

Awkward Consequence

Tomas Lorenzo, Tobias Klein, Christian Clark

School of Creative Media – City University of Hong Kong; Laboratorio de Medios – Universidad de la República

Hong Kong; Montevideo, Uruguay

tomas@laurenzo.net; office@kleintobias.com; christian@clark.com.uy

Abstract

This paper presents Awkward Consequence, a massive virtual reality performance that explores and expands the limits of audio-visual performances, offering alternative paths of exploration of the aesthetics of virtual reality. Using mobile phones and cardboard-like viewers, together with a centrally-controlled architecture, Awkward Consequence immerses its audience in a virtual journey that is simultaneously individual and shared. By joining the rich tradition of musical performance with virtual reality, the piece investigates the future role of virtual reality, while simultaneously celebrating the immense artistic richness of this new medium.

Keywords

Virtual Reality, Computer Music, Performance, Concert, Network, Mobile Phone.

Introduction

“Reality is becoming a stereo-reality. Just as with sounds you can make a difference between somber tones and clear tones, so there will be a concrete, actual reality and a virtual reality. From now on, humankind will have to act in two worlds at once. This opens up extraordinary possibilities, but at the same time we face the test of a tearing-up of the being, with awkward consequences.” Paul Virilio [1].

In this paper, we present Awkward Consequence (AC), a massive virtual reality performance that explores and expands the limits of audio-visual performances, offering alternative paths of exploration of the aesthetics of virtual reality.

AC consists of a musical performance where the audience is immersed in a music-driven virtual reality journey, where the music (composed for the performance) is performed in-situ by the artists. The performance, therefore, exists in what Virilio calls a stereo-reality, simultaneously unfolding as actual and virtual experiences, with each one allowing for different and complementary aesthetic explorations.

This coexistence in two different, often antagonistic, realities is central to the piece: with AC—like in traditional concerts—the experience is co-created by the simultaneous perception of the same stimuli by the audience. However, here the work is perceived from an immersive, isolated experience. The journey through the virtual reality (VR)

worlds is a private, personal experience, where the spectator is completely alone. However, the spectator knows that the individual experience is simultaneously experienced by all the attendees. An individual, yet shared experience.

In this duplication of reality, a new aesthetic experience emerges. New media art often requires making certain characteristics explicit, to allow the creation of new artistic languages. For example, although every artwork can be thought of as interactive [2], only with the creation of explicit interactive works, the *art of interaction* could begin to be explored.

AC not only explores the aesthetics of VR, but also makes explicit—and questions—some of the characteristics of public performances.

The piece was performed twice in Hong Kong in May of 2016. AC uses cardboard viewers and the attendees own mobile phones running our software. The first performance was hosted by ISEA 2016 [3], and the second was hosted by K11 [4].

Virtual narrative

“I wanted my body back” Myron Krueger, 1991 [5]

The recent increase in interest in Virtual Reality together with the popularisation of relatively affordable related technologies, have created a space of interest where companies and organisations fight for influence over this medium [6]. This influence should not be seen only in terms of market share, but also in terms of the definition of what the medium of VR is, what its aesthetic parameters and role within society are. Its “terms of usage and content” are being defined by the dominant forces in the industry [7]. The discussion of the implications of VR both in industry and academy tends to obviate this social and political dimension focusing instead on a “device-driven” definition of VR, that “fails to provide a conceptual framework”, and fails to provide methods for consumers to understand “the nature of virtual reality” [8].

Is in this context, we created a performance where the political dimension is present both in the insertion of an original aesthetic as well as in the explicit impact on the experience of the performance’s audience. AC’s aesthetic builds on the traditional graphic language of VR moving towards uncharted territories, questioning and systematically negating the basics parameters of this nascent language.

AC orchestration of the perceptual experience of the attendees showcases the narrative and behavioural power of

VR. By requiring the audience to surrender and immerse themselves in the performance's space, the asymmetries in power inherent to any massive medium in general, and to VR in particular, are revealed. The artwork is constructed from the exploration of the aesthetics of this relationship. Designing a VR experience implies creating a world and situating an observer in it. Camera-placement and world creation are, however, not new, for there are long cinematographic and theatrical traditions available. This generates a tendency to think of VR in relation to these previous practices, where the Platonic categories of "Diegesis" (directly addressing the audience), and "Mimesis", (addressing the audience through characters) are directly applicable [9].

VR, however, is able to escape the diegetic-mimetic dichotomy; artists are not verbally narrating, nor they are (only) deploying characters. Instead, a VR poet offers a computationally-backed meta-narrative. The narrative becomes implicit and emerges from the interaction between the participants and the virtual world behavioural and perceptual rules.

In AC we designed a sequence of worlds that starts offering an understandable environment to the audience, and then explicitly negates some aspects of the metaphorical world. The narrative unfolds then as a meta-narrative, inhabiting a meta-world that emerges from this aesthetic questioning of the environment's design.

If, as Bordwell states, "perspective is narrative" [10], AC's meta-narrative inhabits the construction of these autocratic scene-worlds, allowing the audience to reflect on the meta-aesthetics of the experience: an artwork that exists in the artistic discussion of its own medium.

"Perspective as narrative" refers not only to the technical ability needed for VR's *trump l'oeil*, but also to the narrative that emerges from the shared technological knowledge between artist and audience.

If "to see something as art requires something the eye cannot descry – an atmosphere of artistic theory, a knowledge of the history of art: an artworld" [11], new media art also requires a techno-world, where the consumption of the technological object is complemented with an understanding (by both audience and creator) of its environment and social roles.

If being an artist requires questioning the nature of art [12], technologically mediated artistic production also requires challenging what technology is, what its social roles and possibilities are.

Image as stage, place as narrative

AC's experience consists of a fifteen minutes' journey through a series of related scenes. As the performance plays, both in the actuality of the music played by the artists as well as in the reactive synchronisation of visuals and sound, we can explore a new reality that expands the idea on virtual scenography [13]. However, in difference to

early speculations on the idea of the augmentation of a performer via projection mapping or reactive visuals, as discussed by Jacquemin and Gagneré [14], AC augments the perception of the participant, expanding the limits of what is cognoscible and what is perceptible within the fictional universe.

The virtual environment is reactive and augmented—a stage without actors—suggesting a possible reversal of the actor/spectator relationship. Again: perspective is narrative, opening the possibility to enhance the theatrical where, "as a consequence, architectural forms built in cyberspace can respond to the viewer, encouraging provocative and illuminating interactions. In cyberspace, architecture becomes a form of poetry" [15].

The total immersion of virtual reality, draws us closer to the total art, the *Gesamtkunstwerk* and its relation between media throughout the past centuries. Predating Richard Wagner's articulation [16], the Rococo, in the 18th century also created exuberant, anarchic forms and wild ornaments (Figure 1). Notably, due to the technical ability to materialise the complexity designed by the artist being insufficient at the time, the most exuberantly designed elements can be found in the ornament prints of that time.

With conscious disregard of formal alignment and rules of constructed perspective, the *capriccios*, printed and distributed as an early form of advertisement, showed the possibilities of the Rococo (Figure 2), where the wilderness merges, and the foreground is distorted, blending with



the middle ground of the pictorial plane. Perspective as narrative.

Figure 1. Johann Michael Fischer, German architect of the interior works and integration of stucco and painting at the Abbey of Ottobeuren (1744). Photo Johannes Böckh & Thomas Mirtsch.

Grau, Punt, and Asberry [17], see this mixed-reality space as a "faux terrain", a space that exist simultaneously as a physical reality, and as a virtual quality of a perspectival constructed image plane.

Our work proposes a related discourse: the actual sound of the performance drives the behaviours in the virtual world. The audience is presented with a real object and a virtual causal relation, and this unfolding guides the journey



Figure 2. Johan Esaias Nilson, "Natura miracula" ca. 1770. The etching shows the confluence between natural and ornamental artefact, embedded in a continuum blending frame, foreground and middle ground. (© Museum of Applied Arts_MAK, Vienna).

Choreography as performance

AC exits in contradiction, a virtual journey and a physical static attendance.

The initial virtual scene consists of a wireframe landscape, fully reactive to the music and environmental sound. The scene, titled *The landscape* (Figure 3), adopts an early virtual reality aesthetic, reminiscent of cinematic experiments—such as the rendered wireframe surface of the film *Tron* (Steven Lisberger, 1982), or the contour map of a planet's surface in *Alien* (Ridley Scott, 1979)—where the audience already knows the metaphorical world representation.

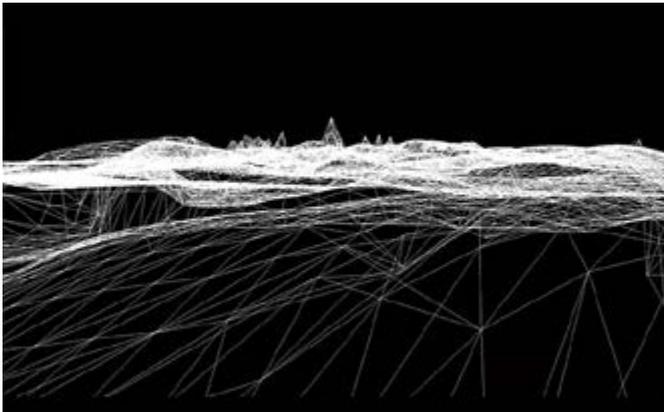


Figure 3. Rendering of the opening sequence of Awkward Consequence. (© authors)

The following scene presents a shift from the static camera position of the participant to a directional linear movement. *The tunnel* (figure 4), resembles a slow linear movement, reminiscent of the movie *2001: A Space Odyssey* (Stanley Kubrick, 1968). Reframing Kubrick's frequent symmetrical arrangements, this second stage is symmetric and

closely reassembles the final scene of time and space. Also similar to Kubrick's usage of early CGI effects to illustrate a passing of time, this scene uses illuminated platonic geometric elements that gradually increase in complexity through aggregation.

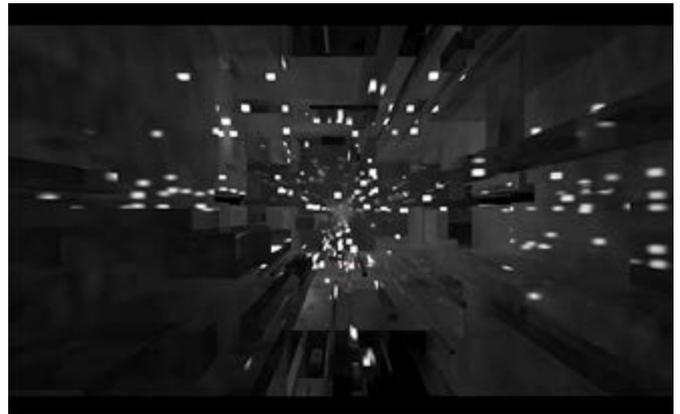


Figure 4. Rendering of the second sequential movement of Awkward Consequence. The Tunnel introduces a linear movement to the Virtual Reality performance (© authors).

The first two scenes allowed a certain degree of openness. *The landscape's* sky is black and empty, *The tunnel* allowed to look back creating a sensation of spatial and temporal continuity.

What follows is the first pre-rendered scene. *The room* (Figure 5), a closed, pulsating, and rotating environment where up or down, left or right lose relevance. No horizon is visible. Instead, the space is defined by a complex ornamentation and the dissolving of structured space and wireframe contours. The journey has arrived in a manmade environment, crafted with ornaments, reminiscent of gothic architecture.



Figure 5. Rendering of the third movement of Awkward Consequence. The Room is a fully closed environment. The participant has no horizon; landmark or similar known orientation help and is immersed in the performance. (© authors)

Reacting to a sudden change in the music, the journey is abruptly interrupted by digitally intervened bi-dimensional footage of Hong Kong (Figure 6). After losing a frame of reference in *The room*, here the ultimate treason of VR is

fulfilled: all illusion of three-dimensionality is discarded, the audience loses the control of the point-of-view and is rendered immobile, taken into a figurative trip through the city. Contradiction arises anew: the footage moves through a city were the actual audience is still.

Although AC is not thought of as a location-specific artwork. The performances in Hong Kong (2016), allowed for this reflection of the role that place plays in human realm. What does it mean to *be* somewhere?

The already-present dichotomies between performance and world, shared and individual experiences are here maximised. A climax of hyper-real bi-dimensional representation operates as a negation of the stereo reality, of both the virtual and actual worlds. Representation becomes figurative and abstract. AC reminds the audience that the construction of place is always arbitrary, places don't exist until we grant them existence. Place is narrative.



Figure 6. All footage is filmed in Hong Kong. The participant is confronted with the location clash of his/her position in Hong Kong in a VR environment. Even more so, the 2D real film footage is questioning the otherwise iteratively intensify visual narration. (© authors)

From this point, in reverse order and with significant alterations, AC retraces the constructs visited. From *The room*, through *The tunnel*, the participant arrives at a new open landscape. *The sea* (Figure 7) is the second and last pre-rendered space. An unapologetic abstract hyperrealism that celebrates the possibilities of the medium, while reminding us of its inherent strangeness. With a duration of three minutes, it shows a waving sea, materialised as a thick wireframe carpet of colliding geometries.

Formally quoting Sugimoto Hiroshi's cycle of seascapes [18], a blend between the sky and sea into an almost whiteout space that retains the spatial qualities, is fundamental in the design of the environment. Yet, where Sugimoto inspires calmness, *The sea* also references works of Peter Schlör: disturbing, wild, and contrasted photography [19]. These two artists provide the formal framework for the environment.

The sea is also the only scene with other inhabitants: abstract creatures that ignore the audience, drifting in the dark environment. Peaceful, yet distant. Alive, yet alien. Actors yet scenography. A metaphorical representation of a stereo reality from within.

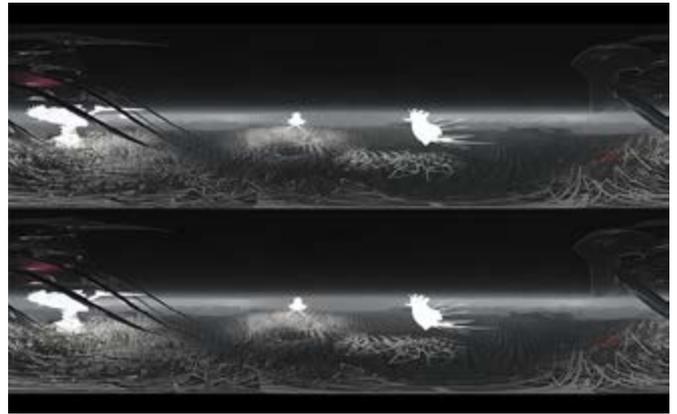


Figure 7. Raw data before being mapped in Unity 3D to two spherical environments. 360 spherical renderings of the sea environment upper and lower mapping. (© authors)

Awkward Consequence

The development of AC's hardware and software infrastructure faced several technical complexities, particularly regarding the integration of known solutions in a computationally heterogeneous environment.

A client-server architecture was adopted, with client-hosted data. Clients were implemented using Unity3D 5.4 [20], together with Google's Cardboard SDK [21].

Unity3D's straightforward asset pipeline and importing tools greatly streamlined the development process.

To provide a consistent visual experience, our tests shows that a minimum of 60 FPS was necessary. The following rules allowed us to achieve it in the heterogeneous computing park of AC:

- Not using full frame shaders.
- Never rendering more than 16.000 vertices (this required simpler 3D models, and to load and unload geometry in execution time).
- Only using triangles as primitives (mobile graphics chipsets are optimized for triangles).
- Using a maximum of three light sources per scene.
- Preferring alpha blending and baked lighting over new light sources.
- Using small textures, and texture atlases (AC uses a max texture size of 1024 by 1024 RGBA pixels).

Given the substantially different processing power and rendering capabilities of the audience's phones, to ensure the required framerate, the two most complex scenes—mostly in the form of high polygon count, complex lighting and material properties requiring—were pre-rendered and played as stereoscopic 360 videos (Figure 8).

To reproduce these videos, we used a third-party video player solution [22] that allowed using Android's and iOS's native video players (Unity3D's native video player has serious performance limitations), offering the video to Unity3D as a new equirectangular texture that was mapped onto inward pointing spheres surrounding each eye (Figure 8).

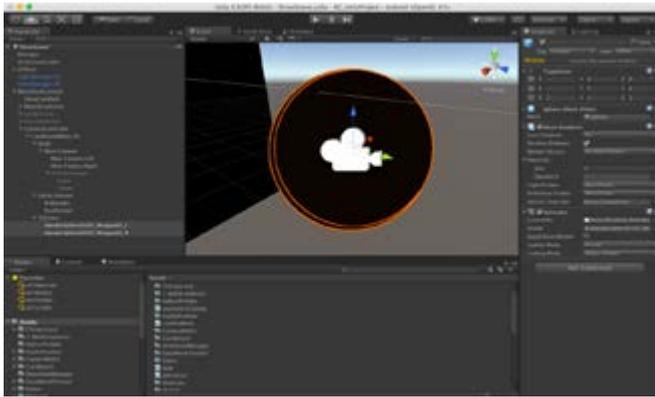


Figure 8 3D video rig with two spheres - one on each camera, creating a parallax effect (© authors)

Bi-dimensional video only required a fixed frustum aligned with the user’s point of view (Figure 9). To achieve smooth video reproduction, the combination of codec and resolution depicted in Table 1 was followed.

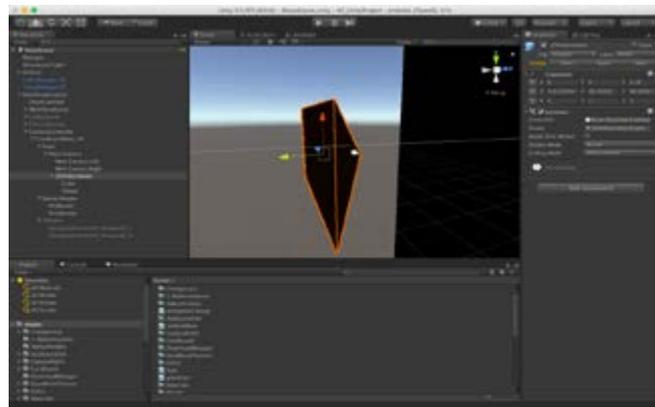


Figure 9 2D video rig - a single frustum aligned with the main cameras using Unity3D. (© authors)

All video content was stored as a single file that was reproduced following AC’s script. This video weights 1.2 Gb making it impossible to store it within the application. A custom Unity3D plugin was implemented that reliably downloaded the video from an Amazon S3 server [23].

OS	Codec	Resolution	FPS	Avg. Bit Rate
Android	h.264 (Base-line, level 4.2)	1920 x 1080 (3840 x 2160 on high end devices)	30	20-30 Mbps

iOS	h.264 (Base-line, level 3.1)	1920×1080	30	10-14 Mbps
-----	------------------------------	-----------	----	------------

Table 1 – Codec and resolution criteria for video files used in Awkward Consequence.

Wireless synchronisation between the server and all the clients was implemented using OSC messages over UDP in a WLAN. Within this architecture, the server coordinated the show. It emitted a periodic (heartbeat) message and controlled specific real-time parameters sending orders to all the connected clients.

Given that IP broadcasting was unavailable due to mobile phones ignoring broadcast messages to save power, AC implements a unicast broadcast-by-subscription protocol, where one component [24] acts as a client register and message relay.

Epilogue

Robert Barker patented the panorama in 1789. In effect, for several centuries, “extraordinary efforts were made to produce maximum illusion with the technical means at hand” [25].

The contested space of contemporary virtual reality, however, for the first time presents a problem that is much less technological than artistic and socio-political. The reasons behind massive adoption depend not on the ability to render convincing illusions, but on the economic and social role that the VR as a medium will play.

In this context, there is an urgent need for artistic exploration of this new medium. Awkward Consequence aims at generating some space for this exploration: via the creation of a compelling aesthetic experience, we propose that the search for alternative paths is not only urgent but also attainable.

Even if it’s true that new media art is always somewhat subversive—it systematically attempts to escape from the role of passive consumer—virtual reality art has not been able to reach a significant audience.

By joining the rich tradition of musical performance with VR, our work generated spaces of reflexion, while simultaneously celebrating the immense artistic richness of this new medium.

Acknowledgments

Awkward Consequence was possible thanks to the generous help of our sponsors and collaborators: K11, Microwave, Videotage, School of Creative Media, ISEA2016, Tatjana Kudinova, Alex Tobler and Federico Linn.

References

[1] Oliveira, C. (1996). Global Algorithm 1.7: The Silence of the Lambs: Paul Virilio in Conversation. Journal

- CTheory. Retrieved from <http://journals.uvic.ca/index.php/ctheory/article/view/14317/5093>
- [2] Duchamp, M. (1957). *The Creative Act*.
- [3] ISEA 2016. Conference's webpage: <http://isea2016.isea-international.org/>
- [4] K11. Company's webpage: <http://hk.k11.com/>
- [5] Krueger, M. W. (1991). *What Should You Wear to an Artificial Reality?* Proceedings from International Conference on Artificial Reality and Telexistence, Tokyo, Japan.
- [6] Ecenbarger, C. (2015). *Are we still in the game? Constructing consumer virtual reality through the lens of artist and industry*. Master of Arts. Ball State University, Muncie, Indiana.
- [7] Law, J. (1991). *A sociology of monsters: Essays on power, technology and domination*. 171. Retrieved from <http://library.wur.nl/WebQuery/clc/1900885>
- [8] Steuer, J. (1992). *Defining virtual reality: Dimensions determining telepresence*. *Journal of communication*, 42(4), 73-93. doi:10.1111/j.1460-2466.1992.tb00812.x
- [9] Aylett, R., & Louchart, S. (2003). *Towards a narrative theory of virtual reality*. *Virtual Reality*, 7(1), 2-9. Retrieved from <http://link.springer.com/article/10.1007/s10055-003-0114-9>
- [10] Bordwell, D. (2013). *Narration in the fiction film*. Retrieved from <http://www.hi.zpok.hu/filmtext/Egyeb/Bordwell-Mimetic.pdf>
- [11] Hershberger, E. (2006). *Photography as readymade art*. Texas Tech University, South Plains.
- [12] Kosuth, J., Guercio, G., and Lyotard, J.-F. 1991 *Art after philosophy and after: collected writings, 1966-1990*. MIT Press Cambridge, Mass.
- [13] M. Reaney, "Virtual reality and the theatre: immersion in virtual worlds". *Digital Creativity*, 10(3), pp.183-188. (1999)
- [14] C. Jacquemin, and G. Gagneré (2007), "Revisiting the layer/mask paradigm for augmented scenery". *International Journal of Performance Arts and Digital Media*, 2(3), pp.237-257.
- [15] Ken Jordan, Randall Packer Ph.D. (2001), "Multimedia: From Wagner to Virtual Reality".
- [16] R. Wagner (1849), "The Art-work of the Future".
- [17] O. Grau, M. Punt, and K.R. Asberry (1999), *The Panorama: History of a Mass Medium* by Stephan Oettermann (review). *Leonardo*, 32(2), pp.143-144.
- [18] H. Sugimoto (1988). *Photographs by Hiroshi Sugimoto: Dioramas, Theaters, Seascapes*. New York/Tokyo/Kyoto: Sonnabend Gallery & Sagacho Exhibit Space.
- [19] P. Schlorr (2012), *Black & Wide*. Gosling Nabakowski. Städtische Galerie Neunkirchen.
- [20] Unity 3D. Company's webpage: <https://unity3d.com/>
- [21] Google Cardboard. Product's webpage: <https://vr.google.com/cardboard/>
- [22] Easy Movie Texture. Unity Plugin. Asset store url: <https://www.assetstore.unity3d.com/en/#!/content/10032>
- [23] Unity Mobile Downloader. Git repository url: https://github.com/tenderbolton/AWK_UnityMobileDownload
- [24] AWK_Comm component. Git repository url: https://github.com/tenderbolton/AWK_Comm
- [25] O. Grau (2002), *Virtual Art, from illusion to immersion*. pp. 5 ISBN: 9780262072410
- [26] K11. Company's webpage: <http://hk.k11.com/>
- [27] Microwave. Festival's webpage: <http://www.microwavefest.net/festival2016/>
- [28] Videotape. Organization's webpage: <http://videotape.org.hk/web/>
- [29] School of Creative Media. School's webpage: <http://www.cityu.edu.hk/scm/>
- [30] ISEA 2016. Conference's webpage: <http://isea2016.isea-international.org/>
- [31] Tatjana Kudinova. Artist's webpage: <http://tkudinova.com/>

Author(s) Biography(ies)

Tomas Lorenzo, PhD is an artist, computer scientist, and academic working with both physical and digital media exploring the artistic construction of meaning and its relation with power and politics. Lorenzo's production spans across different practices, including installation, interactive art, music, live cinema, and digital lutherie. His artworks and performances have been shown globally. He is Assistant Professor at the School of Creative Media of the City University of Hong Kong. He has published mainly in the areas of New Media Art, and HCI.

Tobias Klein works in the fields of Architecture, Art, Design and interactive Media Installation. His work generates a syncretism of contemporary CAD/CAM technologies with site and culturally specific design narratives, intuitive non-linear design processes, and historical cultural references. Before joining City University of Hong Kong in the role as interdisciplinary Assistant Professor in the School of Creative Media and the architectural department, he was employed at the Architectural Association (2008-2014) and the Royal College of Art, (2007-2010), in both cases in the postgraduate level. The resulting works of his studio are exhibited internationally with examples being in the collection of the Antwerp Fashion Museum, the London Science Museum, the V&A, the Bellevue Arts Museum, Museum of Moscow and Vancouver. He is lecturing and published internationally with most recent articles focusing on the translation from craftsmanship to digital manufacturing.

Christian Clark is a computer engineer working on new media art, interaction design, aesthetics, and interaction in public settings. Based in Uruguay, he is a member of Bondi, an interaction design collective, as well as Assistant Professor at the Laboratorio de Medios, Facultad de Ingeniería, Universidad de la República.

Clark, who holds a MSc in Computer Science, currently directs Shaman, a software development studio.