

The Urban Book Series

Eugenio Arbizzani · Eliana Cangelli ·
Carola Clemente · Fabrizio Cumo ·
Francesca Giofrè · Anna Maria Giovenale ·
Massimo Palme · Spartaco Paris *Editors*

Technological Imagination in the Green and Digital Transition

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Chapter 72

A Serious Game Proposal for Exploring and Designing Urban Sustainability



Manuela Romano and Alessandro Rogora

Abstract This contribution reports on part of the research carried out in the development of a digital serious game to explore and design urban sustainability. The work investigates the application of role-playing logics in urban transformation planning processes. Digital technologies support the participatory process and allow users to learn, interact and discuss the effectiveness of solutions when co-designing quality conditions for the everyday living environment and the sustainable development of their area. The method intends to develop procedures and simulations that aim to clarify and verify the results that transformations can have on the area's ecological footprint. During the game, players gain knowledge and awareness of the individual behaviour changes and the built environment transformations, necessary in order to impact their areas as sustainably and as little as possible. Prefiguring resilient and sustainable urban habitats, increasing user awareness of the need to adopt more responsible behaviours, increasing ability of the built environment to meet community needs by practising low environmental impact lifestyles: these key aspects are observing at all phases of the design process. This paper describes the progress of research carried out on the construction of the structure and rules of the game, developed prior to testing the method in the context of the municipality of Rescaldina, in the Milan metropolitan area.

Keywords Sustainable communities · Serious game · Digital tools · Urban game · Urban sustainability

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72.1 Introduction

The technological and digital revolution over the last twenty years has changed many social processes with forms of *gamification* (Deterding et al. 2011) that have changed the habits and behaviours of society in every area of life, such as relationships, work, training and entertainment. Encouraged by common interests or objectives, groups of people have built collaborative enterprises (Barricco 2019) by aggregating skills and experiences that, within digital platforms, have shortened physical and cultural distances and brought about what Pierre Levy has defined as *collective intelligence* (Pierre 1994); namely, the collaborative effort in solving common problems through the sharing of information and results.

This process also applies to design practices, where digital technologies play an increasingly important role in the transformation processes of the built environment (Perriccioli et al. 2020).

Digital tools and interactive technologies are defining new forms of dialogue between project and user. The quality of urban governance appears to be increasing thanks to a greater ability to data collection, orientation and control the impact of project decisions and the involvement of a larger number of stakeholders experimenting with problem-solving-oriented design approaches.

This contribution describes part of a research project carried out on the development of a digital serious game for exploring and designing urban sustainability. The study—carried out by the SEEDItaly research group of the Department of Architecture and Urban Studies at the Polytechnic University of Milan—aims to understand how the serious game aspects and digital technologies can be adopted in the participatory planning processes for territory interventions. The goal is to understand to what extent the logics of role play can support decision-making processes in urban and building transformation initiatives in the prefiguration of sustainable urban habitats. Increasing user awareness of the need to adopt more responsible lifestyles and the ability of the built environment to meet community requirements are observing as fundamental aspects in all phases of the design process.

72.2 The Contribution of Serious Games in the Development of a Sustainable Society

In recent years, in an attempt to develop actions to transition to more sustainable lifestyles and move closer to attaining Sustainable Development Goals (SDGs), the involvement of society in decision-making processes has been considered fundamental.

It has been acknowledged that technological components alone, without a societal assumption of responsibility and the modification of lifestyles practised on the ground, are not sufficient to achieve effective results. In this context, serious games have become increasingly important in communicating and raising awareness of

climate change issues (Wu and Lee 2015; Flood et al. 2018), with the goal of engaging users to explore the personal and collective decisions and changes needed to address this global challenge. Most games have been developed to enhance educational experiences, especially in school settings (Neset et al. 2020).

The issues addressed are multiple: pollution, plastic consumption, water resource use, natural disaster management, land resource use, energy and sustainable mobility.¹

Within digital platforms or with table games, players can immerse themselves in simulations while developing skills and competencies to apply in the real world. Including targets within the game supports social learning (Ensor and Harvey 2015) and an increased awareness of the need to adopt environmentally conscious daily habits.

Recognising the relevance of this issue at the international level, the ‘Playing for the Planet Alliance’² initiative was launched in 2019, in which many companies operating in the Gaming sector collaborated to develop games with a primary reference to issues related to the 17 SDGs of the 2030 Agenda (Patterson and Sam 2019). The proposed games aim to increase skills on topics such as: sustainable production chains (Anno 1800), biodiversity protection (Away: The Survival Series), renewable energy (Transformers Earth Wars) and building sustainable communities (Minecraft-Climate Hope City). The games demonstrate the technologies and processes needed to solve problems related to pollution and unsustainable resource use and to build a society in harmony with the environment.

In Eco,³ for example, players are called upon to seek compromises and agreements by developing new laws and economies to manage the resources available to them and avert the destruction of the ecosystem. The game’s name was conceived from the relationship between ecology and economics, which must be managed by good governance and appropriate regulations on the use of the resources that the ecosystem provides, without destroying its natural state.

Serious games were theorised in the 1970s (Abt 1970) as games developed for educational purposes that use fun and playful communication to convey educational notions and promote experiential learning. Today, they are increasingly used in various settings (business, education, government) to promote training programmes for individual development and cooperation within work groups by

¹ There are online platforms where users can access games geared towards sustainable development education. For example, Games4Sustainability (games4sustainability.org) or GamesForChange (gamesforchange.org), where multiple experiments can be explored.

² The Playing for the Planet Alliance initiative was launched at the Climate Summit held in New York in 2019 with the aim of empowering the games industry to support action against the climate crisis. Numerous games were developed through the ‘Green Game Jam’ 2020 and 2021 competitions (playing4theplanet.org/greengamjam/).

³ Eco is an online game developed by Strange Lop Games in collaboration with the University of Illinois Urbana-Champaign, with funding from the United States Department of Education (<https://play.eco/>).

exploring processes. Their main feature is highlighting real problems as interesting and fun, thus enhancing awareness of the actions to be taken towards shared solutions. Knowledge is fostered by exploring reality and carrying out activities that require behavioural changes from actors according to a ‘learning by doing’ approach. Some studies (Patti 2018; Viola 2011) observe how role-playing games in everyday life can influence emotions, having been deliberately designed by developers with the aim of guiding people’s behaviour in and outside of video games.

In academia, the potential of applying role-playing game logic is the subject of several studies (Sousa et al. 2022), aimed at understanding the contributions these tools can make in the development of co-construction processes oriented towards sustainable development goals. For example, some experiments simulate climate negotiations, in which participants can gain insights into the urgency and complexity of environmental action and the influence that policy choices have in the transition to a green economy. Even in urban planning, some studies (Brkovic and Groat 2020, Papathanasiou et al. 2019) note how the use of role-playing can improve knowledge of the urban environment and the exchange of views amongst various stakeholders in the decision-making process for urban habitat transformation. Civic engagement and community participation in urban planning can be supported by providing citizens with the tools and opportunities to address global challenges in solving real, local problems, therefore increasing knowledge on how to develop a more sustainable society.

72.3 TRAcE S: A Serious Game that Explores and Designs Sustainable Communities

As part of the research presented in this text, the aim of the game experience in question is to encourage shared and informed planning choices within the regeneration processes of the built environment (Rogora 2022). The game aims to facilitate the planning of urban and building transformations. Digital technologies support the participatory process and enable users to learn, interact and discuss the effectiveness of solutions as they co-design new conditions for the quality of the everyday living environment and sustainable development of their area.

The method aims to involve inhabitants, public administrations, professionals, associations and all those who express a willingness to be involved in their area’s transformation processes. Transformation scenarios are constructed within a framework of the resources that are locally available. During the game, players gain knowledge and awareness of the individual behaviour changes and the built environment transformations necessary in order to impact their areas as sustainably and as little as possible. The method aims to produce simulations that are intended to be a tool for knowledge, comparison and debate when validating the choices to be made, thereby clarifying and verifying the results that transformations can contribute to help determine the area’s ecological footprint.

72.3.1 Tools and Methods

The game’s universe represents a real context. The municipality of Rescaldina, in the Milan metropolitan area, has been used in the experimentation conducted in the research. The municipal territory has been reconstructed on a digital platform (Fig. 72.1).

The information is organised and processed with the help of GIS software. The initial knowledge phase of the game’s universe is aimed at understanding the initial environmental impacts and their main causes, in relation to which the urban sustainability scenarios are designed.

The impact is measured in per capita cost per inhabitant, expressed as the amount of area occupied and tonnes of CO₂ emitted for the production and consumption of goods and services needed to sustain the lifestyles of the community settled in the game area.

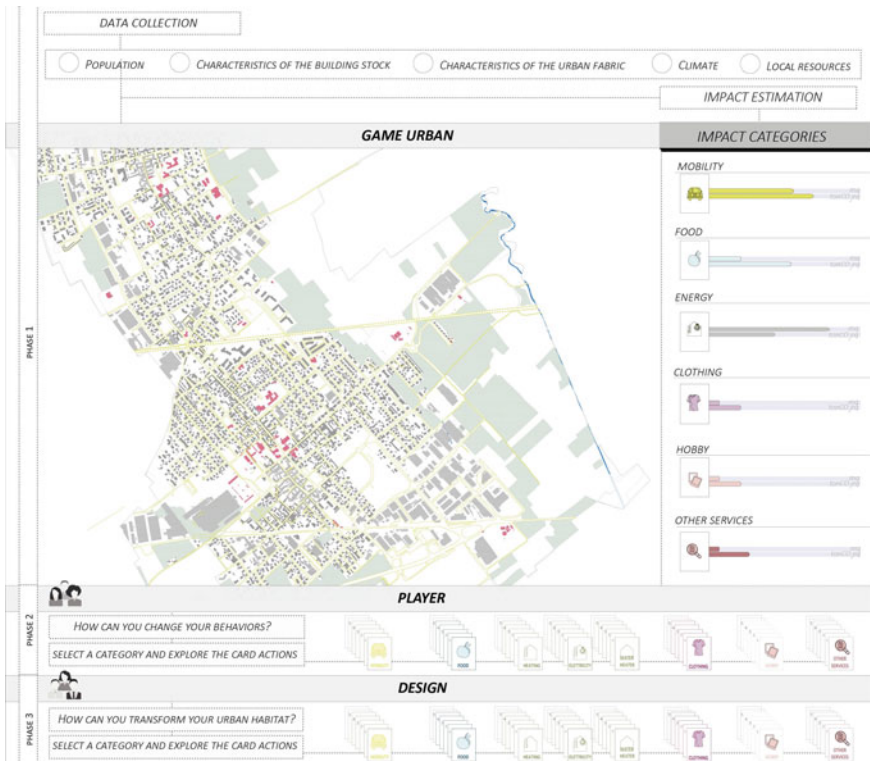


Fig. 72.1 Graphic representation of the game urban

The main data considered include:

- Population and average consumption;
- Characteristics of the urban fabric (morphology, infrastructure, services and their distribution);
- Characteristics of the public and private building stock (typological, constructive and performance related);
- Climate (solar radiation, temperatures, prevailing winds, etc.);
- Local resources (arable land, forests, water resources, renewable energy sources).

Data collection is also aimed at defining transformations that are appropriate to the needs and potential of the context. The possible transformations are described on the playing cards. The transformation actions represent suggestions in the form of best practices, technologies and processes aimed at developing self-sufficient communities (Clementi 2019). The actions are grouped by impact categories related to the main types of expenditure for everyday goods and services that are consumed by the population settled in the game area (mobility, food, housing, clothing, leisure and services). The solutions refer to technical and/or functional choices, briefly described below, that would impact local urban metabolism in the way energy, water, food, transportation, goods or daily services are used, managed and produced.

Mobility. To reduce pressure from the transportation sector, options include building bicycle lanes, and bicycle workshops and express stops, increasing the public transportation service by increasing bus lanes and replacing old vehicles with electric vehicles, replacing owned vehicles with electric systems and installing electric charging stations, reducing parking for private cars and increasing parking for low-speed vehicles.

Food. To reduce impact from food procurement, players can choose to build urban gardens, productive greenhouses or experiment with domestic solutions such as hydroponics or vertical gardens, activate solidarity purchasing groups or market for zero kilometer food.

Housing. Players can opt for solutions to reduce building and urban energy consumption with actions that increase the efficiency of public or private assets, produce energy locally to cover public or private needs, such as lighting and build energy communities. In addition, players can opt for actions that reduce urban water consumption by increasing the permeability of outdoor pavements or building roofs, creating bio-retention and infiltration green spaces and collecting rainwater for domestic water reuse.

Clothing and other everyday products or services. To reduce pressure from secondary industrial sectors and urban waste management, actors may opt to create spaces dedicated to the recovery or upcycling of clothing or everyday objects, such as neighbourhood tailor shops, creative workshops, craft workshops or collaborative enterprises, possibly located in disused spaces in the area.

For each action, transferability is checked during the preliminary stage of preparing the call for proposals. The environmental effect and economic cost required to implement the action are estimated and described. In addition, best practices are suggested to encourage the development of new local entrepreneurial activities related to proposed activity management.

The design process takes place throughout the game, which is organised into three main phases (Fig. 72.2). Once the game urban is constructed, we move to the Player phase, which is preparatory to the Design phase. In the Player phase (Fig. 72.3), with reference to the six impact categories, players are asked to choose from alternative proposed actions to change their daily behaviours and understand the extent to which adopting more responsible lifestyles affects the environmental impact of the game’s field. The changes that players can make are contained in the ‘actions of behaviour’ deck of cards. During the Player phase, the goal is to provide players with the tools to, first, understand the individual contributions they can make in building sustainable communities and second, to understand the context’s ability to facilitate the sustainable behaviours suggested by the cards and the intervention needed to ease these transitions.

Information gathering guides choices in the second design phase (Fig. 72.4). Players learn about creating healthy and thriving urban environments and help prefigure local sustainability scenarios by exploring the effectiveness of design solutions contained in the ‘project actions’ deck of cards. Actions aim to maximise locally available resources and/or mitigate impacts associated with the consumption of everyday goods and services.

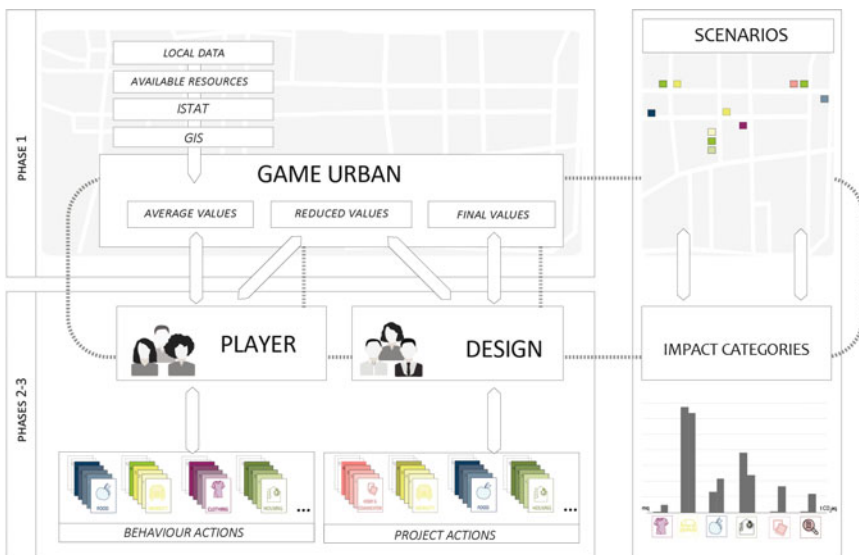


Fig. 72.2 Structure of the TRAcS method

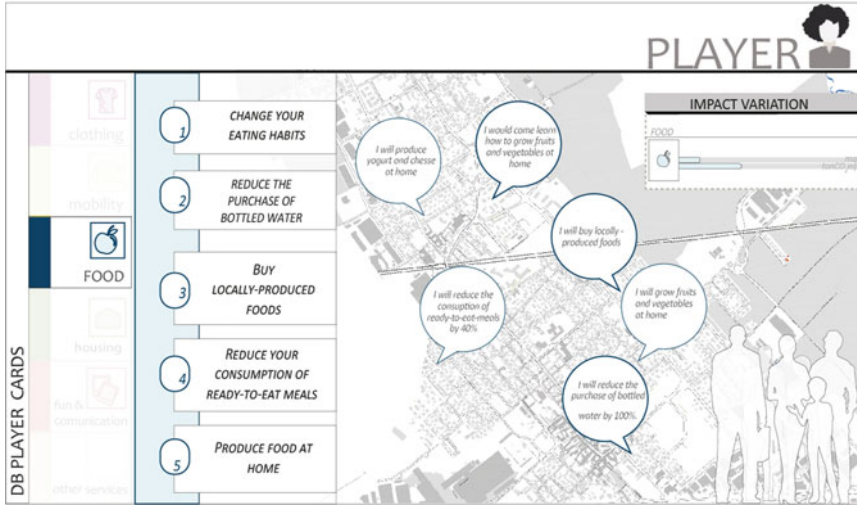


Fig. 72.3 Graphic representation of the player phase in the food category



Fig. 72.4 Graphic representation of the design phase in the food category

During the game, in the prefiguration of possible scenarios, the population’s ability to accept certain transformative actions is tested. The design solution’s effectiveness is evaluated with respect to the propensity of the actors to accept the transformations achieved by implementing a participatory process between citizens, professionals and public administration.

72.4 Conclusions

Digital games represent an emerging field of research (Papathanasiou et al. 2021) and application that enables playful learning about the urban environment and an exchange of views in the planning choices to be made in transformation actions.

The development of TRAcSeS is intended to represent an innovative approach aimed at participatory planning processes in which involvement from the community in improving the quality of life in their area is supported by tools for knowledge building and maximising locally available resources.

The objective of the game is twofold: to increase knowledge about the difficulties of the climate adaptation challenge and the importance of individual and collective engagement amongst governments, professionals and citizens and to understand the extent to which urban and building transformations can foster more responsible human behaviour.

The method is currently being tested within the research team and in educational workshops. To test its effectiveness and refine its potential, simulations will be conducted in the coming months to test the ability to imitate and represent the results.

The test will be carried out by students under the direction of the research group in order to fine-tune the rules of the game and the calculation procedures for the implementation of the results obtained in preparation for the experiment in the municipality of Rescaldina.

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