

Castles, Fortress and Citadels – A New Method for Exploring Military Heritage Through 3D Immersive Geovisualization

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Abstract:

This study will aim to develop a new method for exploring fortified military heritage through the use of 3D immersive geovisualization. The research will involve an analysis of existing geovisualizations of fortified heritage sites to identify their key features, strengths, and limitations. Based on this analysis, a classification system for these visualizations will be established, and guidelines will be proposed to ensure that future 3D representations adhere to the principles of cartographic sciences.

The study builds upon prior research that underscores the necessity of developing infrastructure for cultural heritage visualization (Rodríguez-Gonzálvez et al., 2017) and highlights the importance of diachronic reconstruction to analyze changes in heritage sites over time (González-Aguilera et al., 2017). Additionally, it draws on work demonstrating the potential of immersive technologies, such as Virtual Reality (VR), for enhancing cultural heritage visualization through advanced rendering engines and interactive experiences (Choromański et al., 2019). Furthermore, it incorporates recent studies exploring navigation tools like mini-maps and teleportation, which enhance user interaction within virtual spaces (Zagata et al., 2021). While these studies provide valuable insights into technical and user experience aspects of geovisualization, they often prioritize visualization mechanics over the historical and spatial characteristics of the heritage objects themselves.

A key aspect of this research is its alignment with the **ICOMOS Guidelines on Fortifications and Military Heritage**, which emphasize the unique territorial and geographic values of fortified systems. These guidelines highlight that the significance of fortifications extends beyond individual structures to encompass their role as organizers of surrounding cultural landscapes. In cases where fortifications form part of a broader defensive system, their collective value surpasses the sum of individual components. The guidelines further underscore the importance of evaluating strategic aspects, such as location advantages, responses to spatial distribution of weaponry, and adaptations to topography and ecosystems (ICOMOS, 2021).

Additionally, the ICOMOS guidelines identify distinct characteristics of fortifications—such as **barrier and protection, command, depth, flanking, and deterrence**—which are essential for understanding their historical and functional roles. Properly classifying geovisualization data and formats is crucial to ensuring that these attributes are accurately represented. This study will focus on evaluating how existing visualizations incorporate these strategic and spatial aspects and on developing methods to enhance their fidelity to the historical and geographic context.

Fortified military heritage, such as castles, fortresses, and citadels, provides a rich domain for exploring these themes due to its intrinsic connection with geographic space. These structures were designed to adapt to and manipulate their terrain for defensive purposes, reflecting the interplay between military strategy, architectural design, and environmental factors. Furthermore, fortified sites often underwent substantial transformations over time due to shifts in military technologies, political dynamics, and broader societal changes. Capturing these diachronic changes requires not only rigorous visualization methods but also a robust understanding of the historical and spatial contexts of the structures (Figure 1).

By integrating these insights, this study aims to establish a scientifically rigorous framework for 3D geovisualizations that effectively capture the spatial, temporal, and functional dynamics of fortified military heritage, while adhering to both cartographic principles and the guidelines set forth by ICOMOS.

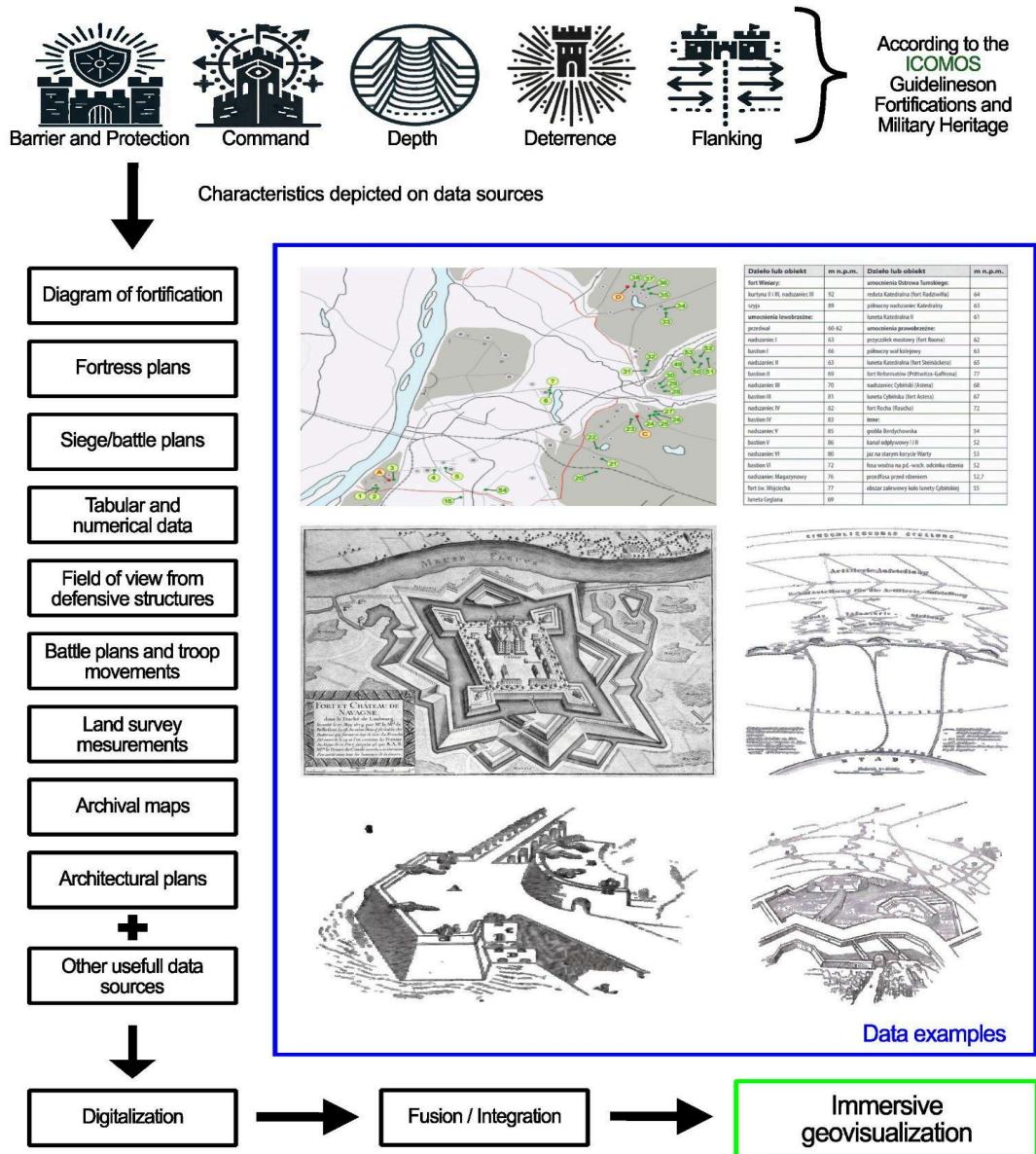


Figure 1. Concept of a workflow

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