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Preparing for the Future of Animation

Interactive, Immersive, Intelligent

Introduction

We are on the verge of a revolutionary transformation in mass market entertainment and personal content enjoyment: a radical shift from the passive consumption of traditional media to interactive immersion in cross-reality (XR) experiences, sometimes also referred to as mixed-reality or MR. Interdisciplinary collectives of artists, engineers and storytellers are currently working on the cutting edge of intelligent immersive entertainment, incorporating neuroscience, machine learning and immersive storytelling to create virtual beings, interactive experiences and cross-reality entertainment that will be woven into the fabric of our lives.

The immersive media revolution will disrupt every aspect of the traditional entertainment industry, from live-action to animation, and will in fact hasten the dissolution of traditional categories, classifications and contexts. While the specter of a disruptive technology that simultaneously presents challenges and opportunities is nothing new, the significance of the paradigm shift this time around will be unprecedented: the creation of a pervasive, immaterial digital metaverse layered upon our physical reality - touching our emotions, playing upon our psyches, and redefining our lives. In a 2019 New York Times interview, philosopher David Chalmers noted:

The view that virtual reality isn't real stems from an outmoded view of reality. In the Garden of Eden, we thought that there was a primitively red apple embedded in a primitive space and everything is just as it seems to be. We've learned from modern science that the world isn't really like that. A color is just a bunch of wavelengths arising from the physical reflectance properties of objects that produce a certain kind of experience in us. Solidity? Nothing is truly solid out there in the world. Things are mostly empty space, but they have the causal powers to produce in us the experience of solidity. Even space and time are gradually being dissolved by physics, or at least being boiled down to something simpler. Physical reality is coming to look a lot like virtual reality right now. You could take the attitude, 'So much the worse for physical reality. It's not real.' But I think, no. It turns out we just take all that on board and say, 'Fine, things are not the way we thought, but they're still real.' That should be the right attitude toward virtual reality as well.

While one could argue that the most compelling content achieves resonance in any medium, the super-charged combination of interaction, immersion and intelligence intrinsic to cross-reality experiences promises to exceed our wildest expectations by bringing imagination to life in the most vividly personal way - with adaptive characters and environments responding to the individual in a bespoke context. These virtual beings will range from cross-reality manifestations of characters from the “cinematic universes” of major corporations such as Disney and Marvel, to more intimate fare from boutique studios such as Fable, but all will be imbued with a level of artificial intelligence (AI) that affords adaptive appeal to nearly any individual, in nearly any situation.

Cautionary notes abound, particularly with regard to issues of privacy and security. Designing immersive environments and virtual beings capable of responding convincingly and personally to an individual requires an ingest of personal information that necessitates the complicity and trust (and in some cases the ignorance) of the participant, who may not be aware of the degree of data that is being collected, or the subsequent potential for abuse. Matt Miesnieks, co-founder & CEO of 6D.ai, has commented extensively on the dystopian dangers, while Apple CEO Tim Cook has (ironically, in the minds of some) warned of a “data industrial complex” while advocating for privacy as a basic human right.

The road to hell is indeed paved with good intentions. It’s not a stretch of the imagination to envision a future where we are inundated with visual distractions while our every eye twitch is recorded and emotional reaction tracked. For those who need help with this visualization, I recommend watching the short film *Hyper-Reality* by Keiichi Matsuda - a provocative vision of a future where physical and virtual realities have merged into a hyper-saturated media environment. On an ostensibly consoling note, David Chalmers observes:

What I can easily imagine is that 99 percent of the population lives in the virtual world, especially if the physical world becomes dystopic, after nuclear destruction or terrible climate change, say. The virtual world will be much more interesting and pleasant. There will be some hankering. There will be people who just like being in the level-zero world, just like people who like living in cities or people who like living in the country. We’ve got an increasingly urbanized society now, but that doesn’t mean everybody lives in the city. Maybe we’ll have an increasingly virtualized society. But that doesn’t mean everybody is going to be virtualized. I don’t think virtual worlds are going to be a panacea for problems of humanity. They’ll be like the internet. It’s led to wonderful things. It’s led to awful things. My prediction is that they will have room for the full range of the human condition. In that sense, it will at least be on par with physical reality.

That said, let us take a topline view of what this means for the field of animation, and how we can keep ourselves entertained in new and exciting ways while the world is going to

hell (if the more dystopian predictions of Chalmers and others come to pass). The attendant socio-political and ethical challenges of cross-reality are profound and thorny, but beyond the purview of this paper. We will instead focus upon the evolution of the animation medium within the context of this technological and conceptual revolution.

The Tradition of Animation Innovation

The history of animation precedes that of cinematography and is defined by innovation, whether traced back 5,000 years ago to the sequential pottery images of Paleolithic Iran, or more recently to the revolving phenakistiscopes of the early 1900's. After cinematography became a popular medium, manufacturers of optical toys adapted "magic lanterns" into miniaturized looping film projectors. Early 20-century filmmakers such as J. Stuart Blackton experimented with the creative possibilities stop-motion animation, blackboard drawings and cutout animation.

In 1914, Winsor McCay's *Gertie the Dinosaur* charmed audiences with an appealing, empathetic animated character. During the same period, the production of animated short films known as "cartoons" became an industry standard, with cartoon shorts screening regularly in cinemas ahead of feature attractions. The earliest known feature-length animated film is *The Adventures of Prince Achmed*, released in 1926 by director Lotte Reiniger and her collaborators Carl Koch and Berthold Bartosch. Walt Disney's *Steamboat Willie* (1928), starring Mickey Mouse, was the first animation with full sound synchronization.

Significantly, the "Golden Age" of America animation in the 1930's, 1940's and 1950's saw a generation of beloved animated character emerge: Bugs Bunny, Daffy Duck, Donald Duck, Daisy Duck, Porky Pig, Elmer Fudd, Goofy, Popeye, Betty Boop, Sylvester & Tweety, Tom & Jerry, Woody Woodpecker, Mr. Magoo, Wile E. Coyote & the Road Runner, Foghorn Leghorn, Yosemite Sam, Mighty Mouse, Heckle & Jeckle, Casper the Friendly Ghost, Little Lulu and others. This constellation of fictional animated characters became as real to viewers as their own friends and family (and oftentimes, more beloved).

In 1995 Disney/Pixar released the first computer-animated feature film, *Toy Story*, ushering in a new era of 3D digital animated films that dominates the international market to this day. Given the prevalence of this commercial manifestation, it's easy to overlook the variety of innovative forms that animation has taken over the past century, including but not limited to:

- 2D cel animation & rotoscoping (photographs of sequential drawing on paper)
- Stop motion animation (manipulated objects, clay, cutouts, sand & pin screens)
- Pixilation (the use of live humans as stop motion characters)
- 2D computer animation (employing bitmap or vector graphics)
- 3D animation (including motion capture, simulations and machinima)
- Animatronics (animated machines)
- Tunnel animation (utilized for subway advertisements)
- Hydrotechnics (high-definition projection onto mist screens)
- Erasure animation (ala William Kentridge)

Irrespective of their exposure to the above, most people are from childhood familiar with simple flip book animation, in which a series of images sketched into the corner of a book appears to move when the pages are flipped. In short, the animation medium has been defined by a history of experimentation and innovation, while also being quite accessible. At the same time, the predominant mass market manifestation of the medium (ie. - the Disney/Pixar model) has produced a form both wildly successful and rather conservative, with the latter factor perhaps contributing to the former.

Matters of taste aside, animation in any medium is ultimately - as Disney animators Frank Thomas and Ollie Johnston aptly put it - “the illusion of life”, an illusion which satisfies a primal creative need of mankind:

Man always has had a compelling urge to make representations of the things he sees in the world around him. As he looks at the creatures that share his daily activities, he first tries to draw or sculpt or mold their form in recognizable fashion. Then, when he becomes more skillful, he attempts to capture something of a creature's movements - a look, a leap, a struggle. And ultimately, he seeks to portray the very spirit of his subject. For some presumptuous reason, man feels the need to create something of his own that appears to be living, that has an inner strength, a vitality, a separate identity - something that speaks out with authority - a creation that gives the illusion of life.

While two-dimensional animation and three-dimensional digital imagery may mimic the form of life, content that is interactive, immersive and “intelligent” can actually begin to approach the function of life, synthesizing fictional storytelling with our daily reality.

The Evolution of Storytelling

Storytelling has always been the most natural way for humans to make sense of the world, to find common understanding and express aspirations. Stories - and the characters who inhabit them - are compelling constructs for engaging hearts & minds. This has been true for thousands of years and will remain true in light of our rapidly changing world.

Story maven Robert McKee has observed: “A culture cannot evolve without honest and powerful storytelling.” Indeed, from prehistoric times until the present day, storytelling has been humanity’s bridge of understanding and aspiration. In his seminal screenwriting tome, *Story: Substance, Structure, Style and the Principles of Screenwriting*, McKee describes classical story design as “a story built around an active protagonist who struggles against primarily external forces of antagonism to pursue his or her desires, through continuous time, within a consistent and causally connected fictional reality, to a closed ending of absolute, irreversible change.” Powerful stuff, evident in stories ranging from Homer’s *The Odyssey* to Disney’s *Zootopia*.

McKee essentially notes that “story is a metaphor for life”. Life is a voyage of discovery in which we are active participants rather than passive spectators. We muddle through and learn from experience. Immersive media, occasionally maligned by the old guard for its lack of “true” storytelling, is actually the perfect form in which to realize story as a metaphor for life. In immersive experiences, storytelling becomes story discovering.

On that front, let’s touch upon the evolving role of the discoverer: the hero, who in immersive media more often than not is yourself. Characters are vessels for story, with the hero (or protagonist) foremost among these. At the core of nearly every story is a hero’s quest to attain, protect or restore something in response to an inciting incident. In *The Hero with a Thousand Faces*, Joseph Campbell famously outlines the classic hero’s journey in his 17-stage “monomyth”: Call to Adventure, Refusal of Call, Supernatural Aid, Crossing First Threshold, Belly of the Whale, Road of Trials, Meeting with the Goddess, Temptation, Atonement with the Father, Apostasis, The Ultimate Boon, Refusal of Return, Magic Flight, Rescue from Without, Crossing the Return Threshold, Master of Two Worlds, Freedom to Live.

Traditionally, you follow the hero’s journey from a distance: through the spoken word, through the printed page, through the proscenium or through the screen. In virtual reality, we can experience the hero’s journey in a couple of ways more intimate than observing from a

distance. In the first of these, you accompany the hero's journey in the moment. In John Bucher's *Storytelling for Virtual Reality*, pioneering VR filmmaker Jessica Brillhart expounds:

In terms of the hero, what's interesting is shared experience - having something big happen, some kind of main event. You're there right next to the hero watching it. That creates camaraderie. That creates shared experience. That creates empathy. Additionally, we provide opportunities to discover elements, like owning memories, owning moments, owning the hero. Maybe the first thing you don't see is the hero. The hero emerges and you discover her. Suddenly, it's like she's mine now. She's part of me.

In other words, the presence intrinsic to immersive media enables you to experience rather than to watch, to empathize rather than to sympathize. However, there will be users who are not satisfied with the role of "phantom sidekick", and wish to engage as active protagonist.

To this end, immersive cross-reality experiences provide a second, more compelling option for the user: you are the hero, and the journey is yours. As storytelling becomes story discovering in immersive media, as users hunger for agency, and as cross-reality serves as a medium in which to manifest story as a metaphor for life, first-person narratives evolve from novelty to necessity. The challenges for immersive storytellers are many, given that each user approaches a first-person narrative not only with different life experiences, but with different expectations regarding interactive narratives.

When the hero is you, it is essential that you are the driving force of the first-person immersive narrative, with "front row feet" as opposed to a "front row seat". Agency demands that you can make decisions and effect changes throughout the narrative journey. Agency also requires that cross-reality creators "leave space" for the user (literally and figuratively), and design experiences that allow the user to interpret and "fill in the blanks."

The Future of Animation: Interactive

Throughout history, human beings have engaged in active story discovery around campfires and over books. Modern immersive storytelling must take a cue from this history, leveraging on the human imagination and our innate ability to recognize patterns and form mental images. In contrast to the passive storytelling frame of traditional screen media, interactive media facilitates an (inter)active storytelling paradigm: the participant enters the narrative, determines her own path through it, and ideally influences it. When constructing

interactive narratives, it is therefore crucial to leave elbowroom for the participant in the form of narrative rest areas. Not everything must be spelled out. The participant needs her space, literally and figuratively.

Interaction is essential to our lives. As humans, we interact with others from the day we're born until the day we die. Life is interactive by definition. Irrespective of how outgoing or reserved we are, we must interact with other people on terms that are satisfying to us while acceptable to others. Essential survival skills such as influence and negotiation are learned and refined through interaction.

We find satisfaction in cause-and-effect. In virtual reality, people quickly tire of being virtual ghosts, especially (and perhaps ironically) in more compelling immersive environments. Expectations are higher. Human beings want to be involved. There is a fundamental satisfaction in seeing something or someone react to our intention, whether bowling a strike or catching someone's eye. Cause-and-effect is an essential aspect of storytelling. We enjoy watching things play out as anticipated, and are even more intrigued when twists & turns surprise us, while remaining believable. Seamless interactivity is essential throughout.

Interactivity naturally leads to the subject of game design: the art, craft and engineering of challenging experiences for entertainment, educational or experimental purposes. These experiences can take various forms - from board games and role-playing games to video games and sports - but the common element is the motivation of competitive and/or cooperative interactions among the participants (and occasionally the spectators). In *Rules of Play: Game Design Fundamentals*, Katie Salen Tekinbas & Eric Zimmerman summarize:

Games are a subset of play: The category of play represents many kinds of playful activities. Some of these activities are games, but many of them are not. In this sense, games are contained within play. Play is a subset of games: Games are complex phenomena and there are many ways to frame them and understand them. *Rules, play and culture* are three aspects of the phenomena of games. In this sense, play is contained within games. A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome. The key elements of this definition are the fact that a game is a system, players interact with the system, a game is an instance of conflict, the conflict in games is artificial, rules limit player behavior and define the game, and every game has a quantifiable outcome or goal.

Academic theory aside, games have always had a perception problem. From craps to Doom, gaming is often perceived as frivolous and sometimes downright dangerous. Yet games are serious business. We use games to understand the world, each other and ourselves. The field of game design can be more properly understood as a subset of interaction design theory, which encompasses every conceivable human endeavor. The strategic principles of

game design and game theory are often applied to social and business situations in the form of gamification, and have motivated research across a broad spectrum of areas, including probability, politics, economics, optimization, nudge theory and artificial intelligence.

Interaction design and interactive storytelling must be an organic experience. Speaking at the 2016 Cannes Film Festival, Academy Award-winning director Steven Spielberg expressed concerns about virtual reality and interactive storytelling, apparently fearing that if people wander around as they please, they won't have a cohesive story experience (or that they might have one, but it won't be the director's vision). Well-designed interactive experiences address this concern by presenting key story points that the participant must pass through in order have the complete narrative experience. While doing so, the participant should be allowed to organically explore the space and have a sense of agency, while not missing crucial information. The interactive storyteller ideally structures an experience wherein any given person can have the impression of navigating as they please, while being subtly guided through those anchor points.

Much of this development work can be done on paper, using simple index cards to plan out the structure and the logic of the story. Infinitely branching narratives are undesirable for logistical reasons (although this will not be the case with future real-time generative AI story scenarios), so a certain amount of narrative recursion is currently required. In the most elegant scenarios, the interactive storyteller devises a choice architecture that influences without coercion: one that nudges the participant in the desired direction rather than dictates each step of the way.

When skillfully devised and gamely engaged, the designer and the participant become (inter)active partners who collaboratively construct the final narrative: a dynamic experience that assumes different meaning with each user and with each iteration.

The Future of Animation: Immersive

As animators and storytellers, we must consider the point of view of what we're trying to say and through whose eyes we're saying it. This is something that any storyteller ideally wrestles with in a book, in a play or in a film. Immersive media simply expands the options. It's important to remember that things which are currently considered to be natural in film - the storytelling conventions, editing, montage, etc - are essentially unnatural. There's no such thing as a "natural" experience of cinema. We have learned to accept the conventions of

cinema over time. Everything that we now accept as a convention of film or television storytelling was at one point an experiment. The experiments which mature and persist - in our heads and in our hearts - become the new normal. And so it will be with virtual reality and immersive media

In their seminal work, *Infinite Reality: Avatars, Eternal Life, New Worlds and the Dawn of the Virtual Revolution*, Jim Blascovich and Jeremy Bailenson expound on the non-technological essence of what we refer to as “virtual reality”:

“Virtual reality” typically conjures up futuristic images of digital computer grids and intricate hardware. But we believe that virtual reality begins in the mind and requires no equipment whatsoever. Have you ever spoken face-to-face with someone whose mind wandered off? Have you been startled out of your own mental reverie by someone else waving her hand in front of your face and asking, “Where are you?” Indeed, everyone experiences being “somewhere else” in their own minds, whether they are conversing with others or not—at times for a few seconds, other times for much longer—as our minds wander amid imagined, remembered, or misremembered places. Anyone who’s sat through a boring meeting knows this.

The remarkable thing about immersive media is that it allows us to look at things in different ways, to flip the space. We can use VR to augment the experience of what we're trying to say in standard film. We can also mold the space - especially in animation. We can scale down to a micro level or up to a macro level. There are many ways to think about how to navigate the space, what we are trying to convey as we manipulate the space, and ultimately what experience we want the participant to have in the space.

Therefore, immersive direction must be approached with a fresh perspective. The traditional media director is a dictator of sorts, with the audience following along in lock step (their only recourse being to close their eyes or leave the theater). Most viewers don't realize the degree to which they are compelled to see and feel what the director wants them to - especially in the best films. This is the narrative form Steven Spielberg pointedly prefers, and it isn't necessarily a bad thing

With interactive, immersive narratives, the director must become an "indirector". The art of indirection suggests rather than orders, attracts rather than dictates - using sound cues to draw attention, visual elements to focus the eye, expectations to anticipate the participant, and programming to respond intelligently. Accordingly, many immersive storytellers not only incorporate architects for the navigation of space, but also psychologists to understand how the human mind works, how human perception works and how human emotions work.

Immersive media, while still struggling to find mass market distribution and consumer traction, is nevertheless having a major impact on the entertainment business in the form of virtual production, where the distinctions between live-action filmmaking and animation break down entirely. Virtual production is a game-changer, the true significance of which should be separated from Disney's polarizing remake of *The Lion King*, which is merely a manifestation of (not the definition of) virtual production.

The significance of virtual production, as *The Lion King* director Jon Favreau notes, is that the virtual production environment sparks the "walk-around" thinking that is essential to a live-action director, versus the "over-the-shoulder" point-of-view of an animation director. The live-action point-of-view and the animation point-of-view are not mutually exclusive, but are in fact complementary. We have entered the era of the hybrid.

Virtual production scales up and down. Virtual production is incorrectly assumed to be an expensive proposition requiring millions of dollars and dozens of technicians. High-end, high-fidelity virtual production can indeed be as complex and expensive as any major studio can afford. But grassroots virtual production can be employed by individual in their homes with off-the-shelf hardware & software - and perhaps with more interesting results than the commercial efforts of studios constrained by massive recoupment considerations.

Virtual production is furthermore not tied to realism. Given current mass market visual effects manifestations - such as Favreau's remake of *The Lion King* - most people incorrectly associate virtual production with photorealism. But the core value proposition of virtual production is related to conceptualization, not execution. Virtual production can and will encompass an unlimited range of artistic expression, from photorealism to abstraction. This will most likely occur (as most innovations do) on the independent end of the creative spectrum, before being co-opted by the commercial end as it pursues cachet when audiences inevitably grow tired of the status quo.

From a purely artistic point of view, it is unnecessary and uninteresting to overwhelm cross-reality participants with a deluge of detailed realism. Human beings have an innate tendency towards anthropomorphism: the attribution of human traits, intentions and feelings to non-human and inanimate entities. Anthropomorphism has primal artistic and storytelling roots that persist to this day. Most cultures have fables featuring anthropomorphized animals as characters, and Walt Disney built a modern entertainment empire on the backs of anthropomorphic creatures.

Anthropomorphism extends well beyond our fellow mammals, feathered friends and sea creatures into the realm of the abstract. In 1944, Fritz Heider and Marianne Simmel co-authored *An Experimental Study of Apparent Behavior*, now a classic work of social psychology, which launched the study of intention perception (the ability to guess intentions by observing behavior). Heider & Simmel's research demonstrated that, when presented with animated configurations of abstract shapes, people are inclined to assign intentions and even emotions to these - a phenomenon which seemingly underscores the human storytelling instinct.

In the course of their study, Heider & Simmel created an abstract animation: a tableau between a large triangle, a smaller triangle and a circle. People who were shown the animation and then queried on the content responded with creative narratives that anthropomorphically assigned human intentions, actions and emotions to the moving objects. Only one person in the original study recounted the animation in geometric terms.

What Heider & Simmel realized is that most people who watched this abstract film of animated shapes were quick to see a story. In those simple shapes, viewers empathetically recognized characters with emotions, motivations, and purpose. The lesson for those of us working today is that abstraction and elbowroom can facilitate agency and engagement in immersive media.

The Future of Animation: Intelligent

Interactive, immersive environments necessitate intelligent responsiveness. These narrative experiences - from humble mobile phone chatbots to expansive immersive environments - must be imbued with artificial intelligence in order to organically respond to unpredictable, organic user input. The future of entertainment is virtual beings: AI characters that interact with humans in cross-reality experiences.

Artificial intelligence is software with a learning mechanism that makes choices in new situations and learns from inputs and experiences. AI has become a priority for the global tech community, with significant advances in deep learning, natural language processing and computer vision leading to the development of artificial neural networks, which work much like the human brain. Benefits of AI include complexity management, decision making and lifestyle enhancement. AI technology is already being employed across a range of activities including finance, medicine, education, journalism, manufacturing, agriculture, retail, travel, politics and entertainment.

Recent advances in artificial intelligence have been touted in the media to great fanfare and fear. But true AI - the sort of technological self-awareness that enslaves humanity in sci-fi fiction and Hollywood fare - is far off. Most of the purported advances in artificial intelligence are not due to improvements in the science or the algorithms, but simply related to the massive amounts of computing power that are now being applied to the same algorithms and processes that have been employed for 50 years. And emulating the human intellect is not merely a scalability issue.

Artificial intelligence is both less advanced and more pervasive than you think. When a computer achieves a milestone (such as Google's AlphaGo beating reigning human Go champion Lee Sedol in 2016), people are quick to infer intelligence and intuition where none exists - perhaps due to our tendency to anthropomorphize. We assume - and sensationalist media fans our fears - that it is only a matter of time before the machines come for us. But just because your watch can tell time more accurately than you can doesn't mean it's smarter than you are: it's merely a tool that you use. AI technology is no different. Front-page hype aside, we're decades or more away from anything approaching general artificial intelligence. In *Applied Artificial Intelligence: A Handbook for Business Leaders*, authors Mariya Yao, Marlene Jia and Adelyn Zhou observe:

Artificial intelligence, also known as AI, has been misused in pop culture to describe almost any kind of computerized analysis or automation. To avoid confusion, technical experts in the field of AI prefer to use the term Artificial General Intelligence (AGI) to refer to machines with human-level or higher intelligence, capable of abstracting concepts from limited experience and transferring knowledge between domains. AGI is also called "Strong AI" to differentiate from "Weak AI" or "Narrow AI," which refers to systems designed for one specific task and whose capabilities are not easily transferable to other systems. Solving tasks outside of the program's original parameters requires building additional programs that are similarly narrow. Approaches that work well for solving narrow problems do not generalize well to tasks such as abstract reasoning, concept formulation, and strategic planning—capabilities that even human toddlers possess but our computers do not.

However, AI doesn't need to achieve human-level general intelligence to cause massive disruption economically, socially and politically. The mundane fact of modern life is that most day-to-day activity is predicated upon recognition, retrieval, repetition and barely requires self-awareness: easy pickings for AI displacement.

Dispiriting dystopian scenarios aside, the degree of AI we need to apply to a virtual reality experience is not on the order of HAL, but just enough to provide the illusion of interaction and agency for that piece of content. This is where the intelligent planning of the virtual reality experience - the story that's being told, the way in which it's being conveyed,

and the technology that's being applied - is crucial. Retrieval systems are ultimately unconvincing, and quickly fail the Turing Test (whether or not the user is aware they're applying it). Generative AI environments and agents are ultimately required, incorporating high-level machine learning technologies such as image recognition, fuzzy logic and natural language processing.

Artificial intelligence will provide immersive, interactive access to animated characters on a personal level, letting us relate to them as old friends who talk to us, interact with us, share their thoughts with us, and remember us. Virtual beings will seem to be aware of you and engaged with you, not because they have been animated to do so, but because they are reacting to you. Virtual beings can exist in any digital medium, and will freely cross platforms to accompany you when and where you like.

While the embryonic beginnings of such AIs exist in the form of digital servants such as IBM's Watson and Amazon's Alexa, the essential difference between virtual assistants and virtual characters is in the storytelling. Beyond the technological benefits and socio-political challenges, AI is poised to become the next great art form and storytelling medium: bringing enjoyment - and perhaps even meaning - to our lives, with virtual beings who enter our world as we in turn enter theirs. The animation field is perfectly suited to take advantage of the myriad possibilities.

Preparing for the Future of Animation

The technological and conceptual revolution facing humanity overall, media in general and animation in particular requires a philosophical reconsideration of creative principles and a practical reconstruction of curricula and professional practices. It is beyond the scope of this paper to propose a detailed academic program preparing the future of animation, but we can identify core philosophical precepts and make high-level recommendations in key areas of curriculum.

Precepts:

- 1) Preparing for the future of animation requires the embrace of constant change, lateral thinking and lifelong learning. This can be said of any field heading into the 20th century, but is worth underscoring for animation due to the ironic contrast between the medium's innovative history and unlimited potential, and the constrained thinking and conservative execution

evident among so many of its practitioners. 3D computer animators sometimes deride 2D hand-drawn animators for being Luddites, while themselves failing to recognize the factors that will flip the field on its head once again, in a far more dramatic way than Pixar's *Toy Story* did in 1995. Individuals, institutions & enterprises that fail to grasp, prepare for and capitalize on this will suffer from it.

2) Preparing for the future of animation requires an interdisciplinary synthesis of art and technology. Much lip service is paid to this principle, with artists & scholars pointing proudly to Leonardo da Vinci as the art/tech poster child while failing to follow his example. Far too many schools and studios continue to tolerate (and even advocate) walled thinking and divisive practices, usually over misplaced concern with maintaining identity and territory. Ironically, a porous philosophy is preferable to a protectionist stance, and ultimately more powerful. While every animator does not need to be a programmer or scientist, all should at least be conversant and collaborative in these areas, with the full guidance and support of their instructors and educational institutions.

3) Preparing for the future of animation requires the interaction of theory and practice, unconfined to the ivory tower of academia. By necessity, this must go beyond simple critical studies courses or summer internships. Our charter as educators is to situate students on the frontiers of their vocations while positioning the academic institution as a thought leader in the field. External avenues of affiliation must include a lively combination of cultural, educational, entrepreneurial, commercial and industrial channels, providing creative crossroads for students, researchers and professionals.

Academic programming for the future of animation should set “the illusion of life” upon the three pillars of interaction design, immersive media and artificial intelligence, whether within the same school or among a network of like-minded partnering institutions. Curriculum recommendations pertinent to the future of animation can be grouped into six key program areas:

General Education - A good general education program provides the comprehensive breadth of knowledge necessary to be a well-educated person instilled with intellectual curiosity and the capacity for self-directed life-long

learning. Given the rapid pace of technological change and the attendant socio-political, economic and cultural consequences, a forward-thinking general education paradigm is a must for students of all disciplines.

Core Studio - The fundamental principles of animation, while hardly sacrosanct canon, still constitute a compelling foundation for resonance with audiences - whether those are the passive viewers of yesterday or the active participants of tomorrow. Any future animation program should continue to have the mastery of these expressive creative principles at its core, to ensure that style does not supplant substance. Perception Principles, Brainstorming & Problem Solving, Future Storytelling and Experience Design are key components of next-generation content creation.

Technical Skill - In current animation programs, technical skill is typically relegated to proficiency with commercial software platforms, perhaps with a coding class thrown in for good measure. The future of immersive, intelligent animated entertainment requires a DIY hacker mentality that returns creators to the days when artists made their own tools to facilitate innovation - whether on their own, or in collaboration with others.

Media History - Although the view of history as a progressive continuum is a fictional construct, the historical examination of animation, cinema, TV, the internet and other media nevertheless provides crucial context for creative orientation and action. Given the global pervasiveness of media - and with basic humanist principles in mind - it is essential that this historical examination be multi-faceted and multi-perspective.

Critical Theory - The problems caused when technological advances are either unguided or misguided by critical theory are unfortunately numerous and evident. The risks of technological advance being “slowed” by self-examination and reflection are far outweighed by the risks of unfettered technological “progress”. Critical theory - sometimes dismissed as navel gazing - instills the tradition of questioning necessary for meaningful, ethical creative practice.

Professional Practices - Internships were all the rage when I was in graduate school a generation ago, and are still in use today. But traditional internships are of dubious value in preparing students for a “jobless” future in

which only the entrepreneurial will thrive. The new currency for anyone who wishes to “future-proof” themselves is a startup mentality that begins with incubation in school and is cultivated beyond graduation.

Many educational institutions are already making strides towards preparing students for the evolution of media and the future of animation. The University of Southern California (USC) is a good example. Arguably the definitive program of its kind, the USC School of Cinematic Arts (SCA) is the oldest and largest such school in the United States, and one of the most reputable in the world, founded in 1929 as a joint venture with the Academy of Motion Picture Arts and Sciences. With a highly competitive admission rate of less than 3%, the USC SCA touts itself as “the only media school in the world that teaches all the major disciplines of the Cinematic Arts”. The USC School of Cinematic Arts indeed offers an interdisciplinary learning experience, with students taking classes across seven divisions that cover the complete breadth of film, television, and interactive media.

The core strength of the USC SCA is the underlying philosophy that “the best education comes from creating an environment where theory and practice are in constant interaction.” Regardless of major, all Cinematic Arts students are required to take courses across the full spectrum of the School's offerings - instilling a holistic understanding, collaborative perspective and imaginative outlook that supersedes the specific fields. In today's world - and facing tomorrow's challenges - such lateral thinking is essential, irrespective of discipline.

In order to adapt to the evolution of media and remain relevant, schools of art and animation must become hubs of design-driven immersive content, discourse and development. They must reframe themselves as entrepreneurial studios, laboratories and think tanks serving art, education, entertainment and business - preparing for the issues, industries and imagination of the future. Artists and animators already have a leg up on the future with the creative mindset, self-awareness and resilience required to remain engaged. The charge for institutions and teachers today is to help reframe and refocus these qualities for maximum relevance and impact in future media.

Conclusion

The future of animation will always be predicated upon creativity, which includes the innovative application and expansion of current and future technologies. Immersive storytelling experiences have been part of human culture since prehistoric times, helping us make sense of our place in the world. Over the past century, humanity has enjoyed a rapid evolution of personal media technology, from the phonograph to virtual reality. Yet the current state of immersive media is akin to the early days of cinema - it has not come into its own as a mature form with a distinct vocabulary. The future of animation will produce immersive experiences in which participants naturally expect compelling interactivity and transformative storytelling.

Artificial intelligence technology will be the nervous system of these reactive, adaptive experiences. Successful animation directors will be those who evolve their storytelling skills to master the art of indirection. Future animated entertainment will be fully integrated with the mixed reality of our daily lives in a blend of physical and virtual experience. But regardless of the technology, imagination will always serve as the aspirational heartbeat of our storytelling experiences.

In *Infinite Reality*, Blascovich and Bailenson summarize:

We believe that we are at or slightly past the threshold of creating technologies that, for good or bad, will transform the experience of being human. Life will be seamlessly altered, if not enhanced, as digital technology becomes part and parcel of our daily lives, allowing humans to break through the constraints of past technologies. Technology will soon provide levels of visual fidelity (and, later, touch and smell) comparable to the audio fidelity of the telephone. In other words, virtual worlds encompassing all of the senses (roughly speaking, think *The Matrix*) will at some point "feel" as "real" as a telephone conversation does today (imagine *Avatar*). Might those worlds be disorienting at first, like the prism glasses and their upside-down world? Now that the technology has begun to catch up to the sci-fi musings of the past, we can begin to see how humankind will soon ground more and more of its reality in virtual worlds—to astonishing effects for existence, individual and collective. Welcome to the next great advance in the history of human communication.

Welcome to the future of animation.

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