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Immersive Storytelling and an Afro-centric Future for XR

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Abstract

This paper opens a conversation around a possible Afro-centric future for Immersive storytelling, particularly in XR, one that might challenge Western-centric approaches to XR (extended reality) technologies and storytelling methods. The author argues that African creators across the continent's 54 countries offer vital perspectives that could reshape global XR practices. Drawing on theoretical frameworks from postcolonial scholars like Trinh T. Minh-ha and Jaishree Odin, the paper positions spatial and immersive storytelling as an epistemological challenge to Western narrative traditions. It highlights successful African XR projects, including Joel Kachi Benson's award-winning VR work and initiatives from studios like Black Rhino and Electric South, while acknowledging persistent access barriers. The discussion explores the convergence of XR with Internet of Things (IoT) and Artificial Intelligence, proposing that diverse experimentation is crucial for the medium's maturation. The paper advocates for moving beyond mimetic approaches and mobile-centric development to embrace more varied storytelling traditions, particularly those grounded in African orality and participatory practices. This research suggests that an Afro-centric future for XR could significantly expand the medium's potential for global storytelling and cultural expression.

Keywords: XR, immersive storytelling, African electronic literature, postcolonial digital practices, emerging media

Résumé

Cet article ouvre une discussion sur un avenir possible afrocentrique pour la narration immersive, en particulier dans le domaine de la XR (réalité étendue), qui pourrait remettre en question les approches occidentalo-centrées des technologies XR et des méthodes de narration. L'auteur soutient que les créateurs africains issus des 54 pays du continent offrent des perspectives essentielles susceptibles de remodeler les pratiques mondiales en matière de XR. En s'appuyant sur des cadres théoriques proposés par des universitaires postcoloniaux tels que Trinh T. Minh-ha et Jaishree Odin, l'article positionne la narration spatiale et immersive comme un défi épistémologique aux traditions narratives occidentales. Il met en lumière des projets XR africains réussis, tels que l'œuvre primée en VR de Joel Kachi Benson et les initiatives de studios comme Black Rhino et Electric South, tout en reconnaissant les barrières persistantes en matière d'accès. La discussion explore la convergence de la XR avec l'Internet des objets (IoT) et l'intelligence artificielle, en suggérant que des expérimentations diverses sont cruciales pour la maturation de ce médium. L'article plaide pour un dépassement des approches mimétiques et du développement centré sur les appareils mobiles, afin d'adopter des traditions narratives plus variées, notamment celles

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enracinées dans l'oralité africaine et les pratiques participatives. Cette recherche propose qu'un avenir afrocentrique pour la XR pourrait considérablement élargir le potentiel du médium en matière de narration mondiale et d'expression culturelle.

Mots-clés : XR, narration immersive, littérature électronique africaine, pratiques numériques postcoloniales, médias émergents.

1.0. INTRODUCTION

I'll need to start by saying that the original title for this paper - *African Electronic Literature on Immersive Platforms - techniques and practices for Africans - was* assigned to me as a placeholder – and one that I encountered this week with trepidation. Far from having a great deal of lessons for Africans I'll offer, instead, based in my experience, that African creators, in 54 countries, with multiple languages and histories, have instead a great deal to teach me and the global XR community as we consider the promise and potential of immersive storytelling – both in terms of new stories, and also in terms of new approaches, methods, investments and storytelling traditions that could profoundly impact the poetics and the future of immersive storytelling for everyone (Figure 1).

Figure 1: Outtakes of a volumetric XR experience

As a graduate student I remember Trinh T. Minh-ha trying to figure out what a postcolonial filmmaking practice could be and wondering whether the poetics of hypertext literatures might concretize a form of speaking alongside that she advanced as being a space of potential (Trinh). Odin (598-630), too, would theorizing hypertext and linking strategizes as being resonant with demands for new ways of thinking and being in the world: a feminist, postcolonial poetics made possible by the affordances of emerging media.[1] Inspired by these voices and reinforced by my own experiences of making stories that disrupt teleology and play with holding multiple truths together in tension - a daughter's circular pathway of 'and and and' (Gagnon and Knights 88-93) - I see spatial and immersive storytelling as constituting an epistemological challenge to the western philosophical line, to dominant forms of narrative pleasure and to traditional academic form. A radical practice full of promise. But one that has not nearly realized its potential.

I work in XR - a field that includes virtual, augmented and mixed reality, but that, for me, exists in its most potent form when it combines the digital with the analogue, where the physical world and the digital make meaning co-constitutively and local context meets dreaming. XR has a relatively long history of technological development, but remains an emerging storytelling genre, and one whose development would be strengthened by new voices, and new approaches - works grounded in orality and participatory storytelling traditions, for example, and works that disavow traditional heroes' journeys. Works that approach audiences in new ways. Creators working outside Western storytelling traditions who, like Trinh in the context of film, might look at XR and ask what new kinds of stories and ways of communicating might be

supported – and the work those stories could do in the world. We also need creators interested in proprioception – haptics and movement. And all of the senses - XR has the capacity to engage the full sensorium, yet so few existing works do - and we need diverse creators from diverse traditions to experiment, interrogate and explore XR's grammars and poetics as well as investigate new themes and content, in order to flourish.

I hope, then, that this is the beginning of a vital conversation where we can start to share knowledge and perhaps find ways to work together and support each other in the development of truly global Immersive storytelling practices. I will start by sharing some of my own story, my hot take on the field, and approaches to immersive platforms, techniques and practices *as I understand them, from my own location and contexts.* But to truly move toward an Afro-centric future for XR you will need to take up where I leave off and talk back to these ideas, or carry them forward to new places. This is not, in other words, a definitive vision - it is, rather, a moment of invitation.

Figure 2: My first lab, with Intersense tracke

For 20 years I've worked at the intersection of science and story, engineering and humanities, founding one of the first augmented reality labs in a fine arts context anywhere in the world – in large part owing to the generosity of colleagues at Georgia Tech, in Atlanta (Figure 2), who gave me the gift of code, advice on infrastructure and endless generosity and inspiration. I also received a large Canada Foundation for Innovation grant to purchase equipment (Figure 3). That's what it takes to start a lab: a collision of luck, resources, effort and generosity.

Figure 3: Some early experiences in the lab – trackers and fogscreen

My working life has largely been about bringing a diversity of humanists, filmmakers, screenwriters, poets, children, historians and visual artists into collision with amazing computer vision scientists and electrical engineers to build new stories for new screens … mostly works that I think help grow the field of electronic literature, but also projects that advance the digital humanities more generally … and I'm thrilled to share some of the lessons of that work here today on the occasion of the African Electronic Literature Alliance conference. Here are a few pictures, showing some representative work past and present (Figure 4).

Figure 4: Few pictures representing past and present works and me at Cinespace Studios on the volumetric stage, 2021

So, I'm speaking to you from my location as the director of an early AR lab in the fine arts, founded on cross-disciplinary, international collaboration in the global North.

I'm also speaking to you as a writer with a research-creation practice centrally organized around the creation of augmented reality interfaces, XR literatures, creating drag-and-drop AR tools for non-programmers, a practice of making small worlds, haunted cabinets, first-personal confessionals, treasure boxes, book objects and large-scale cinematic palimpsests, objects to think with and through, VR novellas and long-form interactive narratives. This work has also informed hardware and software designs and a generation of student work in this area and is now undertaken under the umbrella of the immersive storytelling lab.

But as I said, my take is necessarily partial. And I'll mostly stick with my sweet spot of XR (meaning virtual, augmented and mixed reality) today.

This is an energizing and pivotal moment for building and understanding immersive storytelling across established and emerging technology and, in a way, one that returns me to my early enthusiasm of the early 2000s, while enabling all of us to think about narrative futures for the next 20 years.

It's exciting to address you here because I really feel that we're on the cusp of something incredibly exciting– and from a personal perspective, I feel on the verge of being able to more fully realize many of the dreams that at least *I've* had over the last 20 years when I began my work in augmented reality, at a time of so much excitement, of accidents of generosity in those early days of opening up the Virtual Reality caves to writers.

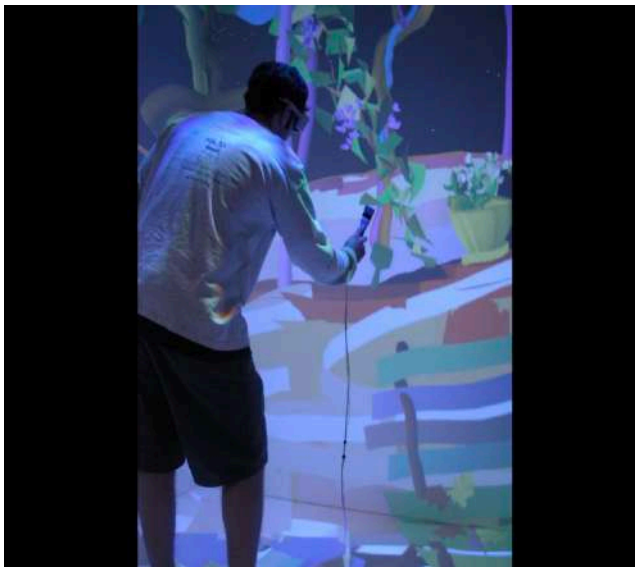

Figure 5: Cave Painting by my MA Student

I remember my first encounter with the VR cave at Brown University, exploring a model of the human heart, the Parthenon… with multiple people in the experience even if only one person's head was being tracked and everyone else was a victim of gentle latency and possible nausea.

No matter: one of the things that sticks most in my mind and that, in rear view, I can see inspired so many of the things that I did later, was an MA student's work I saw there called *Cave Painting*

(Figure 5). It was like being inside Adobe Illustrator or Photoshop. Picking up the brushes, and creating a sculpture midair with no intermediary of code - being able to shrink my creation, throw it into the abyss, retrieve it, enlarge it, inhabit it - changed my life. I probably spent about ten minutes total in that experience and it has been a haunting ever since, leaving me with a feeling I have tried to recreate for people in at least half of the things I've ever made.

Figure 6: Artist Wallace Edwards creating a VR piece inside the VR environment Multibrush

The reason I'm telling this story is that - flash forward - if you have a VR headset you can now just download Multibrush - Tiltbrush (Figure 6) before that –and experience much the same thing. In your living room. And a new generation of VR experiences is harnessing the capacity to use immersive environments as authoring environments. We don't even talk about it. It's a Copernican shift in the West and one that is coming to Africa, so get ready.

Small children use Multibrush in my lab. And the artist shown here – Wallace Edwards - and my younger daughter co-created a children's book inside this tool, drawing collaboratively in real time. No coding required. They could talk to each other inside the environment, import text and image files, and work together to draw in three dimensions and animate the virtual reality storybook. I could come up with many cognate examples, across media, related to the larger world of extended digital narratives.

But for this moment, let's stick with VR (see Figure 7 below).

Figure 7: screenshot of the VR piece "The Cat with a hundred eyes" created by Wallace Edwards and Stella-Charles Fisher inside Multibrush VR

Consumer caves that harness the ability to create in real time inside a What You See Is What You Get 3D environment (Figure 8) constitutes an incredible an expressive tool that changes the way we can experiment with scale, the relationship with our bodies to structures, *including narrative structures*, and challenges us to think deeply about what it means to create with machines.

Figure 8: Early handheld AR paper-based works, including burning book

These were also the early days of still feeling awe as a piece of paper came to life, like a Harry Potter newspaper, and where we engaged in tiny and powerful experiments animating XR doll houses, playing with physical film editing, and imagining new kinds of texts for spatial and interactive environments. Heady days when it felt like the possibility of entire new forms was within grasp.

And today feels like that, too, for the first time in probably a decade.

At the same time, we do *not* have enough global experimentation and not enough movement away from the mimetic. There is so much more that we can do – and need to do – beyond realism. There are both artistic and political rationales here. You can be entering at the moment of a great possibility.

Figure 9: Head mounted lenses early experiment

A lot of things that we started off with early on, in that long-ago very well-resourced lab involved walking seamlessly through the world wearing these head mounted displays. I think one of the reasons why I often show a lot of early experiments (Figure 9) at these talks is that so many of the works that we made in the lab were absolutely landlocked and seen by so few people.

And while handheld devices –cellphones and tablets – opened up this work to wider audiences (Figure 10), it also disrupted the creative trajectory of so much of what was happening in those spaces. I have a love-hate relationship with these devices.

Figure 10: My AR work Castle on iPhone

There were tradeoffs, of course. In Africa where cell phone usage and penetration out-strips all other ways of accessing XR, phones are an absolute necessity for even getting started – and Google Cardboard, for example, provided an important viewing context and created audiences here. Writing for mobiles phones and tablets is accessible, then – and that's a big one – and I do love using my phone as a magic looking glass, a window to another world (even now, as you'll see at the end of this talk) but when every story for AR becomes a magic looking glass it does limit the potential of XR for storytelling in critical ways – what kind of stories work best when you have to hold your phone up in front of the world? How is the length of those stories affected? How does it change how you move your body inside the story? How might you write differently for a more seamless experience where augmentation was through AR glasses? AR contact lenses? What kind of climates does an XR mobile device story favour? A positive aspect of the rise of cell phone XR e-literature is the move to relatively more affordable, computer vision-based augmented

reality. But it's a very specific subgenre of augmented reality storytelling that too often in the contemporary moment stands in for the entire thing. So, while there are huge practical advantages and we can reach wider audiences in this moment by creating XR works for phones (Figure 11), we would benefit from seeing creating XR works for cell phones as a productive constraint and not the only, or best, delivery system for the future.

Figure 11: Early tablet story, Banff Centre for Creativity

I liken this to the way that amazing writing systems for hypertext in the 90s and early 2000s like Storyspace were basically killed by 'good enough' systems with widespread access and appeal like eliterature for web browsers like Mosaic. Early and powerful tools that were built in part with a deep understanding of narrative theory and what it means to craft and to experience stories were flattened by web browsing technologies.

XR through phones is still largely experienced as a visual medium, with advances in sound and an understanding of sound's critical function in maintaining immersion just beginning to be better understood. I'd argue that other senses – smell and haptics – are even less understood. The capacity of augmented and mixed reality to harness the power of the physical world working co-constitutively with the digital seems, as I said, to have been set back with the rise of smartphones as go-to platforms, however - a mediating screen we hold in our hands is not the future of XR.

Prior to this time, there were a lot of really interesting ideas about proprioception, room-scaled and even city-scaled stories and a dream for transparency of the technology as you walk through a storyworld that we are only just starting to appreciate again. The idea of technology just falling away also begs critique, for sure, but it's still pretty cool to walk through a digital environment and see perfectly registered ghosts or hold small-scale, animated people in your hands, without experiencing things through the frame of your phone.

The future of XR electronic literatures and experiences involves all of our senses, haptics - touch - and smell, as well as sound and sight, immersing us in the full sensuousness of the world. So, if you've only ever seen augmented reality on a phone, you have to realize that it's a really partial view of what you could imagine if you had an immersive system, especially those of us in cold climates like Canada, where nobody wants to have their hands out in a long form extended digital narrative in the snow.

Another aspect to my point that a lot of development in the early 2000s was interrupted by the idea that we could actually make things available easily through apps through smartphones, and that audiences would be basically bringing their own equipment is that creators in Africa don't have so much catching up to do – we've all been working on our phones ;)

Small labs like mine long ago lost comparative advantage in building our own tools responsive to the kinds of stories we wanted to make – commercial, off-the-shelf tools were simply more powerful than the tools a small lab can build. Most

of us working in the field are still using Unity, Unreal engine and new web-based (WebXR) augmented reality tools like 8th Wall, that are accessible to the extent authors can engage with the cloud and some, like Adobe Aero, that allow experiences to be created on a phone instead of requiring a computer.

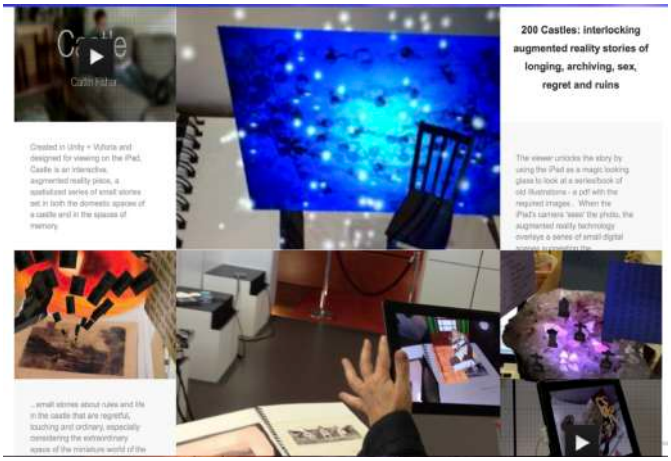

Figure 12: 200 Castles exhibition, Biblioteque Nationale, Paris

Here's another origin story:

Figure 13: Caitlin in early NVIS HMD

XR was always incredibly expensive – and, at first, inaccessible to most, even in countries like Canada.

I purchased my first optical see-through head mounted display (HMD) in 2004 for over $100,000 US. It was military grade and the first thing I did was stick the sensor to the wrong place… two inches off from where it really should have been… meaning for months I thought military grade wasn't so hot ;)

At a time when we didn't really talk about unboxing as performance, I unboxed the headset to great fanfare and in front of a biggish crown of colleagues. I put it on. It was super heavy. It was tethered. The cord was actually so heavy that later on during demos we always had a grad student carry it like a bridesmaid so the HMD wouldn't actually pull away from someone's head while they were in the middle of things. It had a field of view about 30 degrees. It was disappointing. It was also magical.

And it was the start of a long series of moments that led me to theorize that the trick of working in immersive storytelling is imagining your story and your audience and your hardware and your software at least a decade into the future. Because everything I touched was really not quite right in some aspect, physically and also conceptually too clunky. Even so: The too-heavy HMD being tethered, relegating us to indoor experiences, working with very tricky authoring systems … all these things were springboards to new ways of imagining what we needed and what we wanted.

This is a working trick all of us can use – imagine what you might have a decade from now and start to write for the devices that don't yet exist.

And now so much of what I thought I needed and thought I wanted is available to me, at least in Canada. My current headsets look much the same – but lighter, untethered, cheaper and with better field of vision.

So, I want new things now. New optical see-through headsets, new tools, new possibilities for dissemination of even large-scale complex works. new intersections. Globally, we're on the cusp of seeing so much fully realized. But those HMDs aren't manufactured in Africa and often can't even be shipped – and to be in on the ground floor of the

conversation that needs to change - or African companies need to create rival HMDs built right here.

While I don't think the future of XR is centrally about tools, tools matter. Hardware matters – and it matter that here in Africa access to HMDs is difficult. We need to figure out how to get more HMDs here because engaging immersive texts hands-free, and, ideally, free of feeling stupid with these things on our heads - will have big consequences, finally returning us to a more natural way of engaging with content that was widely understood to be the only way to work before smartphones and the magic looking glass took over.

That's take-away number two: made in Africa technology development or licensing may be necessary not to miss out on the next wave of development. You need made-in-Africa platforms as well as global stages in addition to affordable consumer-grade VR headsets, easier to use expressive tools that do not require coding, local advancements in hardware and software and workshops in how to create using these tools, maybe leveraging cognate skills. If this happens, Africans will become creators in larger numbers and could be global leaders, in the XR space – not simply because you will be part of the conversation, but also because of the possibility of unique takes on both content and narrative form.

In anticipation of this, what follows is an overview of past practices, a discussion of what we can already do in the now and some of the items on my own wish list for the future. Your own working context will doubtless change what you hope for here and what you see as possible in the immediate moment.

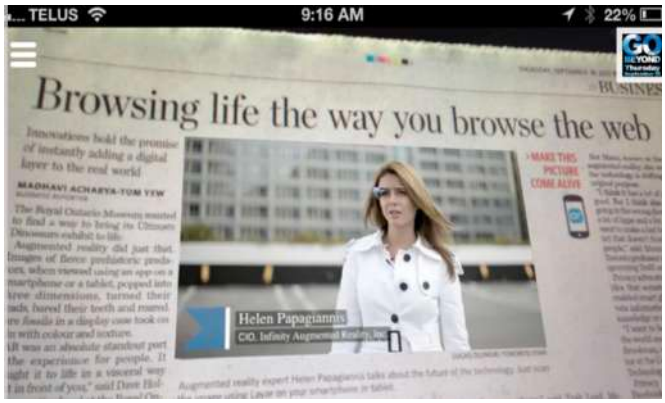

Figure 14: former AR Lab trainee and now global XR pioneer Dr. Helen Papagiannis in early glasses

2.0. TECHNOLOGICAL CONTEXT

Over 2.5 quintillion bytes of data are now being generated every day. Five years ago, IBM Researchers noted that "90 percent of the data that exists today was created over only the last two years" (Wheeler) so that doesn't even capture recent development and massive data generation in AI over the recent period.

Augmented reality is similarly expanding – and has already changed how we work, consume and create. AR alone – not even considering the full XR spectrum, let alone a spectrum that would include Artificial intelligence and the Internet of things (IoT) - is now a $120-200 billion industry with huge implications for industry, education, health and human society - yet the politics, poetics and possibilities of the coming augmediated society are still emerging, open to a great diversity of ideas and our talents and even to change. The potential to innovate, commercialize, train and create in this area - where science meets art, and utility meets storytelling - is enormous and crosses almost all industries. And my own experience has shown me that writers and artists can, and do, and perhaps even *must* influence technology development.

It remains a thrilling, confusing time. Personally, I've been in and out of the trough of

disillusionment many times over the past two decades, and I'm delighted you're catching me on the upsurge. I used to say in talks that this was an intermediary moment. But I feel we are in a new moment now, with more potential – with new head-mounted displays coming to market, with the capacity to walk inside a game engine and have a conversation with a character who is responsive, courtesy of software like Charisma ai., on the cusp of being able to generate entirely new VR environments on the fly via text prompt, with new horizons, new inspiration and new dangers already here at the new intersections of XR, artificial intelligence and the internet of things.

This is surely one of the coolest areas of inquiry in the world, with implications for human breakthroughs in literature, cinema, gaming and, more: perception and understanding. The field needs Africa and the unique perspectives on literature, cinema, gaming, movement, theatre etc. that will enhance and inform these breakthroughs.

Africans who have had access to XR infrastructure have been incredibly successful – already world-leading - with Joel Kachi Benson from Nigeria, for example, winning the Golden Lion for the Best VR Story at the Venice International Film Festival in 2019 for Nigeria's "Daughters of Chibok", a piece that demonstrates the powerful potential of VR for social impact storytelling. Influential immersive studios like Black Rhino in Kenya and Electric South in South Africa are leading the way in content creation, training and dissemination. "*The Lost Botanist*, a South African VR project, combines African mythology with immersive technology in fresh ways. "Lwanda Magere" by Kenya's Black Rhino VR adapts traditional Luo folklore into VR; "Spirit Robot" by Ghanaian creator Jonathan Dotse, explores Afrofuturism through VR; and "Let This Be a Warning" by The Nest Collective in Kenya, presents an Afrofuturistic narrative questioning colonial perspective. These projects demonstrate how African creators with access already using XR to preserve cultural heritage and share stories with global audiences while pushing technological boundaries."[2] African creators have also excelled at 360 video creation – resulting in international dissemination of important works like *Container*, a brilliant 360 immersive piece that I saw in Montreal this past summer. But this is only a taste of what might be possible with greater access to tools and mentorship.

Figure 15: Kachi Benson's Daughters of Chibook

Figure 16: R/VR Africa Hackathons, and the SwiftXr authoring platform out of Nigeria

[2] I am grateful to one of the anonymous reviewers of this paper who pointed me toward these additional examples. I am quoting the comments here in their entirety.

You can build on the AR/VR Africa Hackathons, and the SwiftXr (Figure 16) authoring platform out of Nigeria. You also have the Microsoft Africa Development Centre, a premier center of Engineering. And events like this one, that put the University of Calabar at the centre of a global conversation. There are workshops, hackathons and online communities probably many of you here are hosting and that I would love to hear more about them.

Ultimately you also have a young, tech-hungry population in Africa versus an aging west. But we stand at a crossroads, I think, between siloed conversations and a truly global dialogue that will usher in new practices. Will our ways of working be smaller and more homogenous – or open and expansive? I feel strongly that a critical mass of diverse experiments is necessary to push XR into maturity.

We are also at a crossroads when it comes to next-generation content where we need to choose between further instrumentalizing our lives – AR as information overload, as shopping experience, as map, for example - or making our lives more magical. I lean toward magic rather than wayfinding devices and am hoping for a diverse ecosystem rather than more homogeneity, an ecosystem that will involve all of you here.

I'm reminded that 'our machines are working on our thoughts' - a caution against the consolidation of our tools and the relentless sameness of the worlds they enable and the gentle constraints on our imaginations – even as we forgive the sameness of off-the-shelf solutions like ChatGPT or Midjourney or Multibrush or Unreal engine on the grounds that the most explosive power of that tool may have more to do with creation than reception.

As a creative writer and poet, my impulse with XR and associated immersive technologies has always been to make the world stranger and hopefully more beautiful or interesting; to whisper secrets in public. While I am very interested in data-driven work (more on that, below) I also want to overlay the world with a poem you can touch and that will change based on engagement. I would encourage African artists and writers to use XR to explore making the world more poetic, rather than more efficient, at least at this stage. XR is a revelatory leap into a new poetics and a doorway to implications of these technologies for what it means to be human. We should take inspiration from the cutting edge of science but we should take inspiration, too, from diverse global histories of earlier arts, experimentation, magic, immersive theatre, oral storytelling traditions… a diversity of experience and expression.

One of my earliest collaborators, Jay Bolter, quite famously said that working in AR was more akin to working in cinema at the turn of the last century, when conventions had not yet been established and illusion and experimentation reigned. And on the really fun days in the lab, it still feels like that. With conventions still unwritten, I urge you to make new, Afro-centric rules, privileging your preferred ways of writing and attending to audience here, in the shadow of all the possibilities and dangers of AI, including for the creation and co-creation of immersive stories, even specifically the ones I have maybe loved best for 20 years… navigable, immersive, vast and responsive XR environments… I feel that early excitement again.

Figure 17: The Amazing Cinemagician exhibit at the Ontario Science Centre

The patron saint of our lab back then was probably early filmmaker George Méliès. And one of my amazing students at that time - now Dr. Helen Papagiannis - headed up a remarkable exhibition at the Ontario Science Center one year called *The Amazing Cinema Magician*, where we shared all of our early prototypes and paid homage to the great pioneer of special effects and new cinematic grammars.

In this, our own pioneering moment, we need to grab all of our tools and all of our people. We need to look beyond the West for content and methods. We also need to look backward in time as we face the future… into early and silent cinema to circus to gaming to streaming to literary theory, into ritual and panoramas, storytelling circles and dancing, epics, and into cognate practices we might need for our new visions… like experiments in sounds from the 1960s … or the 1930s… and expanded installations from all the world Expos… experiments that failed in labs 20 years ago, but might be good now… beautiful stories in languages other than English and French, that currently dominate the field, storytelling structures beyond the western convention of three-acts… and all the criticisms from people who have engaged with this kind of technology – or who dismiss or resist it – resistances we might consider as part of a non-insider wish-list as we dream.

And a robust ecosystem that allows for a diverse range of expression, ways of working and rich explorations of the affordances and limits of various technologies will also enable us to use XR technologies and storytelling techniques to meet the urgent need to tackle grand global challenges.

The next section of my talk consists of provocations along three separate lines:

- Immersive Storytelling as read against new technological development
- Immersive Storytelling and the foundational needs of communities of practice
- Some cool things to think about and some cautionary tales.

I'll speak in broad strokes, with the expectation that you will all be able to bring your specific contests and understanding to the issues.

3.0. THE FUTURE OF XR 1: IN THE CONTEXT OF IOT

Ok – so we've barely got our heads around the practice of combining the digital and the analogue, our machines and our natural world – and we're – BAM - faced with the Internet of Things (IoT), a world in which our networked machines talk to each other as well to us – think Alexa and Google home, but also smart thermostats, lightbulbs - enchanted objects I can now pick up at hardware stores in my hometown- but also everything from health sensors to driverless cars. This convergence of augmented reality and the internet of things constitutes a critical technological breakthrough.

Always-on AR wearables will be distinct nodes in the Internet of Things. This concretization of digital information and the bringing together of networked computational information with the physical–represents an unprecedented unleashing of machine-to-machine communication with massive implications for technological and societal shift and also for making, storytelling and the development of new modes of communication. In Africa, uneven, unreliable and expensive internet access means IoT adoption will be slower… but the capacity to think more deliberately about how/when and why you might want to use IoT as part of your storytelling

toolkit could also be a superpower, thoughtfully leveraging the connected storytelling environment predicated on the Internet of Things to extend immersive and interactive experiences in new ways, including the creation of interactive augmentations, and the refinement of methodologies and best practices for the creation of IOT-enabled experiences.

One research challenge for the creation of immersive narratives will be to determine the ways in which content to support fictional or documentary stories can meaningfully interact with real time sensor-driven data, and to develop workflows and methodologies to support XR as an interface to IOT. Projects might include creating dense, spatialized XR long-form storyworlds dependent on sensor data delivered via a user's wearable devices or even based on traffic or home security data and experienced via next-generation HMDs, allowing a spectator/reader/viewer to wander hands-free though poems and dreamscapes, history lessons or political economy textbooks. Data-driven stories could lead to the creation of new hybrid fictions based in real-world phenomenon.

There is enormous capacity for putting immersive and interactive stories in service of larger issues. In my lab, for example, data-driven XR stories are being leveraged in the service of a number of Digital Humanities projects including tackling public health issues like anti-microbial resistance and vaccine hesitancy, engaging speculative energy futures and climate change and sharing untold stories of the Underground Railroad in Canada.

Another more basic challenge associated with this vision of the future will be to encourage work in cognate fields that will feed into XR-explorations of foundational issues in shooting, editing and interactivity design in immersive storytelling environments, resulting in innovations in panoramic and photospherical design, workflow for XR content creation, and APIs and software for creators(Figure 18s).

Figure 18: Steve Mann-visualizing surveillance culture and IoT through XR

4.0. DATA-DRIVEN STORIES: VISUALIZING SURVEILLANCE TECHNOLOGIES AND THE IOT USING XR

What if we thought about augmented reality as an interface for the internet of things as well as a technology supported by its power? What do we build when XR and IoT come together in ways that allow audiences to understand and inhabit the stories in which we are all already immersed but that are generally invisible to us? This potentially powerful digital practice, one that makes the invisible visible in new ways, is 'phenomenological augmented reality.'

Where I live, computer vision is embedded in toilets, urinals, handwash faucets, doors, lightswitches, thermostats, and many other objects that "watch" us. Camera-based motion sensing streetlights are installed throughout entire cities, making embedded vision ubiquitous. As my collaborator and colleague Dr. Steve Mann observes, "technological advancement is leading to increased sensory and computational performance combined with miniaturization that is making vision sensors less visible. Computer vision is 'seeing' better while it is becoming harder for us to see it."

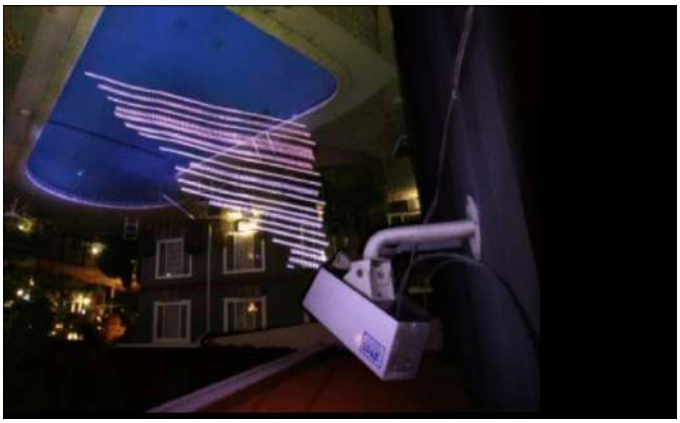

Figure 19: AR Technologies

Figure 20: Mann's pioneering work on the Tactile Sequential Wave Imprinting Machine (T-SWIM)

AR Technologies can be used to make this invisible part of the culture, visible, and tell that kind of story, too (Figure 19). My take on this vision of the future is entirely indebted to Mann who pioneering the field of phenomenological augmented reality in the 1970s and who is endlessly challenging and inspiring. To date the possibilities associated with phenomenological AR have not been fully realized – and have not enjoyed widespread interest - because the viewing situations have been so limited. But this can change.

Being able to see, experience and inhabit veillance fields, wifi clouds and AI datasets represents a new and thrilling epistemological and artistic shift, in addition to proposing a new paradigm for XR – not simply an overlay of digital information, but a mimetic translation that serves as a perfect foil to the enormous imaginative potential of these technologies, the interplay between the real world and the world of our imagination being the foundational condition for artmaking. This is AR on the vanguard of technical possibility that will allow us to see with our naked eyes, as well as with next-generation headsets – new visions and interfaces to our world and its data – deploying XR as both an interpretive lens and concretizing art.

I'm always bugging Steve to work with me to get headsets working alongside MUSE – a commercialized brain sensing technology developed in part in Mann's lab - because I think the results could have fascinating opportunity, for storytelling and beyond, including the development of new artistic genres. We could use AR to capture, represent and communicate the brainwaves of people as they argue and create, for example, paving the way to imagine the creation of digital sculptures of important conversations, last words, poetry…

This vision of the future builds upon and extends Mann's pioneering work on the Tactile Sequential Wave Imprinting Machine (T-SWIM), a naturally augmented tactile reality system for making otherwise intangible electromagnetic radio waves, sound waves, metawaves, etc.(See Figures 20 & 21) graspable. Phenomenological augmented reality also has potential for gaming and theatre.

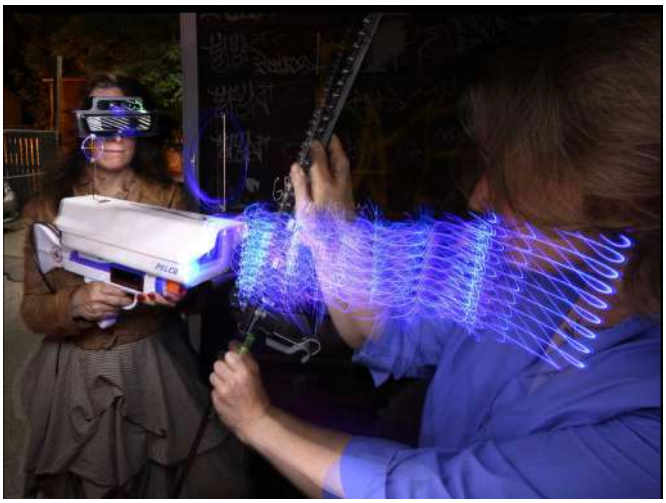

Figure 21: T-Swim Gamming

5.0. THE FUTURE OF IMMERSIVE STORYTELLING 2: IN THE CONTEXT OF AI

Artificial Intelligence and AR are sympathetic technologies that can become more powerful when they work iteratively. AI is the invisible powerhouse behind state-of- the-art machine vision enabling key instances of AR, for example, but AR can be harnessed, in turn, as a powerful expressive tool to animate artificial intelligence.

Almost a decade ago IBM (Figure 22), through a project called Immersive Insights, approached this by giving AR developers a chance to incorporate computer vision and speech recognition AI elements into Unity applications, enabling developers to integrate core Watson services directly into Immersive experiences. It seemed great, but in my experience, Watson was difficult to access and implement. And now, within the current year, users may be able to generate whole landscapes in real time, from within the Unreal engine as they walk through them. Think about that. It's a mind-blowing change for those of us who work in VR. And with new optical see-through HMDs, including the highly-anticipated new apple glasses – it could be a game-changer.

Close your eyes. Think of the environment you want. Imagine words to describe it. Type them into a dialogue box. Or maybe just say them aloud. Or upload a picture that would exist in that environment. Count to ten. Now enter that imagined space. It's one of many things that AI is able to do and that consumer-level tools will soon offer. Other capacities to think about: text to 3d, text to moving image, synthetic characters, AI voices of deceased loved ones. Think of low-hanging fruit first - I had my late father Charles' voice recreated and now the missing two chapters of his last book can be narrated. It's a small technical feat, but one with huge implications. Now think of think of something more ambitious. Maybe synthetic, ai-driven characters and scenarios. What does your imagined space look like? What stories could it support? How you would use these tools?

Figure 22: navigable xr poemscapes – Caitlin's AI+Markov chain + XR work "Tectonic"

One thing I did this summer was to work to incorporate AI into XR environments through a series of prototypes and poetry installations. Some of them were actually poems where the imagery was generated through Midjourney or Dall-e. Others involved using Markov chains to remix existing text, not relying on large language models.

The Markov chains were in part me being in flight from large language models, after having worked

with GPT2 for three unhappy years and what I perceived to be limitations of AI during that period, Notably my own difficulties working for a couple of years with GPT2 and being unable to shift the AI voice in ways that in ways that I wanted to create works that I was interested in or be able to shift syntax. My own experience is that I've been able to do more with AI in the past year than I did in the previous 5 years. My larger point in sharing this here at this gathering is this: even if you haven't been part of the storytelling experiments of the last 20 years, *you can begin exactly in this moment*, without an incredibly steep learning curve and – assuming access… which is a huge assumption I will leave hanging here - you can be successful by bringing in translatable skills rather than having to play catch-up.

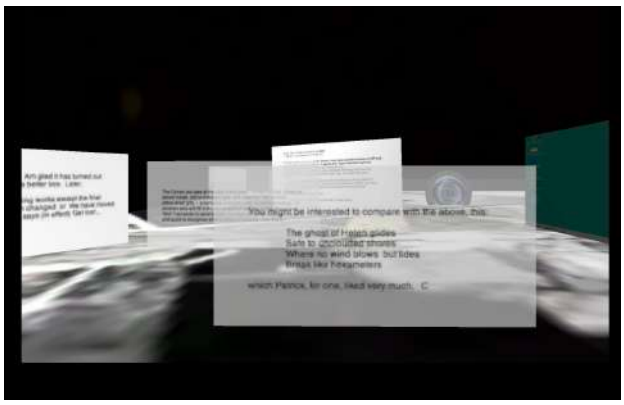

Figure 23: Text poemscapes - This built on some earlier work over the past three or four years using webXR to share navigable poetry and environments

Figure 24: These are little manipulable poetry domes that you can bring to life for yourself. You hide underneath them to hear the poem.

6.0. CO-CREATION + HUMANISTIC INTELLIGENCE

Given all this, this is a moment for immersive storytelling when we desperately need to re-insert human beings into the circuit. My work with Steve Mann informed the development of the Immersive Storytelling Lab, making it a lab foundationally predicated on human intelligence being at the centre of the computing as well as artmaking circuit – a vision in which the computer's primary task is no longer computing, but, rather, becoming an integrated part of its user - something that, to date, has not significantly informed work of labs or artists in the field.

This theoretical orientation is associated with Mann's vision for Humanistic Intelligence (HI) - a framework that puts human beings and the creative act at the centre of technological development, a signal processing framework in which the processing apparatus is inexorably intertwined with the natural capabilities of our

human body and mind. This orientation directly resulted in Mann's founding of the MIT Media Lab's Wearable Computing Project and, consequently, the establishment of the entire field of wearable computing. Mann's HI formulation build upon and re-contextualizes concepts in intelligent signal processing and advocates a future in which signal processing hardware will be built to assist, rather than replace or emulate, human intelligence and creativity. As augmented environments go mobile, viewing devices become increasingly portable, and artificial intelligence interprets our worlds for us based, for better or worse, on who our data reveals us to be, or want, Humanistic Intelligence recentres bodies and communities, empowering human intellect and creativity – rather than simply building more powerful tools. It's a compelling vision for a more sustainable global future and might be an important touchstone for African creators to consider as you build XR worlds in relationship with new AI tools and theorize co-creation with machines.

7.0. SCENES VS TOOLS: THE FUTURE OF XR 3 - CREATING THE CONDITIONS OF CREATIVE POSSIBILITY

If we close our eyes and think about how Super 8 and affordable hand-held cameras and, later, YouTube, the ready architectures of TikTok, revolutionized access to moving image making and distribution we can maybe glimpse what might be possible for a future of XR in which new tools allow us all to be makers rather than audiences.

Software and expressive tools matter a lot, too– maybe especially, in this moment of easy AI creation tools. But now, as earlier, the key to success may really be less about technological innovation and more about creative platforms, laboratories, and artistic scenes in which highly creative content creators can actively engage with the cutting edge. This can be an advantage for Africa.

The hackathons happening here, the incubators, the VRchat spaces, the emerging immersive studios, the nascent course development, the emergence of some global superstars… all of this contributes to a kind of energy that may be your most important asset going forward. Cities with creative ecosystems - cities working, say, to map out their geographies so it's easy to overlay XR content, cities and projects that attract the world to them, like Calabar today - could have a comparative advantage in pioneering the next stages of XR in part because we need a critical mass of ideas/projects/visions/failed projects and beautiful half-visions made by all sorts of people in diverse industries to move us forward… and we haven't had that yet. You are expert knowers already in a field that desperately needs to be diversified both in terms of content and an understanding of how and when and for whom different storytelling structures can be leveraged. To support this you'll need courses not just in computer science of engineering… but in literature departments, cinema, dh courses, poetry workshops…Supportive (think mentorship) and creative (building on made-in Africa stories and forms) and resourced (think access to hardware and software) cultural scenes that will attract a critical mass of talent and energy (think festivals and workshops and startups and university programs) may be the necessary, if not sufficient, for an Afro-centric Future for XR.

8.0. THE FUTURE OF XR 4 ENGAGING ALL THE SENSES

The near future will accommodate a proliferation of XR approaches – networked alongside stand-alone, bleeding edge wearable screens alongside intermediary forms like smart phones, co-creation, author-driven alongside entirely ai-generated, – and for some time to come. African creators can intervene at multiple points in that circuit.

I've been thinking for many years of the miniature - and made many small, affordable

experiments that were rather hilarious in the context of access to a half million-dollar immersive tracking system. But I still think the wonder of some non-interactive, non-immersive, non iot--connected, non-ai or HI supported worlds will persist into the future. And here's one reason why: XR and Immersive storytelling is about philosophical and literary machines as well as technology and, for me, playing with scale in XR – thinking about our human bodies' relationship to small, handheld experiences as well as immersive ones leads me to understand some of its power.

The kind of knowledge produced by the tactile capacities of XR can connect thought to gesture and gesture to action: "Touch here becomes the palliative to the subject- object dichotomy, and the hinge upon which philosophy opens itself to the world'', writes Tschofen (154). Tabletop XR in particular, allows us to hold philosophy in our hands and feel its shape. Immersive works allow us to grasp the structure of the intervention by inhabiting it. For the philosophers in the room, you'll recognize that all this is very Adorno who writes: "Thought-images are...parabolic evocations of something that cannot be said in words. They do not want to stop conceptual thought so much as to shock through their enigmatic form and thereby get thought moving, because thought in its traditional form seems rigid, conventional and outmoded" (322–327). The use of XR as philosophy enabling – as a machine for the creation of thought images - depends less on technological change than understanding the power of what we already have, and resisting the impulse to assume the new is a better cypher than what we hold in our hands. What philosophies might you see concretized in this kind of work? Are there made-in-Africa theories that can help us to understand what is going on and what we might make? African philosophy that might underpin your own work? The global field desperately needs to know.

9.0. THE FUTURE OF XR 5 - THEORIZING HUMAN AUGMENTATION AND AN XR BILL OF RIGHTS

I'll offer, however, a more cautionary note: As we harness the Immersive storytelling power of XR+IoT+AI we do well to remember that the long-term risks of artificially intelligent machines are widely discussed. I was a signatory – along with Mann et al.(web) – to an AR Bill of Rights. The Bill of Rights is a living document framing the potential risks that humanistically intelligent entities pose right now, in different ways across the globe, but soon to impact everyone - whether facilitated by smart buildings, smart cities, cameras in every streetlight, wearable XR technologies or implantable intelligence. Sensory intelligence augmentation technology is already developed enough to be dangerous … as a way to diminish personal privacy and rights, as a way for governments or corporations to use power and surveillance data unjustly. X reality is not just about mediating screens but, rather, already affects all of us ever hour of every day - cities, buildings, cars, and people, are augmented - and we need international conversations to theorizing what is at stake in the futures we imagine and the objects we make and potentially commercialize, thinking about how this technological convergence will affect both adopters, non-adopters and specific communities. These connected technological moments brought together under the umbrella of XR is changing us as already as nations and as people, with implications for privacy, sousveillance, regulation and ethics as well as creation. And we should seize the opportunity to advance a global conversation around these timely and urgent issues. The artistic, technological, archiving and viewing situations we created have social and political consequences. What is at stake? The protection of audiences, artists, adopters, and society from machines of malice as we make magic.

To conclude: I'd like to go back to my early directive to the researchers in my lab – use the point of friction and the obstacles to current success to shape what we hope for the future of immersive stories. Keep the cautions in your back pocket, but think about positive futures, too.

In the future XR will be: spatial, personalized, immersive, connected and multi-sensory. It could be a new canvas for radical new stories – new content, new creators, new forms - with global impact.

Remember how I urged you to think about stories for a decade out and build for tools, situations and audiences that you don't yet have – that may not yet exist? Do that. Really.

I am confident that there are so many stories here in this room – stories you already have in your head right now that should be part of the global conversation.

If you don't have access to a VR headset or a computer capable of running Unity or Unreal… or you live in an area where web-based XR like 8th wall just does not make sense because of connectivity issues, you can still write stories for the near-future. If you don't have a 360 camera, take placeholder shots with your phone, or sketch out what that worlds will look like. Make diaromas. Paintings. Paper prototypes. Use every chance you get to encounter immersive stories. Go online to worlds likeVRchat. Be inspired by the work you love, or by the aspects you love.

Be inspired by the work that leaves you cold and does not speak to you – challenge yourself to build something better. Use everything you don't like about the XR you see as an occasion to ask yourself a question: how could that have been improved? What story would I have done? Was the granularity odd? Was the piece too long? Too short? Too realistic? Not realistic enough? Could you not identify? What it inaccessible? Boring?

If you've had a chance to access hardware and software, do you want hardware to be lighter, faster, with less lag less latency? To want it to be more personalized? do you want tools to be easier? Do you want to be able to make things outside? Want there to be rhizomatic narratives? What bugs you? Think about what you don't have yet think about what you don't like about this work. Think about what you would make if technology if the barriers to entry were lower. Would you want to walk through films set in your city? Do you have a half-forgotten story from your childhood that should be shared? Stories from your community? How might your audience participate? Become part of the story? Could these technologies extend practices and ways of telling stories you already find valuable? Could they retrieve stories that have been lost?

Think about how do we and *when* do we want to co-create with machines? What's the sweet spot between AI and its editing? between equity and its adoption? Insight from Africa will be critical to hear in the global conversation.

Know yourself as a creator with something important to give the field at a pioneering moment. If you are someone with stories to tell who has never had access to VR or AR – maybe that will be your advantage. Because you are free to imagine something truly spectacular without being tethered to current possibility. Do you know that many inventions started as part of a screenplay or science fiction novel? The future, Anne Balsamo reminds us, is created in our imaginations, not in our labs. You might be the holding a key to technology development.

10. CONCLUSION

This is also exactly the time to think about what kind of displays we want. Will we wear them?

Do you want XR contact lenses? Do you need to be able to take a digital narrative underwater with you? Should these experiences scale so that thousands of people can inhabit your work? Is your audience Africa? Is it global? Who are your ideal interlocutors? Who do you care about reaching?

What would mean you'd want to spend as much time in an immersive story as you do on a screen game. Is it just a question of human-computer interaction? Or is it a question of something else? Think of what you might do with the power of the interface being just everyone walking through the world and the potent combination of the real world as your extended digital narrative film set and both the best of your creativity and machine intelligence as the engines for the development of your work. Start there. It's magic.

Take what you don't have yet and use that to imagine future forms to inform the stories of the future. What will meet your needs? What do you want to share with other and with the world?

How do you hope to change the future? A future that can start right now – ready your imaginations and your craft for the time when the next generation of hmds will be in your hands. Or whatever comes after that is in your hands.

I still like thinking 20 years on, to feel at the beginning of something just about to take off. Where now we can maybe fully realize some of the things, we wanted… but are also called to write the next generation of narratives for a new generation. As president of the Electronic Literature Organization, I would like to invite you into our circle – and work with AELF to amplify your contributions.

There is every reason to imagine that immersive technologies – new tools, ways of communicating and new viewing situations could usher in a more Afrocentric future for XR… one founded on new stories, new ways of telling, knowledge you already have changing the conventions of XR constructions, new granularities, leveraging deep roots in participatory storytelling to make foundational interventions in what we understand to be electronic literatures in XR. You have new tools to share your realities more broadly but also to shape the field and help move toward a more Afro-centric Future for XR. Remember, too, that when you intervene in the way stories are told and the shape they take and how stories are disseminated – when you play in the sandbox of the poetics and grammars of emerging technologies – you are fundamentally making art with profound political and epistemological implications. Be part of this moment.

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AUTHOR'S SHORT BIO

Caitlin directs the Immersive Storytelling Lab and is a Professor of Cinema and Media Arts at York University in Toronto. A co-founder of York's Future Cinema Lab and a former Fulbright and Canada Research Chair, Caitlin currently serves as President of the international Electronic Literature Organization. A pioneer of electronic literature, she is the recipient of many international awards for digital storytelling including the 2008 Vinaròs Prize for one of the world's first AR poems, Andromeda, built using software developed in her lab. Recent funded projects include work in 'AI Storytelling', 'Souveillance, Humanistic Intelligence and phenomenological AR for next-generation headsets', "Immersive digital environments and indigenous knowledges: co-creation in virtual reality environments to advance artmaking, digital poetics and reconciliation" all funded through the Social Science and Humanities Research Council of Canada (SSHRC). She recently directed Fiery Sparks of Light, a volumetric XR project featuring iconic Canadian women poets in Partnership with the Griffin Trust For Excellence In Poetry.