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***Evoking Cultural Memory
and Nostalgia with
Volumetric Visualizations:
NeRFs and Point Clouds as
Metaphors for Displacement***

Abstract

The article that follows examines using NeRF and point cloud visualizations to evoke cultural memory and nostalgia. Through a triune framework that encompasses cognitive, emotional, and placial aspects, the study investigates how advanced volumetric imaging techniques can be employed to represent and convey the complex aspects of displacement experiences. Contextualized through the analysis of a 5-channel immersive installation created by the authors, this inquiry analyzes technical processes and discusses ethical implications, while also providing a novel approach to creating visual representations of memory and belonging.

Keywords

neural radiance fields (NeRFs), point clouds, displacement, cultural memory, virtual reality (VR)

1. Introduction

The intersection of art and technology continues to offer unprecedented opportunities to experiment with emerging creative processes. Inspired by the recent increase in mainstream accessibility to advanced computing tools, the authors of this text created a moving image installation using NVIDIA Instant NGP (NeRFs) and point cloud visualizations to produce photorealistic 3D animations. The explanation provided here represents the authors' unfolding investigation of phenomena and realities as they relate to the use of algorithmic technologies in generating volumetric visualizations of cultural memory.

Taking inspiration from time-based art pioneers like Bill Viola and Leo Villareal, *Triunes of Displacement*, the artwork used here as a case study, was presented in July of 2023 at the inauguration of the incoming Rector at Riseba University of Applied Sciences (Riga), following the death of her predecessor. The piece was designed to allow the audience to reflect on the ephemeral nature of being and loss while also confronting ongoing changes in perception created by technological advances that have the power to augment our view of reality. The artwork, which relies heavily on Latvian cultural codes, as well as ecological and architectural imagery, immerses viewers in cognitive interludes of eco-symbolism and cultural references that function as mechanisms to produce sensations of nostalgia and shared remembering.

1.1. The Art of Remembering

Connection and cultural memory are essential elements of the human experience, linking past and present. Incidences of dislocation due to loss or occupation disrupt this dynamic and can deprive individuals of maintaining a sense of belonging. In most cases, this type of displacement has a highly detrimental impact on those affected. In contrast, this article examines how combining structure-

from-motion imaging and advanced computing processes can be used to generate, or reinforce, a sense of connection and nostalgia. The case study also utilizes the practices and observations of the authors as they mitigate Latvian post-colonial displacement and cultural memory to comment on the efficacy of NeRF and point clouds to create algorithmic artworks that become metaphors for displacement.

2. Theoretical Framework

The theoretical framework for this study is grounded in the notion that volumetric visualizations can serve as powerful metaphors for cultural memory and nostalgia, especially in contexts where viewers have personally experienced some form of displacement. The approach taken by the authors is to experiment with using advanced computing and algorithmic technologies to identify humanistic applications for AI. The research employs a triune approach encompassing cognitive, emotional, and placial perspectives to contemplate a novel application for structure-from-motion photogrammetry and AI compositing techniques. At the center of the investigation is the exploration of whether or not the methods employed by the authors achieve the creation of dynamic visuals generated through a metacognitive scanning practice that renders a graceful, suspended motion user experience reminiscent of the tenuous and transient nature of displacement.

2.1. Cognition

NeRFs and Point Clouds function as transformative volumetric algorithms by utilizing fully connected deep networks of photogrammetry, optimizing contiguous scene function with spatial and directional coordinates as inputs [9] (Yang et al., 2023), but they also serve as nodes of metaphor in processes of remembering. The technical framework utilized to create the *Triunes of Displacement* installation is complex and is intended to convey the intricacies of comprehending human consciousness,

memory, and emotion as metaphoric clusters.

The metaphorical framework proposed by George Lakoff (2008) offers a profound lens through which to interpret the interplay between past and present, where Lakoff's conceptual metaphor theory posits that our understanding of abstract concepts is deeply rooted in physical and social experiences. This emotional response can be seen as a form of cultural memory that selectively reconstructs the past, much like NeRFs and point clouds, which selectively reconstruct surface details of an object [10] (Xue and Woolley, 2009). With respect to the Latvian experience conveyed in this text, selective reconstruction can lead to contested memories and varied interpretation of history, distorting the visual field of memory.

Lakoff's theory, in giving hope that the metaphors we live by shape our perceptions and actions, suggests Latvian society should have the ability to foster a more nuanced and empathetic resolution of collective trauma, paving the way for reconciliation and healing, which is what the volumetric visualizations in *Triunes of Displacement* seek to accomplish. Exploring the complex connections between displacement, memory, and perception with an innovative combination of algorithms to shape audience awareness, this novel approach to experiencing memory and displacement as metaphors becomes evocative.

2.2. Emotion

Advanced immersive technologies can add a new dimension to capturing and recreating three-dimensional representations of physical spaces and objects with remarkable accuracy. Neural Radiance Fields (NeRF) generate photorealistic 3D models from a limited set of 2D images, while Point Cloud visualizations extend representations of detailed spatial data [1] (Peng Tu et al., 2024). The landscapes and architectural spaces captured by the authors/artists encompass emotional dimensions of memory. As discussed in the article

"Symbolic Significance and Cognitive Dimension of the Latvian Landscape," environments are not just physical places but also emotional and symbolic structures intertwined with human perception, self-identification, and cultural memory (Nitavska, 2023).

Triunes of Displacement takes a unique approach to utilizing volumetric visualizations by creating emotional connections that promote multi-sensory engagement. As a result, a comparison can be drawn between the metaphorical



Figure. 1

representation of disjointed and overlapping memories associated with trauma and the neural processes NeRFs and point clouds use to synthesize coherent image data from disparate camera angles and scattered data points (Fig. 1).

In "Displacement and Identity Discontinuity: The Role of Nostalgia in Establishing New Identity Categories," displacement impacts identity continuity through the lens of nostalgia, helping individuals reestablish a sense of identity [3] (Milligan, 2003). This phenomenon is essential for understanding the emotional resonance and implications of the *Triunes of Displacement* installation, where the introduction of NeRFs and point cloud visualizations into the realm of collective memory presents a unique counterpoint to the challenges of cognitive dissonance the audience may feel and can help bridge the gap between conflicting narratives or interpretations of the past. For instance, a NeRF reconstruction of a Soviet monument in the Baltic states might seek to remove or to erase the narrative of occupation, but it would also allow individuals to explore and experience that

space from multiple perspectives, potentially reconciling disparate accounts or challenging preconceived notions about the relationship between the occupied and the occupier. While such volumetric visualizations can mitigate feelings of displacement, making the abstract concept of historical trauma more tangible and easier to digest, they also offer the possibility to begin addressing deep-seated anxieties passed down through generations, ultimately contributing to a more integrated and resilient society.

2.3. Place

Throughout human history, displacement has been a recurrent theme, almost a default condition, affecting numerous communities globally through forced migrations and mass movements caused by wars and environmental disasters, all of which leave lasting imprints on cultural memory [4] (Refugees, U.N.H.C.F., 2022). Events like war, economic migration, and environmental dislocation leave lasting markers on collective memory. In the case of Latvia, cultural memory and displacement have become a never-ending sore, enhanced and shaped by economic and political austerity, which serve as an ominous warning of the demise of the nation [5] (Sommers, J., & Woolfson, C., 2014).

To better understand the historical context of displacement events that are crucial for creating accurate and meaningful cognitive visualizations and reconstructions of historical spaces [6] (Beeckmans, L., 2022), emphasis must be placed on metaphorical immersive experiences channeled by those

Figure 2 NeRF rendering of a pastoral Latvian scene



who have been personally impacted by displacement and are witnesses to the dislocation process. To this end, the development of NeRFs and point cloud models echoes the symbolic significance of landscapes where the visual deconstruction of place provides insight into a community's gradual disconnection from belonging as an immersive and visceral testimony to foreboded events (Fig. 3).

The technical and emotive manifestations evident in *Triunes of Displacement* are designed to create an equilibrium of historical, ideological, and psychological viewpoints that promote a holistic experience for audiences. This is pivotal when trying to anticipate future events using history as a guide to facilitate an enhanced appreciation of cultural memories.

3. A Technical Analysis of Displacement & Memory

Through the amalgamation of photogrammetry and NeRF visual rendering, combined with affective narratological design, haunting music score, and temporal components, the authors of this text created the installation *Triunes of Displacement* to demonstrate the efficacy of their integrated approach. The framework established considers the audience's psychological response to objects of Latvian nostalgia, influencing emotional response. The interconnection of these cognitive, emotional and placial symbols supports the authors' intent to produce holistic visualizations that are representative, emotionally resonant, and technically impactful.

Figure 3 Still of a NeRF rendering of a Soviet building



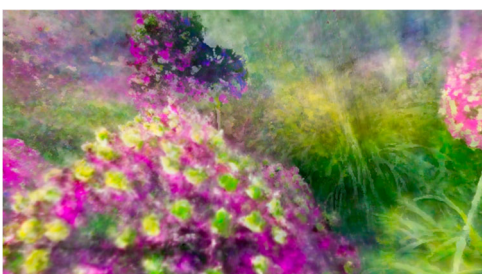
3.1. Photogrammetry and Structure-from-Motion

At the core of *Triunes of Displacement*, which was originally presented as a 5-channel video installation approximately 5:50 in length, are 3D scans depicting light, color, and movement, that portray the ephemeral nature of being. The use of slow motion throughout the piece accentuates the delicate and transient nature of the visual elements, promoting a sense of dislocation amid an atmosphere of clouded memories.

Because technology can serve as both a repository of truth and a potential source of distortion, NeRF and point cloud data can be used to verify or refute historical claims about the physical characteristics of places or objects, as well as mitigate the cognitive dissonance that can exacerbate psychological discomfort from contradictory beliefs or interpretations of the past (Fig. 3). This is relevant in the context of Latvian collective memory and historical trauma drawn from its agrarian feudal past; the eventual birth of the Latvian nation; guilt associated with Nazi collaboration during World War II; oppression under Soviet rule; and economic devastation following the International Monetary Fund's 2009 neoliberal policies. In combination, these shared experiences of cultural memory contribute to a fractured and dislocated sense of national identity.

Ultimately, the visual sequences created for the installation were carefully designed to evoke a sense of historical and cultural memory. For example, the inclusion of

Figure 4 Still of a NeRF rendering of flowers in the Latvian landscape, symbolic in its popular culture



symbolic elements such as flowers (Fig. 4), folk dancers, and Soviet buildings anchor the visual experience of the Latvian diaspora in specific cultural contexts, reinforcing the notion that place, whether real or virtual, is a powerful symbol of cultural memory and identity [8] (Nitavska, 2023).

This approach to the integration of technology in art opens new avenues for exploring complex themes and meaningfully engaging audiences. The use of NeRFs and point clouds in *Triunes of Displacement* highlights the ongoing role technology plays in contemporary art and presents artists with an opportunity to create experiences that are aesthetically unique, visually compelling and, ultimately, deeply meaningful (Fig. 5).

3.5 Auditory Components

Complementing the visual elements of the *Triunes* installation is a hauntingly monophonic musical score. As Ceplitis [11] observes in “The Curious Aspects of Audionarratology in Stereoscopic Cinematic VR,” sound plays a pivotal role in amplifying the immersive effects within virtual reality spaces. Along with the volumetric visualizations discussed in this text, the artwork's original score targets the deep emotional core of viewers, potentially evoking diasporic sensibilities through a binary narrative structure. The composition begins with a rather vibrant, complex, and bright textural element written in the key of F major and featuring a crisp staccato articulation and syncopated rhythms using vibraphone crescendos (Fig 6) that contribute to its lively, energetic mood. Gradually, however, the initial exuberance transitions into darker themes reminiscent



Figure 5
trees

of Philip Glass's minimalist motifs: what starts as an echo of childhood innocence swiftly morphs into waves of repetitive hints, generating tension and anticipation through Logic's tremolo effects. The shift to C#/Db3 minor (Fig 7) underscores the intensity and raw, persistent ache of perpetual displacement that one might endure on a difficult journey. This builds an emotional trajectory that becomes a lingering strain, simultaneously soothing and disquieting, mirroring the complex experiences of those grappling with cultural dislocation.

4. Ethical Considerations

Triunes of Displacement explores complex themes of displacement, fragility, and the precarious nature of perception using an innovative combination of visual, temporal, and auditory elements. The artwork consists of five screens projecting slow-motion NeRF and point cloud animations of objects and spaces meant to elicit feelings of nostalgia via photorealistic animations. The technical execution of the piece is designed to enhance its immersive and interactive nature, allowing viewers to be participants, rather than simple observers [7] (McCreary, 2018).

Neural radiance fields (NeRFs) and point clouds are powerful tools for evoking memory and nostalgia, which can, in many cases, be a positive experience. They also provide a rich contextual framework with which viewers can engage. However, capturing places and objects using these hyperreal photogrammetric processes might also reproduce many of the negative emotions associated with displacement. As a result, the authors would like to emphasize the importance of considering emotional complexities and ethical concerns, especially those of representation and inclusion, when utilizing these techniques in similar scenarios. Creating immersive cultural memory and displacement experiences that respect and accurately represent the complexities of stories that might be difficult to recount, or to be reminded of, is of utmost importance to the authors of this text.

5. Conclusion

The integration of historical and emotional narratives in "Triunes of Displacement" provides a cohesive representation of displacement. The installation, which weaves together cultural and historical symbols, creates a rich tapestry of autobiographical remembering. The approach outlined here represents experiences as trajectories within a high-



Figure 6



Figure 7

fidelity experiential space, defining a framework to convert visual data into dynamic cultural memory content and nostalgia experiences.

This case study is an example of deploying emerging algorithmic processes can lead to the successful expression and exploration of complex themes, including memory, emotion, and displacement. This is particularly poignant in the Latvian context, where collective memory encompasses a complex history of agrarian feudalism, collaboration with Nazi forces, Soviet oppression, and recent economic challenges, all contributing to a fractured national identity.

The study also succeeds in bridging the disciplines of computer science, time-based art and the social sciences, and by leveraging advanced visual and auditory techniques, the installation provides a powerful immersive experience that encourages viewers to reflect on the transient nature of being and the delicate fabric of memory. In the case of Latvia, it offers unique opportunities to bridge gaps between conflicting narratives, mitigate cognitive dissonance, and provide tangible representations of abstract concepts. Finally, the installation's complementary and monophonic score enhances the work's ability to mirror an emotional trajectory of displacement, from childhood innocence to the persistent ache of cultural dislocation.

The emotional and psychological impact of these processes is a testament to the power of emerging immersive technologies in an increasingly interconnected world, providing a means for societies like Latvia to address deep-seated anxieties and work towards a more integrated and resilient national identity. As collaborations between art and technology continue to expand into new spheres, works exploring experimental techniques will play an integral role in shaping the future of immersive experiences.

Disclosure of Interests

The authors have no competing interests to declare that are relevant to the content of this article.

References

1. Tu, P., Zhou, X., Wang, M., Yang, X., Peng, B., Chen, P., et al. (2024). NeRF2Points: Large-Scale Point Cloud Generation From Street Views' Radiance Field Optimization. CoRR, cs.CV, arXiv:2404.04875. <https://doi.org/10.48550/arXiv.2404.04875>
2. Nitavska, N. (2023). "Symbolic significance and cognitive dimension of the Latvian landscape." *Landscape Architecture & Art*, 22, 59-68. <https://doi.org/10.22616/j.landarchart.2023.22.06>
3. Milligan, M. J. (2003). "Displacement and Identity Discontinuity: The Role of Nostalgia in Establishing New Identity Categories." *Symbolic Interaction*, 26(3), 381-403. <https://doi.org/10.1525/si.2003.26.3.381>
4. Refugees, U.N.H.C.F. (2022). *People Forced to Flee*. Oxford University Press.
5. Sommers, J., & Woolfson, C. (Eds.). (2014). *The Contradictions of Austerity: The Socio-Economic Costs of the Neoliberal Baltic Model* (1st ed.). Routledge. <https://doi.org/10.4324/9781315812977>
6. Beeckmans, L., Gola, A., Singh, A., & Heynen, H. (2022). *Making Home(s) in Displacement*. Leuven University Press. Manning, J. R. (2021). Episodic Memory: Mental Time Travel or a Quantum "Memory Wave" Function?. *Psychological Review*. <https://doi.org/10.1037/rev0000283>
7. McCreary, A. (2018). "Hybrid Residues: Exploring experiences of displacement through active participation in art practice." *Memoirs: Hybrid Residues and Memories of Displacement*. <https://core.ac.uk/download/pdf/341768859.pdf>
8. Nitavska, N. (2023). "Symbolic significance and cognitive dimension of the Latvian landscape." *Landscape Architecture & Art*, 22, 59-68. <https://doi.org/10.22616/j.landarchart.2023.22.06>
9. Yang, G.-W., Zhou, W.-Y., Peng, H.-Y., Liang, D., Mu, T.-J., & Hu, S.-M. (2023). Recursive-NeRF: An Efficient and Dynamically Growing NeRF. *IEEE Transactions on Visualization and Computer Graphics*, 29(12), 5124–5136. <https://doi.org/10.1109/TVCG.2022.3204608>
10. Xue, H., & Woolley, M. (2009). Collective Memory and Nostalgia: A New Perspective on Affective Design Strategy for the Chinese Market.
11. Ceplitis, A. (2019). The Curious Aspects of Audionarratology in Stereoscopic Cinematic VR (Vol. 6, pp. 351–358). Presented at the 6th International Scientific Conference on Social Sciences and Arts SGEM 2019, Sofia: STEF92 Technology. <http://doi.org/10.5593/sgemsocial2019V/6.1/S16.041>