## Intermedia Motion Tracking in AR/VR – On Immersive Storytelling and Choreographic Patterns

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#### Abstract

This paper presents narrative concepts developed in the Immersive Media Lab projects use case Intermediate Motion Tracking in AR/VR. Its narration is set in an artistic virtual environment built upon the interaction of body, space, and music. A dancer performs inside a virtual space and uses her avatar to interact with space in order to perform the story in an experimental media installation. The relationship between body and space in general as well as body position, elasticity, speed, and rhythm in relation to the whole body in space is archived as a choreographic substrate in the form of a digital action track and transferred into artistic-experimental, immersive storytelling scenarios. We present an overview of the delimitation from traditional storytelling methods and the development of new narrative concepts.

Keywords: VR, Motion Tracking, Performance, Choreography, Art-Based Research, Webern, Storytelling

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## Introduction

Intermedia Motion Tracking in AR/VR (IMTA) is one of five use cases of the research project Immersive Media Lab (IML) conducted at the St. Pölten University of Applied Sciences (FHSTP) from 2019 to 2022. IML combines current technological expertise on Augmented and Virtual Reality with interdisciplinary research on immersive storytelling. The use case IMTA explores the storytelling potentials of VR spaces in conjunction with choreography and employs an art-based research approach. The FHSTP scientists were joined by dancer and choreographer Andrea Nagl and supported by composer Karl Heinz Essl during the use case.

IMTA relied on methods derived from artistic production processes. Idea generation, form generation, and form giving in terms of rhythm, movement, time, space, aesthetics, dramaturgy, and choreography. Those aspects were constantly in dialogue with current media technologies such as motion tracking & capture and real-time programming in the UNITY Game Engine (motion tracking & capture, real-time programming - UNITY Game Engine), and analysis evaluation.



Figure 1: IMTA Start Research Matrix. Markus Wintersberger, Marlen Jachek and Christian Munk

The research design featured clearly defined experiments combining art & technology with a strict set of rules (Fig 1.) over a period of 10 months. Each experimental component was precisely "observed" (digitally recorded) and analysed and formed an independent prototypical unit. In this transdisciplinary "laboratory", the complexity of the research could be narrowed down and the objective specified. The artistic-technological outline of the research project relied on an experimental-practical methodological approach. This also had an impact on the scientific investigation of new forms of representation. The discovery of aesthetic-visual artifacts inevitably led to new research perspectives providing a shift in the project's epistemological outline. The created materials, emerging from the classical-theoretical processing of the experiment's results, transcended to an independent, visual form of data processing. Those visual elements and their potentials for rearrangements are the visible outcome of the narrative potentials.

## Narration and Story in IMTA

In IMTA, the story serves as a content-related technological matrix, fed by set pieces of current digital motion capture tools in interaction with artistic specifications such as body, movement, time, space, and identity.

From the analysis of the tools - Rokoko Motion Suite (hardware and software) and UNITY (real-time visualisation) - prototypical movement analyses and technologically determined performance structures are derived in direct dialogue with the dancer Andrea Nagl. The motion tracking suit becomes a "costume", as it were, with a meaning beyond its purely technological use. The suit thus exerts a symbolic effect on the dancer herself, "colouring" the impression and perception of visitors viewing a physical performance, while at the same time communicating with the wirelessly connected hardware and software. From this real-time communication, the dancer's movement data is saved as XYZ coordinates in space, resulting in a time-space track. This track can be manipulated with real-time effects available in UNITY such as Pointcloud, Meshlayer, and Tim-Space-Effects. The temporal course, the choreography/story is available digitally as a time-space sculpture and can be visually designed as such or reassembled as a time-space information package and thus be interpreted as a composition that is independent of the real event. This provides at least 4 distinct dimensions of storytelling:



Figure 2: IMTA Rokoko Suite - Unity Experiment I

"Story" = real-time space movement & real-time manipulation "Story" = body performance track & space line drawing "Story" = XYZ volume & time-space sculpture "Story" = non-linear structure & variable composition



Figure 3: IMTA Rokoko Suite - Unity Experiment II

# **Contextual Narration and Time/Space Sculpturing**



Figure 4: IMTA Webern Rastern

Those four dimensions can be further employed in prototypical art productions for the purpose of a general discovery of knowledge and an aesthetic art & technology transfer, as can be seen in the concept and realization of *Webern Rastern*.

The research narrative already begins with the initial conception of the project vision that is made publicly visible via various social media channels such as Instagram and YouTube. The steps in the experimental research process lead to a concrete performance streamed live on the occasion of the 75th anniversary of Anton Webern's death - *Webern.Gedenken.Raster*. A recording of the stream can be found on the FhSPACEtv YouTube Channel. (fhSPACEtv 2020)

In this concrete performance, the insights gained in the course of the project flow together, visualise themselves in the form of an artistic dance performance and thus make the intensive research process conducted over 9 months publicly visible. Technology and science are not only treated as a theoretical matrix but are given a formal-linguistic extension through the interrelation with art, which serves a general comprehensibility in the sense of a transfer of knowledge = target group. The livestream performance via YouTube, designed as a "visual research insight", represents the "IMTA Use Case Research Report" as a public performance. The support of and cooperation with the university professor for electronic music and electroacoustics at the MDW Vienna and contemporary composer Karlheinz Essl, whose composition "*WebernUhrWerk. Algorithmic Music for Computer-Controlled Carillon 2005 - 2020.* Contemplating the anniversary of Anton Webern's death" formed the essential acoustic research contribution to this.

## **Choreographic Concept**

The choreographic art-based research Webern.Rauschen brings a crucial question into the IMTA research project as it generates an artistic necessity from the stringency of the content. This stringency makes it possible to research beyond mere technological experimentation. The IMTA research team, which is versed in and oriented towards media technology, can build on a choreographic substance elaborated by Andrea Nagl: the temporal/spatial movement choreography results from an intensive and well-founded preoccupation with Anton Webern's *String Quartet Op 28* (Essl 1991): intensive listening to the work, conversations with Karlheinz Essl, as well as the approach to music-compositional principles cultivated in many of Andrea Nagl's previous projects, among them Sequitur\_caleidoscopia, Sequitur\_caleidoscopia ext., and LamenToys.

This advances the research perspective beyond common clichés of spontaneous dance improvisation as well as its technological processing with regard to a mostly rather superficial and purely aesthetic-temporal interpretation. Only in the face of a complex, clearly defined common theoretical and artistic basis of the experiment can one of the guiding initial questions be answered: To what extent can specific movement quality and patterns as well as the liveliness and sensitivity of the choreographic expression of a dancer acting live in space and time be captured, transferred and transformed by means of current motion capture technologies? And further: How can they be expressed in a new but equivalent way, or with added value?

In a first step, the previous cornerstones of the choreographic research and discussion were brought into the research team - especially Anton Webern as a composer, the work *String Quartet Op 28*, principles such as series, primordial plant, and the B-A-C-H motif. Andrea

Nagl added graphic translations, transfers, associations, and interpretations of the material with regard to dance composition. This subsequently served as a common matrix for the technological and artistic research, analogous to the series from which everything emerges in Webern's work ("The series secures the context for me." (Essl p.107); "So this is the 'primordial plant' discussed the other day! - Always different and yet always the same! Wherever we cut the piece, the sequence of the series must always be ascertained. This is how the coherence is guaranteed." (Essl, p.108); "But this means that the whole quartet is based on nothing other than this particular sequence of four notes!" (Essl, p.112)

The associations with nature mentioned by Webern as an underlying code were inspiring for the further work, even though they were not immediately visible or even obvious on the surface. Yet they can offer a further common basis in the sense of an associative fog of thought. The essential narrative elements in the use case IMTA are listed again: rhythm, movement, space-time track, 2D - 3D form, architecture, and identity. With narrative forms and structures from experimental film, expanded cinema, and experimental-performative dramaturgies, a different narrative form is explored in combination with technologies that elude conventional narrative strands, such as motion tracking & capture, real-time visualisation and game engine programming, and elaborated by means of individual prototypical experiments. This possible other narrative form is incorporated in the video "Intermedia Motion Tracking in AR/VR". (fhSPACEtv 2020)



Figure 5: IMTA Rokoko Suite - Unity Experiment III

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Figure 6: IMTA Webern.Gedenken.Raster. Composition notes. Andrea Nagl

Excursus "Webern.Gedenken.Raster". Andrea Nagl

Narrative WITHOUT Purpose? Narrative = Purpose Narrative & Purpose = Target Group On 15 September 2020 from 17.00 to 18.30, the YouTube livestream performance (fhSPACEtv 2020) on the occasion of the 75th anniversary of Anton Webern's death took place. Live performative elements by Andrea Nagl were presented as a collage-like mix with digital virtual artefacts, structured by the grid of Karlheinz Essl's composition software *WebernUhrWerk*, which in turn pays homage to the work of Webern. Performance art, electronic music, digital media technologies, and research enter into a communicative field that attempts to decipher itself in this Webern grid on the occasion of the anniversary of Anton Webern's death.



Figure 7: IMTA Unity Real-Time Experiment II - Webern.Gedenken.Raster

Time	Content
17.00	WebernUhrWerk 1 (approx. 60 sec)
17.01	Webern.Noise live choreography based on the composition Op. 28 by Anton Webern without music - the dance is the music
17.15	WebernUhrWerk 2 (approx. 20 sec)
17.16	IMTA.Avatar.Webern I (Particles) + music Anton Webern (op. 28)
	Juilliard String Quartet, Pierre Boulez
17.30	WebernUhrWerk 3 (approx. 40 sec)
17.31	IMTA.Avatar.Webern II (green / memory traces) + sound Christian Munk
17.45	WebernUhrWerk 4 (approx. 20 sec)
17.46	Webern.Memory.Noise Glockner Noise Life Water (BACH) + sound Andrea Nagl
18.00	WebernUhrWerk 5 (approx. 60 sec)
18.01	IMTA.Avatar.Webern III (stick figure and room mix) + sound Christian Munk

#### Webern.Gedenken.Raster - Sequence of Events

18.15	WebernUhrWerk 6 (approx. 20 sec)
18.16	Webern.noise live choreography based on the composition Op. 28 by Anton Webern with music Anton Webern op. 28
18.30	WebernUhrWerk 7 (approx. 40 sec)
END	

Table 1: Time Schedule of Webern.Raster



Figure 8: IMTA Unity Real-Time Experiment III - Webern.Gedenken.Raster



Figure 9: IMTA Unity Real-Time Experiment IV - Webern.Gedenken.Raster

# Conclusion



Figure 10: IMTA Rokoko Unity Real-Time LAB. The research team at work

The essential narrative elements in the use case IMTA finally reemerged in new arrangements along the research matrix. Rhythm, movement, space-time Track, 2D - 3D form, architecture, and identity were able to unfold new relations and manifested themselves in new narrative forms that elude conventional narrative strands and can be further explored in the combination IMTA established with technologies such as motion tracking & capture, real-time visualisation, and game engine programming. IMTA elaborated on that by means of individual prototypical experiments. Those possible other narrative forms are incorporated into the video *Intermedia Motion Tracking in AR/VR (IMTA) - FIRST-PERSON* 

*WALKTHROUGH* (fhSPACEv 2020) and stored as a final dynamic research report on YouTube. They form the narrative pattern of the "plot".



Figure 11: IMTA Rokoko Unity Real-Time LAB. FIRST-PERSON WALKTHROUGH 2020

## References

- Essl, K. (1991). Das Synthese-Denken bei Anton Webern: Studien zur Musikauffassung des späten Webern unter besonderer Berücksichtigung seiner eigenen Analysen zu op. 28 und 30. H. Schneider.
- Nagl, Andrea (2020, February 02) : *Webern\_rauschen* https://andreanagl.wordpress.com/2020/02/29/webern\_rauschen/
- fhSPACEtv (2020) Intermedia Motion tracking in AR VR. FIRST-PERSON WALKTROUGH 2020 [video] Youtube. https://www.youtube.com/watch?v=u08IzjepVUE
- fhSPACEtv (2020) *Webern.Gedenken.Raster* [Video] YouTube https://www.youtube.com/watch?v=P4-0-E3Fi1w&t=2475s
- St. Pölten University of Applied Sciences: *Intermedia Motion Tracking in AR/VR*. retrieved 12 Dec. 2021 from: https://research.fhstp.ac.at/en/projects/immersive-media-lab/intermedia-motion-tracking-in-ar-vr-imta

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