Biography

Dr. Marko Lazić, an Assistant Professor at the Department of Architecture and Urbanism within the Faculty of Technical Sciences at the University of Novi Sad, has made significant contributions to the field. Born in 1985, he successfully obtained his PhD degree in 2017. His prolific research output includes over 20 scientific papers, spanning diverse areas such as Building Information Modelling (BIM), Architectural Simulations, and Virtual Reality.

Dr. Ana Perišić, an Associate Professor at the Department of Fundamental Sciences, Engineering Animation, within the Faculty of Technical Sciences at the University of Novi Sad. She has been working and teaching for over a decade in the field of Video Game Design and Computer Graphics. She obtained her PhD in the field of Applied Computer Graphics and Simulations in Architecture in 2016. Prolific in the field of Human-Computer Interaction design, Applied Computer Graphics in Education and Virtual Simulations.

DFA Jelena Janev (b. 1972), an Associate Professor at the Sub-department of Art and Design, Department of Architecture and Urbanism, Faculty of Technical Sciences, University of Novi Sad. She earned her BFA (1998) and MFA in sculpture (2004) from the Academy of Art in Novi Sad, and DFA in Scene Design (2021), in the Scene Design Program at the Department of Architecture and Urbanism, Faculty of Technical Sciences, University of Novi Sad. She works in visual arts, primarily sculpture, art installation and scene design. She had 15 solo shows and more than thirty group shows in Serbia and internationally (USA, Germany, Bosnia and Herzegovina, Croatia, Montenegro). She has received the Annual Award for Sculpture from the Academy of Art (1997) and the award for sculpture from the Novi Sad October Salon (1997). She participated in a number of international art symposia. Her artworks are in the permanent collections of the Museum of Contemporary Art of Vojvodina, Museum Terra and the New Mexico Highlands University (USA). Janev has published critical essays in Scena, theatre arts review, and presented work at international conferences.

DFA Igor Kekeljević, is an Associate professor at the Department of Fundamental Sciences within the Faculty of Technical Sciences at the University of Novi Sad. Born in 1979, he successfully obtained his Doctorate in digital art at the University of Arts in Belgrade in 2016. Realized numerous commercial projects in the areas of illustration, graphic design, web design, interface design, video games, 3D graphics, and animations. Computer graphics has been actively involved since 2002. Employed as an associate professor at the Faculty of Engineering Science in Novi Sad, Animation in Engineering.

Original scientific paper
https://doi.org/10.24867/bsd-2024-1-021

SPATIAL AND AESTHETIC ASSESSMENT: EVALUATING NOVI SAD'S CENTRAL AREA AS A LOCATION FOR ISOMETRIC VIDEO GAME

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Abstract

The isometric perspective in video games boasts a rich historical lineage, having significantly influenced numerous enduring genres. These genres include action RPGs, MOBAs (Multiplayer Online Battle Arenas), and strategy games, among others. Despite its longevity, the isometric view remains relevant even in contemporary indie titles. In this paper, we analyzed the merits and drawbacks associated with isometric games. We delve into their characteristic elements, emphasizing both functional and aesthetic aspects. Our investigation encompasses a diverse array of titles, categorized by genre and development year. These carefully selected examples serve as a foundation for evaluating the suitability of Novi Sad's central area as a potential location for an isometric video game. Every city has its story built by architects for centuries, but the video game environment and scene design can evolve them to a new level, less serious, more playful and serene by being open to new interpretations. To practically apply our findings, we explore the creation of a game segment within the Unity 3D engine, accompanied by illustrative visuals. The results of our analysis provide valuable insights for game developers considering isometric design within an urban context.

Keywords: video game design, isometric projection, architectural heritage in video games, Novi sad central area, video game analysis

1. INTRODUCTION

There is a specific relationship between the built environment and its experience through the medium of video games. In these virtual realms, users perceive, participate, and create new impressions. Unlike physical spaces, where our perception is anchored to our bodies, video game spaces offer a distinct detachment. Maurice Merleau-Ponty posited that the body is central to spatial conceptions (Merleau-Ponty, 1964), while Jeff Malpas argued that space, conceptually, is tied to inhabiting and using it (Malpas, 1999). In contrast, cyberspace diverges significantly. Lars Qvortrup suggests it should be perceived not just as a mirror of the real world but as a repository of all spatial experiences, illustrating how we perceive and interact with objects in space (Qvortrup, 2002). Here, the emphasis is on experiences and spectacle.

This virtual space starkly contrasts with real life, where objects require deliberate intention and craftsmanship, often taking considerable time to complete—especially in urban environments. Cyberspaces, however, lack these constraints, prioritizing entertainment and immersive experiences. Gernot Böhme, examining the relationship between architecture and scene design, stated “Life is serious; art serene” (Böhme, 2002), a notion that can also be applied to video game spaces. These virtual environments can be manipulated and distorted to enhance user experiences intensively.

Unlike real spaces, which must serve strict functional roles, video game spaces are free from such boundaries. The creators of these virtual environments shape how players perceive and interact with them; a trait common across nearly all game genres. This is particularly evident in isometric games, the focus of this research, where the observation perspective is elevated, providing a bird’s-eye view of city streets, distinct from our usual urban experience.

In the first part of this study, we will analyze selected isometric games based on their characteristics, chosen from over 200 titles. The second part will establish criteria for evaluating the influence and appeal of these games. The third part will present examples within specific locations in Novi Sad. The final section will interpret the results and draw conclusions.

2. ISOMETRIC VIDEO GAMES THROUGH HISTORY

The representation of space in video games has evolved significantly since their inception. Initially, the most popular perspectives were side view, top-down, or with the illusion of perspective. The isometric view, a method to present three-dimensional objects, quickly gained recognition for its ability to create navigable environments without demanding excessive resources.

Today, this rendering technique has largely been replaced in major games by first-person perspective (FPS) or third-person perspective (TPS) with a fixed camera above the player. Despite this shift, the influence of isometric games persists, with many modern titles retaining this style.

The sheer volume of isometric video games is substantial, especially considering its past popularity. For example, the number of games released annually on the Steam platform alone has exceeded 10,000 (Clement, 2024), with a portion belonging to the isometric subgenre under study. The first commercial isometric games emerged in the early 1980s (Kent, 2001) and continue to be released up to the present day.

While scientific research on isometric games is limited, we will explore those that have significantly influenced game development, particularly in the 1990s. Paduan (2001) provides an intriguing historical perspective, highlighting games from the early stages of development. Felczak (2023) examines isometric games through the lens of the spirituality of place, noting the structural cohesion and functionalization of sacred spaces within various games. A select few of these games will be analyzed in greater detail.

2.1. Selection of games

Between 1981 and 2024, numerous isometric video game titles have emerged. This analysis focuses on 20 exemplary games chosen for their influence and portrayal of urban environments and architecture. Figure 1 showcases screenshots from these standout games, highlighting key examples of isometric video game history. The subsequent chapters will provide detailed explanations of the selection criteria and the games themselves.

Fig. 1. Screenshots from video games included in the analysis: a) Zaxxon, b) Knights Lore, c) Glider Rider, d) The Last Ninja, e) Final Zone, f) Desert Strike, g) SimCity 2000, h) Xcom: Enemy Unknown, i) Cesar II, j) Super Mario RPG, k) Diablo, l) Anno 1602, m) Robin Hood: The Legend of Sherwood, n) Eschalon: Book I, o) Project Zomboid, q) Shadow Tactics: Blades of the Shogun, r) They are billions, s) Disco Elysium, t) Hades II.

2.1.1. Zaxxon, SEGA, 1981

The first internationally released isometric game, Zaxxon, followed the release of Treasure Island in Japan. This scrolling shooter featured an aircraft navigating through enemy targets, getting its name from the axonometric projection - Z-axxon. It was a commercial success, climbing the charts and receiving several awards. At the 1984 Arkie Awards, the dedicated console version won Stand-Alone Game of the Year. The game showcased military facilities and bases, with graphics that were state-of-the-art at the time.

2.1.2. *Knights Lore, Ultimate Play the Game, 1984*

Knight Lore is another historically significant game, belonging to the action-adventure genre. Players collected objects within a castle, and the game was lauded for its graphics upon release, winning Game of the Year honors. The game environments were primarily interior spaces with few architectural elements of the castle, and the scale of the character in relation to the space was close to reality.

2.1.3. Glider Rider, Binary Design, 1986

Similar to Knight Lore in genre, Glider Rider focused on the architectural elements of buildings, though it did not receive awards for innovation. The player character, driving a motorcycle, appeared relatively small on the screen, with sizes not proportionate to surrounding objects like trees, buildings, and tanks.

2.1.4. *The Last Ninja, System 3, 1987*

The Last Ninja was one of the most successful games for the Commodore 64, blending action-adventure elements with advanced graphics. The main character occupied significant screen space, moving through both indoor and outdoor environments, showcasing recognizable Japanese architectural elements.

2.1.5. *Final Zone, Wolf Team, 1990*

A scrolling shooter game, Final Zone featured a mecha unit controlled by the player. While it didn't have a notable impact on game development, its collapsing city environment was interesting. Buildings were uniformly brick with flat roofs, and the city streets were regular but with too-large distances between buildings. The main character, a robot, was significantly larger than a human, providing a unique visual perspective of the cityscape.

2.1.6. *Desert Strike, Electronic Arts, 1992*

Desert Strike: Return to the Gulf was a shoot'em up game inspired by the Gulf War and one of the most successful games released by Electronic Arts. The player controlled a helicopter with real-sized surrounding objects and people. The buildings had simple characteristics, and the street network was always regular, with the helicopter's movement keeping the character in focus.

2.1.7. *SimCity 2000, Maxis, 1993*

SimCity 2000 marked the beginning of one of the most successful game franchises, The Sims. This city-building simulation game adopted the isometric style, depicting buildings faithfully without a central character. The street network was regular and accessible in four directions for better visibility.

2.1.8. *Xcom: Enemy Unknown, Mythos Games, 1994*

Xcom is a science fiction strategy game that inspired numerous sequels. It featured operational missions with multiple characters, some set in cities. Buildings could be entered, displaying interiors instead of outer walls. The characters were scaled to be visible alongside the height of floors and trees.

2.1.9. *Cesar II, Impressions Games, 1995*

A city-building game set in the Roman Empire, Caesar II featured diverse architecture with detailed elements, though buildings of the same type were often repeated. It provided a rich portrayal of Roman urban planning and architecture.

2.1.10. *Super Mario RPG, Square, 1996*

Super Mario RPG was a classic role-playing game (RPG) that significantly influenced similar games. Although the isometric view was not common on the Nintendo platform, this game was highly popular. The objects were fictitious but detailed, and the character was stylized with primary colors, ensuring full visibility in various situations.

2.1.11. *Diablo, Blizzard North, 1997*

Diablo is an action role-playing video game renowned for its use of isometric projection. Still considered one of the most influential games ever released, it features not only extensive dungeon crawling but also segments set in rural settlements. The architecture is basic and uniform across all buildings. In its sequels, real cities are introduced. The main character remains centrally positioned on the screen, ensuring constant visibility.

2.1.12. *Anno 1602, Max Design, 1998*

Anno 1602 is a key entry in the successful city-building franchise. The game features highly detailed buildings, although with a repetitive design similar to previous games. Non-player characters (NPCs) are depicted much larger in scale compared to the buildings, creating an interesting visual dynamic.

2.1.13. *Robin Hood: The Legend of Sherwood, Spellbound Entertainment, 2002*

One of the last major isometric games made by big studios, Robin Hood: The Legend of Sherwood is a stealth-based real-time tactics game, drawing heavily on earlier releases like Commandos and Desperados. Set in medieval England, the game features stylized, highly detailed architecture. The irregular street network posed

challenges for character display, resolved by showing the player's silhouette in a primary color when behind buildings.

2.1.14. *Eschalon: Book I, Basilisk Games, 2007*

Eschalon: Book I is a turn-based role-playing video game, part of the indie game movement that gained traction in the early 2000s. Despite its limited graphical detail compared to earlier titles, it received positive reviews. The game emphasizes internal spaces over external architecture, focusing on gameplay-essential elements.

2.1.15. *Project Zomboid, The Indie Stone, 2013*

Still in development and popular within indie circles, Project Zomboid is a zombie open-world RPG survival game. Architectural objects vary but lack intricate detail. The player character is small relative to the screen, though zoomable, and buildings are scaled to match the player, who remains centered on the screen.

2.1.16. *Shadowrun: Hong Kong, Harebrained Schemes, 2015*

Funded through Kickstarter, Shadowrun: Hong Kong is a turn-based tactical RPG set in a future fictional world. It uses isometric projection with characters animated from all angles, unlike the 4 or 8 fixed angles typical of earlier games. The stylized representation of Hong Kong includes relatively few buildings.

2.1.17. *Shadow Tactics: Blades of the Shogun, Daedalic Entertainment, 2016*

Shadow Tactics: Blades of the Shogun is a stealth-oriented real-time tactics game set in feudal Japan, featuring detailed, time-appropriate, and stylistically expressive objects. The game uses 3D objects within an isometric view, allowing environment rotation for multi-angled detail viewing, though objects are oriented towards two axes.

2.1.18. *They are billions, Numantian Games, 2017*

They Are Billions is a steampunk real-time strategy survival game, demonstrating the enduring success of traditional isometric style in modern gaming. Following the popularity of franchises like Starcraft and Warcraft, it features numerous player-controlled units, larger in scale than surrounding objects.

2.1.19. *Disco Elysium, ZA/UM, 2019*

Disco Elysium, another standout indie game, is a non-traditional RPG with a serious narrative and scene composition, not intended for younger audiences. It received critical acclaim and numerous awards for its distinctive style and storytelling. The architecture is in scale, focusing on personal rather than urban perspectives, crucial to the game's experience.

2.1.20. *Hades II, Supergiant Games, early access 2024*

Hades II, one of the most anticipated indie games of 2024, follows the success of its predecessor, Hades I, which sold over 50 million copies. Despite lacking significant external architectural representation, its popularity underscores the enduring appeal of the isometric video game genre.

2.2. Analysis of the selected video games

The selected games were analyzed based on several criteria affecting visibility, aesthetic value, and optimization. Transparency was prioritized, ensuring player characters are consistently visible, with sub-criteria focusing on the player's height relative to the screen, their position, and the height of other objects. Aesthetic values were assessed by the complexity and variety of building designs. Optimization included technical requirements for PCs or consoles and the game's overall stylization. This comprehensive analysis provides insight into how each game excels in these areas.

GAME:	player height/ screen height	player position	player height in	buildings complexity,	variability of	orientations of	hardware requirements	game stylization
Zaxxon	7%	not restricted	no	very low	no		low	16 colors
Knights Lore	16%	not restricted	yes	very low	no		low	monochrome
Glider Rider	9%	not restricted	no	very low	no		low	monochrome
The Last Ninja	19%	not restricted	yes	low	no		low	16 colors, shadows
Final Zone	24%	center	no	very low	no		low	gray-brown palette
Desert Strike	17%	not restricted	yes	low	no		low	yellow-brown palette
SimCity 2000	no	no	yes	low	no		low	cartoony style
Xcom	7-13%	multiple	no	low	no		low	no specific style
Cesar II	no	no	no		no		low	cartoony style
Super Mario RPG	14%	near center	no		no		low	cartoony style, black shadows
Diablo	11%	center	yes		no		low	dark palette with shadows
Anno 1602	7%	multiple	no		no		low	realistic palette
Robin Hood	7%	multiple	yes	high	yes	no	low	realistic, desaturated
Eschalon	7%	center	yes	low	yes		low	no specific style
Project Zomboid	5-9%	center	yes	low	yes	no	medium	no specific style
Shadowrun: HK	17%	not restricted	yes		no		low	dark, soft color palette
Shadow Tactics	5-10%	not restricted	yes	high	yes		high	realistic, soft palette
They are billions	3-11%	multiple	no	low	no		medium	cartoony style
Disco Elysium	25%	not restricted	yes	high	yes	no	medium	pastel colors
Hades II	10%	center	yes	high	yes		high	dark environment, light elements

Fig. 2. Isometric video game analysis based on 8 different criteria.

The following conclusions can be drawn from Fig. 2:

- The size of the player in relation to the height of the screen in games is from 3% to 25%, with an average of about 14%.
- The player's position is not restricted in 7, and the position is placed in the center or near the center in 6 cases. However, if you look at the release time of the games, most of the ones that are not restricted were released in the 1980s. Relatively modern tendencies show a tendency towards central positions for the main character.
- In 60% of the analyzed games, the character's height is proportional to the buildings and objects in the game. In cases where this is not applied, the character is always larger in order to be more pronounced. When it comes to cases of displaying work with an urban entity, it is more common to use a larger character.
- The architectural details of objects in games increase in proportion to the year of release with a few exceptions. The newer the game, the higher the expectation of detail.
- The variability of buildings is present in only about 30% of cases. These cases are all present in games that are newer generations.
- Only in 10% of cases, the orientation of the space in two orthogonal directions is not present. This was done for simpler crafting, understanding of space and movement in the game.
- Games that have higher hardware requirements are those where variability and the spread of buildings in multiple directions appear.
- Game styling was initially hardware dependent, but starting with SimCity 2000 in the list, the most common tendency is to render games in a cartoony style. With higher hardware performance, games with a realistic display also appeared, but only about 15% of them.

3. APPLICATION OF THE RESULTS

Based on the analysis results, the following inputs were integrated into the game creation system to accurately represent the central area of Novi Sad:

- Character size ratio to screen height is 14%.
- The character will occupy the center of the screen.
- The character will be proportional to the objects around him in the game or will be taller so that the urban whole can be observed, or. so as not to be cut off.
- Objects will be displayed with more details.
- Buildings don't have to have a lot of variability, but there must be a building with a known character.
- Orientation of objects is exclusively in 2 directions, except in the case of objects with character.

The game employs a cartoony stylization with realistic elements. Based on defined criteria, Zmaj Jovina Street in Novi Sad, extending from the Church of the Name of Mary (the Cathedral) to the Bishop's Palace, was selected due to its notable architecture. This prominent street, with most structures dating from the 19th or early 20th century, features two culturally significant freestanding buildings at its ends.

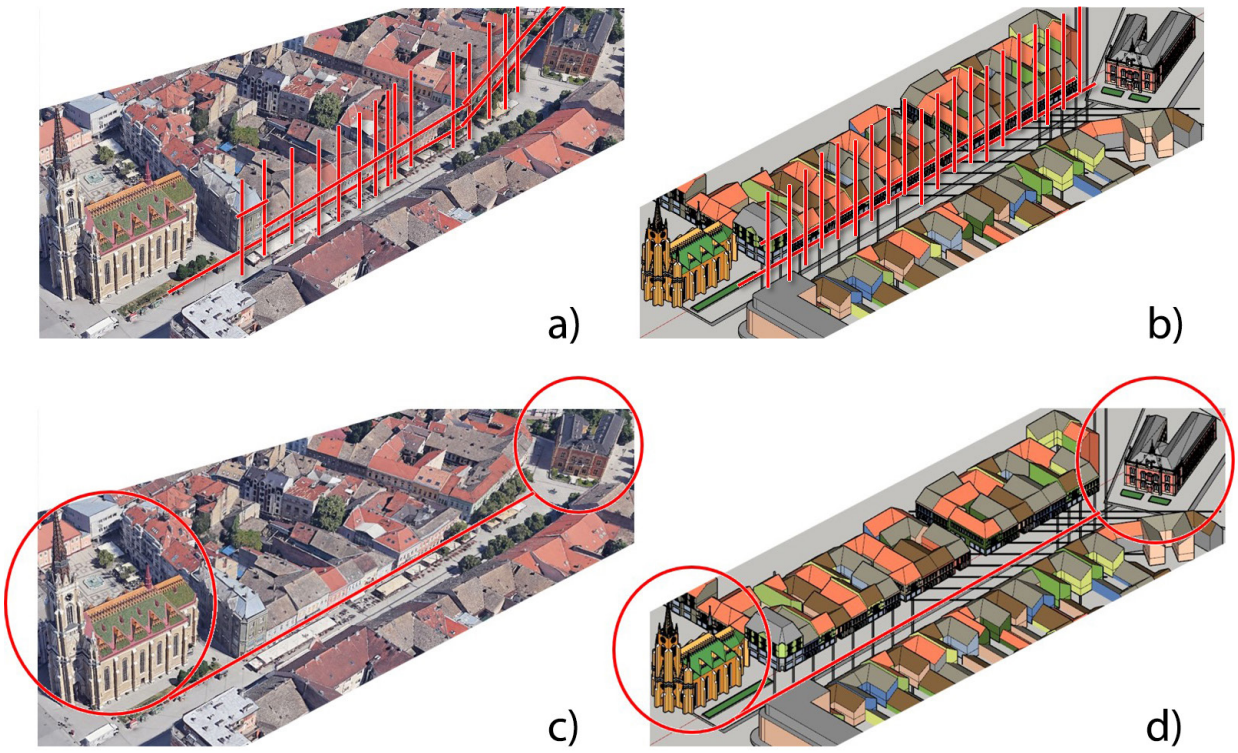

Fig. 3. Evaluation and adaptation of Zmaj Jovina street from reality to video game: a) distance between houses are relatively even; b) distance is made even for simplification; c) two main point buildings are connected with a street that is wider at the end; d) street direction is simplified in virtual world.

In Fig. 3 c) can be seen the relationship between the two main objects and the variation of the street width. In the game (Fig. 3d), the street has been simplified to make it easier to navigate for the players. The orientation of all buildings is uniform, except for the building of the Bishop's Palace. The details of the buildings at the beginning and end of the street had to be done carefully. Both buildings are characteristic for their colors and architectural details. Every major part of the building is carefully modeled so that it can be recognized. On the other hand, the complete modeling of all parts was not approached in order to fit the objects with the buildings located in between, which are repeated. In Fig. 4 it can be seen that the windows on the right are modeled so that not all details are visible. The software used for the work was Autodesk 3ds Max, Trimble Sketchup, Adobe Photoshop and the game engine Unity 3D to create the game. After the 3d modeling and rendering of all the objects, the production of independent images of the objects of urban furniture and greenery, which is characteristic of parts of the street, was started. Objects are rendered independently and are placed with

collisions enabled so players have to go around them rather than go through them. Street lighting, benches, trees, bushes, coffee tables and chairs, etc. have been added to the buildings. (Fig. 4) After all, a character was added that passes through the space and it is visible on the left side in Fig. 4. Collision attributes have been added to the character so that he cannot pass through objects. Collision has been added as a separate image for the buildings as well to make the passage through the level complete.

In Figure 3c, the relationship between the two main objects and the variation in street width can be observed. For simplification and clarity in the game (Figure 3d), the street design was streamlined. All buildings, except for the Bishop's Palace, are oriented uniformly. The details of buildings at the beginning and end of the street required meticulous modeling to ensure their recognition by players. These buildings are distinct in color and architectural details, with every significant part carefully modeled for identification. However, full modeling was avoided to maintain consistency with the repetitive buildings in between. As seen in Figure 4, windows on the right are modeled to hide certain details.

The software utilized for this project included Autodesk 3ds Max, Trimble SketchUp, Adobe Photoshop, and the Unity 3D game engine. After 3D modeling and rendering all objects, independent images of urban furniture and greenery typical of the street were created. These objects, including street lighting, benches, trees, bushes, coffee tables, and chairs, were rendered separately and positioned with collision detection enabled, ensuring players navigate around them rather than passing through.

Fig. 4. Start point of the finished result from the game engine; environment is 3d rendered, character is added to the left, and greenery and urban furniture was displaced.

Upon completion, the character exhibits multidirectional movement capabilities, navigating various obstacles along the street. At this stage, interactions, user interface (UI), and objectives have not been implemented; these elements are intended for future development.

4. CONCLUSION

There are several conclusions that can be made. First, video games, as an emergent medium, provide novel representations of spatial environments, predominantly emphasizing event-driven narratives. Second, isometric video games offer a unique perspective for the depiction of urban environments, though historical examples within this genre are limited, the extant instances hold significant value. Third, Zmaj Jovina street represents good place for isometric type game, because of its orientation, prominence of buildings on its start and end, and uniformity of buildings in the middle. Lastly, observing an unfamiliar city through a video game

can be misleading; however, it presents an opportunity to form a connection with the virtual representation, potentially fostering a sense of familiarity upon encountering the actual location.

ACKNOWLEDGEMENT

This research has been supported by the Provincial Secretariat for Higher Education and Scientific Research, AP Vojvodina (Projects in relation with research and artistic creation in the field of art) and the Faculty of Technical Sciences, University of Novi Sad through the project "Architecture of Vojvodina promotional video game" (No. 000827579 2024 09418 003 000 000 001).[1]

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