Fulldome Immersive Modalities and Materiality: Toward A Poetics of the Firmament

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Dedicated to the late Dr. Millie Young (1966c.-2023), whose scholarship on fulldome films we cite, and whose friendship was delightful.

ABSTRACT

The fulldome projections at the Exploratório's Hemispherium in Coimbra, as part of the Electronic Literature Organization's (ELO) conference, highlighted the social-technology of fulldome projections and a new genre of e-lit. The examples presented addressed the issues of the conference specifically: interconnected global climate and migration flows and crises; animal perspectives on human exploitation; challenge of sign language systems; and Portuguese language and literature. These examples also allude to a pre-history of the dome modality from ancient buildings to church domes to expanded cinema's movie-dromes. Analogous to hypertext which lead to early e-lit, planetariums' domes function as a new mode and communal space for e-lit and knowledge production. The essay concludes with a discussion about teaching fulldome productions and a proposal of a poetics of the firmament; the fulldome can create immersive visualizations and soundscapes of e-poetry, stories, data, and more at every college and university.

KEYWORDS

fulldome, climate change, migration, hypertext

RESUMO

As projeções fulldome no Hemisfério do Exploratório de Coimbra, no âmbito da conferência da Electronic Literature Organization (ELO) destacaram as projeções fulldome como uma tecnologia social e um novo género de e-lit. Os exemplos apresentados abordaram especificamente as questões da conferência: clima global e fluxos e crises migratórias; perspectivas animais da exploração humana; o desafio colocado a sistemas de linguagem de sinais e língua e literatura portuguesas. Esses exemplos também aludem a uma pré-história da modalidade de cúpula, desde edifícios antigos até cúpulas de igrejas e cinemas expandidos. Análogo ao hipertexto que conduziu às primeiras obras de e-lit, as cúpulas dos planetários funcionam como um novo modo e espaço comunitário para a produção de conhecimento e-lit. O ensaio termina com uma discussão sobre o ensino de produções fulldome e uma discussão sobre o ensino de produções fulldome, bem com uma proposta de uma poética do firmamento. O fulldome pode criar visualizações imersivas e paisagens sonoras de e-poesia, histórias, dados e muito mais em contexto universitário.

PALAVRAS-CHAVE

fulldome, mudanças climáticas, migração, hipertexto

I n July 2023, our team curated a series of fulldome projections at Coimbra Exploratorio's Hemispherium as part of the Electronic Literature Organization's (ELO) conference and Media Festival. Our argument elaborated here is twofold: first, the specific technology of fulldome projections moves a usually socially isolating experience of immersive media into a shared public space; second, besides the social and technical consequences of its modality, the fulldome form allows for a new genre of visual e-poetry and e-lit that hopes to use a spherical or global mode to illuminate massively interconnected narratives as Saper and Tomlinson demonstrated in their dome film *CoDomeDigo* discussed below. This essay presents a series of examples of e-storytelling and e-poetry around the themes and motifs of interconnected global climate and migration flows, non-human perspectives of fauna and flora, and the contested hegemony of sign language systems that are heightened in the immersive fulldome space.

In our exhibition at ELO, our fulldome screening and discussion explored this emerging sub-field of the larger and well-established immersive electronic literature (Daut, 2020) and subtly alluded to a history of this modality in uses by artists and visual poets; we also highlighted the material poetic potential of this modality and, because of the context of the presentation in Coimbra and later for this publication, we included examples of projects built around Portuguese language and literature. As our explanation and condensed history makes clear in this essay, fulldome shows engage audiences in communal and public ways to experience immersive media without donning VR headsets. This situation, and our modest demonstration, suggests a poetics suitable to this modality as it takes fuller advantage of electronic literatures' 4-D possibilities; a future essay by Saper and Tomlinson will explore Computer Assisted Virtual Environments (CAVEs) as a parallel technology connected to "animage" (Gaudreault, 2015). While there are infrastructural challenges and opportunities for this emerging genre of fulldome poetics, the primary technological affordances (Norman, 1988: 11) in planetarium dome spaces that encouraged the recent blossoming of interest was a switch to digital projection systems that handle digital video with manageable file sizes, instead of the limits of pre-programmed star-ball systems and occasional laser light shows previously shown in planetarium domes. In terms of the impact of this small change,

one can consider digital projection analogous to hypertext code on personal computers that allowed for a similar emergence of electronic systems to function as sketch and writing instruments on a wide scale instead of only for science and technological uses in planetariums or for big data.

Just as there were some who explored computer poetry and e-lit before these technological and material developments, there were earlier experimenters, in the 1960s through the 1980s, using fulldome modalities in "expanded cinema," a term coined by Stan VanDerBeek to describe his own experiments with dome projections. Those earlier experiments, usually discussed in terms of experimental film and media making, now function as the precursors of the contemporary emergence of e-lit and media arts fulldome. These influential artists like Jordan Belson, Henry Jacobs, Stan VanDerBeek, and the Experiments in Art and Technology (E.A.T.) group experimented with dome projections. VanDerBeek designed and built a movie-drome in the shape of a dome; audiences would crawl inside and look up at the ceiling. Then, three or four 16-millimeter film projectors would show abstract and disconnected images on the inside of the movie-drome. These were psychedelic experiences and are now vaunted as foundational, with retrospectives of VanDerBeek's works exhibited at major museums, including the Museum of Modern Art, New York, with a new version of the movie-drome, 35 years after his death and 50 years since he started experimenting with fulldome projections.[1]

During the same time when VanDerBeek was experimenting with fulldome projections and with proto-electronic tablets, and in the same context of innovators in early computer art and expanded cinema, Larry Cuba made *Two Space* (1979, 8 minutes), which we showed in Coimbra. We explained that Cuba's film used two dimensional patterns, like the tile patterns of Islamic temples, generated by performing a set of symmetry operations (translations, rotations, and reflections) upon a basic figure or tile. Rendered in stark black and white, the patterns produce optical illusions and moiré effect of figure-ground reversal and afterimages of color. Gamelan music from the classical tradition of Java adds to the mesmerizing effect. Cuba was one of the early electronic media makers. Cuba envisioned it as an immersive piece when he originally made the film in 1979, and only later did he convert its format to show in a dome. Cuba had only exhibited the piece twice as a fulldome projection before the screening in Coimbra, and one of those screenings was at another fulldome screening curated and

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1   See for example, Stan VanDerBeek, *Movie-Drome (*1964–65)*,* MoMA, NY collection online. Accessed October 18, 2023. https://www.moma.org/collection/works/273553?artist_id=32424&page=1&sov_referrer=artist

introduced by our team's principal investigator at the Society for Animation Studies conference in June of 2023.

Expanded interest in arts and cultural programming for fulldome spaces, and the interdisciplinary collaborations those involve, beyond astronomy and science-focused planetarium shows, has encouraged a handful of non-exclusively-science fulldome venues, like the SAT (Société des arts technologiques) in Montreal, Canada, The Market Hall Immersive Dome in Plymouth, England, and the CULTVR Lab in Cardiff, Wales. International fulldome festivals are emerging, and groups and sites like IMERSA, Fulldome Database, and the Fulldome Creative Network connect creators, distributors, and fulldome spaces (IMERSA, 2023). Fulldome Creative Network founder, artist and researcher Michaela French, uses fulldome media to illuminate and visualize complicated global issues (French, 2022). Our exhibition sought initially to look at these wider issues for the entire program to fit with an earlier iteration of the ELO conference's theme (*storms,* in terms of environmental and human rights issues), and later, when the theme changed we still included excerpts from Michaela French's fulldome work and sought to screen fulldome media that explore issues of climate change as well as language, interactivity, narrative, and dome projection as a form of electronic literature. *Climate Crimes***,** by Michaela French & Adrian Lahoud (2019, 5-minute excerpt from a 12-minute film), explores the complex relationship between global air pollution, climate change and human migration. This immersive fulldome film investigates how anthropogenic aerosols and other atmospheric particles originating in the wealthy nations of the global north, Europe, USA, China, and others, impact global climate systems and contribute to the desertification and migration in the Sahel region of north Africa. The story demands a way to portray these global flows, and only the fulldome can portray this phenomenon accurately: it is a complicated system of flows of people migrating, climate changing, particles flowing, and the interconnected aspects of these seemingly separate systems that needs an animated graphic visualization in a hemispherical projection. It is also a narrative about climate justice and migration told with global maps, soundscapes, and abstractions of flows.

In the first two decades of the twentieth century, Modernists, like the Bauhaus artists Walter Gropius, Wassily Kandinsky and Paul Klee, were regular visitors at the Zeiss Planetarium in Jena, Germany. The modern artistic influence can be seen in the investigations by many of the artists we showcased both in the Coimbra screening, and in the earlier, June 2023 Society for Animation Studies screening we curated in Glassboro, New Jersey. There, our program included Millie Young's *Elephant Elephant Elephant* (2023, 7 minutes)*,* a hand-drawn animated fulldome film that begins by turning the dome into a big-top circus tent, where performances by

bipedal anthropomorphic cartoon elephants the filmmaker calls "elefunks" entertain the audience with silly and impossible antics. Young suggests using a painterly aesthetic, explicitly reminiscent of Kandinsky's style, and a focus on elephants in her Bangkok, Thailand-based, Silpakorn University, opens the literary and aesthetic possibilities of this new modality. With composited 2D drawn elements collaged in the 3D dome space, the aesthetic reveals the animator's hand-drawn style, which shifts mid-way to realistically drafted elephants, rocking and pacing with the stereotypic behaviors of caged wild animals. At the end, the elephants move at speed, circling the audience and eventually moving off. Young's quest in this project is summed up in the title to a paper she presented at the 2020 Confia Conference: "An experiment in putting an ardent hand-crafted 2D animator into the heady dimension of the non-linear world of 360º and seeing what floats" (2020b). Questions move across the dome as text, asking viewers, "have you ever seen an elephant?" (Young, 2020a). As a narrative/essay fulldome film, the style of presentation is different from the typical VR video game, and the poetic and literary aspects suggest an entirely different use of fulldome projections and VR away from realism and toward an auteurist approach to media-making. Young explains in her dissertation that,

> The idea of telling tales in 360º appears to offer enormous possibilities ... The immersive experiences that are often commercially driven by the software developers tend their focus of attention towards achieving a high degree of technical competency. The drive is often skewed toward an aesthetic of realism or hyper-realistic fantasy and away from the diverse potentials that traditional illustration, storytelling, ... where little research has been conducted to establish a technology-independent principle for 360º creative storytelling. (Young, 2020: 4)

Other contemporary media included in our exhibition look to visual storytellers among influential painterly styles. Among 19th century storytellers and artists, creating immersive visual experiences through painting is famously attributed to Claude Monet, whose water lilies paintings, *Nymphéas* (Water Lilies) at Musée de l'Orangerie, were meant to surround viewers completely and immerse them in the midst of the artist's Giverny garden. Alluding explicitly to Monet's goals, we presented a 3-minute excerpt from Lynn Tomlinson's fulldome work in progress, *Reverie de Giverny***.** We stroll with the artist through his gardens as Monet finds inspiration for his immersive water lilies paintings. Tomlinson began the project just before the COVID-19 pandemic sent people into isolation, and to complete it in 2020, it became necessary to convert the format to a 360° VR video, viewable with goggles or by scrolling as the video plays. After the pandemic eased, Tomlinson began converting the project back to

its original format for fulldome. Many of the effects work best in the dome, like Monet strolling on the horizon, or Monet's hand reaching down from above, seemingly into the audience, to grasp a plant under water. It puts the audience underwater looking up from the perspective of the fish and flora, including the water lilies, thus immersing the viewers in the scene. The film tells a story about the earlier well-known effort at immersive storytelling from the perspective of the object of those stories: the pond, plants, and setting.

IMAX pioneer and director Ben Shedd initiated a project with a class at the Institute of American Indian Arts [IAIA] in Santa Fe, Mexico, a school dedicated to the spirit and vision of Native American and Alaska Native peoples. The fulldome project, *60-50 IAIA*, involved IAIA students in a "Spherical Filmmaking" course Spring 2022 creating a short presentation that celebrated the 60th Anniversary of the IAIA and the 50th Anniversary of the Museum of Contemporary Native Arts also in Santa Fe, Mexico. This work begins with a circle that starts to rotate into a continuous flow of images and portrays a circle across the Atlantic Ocean, an inquiry into the cultural similarities and differences between what earlier generations in the 19th and 20th century Americas called 'the Old World' and 'the New World'. At the same time, it is an exploration of 'old media' and 'new media', emphasizing the interrelation between both and creating yet another circle. The spherical logo hopes to suggest an indigenous perspective on new and old media, and on new and old-world cultures.

Another class project about an artistic approach to environmental issues, *Aqua Dome*, a collaborative animated dome-film produced in a course taught by Lynn Tomlinson, involved working with over 150 collaborators, including students in multiple classes and community members, across disciplines and age groups. *Aqua Dome* combines mixed-media stop-motion animation and animated kaleidoscopic collage video projections with an immersive soundscape in four movements.

Another project produced during a Towson University fulldome production courses taught by Lynn Tomlinson was *Ignite!*, a collaboration with Diana Saez and her choir students (2023, 3 minutes) in which a live choir improvised their singing following the visual images projected in the dome. In the screenings away from their production lab, the singing and sounds were pre-recorded. Sound and language are a surprisingly crucial aspect of these visually immersive presentations.

Saravá by the Berlin-based Brazilian-born media maker, Pedro Rodolpho Ramos (2021, 16 minutes) is an immersive audiovisual composition about how empathic gestures can rise from cultural syncretism, exploring language and comprehension as objects of artistic research. We showed only a 5-minute excerpt. Inspired by the transformation of language through

migration and cultural exchange, *Saravá* is a journey through meditative environments made of field recordings, vocal sounds, and visual music. In introducing the materiality of a modality, it is useful to understand how and why the term fulldome describes not only the spherical visual moving media, but also the multi-channel surround sound that creates a visceral and collective immersive experience. *Saravá* often uses a provocative soundtrack with multilingual voices speaking in ways in which the audience hears the sound as language-like but are unable to understand what is being said. The screen is often mostly black helping the audience appreciate the immersive sound-track, as if overhearing a crowd of multilingual speakers moving around you. In Coimbra, one could hear bits of Portuguese mixing with German and a few almost-English words.

We included *CoDomeDigo* by Lynn Tomlinson and Craig Saper (2023, 3-minutes) in Coimbra as a fulldome adaptation and interpretation of a concrete poem, "CODIGO," by the Brazilian poet, translator, and pioneer of visual poetry, Augusto de Campos. The soundtrack of the presentation included overlapping voice-overs talking about the poem and about this particular spherical adaptation. One of the best-known concrete poems, "CODIGO" looks at first like a series of concentric circles in the fulldome projection. Some of the circles are incomplete, some resemble stylized letters of the alphabet— a C, a G, an O, a D, an I — and the overall pattern makes the individual parts appear, at first glance, as one single image. Because of the moiré effect, that visual vibration created by the concentric circles, it is difficult, at first, to see which circles are complete and which are not. The whole simply looks like a logo–which is part of the theme of that poem. With the projection taking apart each part of the circular poem and lining up the parts one sees rhymes, portmanteau words, embedded words, and more, appear because of a visual layout that stresses these linguistic relationships. From these poetic tensions, semantic relationships appear as well. For example, we see embedded in this circular logic the word Código, the Portuguese word for code, as in zip code, and the English word God appears toward the center of this image of logo-centrism. The English word "I" appears at the center of the eye-shaped image, and the word "digo" ["I say"] appears as well. In its concreteness, the fulldome projection expands and recombines the letters. Then the English word "God" floats briefly at the crown of the dome. As the audience seems to float up through the concentric circles, this poem seems to mock a literary tradition that privileges a poem of many lines.

This poem has an all-at-once development similar to a neon sign or billboard on the highway which the fulldome projection reinforces, turning it into an animated space surrounding the audience. The poem resembles a kind of poem-as-advertisement, and now poem-as-ride. It shows that the God

of our modernity is the sign systems and codes we use as we are enveloped in the sign system of this poem during an immersive experience. The God of the modern, multicultural urban world does not float in the clouds, it sits at the center of the semiotic codes we make, and in the fulldome we almost feel like we are floating up into the letters. Through its concrete and fulldome poetics, the logo also functions as a visual poem with a conceptual coding of contemporary culture. Because of its foundational importance, many artists and poets have translated and adapted "CODIGO" into many forms. In this translation, the fulldome version illuminates aspects of the poem, celestially immersing the audience, positioning us, and addressing us. In this *CoDomeDigo*'s effect now becomes visceral and 4-dimensional as we feel drawn up into the code itself, into the semiotic God's chapel-like dome as if in an amusement park ride that supersedes God with tracking codes.

Global Reading Supplement (2023, 3 minutes), a second collaboration between Craig Saper and Lynn Tomlinson, reimagines the purpose of printed-on paper and bound texts. The projection has ribbons of text that visualize what Saper calls "spherical knowledge design," that allows writers to explore new layout and design of information and, by extension, a different reading experience; just as the multiplicity of perspectives made possible by cameras changed text layout, the new virtual shape and space of information, changes the possibilities of the page and spatialized information. Instead of reading this essay as an individual text alone, it can be read through its design in relation to, or in an assemblage with, other apparatuses of reading like bookshelves, libraries, archives, binderies, globes, and the virtual space of information in this fulldome projection.

What Saper calls a "fulldome-essay" suggests instructions for an experiment with reading. The fulldome project translates the qualities of the printed essay into an immersive move through texts. The layout of the page, and the entire regime of the flat-page interface, would change as we begin to think of information in depth, distance, and spatial relationships all at once and all around the readers. In a spherical platform, one might have the opportunity to conceptualize data on a timeline and then zoom-in on one year, one date, one name, one moment, and, on into the materiality of the page. This hemispherical mode has the same goals as other efforts to spatialize knowledge and to consider the scale of reading practices central to debates and issues confronting text analytics, data analysis, and the digital humanities, especially in discussions of distant or close readings, analysis of data, or algorithmically or rhetorically parsed texts. It also changes reading and the event of a reader's scanning a page.

Our fulldome exhibit also had a pedagogical challenge as the principal investigator of our team seeks to build a way to produce original fulldome content by, and for, college students and faculty in an expanded electronic

literature and media lab. Students are usually unable to realize the full potential of fulldome content development. These multimodal labs will use visualization technologies, including virtual reality, augmented reality, and planetarium projections as examples of expanded arts, literature, and scholarship. Most importantly, the fulldome is an important space for necessary public-facing scholarship across interdisciplinary sciences, literature, the humanities more generally, social sciences, health and medicine, the arts, and data visualization. At present, most university-based planetarium shows are either created in real-time within the planetarium presentation system, or are pre-packaged products licensed from third parties. Our curated exhibition at Coimbra's Exploratorium challenged the audience to consider a pedagogical component for the development of new literary, artistic, and non-fiction narratives.

An interdisciplinary immersive media lab at research universities can be developed to meet a wide variety of needs: large-scale visualization, interdisciplinary production, and collaborative work. Students, faculty, and researchers would develop, create, and explore 2D and 3D visualization technologies that are increasingly on demand in industry, education, and research needs. The fulldome video content created in these labs would involve open-source educational resources in order to be widely shared and exhibited at other educational centers. Eventually these research centers would set up a distribution network among themselves beyond the astronomy and physical science focus of planetariums. One could imagine a poetry workshop producing e-poetry and then distributing it widely to a global network of existing fulldome spaces including planetariums.

As mentioned at the beginning of this essay, the decreasing cost of fulldome projection systems and the wide accessibility of video formats, makes its pedagogical uses available to a growing number of universities, science and nature centers, and other public venues that already have the capability to screen these projections. Fulldome organizations are emerging, and there are national and international festivals and conferences that focus on fulldome media, education, and best practices. There is an expanding need for well-produced content on a variety of subjects, including e-poetry and e-literature. Without the dome masters (a circular grid that defines a hemisphere within a square), one could not easily produce media for fulldome modalities. Newer planetarium projection systems can now make the process even more accessible by having makers use "dome masters" allowing the producer to simply format media on a computer to eventually move it to the projection systems seamlessly.

There is a historical dimension in teaching in and about domes that have long appealed to artists. Recently, with developments in projection and digital production the fulldomes are emerging as sites for interdisciplinary,

collective, and embodied experiences. Early live-action dome cinemas used wide-angle lenses and 35- or 70-mm film stock. There are still around 125 giant screen dome cinemas operating in the world. However, the expense and ungainly nature of the giant screen film medium has prevented more widespread use. Also, film formats such as Omnimax (Imax Dome) do not cover the entire dome surface, leaving the rear section of the dome blank even though, due to seating arrangements, that part of the dome sometimes was not seen by most viewers. Early approaches to fulldome video projection utilized monochromatic vector graphics systems projected through a fisheye lens. Contemporary configurations employ raster video projectors, either single projectors with wide-angle lenses or multiple edge-blended projectors to cover the dome surface with high-resolution, full-color imagery.

Although beyond the scope of this essay, domes, of course, have a long and important history in art and architecture as a space that suggests the awe-inspiring firmament, a physical representation of the sky and the infinite; in a future essay by Saper and Tomlinson, and in Tomlinson's dome projection presentation, our team will explore that history. Today, the word *firmament* is mostly literary, used to poetically describe the visual curve of the sky as globally inclusive. Poetic and cultural fulldome shows inspire a similar communal and immersive experience.

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