in-game quests/tasks provide an opportunity to engage in learning activities. Generally, such activities blend with the gaming experience and are perceived by the players as playing time instead of idle time" (SCHLIEDER, 2014b). A geogame usually use a 1.5 x 1.5 km² area for a game-duration of 30 up to 60 minutes.





Types/genres:

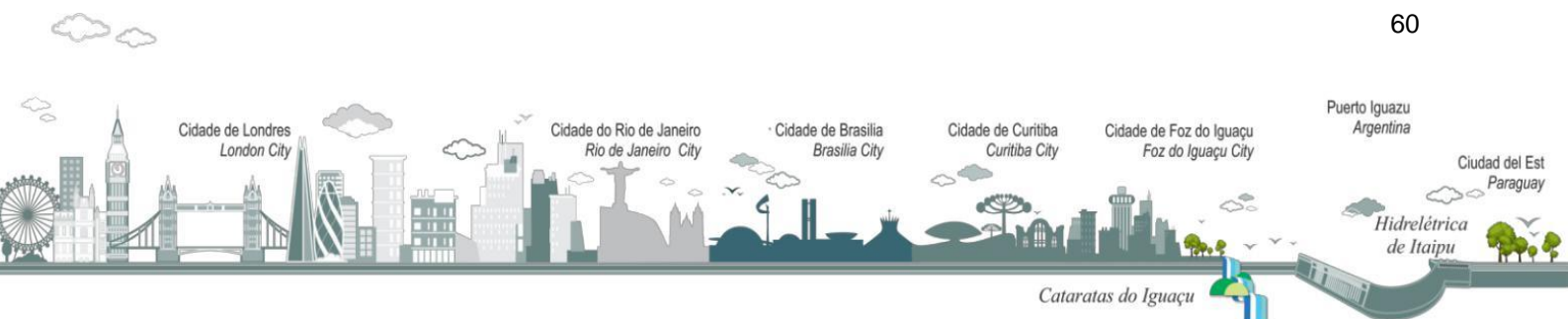
- Exploration games: for learning how to make use of an existing spatial design (e.g. a campus game for freshmen);
- Feedback games: in which the players report what they experience as the strengths and the weaknesses of a design (e.g. an urban usability game);
- Allocation games: in which the main criterion for winning is to occupy the majority of game location;
- Configuration games: in which the main criterion for winning is to occupy specific pattern of game locations;

2) Alenka Poplin develops the concept under Geoinformation and Urban Planning domains. Definition:

The fundamental principles of geogames for civic engagement are based on the concepts of collaborative planning and playful public participation (POPLIN, 2012). Participants must be in a state of flow during the gameplay, given the pleasure and joy that they would feel.

“GeoGames are participatory games for urban planning that complement and optimize the conventional process of public participation and civic engagement in general. They offer the advantage to address important development issues in a playful way. Making the process of participation enjoyable in form of a game is an innovative way to incite residents and other interested citizens to take an active role in the plan making process. With GeoGames, you receive a tool to show and discuss your ideas in a creative way³”.

³ Available at <https://geogameslab.net/why-geogames/>. Accessed on 15 April 2020.





Types/genres:

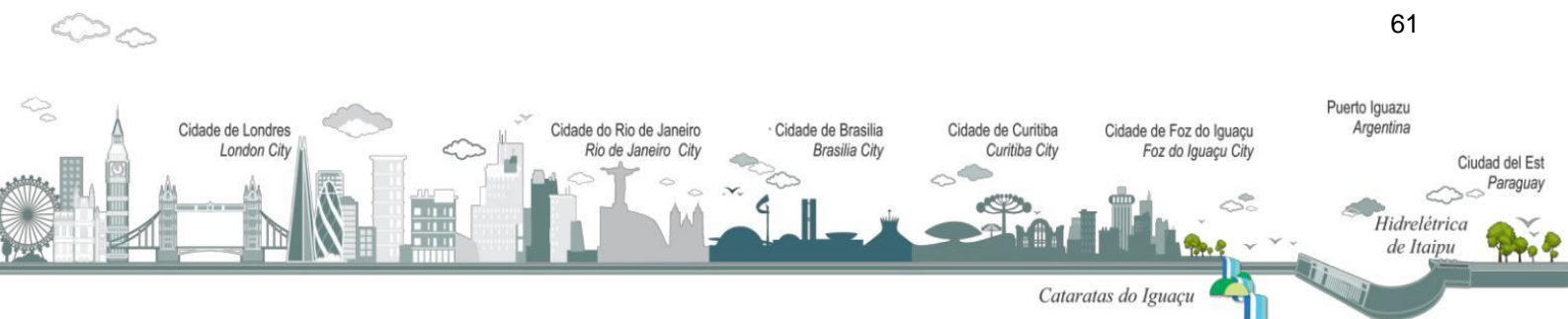
- Urban planning games: Visualization of space often follows a realistic representation of the city depicted on a realistic map or in a realistic 3D model of the city or neighborhood. Civic engagement is very specific, very concrete, and enables communication, negotiation, and planning by addressing common problems and voting for the best solution.
- 3) Bruno de Andrade develops the concept under Architecture and Urban Design and Geoinformation domains. Definition:

“Geogames are digital and non-digital games, individual or collaborative, anchored in a spatial context, created with georeferenced data and maps, favoring learning and design with ludic aspects. Another important characteristic concern adding the dimension of cultural values as a factor of place-attachment, history and memory. This dimension supports learning lessons from the past and favoring a learning experience about the territory for all-ages throughout engaging their own representations and designs in the game ambient. In addition, geogames should favor, in a serious but playful way, decision-making and problem-solving towards reaching the maximum consensus amongst stakeholders in urban planning” (DE ANDRADE, 2018).

The author’s geogaming approach is intrinsically articulated to heritage values and to participatory digital and non-digital methods, such as A) Exploratory: Teatro forum, World cafe; B) Ideation: Open space technology, Design studio; and C) Deliberation: Electronic town meeting, Citizens jury.

Types/genres:

- Exploration games: using electronic devices to explore physically architectural and urban spaces and raise awareness on heritage values and attributes, e.g.



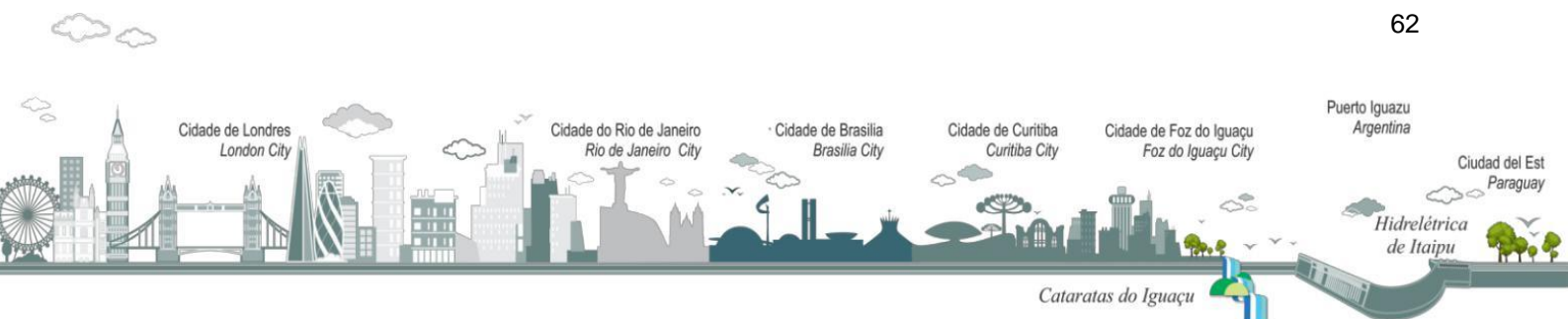


“Pokémon GO”, “Ingress” and “Harry Potter: Wizards Unite”. If done virtually it should include social media connections, such as “Second Life”.

- Design games: (re)designing collaboratively architectural and urban spaces with a particular interest for a greater conservation and sustainable development of protected heritage buildings and sites, e.g. Minecraft, Lego Worlds, Cities Skylines, SimCity, Age of Empires, and Civilization.
- Decision-making games: empowering participants to make a decision on which design to move forward based on competitive or collaborative gaming dynamics, e.g. “SimCityEDU: Pollution Challenge”, “Rising cities”, “Energy City”, “Democracy 3” and “Landopoly”.

The bridge between geogames to climate geogames lies on the literature review of Stephen Flood and colleagues. They argued that “climate change games” typically have three primary objectives (FLOOD; CRADOCK-HENRY; BLACKETT; EDWARDS, 2018): 1) teach knowledge and provide familiarity with the issues of climate change; 2) make players aware of the challenges associated with global warming and encourage players to develop solutions (RECKIEN; EISENACK, 2013); 3) games also act as safe innovation spaces (JOHNSON; RICE; GEELS, 2011) to interactively engage with alternate climate futures, build capability and capacity for resolving difficult problems and socialize adaptation with different publics.

We would add 3 more objectives based on the works of Christoph Schlieder, Alenka Poplin and Bruno de Andrade previously discussed: 4) design; 5) management; 6) evaluation. Hence the six objectives of climate geogames would be: 1) knowledge building; 2) raising awareness; 3) solving problems and socializing; 4) co-designing solutions; 5) co-managing solutions; 6) co-evaluating the process. We highlight the educational aspect of climate geogames as a way to build a culture of participation through games.





RECENT EXPERIENCES: A GAMEPEDIA

This item focuses on two initiatives that are leading the creation of environmental and climate related games, which are the Dutch Climate Centre’s game resources⁴ and Polish Games4Sustainability’s resources⁵. The Climate Centre, established in 2002 by the Netherlands Red Cross, have designed and tested at least 45 serious games about humanitarian issues like disaster preparedness, gender, food security, health, and migration. Games4Sustainability have compiled more than 100 serious games and simulations arranged by the UN’s Sustainable Development Goals.

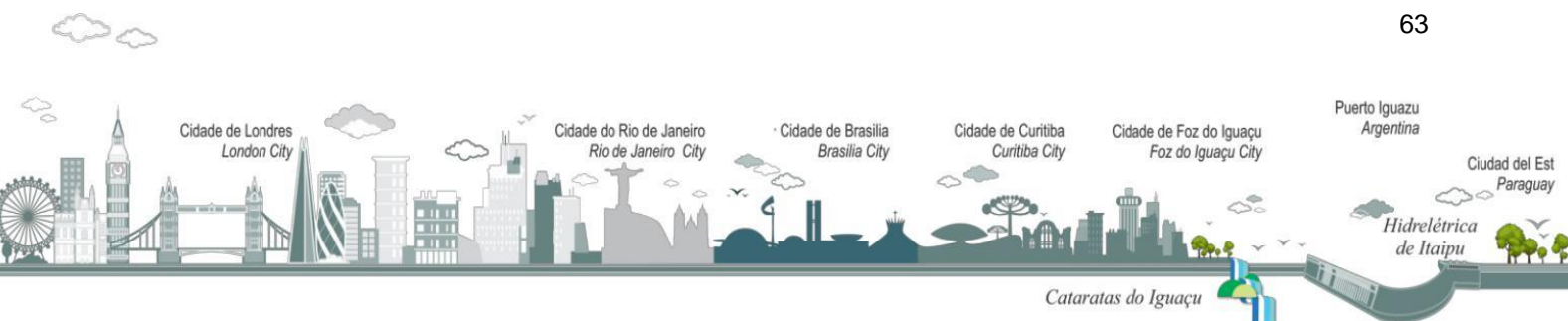
From the Climate Centre gaming resources, we highlight some related to climate change adaptation (Figure 1):

Figure 1 - Games related to the adaptation to climate change of Climate Center resources

Name	Description	Learning objectives
Spot the Status	The aim of this card-playing exercise is to increase consciousness, flexibility and choice in our interactions by enhancing the understanding of status behavior	To explore the concept of status behavior. To energize and create a sense of bonding among participants.
Seasonal Forecast Game	During this game, players are presented with a probabilistic forecast, for example: there is 40% chance that there will be drier than average conditions. Players have to make decisions based on this information and will see the consequences of their decisions.	To explore making decisions under uncertainty To explore the use and limitations of seasonal forecasts
Invest in the Future	Invest in the Future is an interactive card game. It combines story-telling and strategy to engage players in thinking about the importance of taking Climate Change into consideration as they strive to make responsible, sustainable development investment decisions.	Climate change is happening and the rising generation will need to understand how to make resilient development decisions in order to build the future with well-being for all.
Decisions for the Decade	“Decisions for the Decade” is an intensely interactive game designed to support learning and dialogue about key aspects of long-term investments under uncertainty.	Planning for extremes, experiencing climate change impacts, cooperation to better manage risk.

⁴ Available at <https://www.climatecentre.org/resources-games/games>. Accessed on 18 April 2020.

⁵ Available at <https://games4sustainability.org/gamepedia/>. Accessed on 19 April 2020.





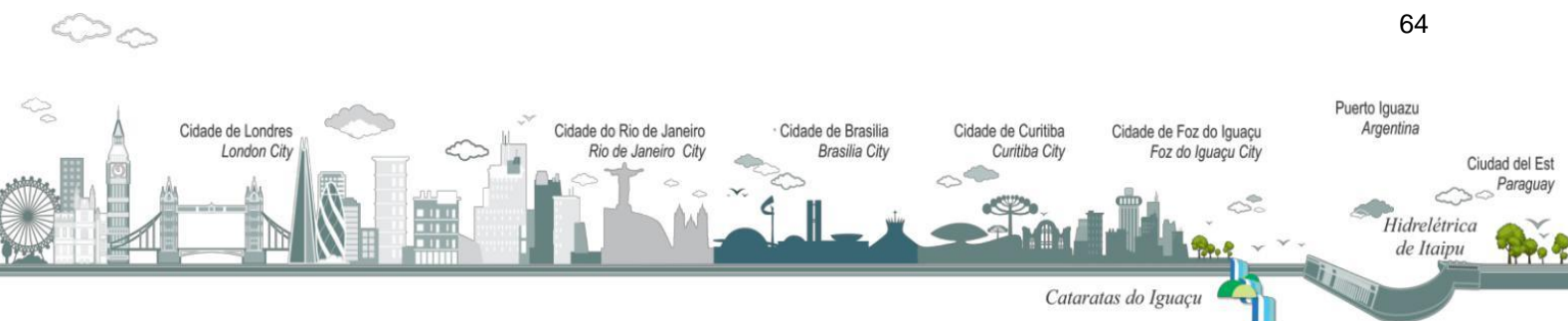
Climate Message	Complex climate messages can often cause more confusion than clarity. This light hearted exercise can open the space for an exploration on the effectiveness of seasonal forecasts and how to communicate them effectively without oversimplifying the message.	To explore how complex climate messages are transferred To explore options for appropriate use of climate messages
Ananse Games	Handwashing with Ananse is a three-chapter story and game experience centred on the popular Ghanaian folklore character Ananse. In this game, Ananse has stolen all the knowledge about handwashing and hidden it in his pockets. The children have to play through three scenarios where they trick Ananse to win the handwashing knowledge back from him. The three chapters on why it is important to wash hands with water and soap; how to do it correctly; and when to do it.	Learn why, how and when to wash your hands with water and soap.
Act to Adapt	A giant board game during which the 'community team' has to prioritize vulnerable community resources and take collective or individual actions to protect them from the 'hazard team'.	To experience the impacts of climate change; to explore how different community resources are vulnerable to different types of extreme weather and hazards and what you can do individually or in groups to address this.

Source: Elaborated by the author.

From the Games4Sustainability resources, we highlight some games related to the UN's Sustainable Development Goal 13 – Climate Action (figure 2):

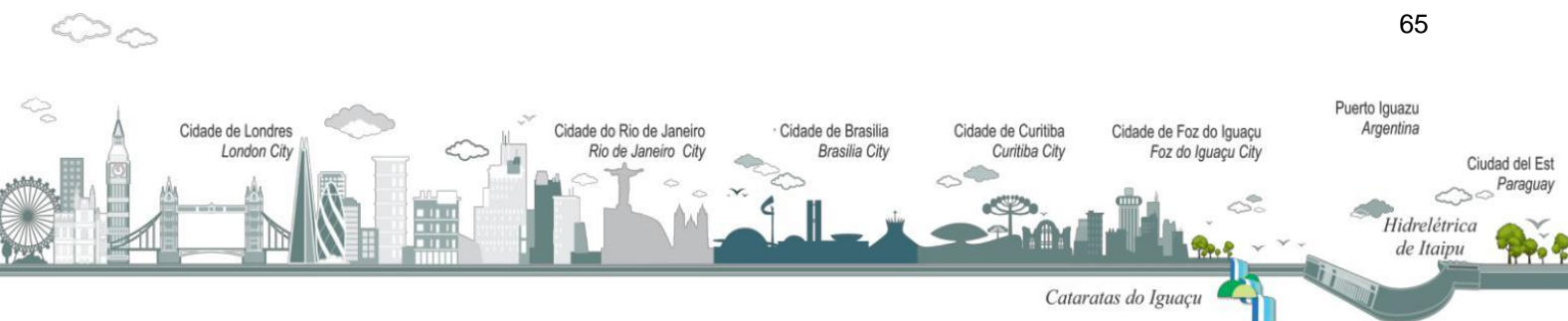
Figure 2 - Games related to the UN Sustainable Development Goal 13 - Climate Action from Games4Sustainability resources.

Name	Description	Learning objectives
GO GOALS!	A board game designed to be fun and engaging while informing and motivating children to actively pursue the SDGs.	To help children understand the Sustainable Development Goals, how the global aims impact kids' lives and what they can do every day to help achieve the 17 Goals by 2030.
World Rescue	A mobile game in which players meet and help five young heroes and help them solve global problems - such as displacement, disease, deforestation, drought, and pollution - at the community level.	To learn about 21st century development challenges in different parts of the world. To learn about cultural diversity from five characters from different





		parts of the world - India, China, Norway, Brazil, and Kenya.
Climate Challenge	The game aims to provide players with insights into the dynamics at play and to stimulate reflection on collaboration between different players with different interests and perspectives. It is based on the tragedy of the commons, complexity theory, game theory and cooperation strategies.	During the challenges, participants will face the issues that our world leaders are all too familiar with: growth spurts, limited resources, international negotiations, downturns and conflicts. To experience the impact of the choices of individuals as well as of groups make. To improve understanding of how a sustainable future could materialize.
New Shores: a Game for Democracy	An online multiplayer game that takes players on a quest to settle on a green, vibrant island. Wild forest covers its surface, hiding rich coal deposits underneath. Free to govern themselves, players can communicate and collaborate – or go through the game without giving much concern to the others. Using coal can dramatically improve the island's development.	To learn and explore practices that promote sustainability. To discover correlation between greenhouse gases and climate change. To set and align goals, negotiate conditions and coordinate actions.
Cultural Memory Game	The game draws on the concept of cultural memory as the key factor contributing to community resilience. The bits and pieces of past catastrophic events are scattered around the city, offering prompts to those who are ready to relate facts. Will you use your time to visit the Local Museum or would you rather opt for a shopping spree? The choice is yours, but it will certainly affect your future.	To learn from the past to shape your present and future. To understand the role of cultural memory in developing resilience To master decision-making in an uncertain environment
Tradeoff!	Tradeoff! operates on the premise that if we can bring more information about natural capital into decision-making, then better decisions will be made, both for people and nature. The game is a simple, introductory way for players to interact with the potential trade-offs and synergies between traditional development and natural capital values.	To explore tradeoffs across multiple ecosystem services and between nature's value and development; To demonstrate how spatial data can help inform these decisions; To simulate group and cross-sector collaboration and decision-making.
Urban Climate Architect	An educational flash game that allows you to create your own environmental-friendly city. You can design the city by building houses, streets and green spaces, employ citizens in	To gain knowledge about suburbanization and its effects on environment.





	<p>offices and industrial plants while observing the effect of these actions on the climate of the city.</p>	<p>To understand the importance of building a city sustainably and in an environmentally-friendly fashion. To learn about climatic differences between global regions.</p>
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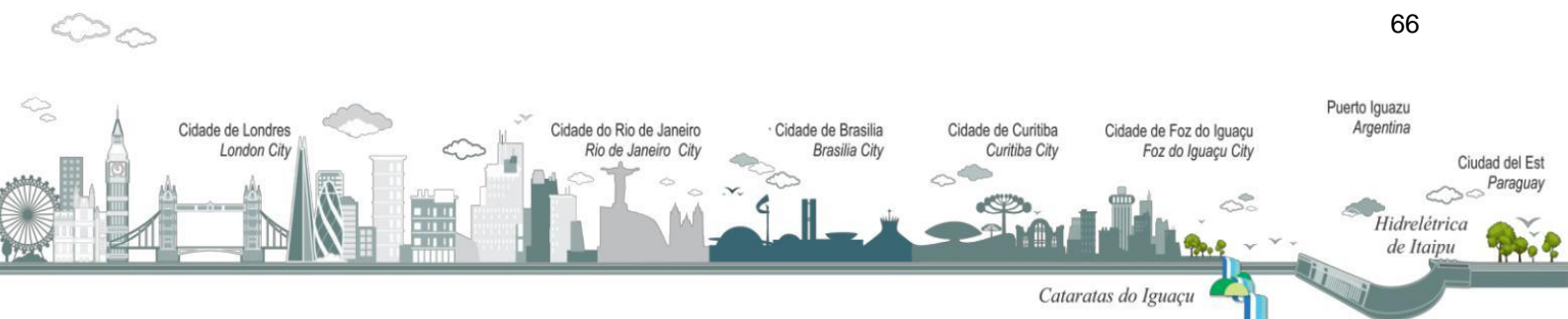
Source: Elaborated by the author.

CONCLUSION AND UNFOLDINGS

Climate geogames can be a powerful tool to tackle UN's SDGs, especially those correlated to Climate Action and Sustainable Cities and Communities, by involving citizens in learning processes about environmental and climate issues. Such games could and should be appropriated not only by academia, but also governments, NGOs and the private sector. Climate geogames work as a motivational method and a tool to face real and complex problems in cities and allow participants to play an active role in its processes of planning and management, which, by the way, include them.

The advantages of climate geogames are that people can learn by following their own speed and rhythm, the order that they want and decide the activities that pleases them the most. This game system favor knowledge accumulation through the experimentation of different solutions and strategies in a constantly shifting environment. It can be digital or non-digital, although recent events such as pandemic justifies the further investment on digital games as teaching and learning resources and civic engagement tools.

In our continuing work on climate geogames we will deal with its concepts and possible implementations. The intriguing questions are: How can digital climate geogames be designed to attend the UN's SDGs? How to co-design climate geogames with local stakeholders? How can climate geogames be used for youth engagement in





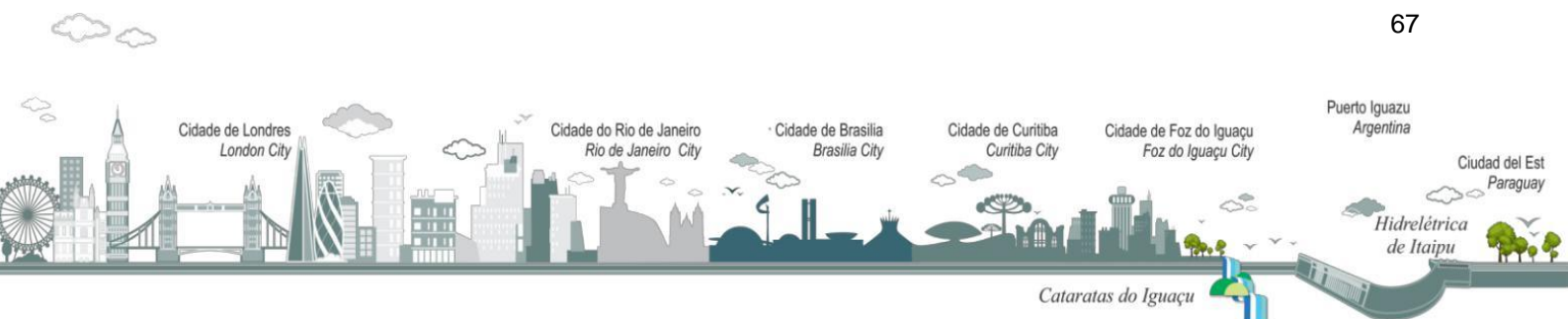
updating Master Plans towards resilience? How to achieve such a level of concentration in which participants focus on serious matters while avoiding climate anxiety?

ACKNOWLEDGEMENT

This paper was developed with the support of the Coastal Communities Adapting Together (CCAT) project, funded by the EU Ireland-Wales Programme. We acknowledge Karen Foley and the CCAT team Philip Crowe, Pauline Power and Louise Dunne at the Landscape Architecture section of the University College Dublin, for without their encouragement, tackling this urgent research topic would not have been possible. To the potential legacy that climate geogames can have on present and future generations to help them in any way face unimaginable challenges.

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