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Embodying Virtual Volumes: Bambi Cannot Die Like Shao-Kahn

In *Mortal Kombat 11,* delivering the final blow to an opposing fighter yields mixed results: a decapitation may spew blood onto the in-game camera watching the battle unfold. Or one can vivisect in real time, a trope of the franchise: a character tears through the mid-section of its opponent, causing their body to come apart at its seams, disclosing a neat cross-section – a spine encased in plasma, or internal organs drifting neatly upward from the player-character while bits of blood and guts hit the lens. The camera pauses and a voice screeches a victory message at the precise moment of fatal impact when the scene is amidst a bloodied and gravity-defying severed arm or spine-lash. The continuity of time and space is reconfigured before us as body parts drift lethargically up towards the camera.

As the newest game in the longstanding franchise, *Mortal Kombat 11* made significant graphic strides compared to previous generations. The game relies on strong simulations to produce the illusion that its bodies are filled with human-like sinews and guts. But the designs lack functional bones and muscles—they are pure surface. These “meshes” – collections of vertices, edges and faces that define objects – describe anatomical form purely topographically. Smashing through a character emits a flipbook of innards from the area of impact, cheating the idea that they have fluid inside of them. The game's VFX artists pulled this trick off by incorporating a blood “library” consisting of fifteen samples –l ess than 155 megabytes of data –which comprises the entirety of the game’s blood cinematics. It is diverse enough to account for all possible blood arrangements resulting from fatal blows, having varied enough vertical “splash,” tilt, and spray to replicate a gushing liquid. The end results are images that resemble an exploded-parts diagram: eyes slickly bulging atop sockets, ligaments floating farther and farther away. The carnal diagram is more than an abstract death schematic, however; it becomes a gory field of virtualities captured by a camera that can be anywhere at any time. Since the physical location and mobility of the “camera operator” is nowhere to be seen, we instead witness the reproduction of an effect that Evan Calder Williams (2017, p. 232) calls *distributed sight*: that which is “able to be everywhere and nowhere at once, less a discrete recording apparatus than an ambient field of registration and perspective.” We can be behind a cracking skull; at the very tip of a cleaver that’s just been drop-kicked into a decapitated enemy; or watching the still-beating heart of a grizzly ogre come to a complete halt in real time. All this clever modelling to achieve maximum visual impact, using as few computational resources as possible.

Like exploded-view drawings, which illustrate the relationship of parts to a whole in the context of their assembly, the carnal pastiche maps the seams of an avatar. They reinforce the impossibility that surface meshes can possess working muscular vascular systems. They preserve the look of the body, but not the possibility of the relation to its own forces;

i.e. the bodies, once adequately assembled, do not breathe and are not simulated to do so. Not unlike miniature controlled explosions, virtual death separates parts from the whole, and a viable body from its simulacrum. In other words, the moment of explosive impact emphasizes the imitative nature of the in-game bodies. The bloodbath erodes the distance of optical space, and so we confront the lure of screen space, of hapticity, of being swallowed up by corporeal matter.

It is not a failure of empathy which underwrites this neutralization – virtual technologies are, after all, not empathy machines – but the presence of a technical condition I will call "parameterization." A parameterized subject is an image born out of the infinite parameters built into software. In other words, it is a virtual, non-living entity comprised of data that carries with it the range of software possibilities in its construction. One sees an expanded zone of motility or agency in the parameterized image, as well as its phantasmatic potential. Backlit by the protoplasmic elasticity of cartoons, as well as by the tropified and impossible treatment of immortal flesh in fighting games, the parameterized subject admits that there is no such thing as an authentic body, at least not at the limits of flesh. Like watching scripts be deployed, the parameterized subject exemplifies the agony of being a pre-configured set of bodily possibilities retroactively fitted onto a model. Bambi and Dumbo could never have died the same way, but Shao Kahn and Sub-Zero, built of this new parameterized world order, can.

It is difficult to process the commonalities of parameterized subjects unless seen *en masse*. What can be felt, however, where it is difficult to parse the peculiarity of software's parameters, is a recognizability or the "as-seenness" of an image. This is unique to the construction of these images, which, despite technically being seen for the first time, reference a slew of effects, styles, and techniques which crystallize in them and which allow for something radically different to feel relatively normal. Recognizing parameterization involves some familiarity with the points of construction of a 3D modelled body, but even an uninitiated viewer can pick up on and feel the repetition. Despite absolute dismemberment, one can recognize the cast of *Mortal Kombat* dying the same way, across platforms and across media. Bodily trauma is carefully orchestrated so that the supposed and randomized calamity of it is seen but not felt. For all interactive media's supposed ability to mirror chance, its scenes end up choreographed. A viewer feels neither empathy nor sadism, just effects and marvels.

The precedent established by the Mortal Kombat gaming franchise is not towards images of hyper-violence – although I am certain those who demonize violent video games as capable of inducing a "moral panic" would disagree with me on this point – but towards images that are parametrically real, which produce certain, constraint-based effects and elicit responses from audiences that can read both those effects in relation to themselves. In the case of *Mortal Kombat 11,* the treatment of these images extends its synthetic realism into a space of representation which does not exclusively produce nausea or disgust, but which even verges on comedy or tragedy. With so much "fake" – yet resonant – matter on our screen, the images transform into something altogether novel. Not only do these virtual forms reference the internal logic of how they are made (i.e., synthetically, via complex modelling software and its conjoining of physical movement and data), they display bodies which reference something outside themselves. The fatal blows are not about death, they are gestures towards the fantasy of the camera that can zoom into the body—of that which *is not visible but structures visibility.*

Despite the grotesqueries of a revealed interiority and the floating products of decapitation and dismemberment, these images are not hyperreal in the typical sense of the word. That is, the images are not, in the Baudrillardian sense, simulacra of a 'real' entity that they are intended to reference of replace. Rather, they implode the distinction between reality and its replacement ("failed" simulation) and become wholly new sign-systems which are neither simulations with referents to a 'real', nor 'false' images without origin. The impossible x-ray vision at the moment of impact, wherein time destabilizes and body parts move in a slow, stilted rotation out towards the camera, obviates gravity to reveal a sanitized and tragicomic performance of brokenness. The characters get defeated but do not die – they must keep expressing themselves in future battles. Their purported verisimilitude is a testament to their "failure" to get the job done the first time; they are stuck in a tragic loop of re-sequenced deaths.

These expulsions and abstractions of the body are the topology of game-forms themselves. The way that the characters were rigged – or, in technical terms, given skeletal frameworks – and then animated are engineering techniques that translate into certain qualities of gameplay; it is consequently possible to observe the parameters with which the game designers contended when constructing these virtual forms. The texture of leather on the vest of a player-character or the downward velocity of an avatar falling from its stage can be uniquely recognized and felt by the player, so that the new status quo is not one of real-versus-cartoon, but a new visual paradigm entirely: *parameterized*-real-versus-cartoon. The way these characters come to be constructed in the modelling state – the polygons that compose them, the real-time simulations and the skeletal rigs that form the underwire of thrashing corpses, the reliance on the richness of soft-body simulation – belies their beginning as metrics, inputs, algorithms, and other coding languages assigned by animators and programmers. The images produced by these original technical apparatuses thus introduce a new level of estrangement wherein the major referent is no longer the physical world, but technical culture. Game developers have managed to put on display the correspondence between the broader organizational culture of which their games are apart, as well as the non-simulative experiences that make "hyperreality" itself playable. Realism thus begins to include more than what resembles the real; it must account for an invisible set of inputs which produce the parameterized picture of its reality. The gory cross-sections and floating limbs of *Mortal Kombat* become diagrams of all the questions, software constraints, corporate limitations, and computational expenses that game developers undergo to produce the images, yet they are presented to us *ab ovo*.

Evident in these historical shifts—and across contemporary visual cultures which utilize CGI to extend or enliven characters—is the correspondence between the subjective imagination of ourselves and our objective being as they become increasingly irreducible to one another. The *Mortal Kombat* fatalities are a small sample of a cross-section of what it means to "embody" virtual volumes and constitutes just one example of a much broader phenomenon of digital culture: the infusion of vitality into a set of data that then becomes manipulable. The transfer of animacy to the inanimate (and its inverse—inanimacy to the living) is detectable in the onscreen flesh-cannons. In fact, the explicit nature of *Mortal Kombat,* fatalities is emphasized by developers in the cutscenes: substituting the customary temporal flow of fighting games for a slower, sumptuous emphasis on the moment of *Fatality,* ultimately suggesting the in-game relevancy of identifying the seams of animacy. The moment a character is rendered dead happens to coincide with the

complete obliteration of their corporal form, and thus their parameterized form. This phenomenon, however, is not exclusive to sites where bodies are operationalized. As when playing video games, we also reactively embody computer-generated effects in movies. By "reactively embody," I want to suggest that profound bodily inversions/responses occur as a result of newer forms of visuality which can account for them, not unlike a gamer haptically leaning in the direction of their onscreen race car, or the sensitivity ushered forth from a burst of volume when a car explodes. This response moves us beyond preconceived notions of passive, second-order viewer experience and into an operational, psychoanalytic, and corporeal exchange. It is no longer possible to passively consume media.[i] Images bear traces of the world and we adhere to them—and technical culture—in real time. The increasing operationalization of bodies translate into mutually determining effects on users. There are no pure relations.

From anthropomorphized brand ambassadors (e.g., McDonaldland, GEICO, Aflac) to dead actors reanimated for new roles (e.g., Peter Cushing coming back to life as Grand Moff Tarkin in *Rogue One*) we have been watching computer-generated flesh – the friction of skin encasing a kneecap, or the soft, variable densities of the upper lip too seamlessly melding back into the face—for decades, but do not yet have adequate language to understand how the ways in which they're made consecrate the images rendered before us.

The relationship between body schema, technics, and culture is transductive: bodies, images, technologies, and aesthetic modes merge in relation to and co-determine one another. "Embodiment" itself, as terminology, is affected and informed by images; moreover, it does not pre-exist culture but emerges from it. Digitally produced and parameterized bodies trigger new forms and experiences of embodiment.

Under the Hood

In order to understand how imaging strategies produce the aesthetic effects that we frequently and unconsciously watch in the world, we must first understand the basic infrastructure of how these images are made, including the software that composes them. Software is a constellation of relations that comprises power dynamics, visual cues, embodiments, and expressions of culture. The aforementioned elements come together as the observable frames and patterns that constitute a *user interface*, or UI. Each button input is attached to a set of data; while a user observes changes to their model in real-time, that model is receiving a flurry of mathematical inputs on the back end (its administrative view, which cannot be accessed by a user) dictating the way it appears on-screen, including which simulated mechanisms are at play. The operational logic of the user interface generates degrees of opacity for users who neither see nor fully comprehend the binary code causing the permutations of the forms under construction.

At its core, a 3D model is simply a piece of data connected to additional data that describe its physical characteristics, physics principles, degree of detail, and more. This additional data describes such things as what material a model is made of; how the light hits it and at what angle; whether it casts or repels shadows; so on and so forth. On the front end (i.e., its presentation layer, or the end-user facing view) is a viewport which allows an animator to see its manipulation in real-time. In this way, agency is distributed between a user and the algorithms that comprise a subject. The numerous tensions that exist between user

and software redistributes agency between people, machines and "contemporary symbolic environments" carried as code (Mackenzie 2006, p. 19).

All modelling software is set up according to a logic based on realism as its de facto mode of construction. This is because, as Leon Gurevitch (2013, p.134) contends, the automated algorithms of software provide the spaces, objects, and "camera" consistent with real-world physics. The aesthetic possibilities offered by 3D computer animation are dominated by work simulating human movement and photoreal phenomena and are spearheaded by high-budget production studios. This is not to say that software does not allow for bending the course away from realism, but the continual negotiation between artistry and technical skill, as well as the emphasis on photo-real animation by glossy, economically salient studios, brings about the seemingly natural association of realism with the development of animation software. Animation entails a different skill set than modelling, and the demands do not always mesh: "the sometimes-awkward and tension-filled discursive and material relationship between getting technology to work well and good storytelling is apparent" (Wood 2014, p. 27).

Realism in computer-generated imagery has a wide-ranging set of connotations, including images of verisimilitude (e.g. the "accurately" modelled body or landscape) as well as parametrized-real subjects that are the result of a precise choreography of inputs (e.g. the bodies in *Mortal Kombat* which "accurately" simulate physics). Realism is a style predicated on contact with the real; it does not need to depict feasibility. Realism's effects can be felt by viewers despite their being "real" images; fantastical and artificial effects can produce a corporeal empathy which has no semblance of realism or indexical link. Thus, realism is an admixture of that which resembles the real and an irreality which produces "realistic" effects.

Rigging: Root ? **Spine** ? **Shoulder** ? **Elbow**

Before a character model can be posed and animated, it must be bound to a system of interconnected joints and bones. Otherwise, a model is a static mesh – an unwavering digital asset, not unlike a two-dimensional still image. A character animator folds an invisible skeleton into a three-dimensional mesh, specifying joints and defining their overall motion. They must go as far as to specify the weight of each bone in a process called weight painting, as well as the joint hierarchy which follows. This works by establishing a choreography for the bones: the farther the vertices get from the "root" bone, the less they are affected (i.e., root ? spine ? shoulder ? elbow). An animator must also demarcate a rig's degree of freedom, since realistic, "human" bipedal motion is typically constrained to one axis. The elements of a rig are modular; they are assembled into larger scale objects but can continue to maintain their separate identities. After all joints and bones have been indicated, a model has been "rigged," and an animator can bend models into a desired pose.[ii]

The increasing parameterization of software, which includes rigging in the process, has forced animators to contend with questions that were previously irrelevant. Questions such as *How much does Sonic the Hedgehog weigh? How thick is his skin?* did not matter in an era which lacked the technical sophistication to apply bone density to skin; software did not initially support the notion of a robustly quantified body the way it does now. These days, to crawl closer to realism, software must account for as many contingencies as

possible. And it must contain not only the "correct" formulae for realistic motion, but its reverse: a complex set of parameters which define an armature of *constraint*, and which prevent crossing into the realm of "unrealistic" animation.

Many additional extrapolations can be made on the specifics of rigging and character animation – such as that the technical specifications of kinematics and automatic interpolation by computers have a vast effect on the way bodies move – but of note is that rigging is a radically different method of sculpting the body than its precursor, the animated body. Early animation techniques, such as rotoscoping, traced the outline of a form frame-by-frame to produce realistic looking action.[iii] What the rotoscope offered hand-drawn animation was the relatively novel appearance of grace and continuity, indebted to the live-action footage it directly referenced. Rotoscoping, with its emphasis on tracing the outline, systematically differs from rigging, which approaches realism as a process of construction from the inside out.[iv] Lisa Cartwright (2012) further argues that the rotoscope is less tied to the mimesis of normative aesthetic form and movement than to a device which renders interpretive condensations and projections from fantasy—including specifically racialized ones.

What is the shared basis between imaging strategies and inherited tropes in this category of techniques? The encroachment of physics and parameterized design onto the fatalistic and surreal movements of cartoon protoplasms has had a profound effect on the imaging of bodies. The routine reliance on verisimilitude has a long history and pioneering use in science-fiction, horror, action games, etc; in other words, the manipulation of bodies is deeply linked to the depiction of the fantastic. Moreover, computer-animated imagery has a long precedent of modelling that which is too difficult to photograph or risky to replicate, and much of what gets prioritized in modelling software are the simpler solutions for depicting realistic catastrophes, which are made to sell. A high-risk dive into an explosive pyre might be a combination of practical effects – a stunt performer, a final detonation that releases a ghostly and algorithmically-constructed fog. Cloth, fog, and fire require massive budgets and serious technical expertise to realistically render – tools which typically belong to the domain of the most successful production studios. Thus, the subjects which lead the charge in developing these glossy imaging strategies are those companies that can afford to add further spit-shine and richer transparencies to their models. Viewers are experiencing bodies which, first and foremost, showcase the cost of their production, making obfuscation an inherent fact of a viewer's interaction with them. With verisimilitude being the new *modus operandi* of representational strategies, how has the depiction of bodies changed over the last three decades with this new manipulability baked into software? What happens when the mechanics of depicted surficiality are laid bare?

Bodies Are Industrially Calculable

Our new body-building paradigm revolves around the idea of parametrization. When a character is figured in modelling software, a host of characteristics are quantified and translated by code into compelling visual objects and motions; we thus perceive a shift from building images into building *modules* which target the primary/secondary characteristics of characters. This means that when we read these modular images through the immanent possibilities of their production, what we are seeing onscreen is the simulation of the *effects and look* of the natural world into quantifiable information. This is not a 1:1 duplicate of the natural world nor a direct translation into quantification the way a

digital camera sensor produces indexicality, but rather, a simulated substitute which nonetheless precedes and determines the real.

The notion of a system recreating the world in its own image can be found in the work of philosopher Vilém Flusser (2014), who argues that technical images, or images produced through technological means, operate differently than traditional images. These images are not direct representations but are composed apparatuses which "reflect the scientific statements that allowed for their production" (Thurtle 2018, p. 11). The notion that bodies become industrially calculable before they become informationally computable will be useful to our study of the parametrization of these emergent, visual forms. What are the consequences of these uniquely constructed forms when they are beholden to the limitations of the programs, processes, and physical properties that hold them together? And what are the connotations born out of these images—out of the corporeal practices which reprogram us via their uneven relation to realism?

The parameterized technical image maintains not only a potential for "advancing" virtual reality, but for inhabiting it through a regime of simulation; that is, by cutting ties to an underlying, indexical reality. These modelling systems recreate and reprogram the world in their own image – the immanent possibilities of production made by rendering the natural world as consistent data. The simulated images we unwittingly view onscreen are subject to simulated micro-adjustments – the imperfection of the viscosity of a simulated honey pour, for example, or the counterfactual drag of a cloth dress simulation – that are just off enough from real life but nonetheless prefigured as such. Unable to be accurately reproduced or rendered, and still subject to our great capacity for sniffing out indexical links, the images are close copies of the natural world. Despite this entanglement of realist aesthetics and software, realism remains an effect of software. It is because verisimilitude can "fail" harder and yet more adequately execute a depiction of ingenuity that I consider realism's primary effect, or what Lisa Purse (2013, p. 4) refers to as its "digital-ness" – the digital image which has the potential to produce connotations of its own. We are viewing a realism which is highly uneven, and which produces effects in viewers.

Aylish Wood (2014, p. 84) calls these forms "digital contours" as they are exclusively born out of digital space. They are images that comprise an expression of a different kind of reality—one which is full of impossible yet familiar camera movements and perspectives that manage to take us beyond our ingrained understanding of a camera frame. A virtual camera can position itself anywhere in relation to a parameterized object, as *Mortal Kombat 11* demonstrates. The mediating influence of software modules and toolkits reveals itself as a material *property* of images, evident in their facade; there is evidence of a "wave modifier" module when the rigged tentacle of a CG octopus laps at the current. Even if an unenlightened viewer cannot recognize this technical feat of software, they still see the vestiges of its algorithmic flow: the ripple-like, sinusoidal tentacles that once belonged to the rigid bone structure of a digital armature.

This range of digital effects which rip apart an industrially produced image, e.g. a *Mortal Kombat* character, into an emulative and operable entity—in this case the user-camera interface—is also displaying its own modularity. In a discussion of the mimetic properties of representation, Thurtle claims that:

> In the age of technical images all types of representation require some element of fabrication. Representation is no longer just a

property of the mimetic revealing of the world, it is a fundamentally constructive element that allows the concrete to emerge from a sea of potentials. (2018, p. 84)

The “concrete” emerges through shaders, textures, photoreal renderings, and through animations of smoke, fire, and sea spray. When a fluid is simulated, for example, it is often done using something called a particle emitter. To account for the dynamic array of effects possible with liquids – dripping, pooling, splashing, squirting, gushing – and all the subtle variations that come with them, liquids are digitally constituted as collections of interacting particles. These particles produce the appearance of randomness, but are in fact highly controlled; indeed, the influence of gravity and pressure on liquids exist as equations as part of liquid simulators.

What these purchasable, market particle engines have in common is that they all package the physics of fluid simulation. But where they differ is regarding what concessions they make in exchange for their realistic effects. The viscosity of a liquid, for example, is frequently ignored for its “small” role in the appearance of naturalism for most fluids. Consequently, the boundary conditions of liquids – the edges they interact with, their surfaces and boundaries – is a crucial aspect of a successful liquid simulation and is numerically generated.[v]

The implementation of accurate simulation is a balancing act between computational strain and total verisimilitude. The impossibility of accounting for all principles of realism has resulted in an industry with clever workarounds, not unlike the glove that cartoonists once used to skirt the challenges of rotoscoping. This is also the case when it comes to technical processes in modelling, such as rigging. With rigs, animators will often create poses that are intended to mimic real life—exaggerations for the purposes of realism. An arm can be posed beyond anatomical comfort, so that, from another angle, a scene appears more naturalistic. The arm cannot, however, be posed so far that the model’s skeleton – its rig – snaps. Thus, when it comes to performing naturalism in animation, there is a boundary: a model’s rig, its interiority, represents the limit at which something can be bent but not broken.

Consider the visualization of a limb breaking as opposed to a representational system “break” or glitch. For a break to be represented, it needs to be drawn in and programmed. This produces a threshold of visibility and legibility where an image not explicitly depicted causes a glitch—it comes apart because a system cannot process it. One subsequently must predetermine what effects are allowable and account for them in the modelling stage. In other words, to illustrate a broken limb, one must make an extra effort to draw the conditions of that breakage, since playback will not naturally support it. Physical constraints, however extreme, are still constraints; the process of controlling movement invokes an uneven distribution of agency between user and software. Software disperses user agency in that it establishes the possibility and limitations of movement. In this case, we have a rigged skeleton whose breakages can only go so far, whose movements are automated by software.

Behavioural experiments, moreover, have found that there is not an obvious correlation between the accurate simulation of physics and the appearance of realism. A recent behavioural study by Christopher Bates (2019) found that people claimed simulations built from efficiency model – those which “drew the natural appearance of fluids” – were more

realistic, rather than those which deployed costly neural networks to reproduce technical accuracy. This same study also found that its participants consistently underestimated the potential energy of a splashing liquid in virtual scenes. One wonders if the quick and unconscious judgements we make in our interactions with the world, such as how far a partially filled glass of water can be tipped before the water is in danger of spilling, better account for the *appearance* of realism, rather than the enactment or simulation of it. The embodied judgements of these unique situations, as opposed to the heuristic and empirical extension of physics properties into software, complicate our notion of "realism."

According to Wood (2014, p. 63), making sense of the digital is "accounting for its enhancement of depictions and simulations based on conventions of realism, while seeing too how moving images reveal a perspective on the ways mediations of software embedded in the physical world alter our experience of time and space." Digital images, as expressions of a different and not necessarily inferior kind of reality, offer a fully coherent (but not photographic) expression of something else entirely. They are the "consequence of a different or more perfect human vision," the basis of a unique viewing experience combining the representational and the more-than-representational that software points toward (2014, p. 79). Immersed in these simulations and exhilarated or troubled by their possibilities, we feel vulnerable: bodies move down the pipeline and become manageable matter, increasingly viewed as resources to be mastered. Parametrization expands representational strategies of corporeality as we know them.

"Already-Seenness": Blood Libraries and Grab-and-Go Animation

Sociologist Cassandra Crawford has one of the most provocative and eccentric accounts of phantom limbs as ingress into epistemological questions about embodiment and techno-corporeality. She writes,

Phantom limbs are curious to be sure because they often move in the world like fleshy limbs—waving goodbye or gesticulating during conversation—because they possess lovely or disturbing histories—wearing precious engagement rings, favourite lace-lined socks, or blood-filled boots; because they can exist tenaciously and sometimes audaciously—penetrating solids, objects, and even the very viscera of others; and because they "physically" detach from the body—leaving gaping holes as the hovering bit follows the body with reverence and in perfect harmony (2014, p.7).

Techno-corporeality is thus a matter of self-image as much as it is a hard-wired, corporeal configuration. These shadowy limbs, and the embodied ghosts that come with them, are themselves "technologies." They are influenced by and influence the subjectivity of their hosts. The features of the social world that we take on, and whose material and ideology we come to embody, comprise our bodily schema.

The capacity to "penetrate solids, objects, and even the very viscera of others" by the particularly enterprising phantom limb reminds one of the forcefulness of the "impact" of violence in *Mortal Kombat*. I want to argue, however, that there is something more pervasive at work than the passive familiarity of screen violence, or the tenacious products of decapitation. The familiarity is not merely a function of the "interchangeability" of limbs, of blood, or even of perfunctory violence, but a function of the parametrized body and its open-ended, extensively modular/reworkable potential. This is because the parameterized

body is oriented not solely towards the production of meanings, but towards a spectator's familiarity with previously depicted imagery. In other words, what is distinctive of the form of the parametric is its "already-seenness" of an image—the resonance of familiarity users receive, an interchangeability of action that can be felt and absorbed. The already-seenness of images starts to become culturally omnipresent enough to produce effects in the era of instant image relay.

Specific to the parametrized-real is the emulation of standardization—for example, seeing a CG tiger dying the same way in different movies, or a median shock value established by fatalities that are consistently shocking enough in their mellifluousness. The encounter with death and the accompanying visualization of it as absolute dismemberment gets transposed between characters; yet, for those characters' supposed ability to mirror chance, they're already choreographed to take it either way. A parametrized subject is an amalgam of familiar parts, whether familiarly unfurling sequences or repeating well-worn clichés. These representations are the result of either limited computational capacity (e.g., the inability to compute distinct entities), the limitations of physics engines to produce novel or highly realistic images, or something altogether stranger.

Resulting from the need to make images meet computational budgets, an industry of downloadable animations exists to fit the function of images whose source material is original. Despite attempts by visual effects studios to replicate contingency and affect, the parametrized subject is often the amalgam of downloadable, secondary software, extensions, and pipelines which exist to standardize and simplify a single function of animation or the construction of a mesh. Wave modifiers add a ripple-like motion to an object's geometry; Perlin noise – a type of gradient noise – produces the appearance of pseudo-randomness; computer-generated imagery seeks to simulate the randomness of natural phenomena, and visual effects industries introduce a set of proprietary solutions to identified problems of realism. To complicate things further, today's distributed and multidirectional media landscape makes it much easier to bring novel aesthetic strategies to market faster thanks to low-cost distribution.[vi] The new network topology of image production, where derivative work is the status quo, means that novelty itself is more difficult to eke out of a system in which everything is visible, accessible, and relativized.

The industries around 3D modelling privilege a pipeline which produces the same image qualities over and over, departing from known visual entities to, ironically, maximize newness. Too much "seenness" is negative currency but striking the right balance between asynchronous accessibility and clever topographical edits puts the viewing subject in novel territory. An aesthetic trope never dies; it is constantly refashioned by the parameters of its seenness. The results of this production-ready topology dampen the overall effectiveness of novelty, desensitizing users to it.

We can return to *Mortal Kombat* for a case study of this "already-seenness" via something called a blood library. NetherRealm Studios needed to come up with a solution for the depiction of blood that would be applicable to the computational budget of real-time games. The blood needed to be rendered close to the camera, have the capacity to easily switch from explosive speed to slow motion, and possess believable fluid motion and subsurface lighting. All blood stipulations needed to remain directable. In order to make a flexible system, they landed on the solution of building a "blood library" (Houdini, 2019). The blood library is an in-game repository of fifteen blood animations. The existing and

reusable assets are persistently loaded in-game, fitting within the 155-megabyte budget allotted to the VFX artists on the team. Every fatality and crushing blow in game references this blood library. The end results are a blood graphic which facilitates the experience of déjà vu in a viewer, despite the topology of blood being technically unique from frame to frame.

This ability to codify and corporatize the bizarre weightlessness of blood, and the subsequent transfer of corporal déjà vu to audiences, is only made possible by blockbuster-budget companies with the resources to do so. Adobe's *Mixamo* spin-off is yet another example of such a company with the means and technology to corporatize and consolidate animation. The primary function of *Mixamo* is to make downloadable an increasingly vast set of motions across bodies. The technology enables one to purchase ready-to-use 3D characters, rigs, and animations and fit them to any mesh.

The software has a number of customizable options, including adjustments for the frequency/intensity of "injury," "stance," "posture," "focus" and even "funniness" (referring to the way their laughter is animated), ranging from zero to one hundred. The animatic scope is vast; one can download and readapt everything from "Bellydancing" to, "Breakdance Footwork," "Opening a Lid," and "Grab Rifle From the Side and Put on Back." A zombie can be made to "Right Turn With Briefcase," a Sporty Granny asked to "Strafe" and "Samba Dance," and a petite, cartoon mouse to "Zombie Kick" before celebrating via a "Wave Hip Hop" dance. The impressive bravura of ready-to-use animatic potential is accessible to any user with a laptop, who can not only scroll through endless character options, but adjust/manipulate the slider with immediate perceptible effect, feeling the uneasiness of weight distribution within a particularly lanky character, or the elongation of skin built from algorithms. Any specificity of these animated subjects is subdued by their being packaged for users via the minutiae of paramaterization. This "grab-and-go'' animation is the product of companies seeing corporeality—rigging, motion, animation—as a client-facing service, disabling any meaningful conversation around medium.

What has come to be specific to the parametric, then, and why phantom limbs and their confusing parlay between familiarity and misconception is relevant here—is the notion that corporeality can be crystallized into style.[vii] The "already-seenness" of an image, which allows radically different motions, effects, and phenomena to feel similar despite being technically seen for the first time, flips the terms of figure-ground relationships – there is no constant subject. What you have is a continual refashioning of special effects towards uncanniness. It is not the interchangeability of animation that exclusively produces this effect, but an innate quality in the construction of these forms as parameterized-real subjects.

The inability to program everything as though it were a distinct entity – consider buildings/cities which rip apart the same way if destroyed across films, or the generated, algorithmic randomness of a crowd simulation – is the consequence of procedural animation techniques which simulates] effects, not causes. The simulation of randomness via the *effects* of a realism translated into code is often taken as proof of "real" materiality. Sophisticated software abstracts movement, light patterns, texture, and other accoutrements of live-action cinema, and repackages them into a recalculable image. How many points of supposed randomness does a simulation need to trick us into realism?

Animation draws from the bigger picture the smaller units behind it, disaggregating images into their modular parts.

What are the ideological consequences of these forms of imaging, where a clown, a dinosaur, and an alien can all dance the same way, die the same way, and cock a gun the same way, and a user can flick through them at once, seeing the transformation in real time? The computational systems that encompass audio-visual meditation for users create a troubling opacity in the relations of which they are a part, with an active capacity to bare their seams.

Conclusion: Impossible Life, Impossible Death: Modelling as an Act of Visuality

Returning to the introductory *Mortal Kombat*, wherein fledgling and modelled bodies are placed in a context of fluid devastation, perhaps the ostentatious and twirling virtual camera –which can travel anywhere in virtual space, into the floating sea of particulate, simulated matter (e.g. blood) – provides a utopic surrogacy for its viewers. The fantasy of omniscience via the interactivity of gaming affords us access to the degree of navigability of space found in the UI of the modelling software. It is these media forms which provide a map for the experience of translational fantasy—for results that are (literally) fleshed out differently. These are the untested protocols of experience. Furthermore – and to come full circle – these forms are a new frontier in scholarship on animation and cartoons.

The felt limits of the body and the body in space can misalign. The de-realized and "disembodied" influence of simulation technologies challenges the status quo depiction of cultural and geopolitical realities by appropriating realism towards reanimation. (Virtual reality is an extreme version of this, which sees a convergence of the awareness of one's own vulnerability with the embedded hostility of the limits of a naturalistic depiction.) Vivian Sobchack (2004, p.179) puts this best, describing the impoverished and alienated sense of both bodies and vision:

> Indeed, there seems to be an inverse ratio between seeing our bodies and feeling them: the more aware we are of ourselves as the cultural artifacts, symbolic fragments, and made things that we see in – and as – images, the less we seem to sense the intentional complexity and richness of the corporeal existence that substantiates them. In a culture like ours, so preoccupied with images of bodies and bodies of images, we tend to forget that both our bodies and our vision have lived dimensions that are not reducible to the merely visible.

Modelling and the techniques that accompany it constitute a short list of the collected freedoms—desires that exist subconsciously and culturally—played out in these "recartoonized" exaggerations, many of which represent operability, bodily invulnerability, and unregulated play in a hyperregulated world. "The plasticity of the image (and our imagination) has overwhelmed the reality of flesh and its limits" (2014, p. 50).

The rich corporeal information of images has the potential to alter our experience of time and space, especially as additional simulation technologies come on the scene and, in their bite-sized and modified forms, enable the further re-enactment of corporeality. Working with our psychic structures, contemporary forms of modelling make visible the supernatural and invented nature of fabrication, but do not make them any more unreal. At stake here are how different technical capacities have the potential to determine the transformation of our image via the image of our transformation. Images bear traces of the world, and these newer forms of comportment foster alternative socialities – an impetus in

agency and investments of our flesh.

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Notes

[i] Consider filmic viewing: when an apparatus is procuring an image – a projector in a movie theater, for example –a spectator can fidget and leave. With phone scrolling or gaming, however, a viewer is made so complicit in the movement of images that their corporal functions become automated.

[ii] This "digital" form of modelling is not, however, unique to an era of computing; in fact, modelling has a long precedent of material forms, including as hand-sculpted precursors to

sculpture, visualization and operationalization (e.g., scientific modelling), and much more.

[iii] In fact, one of the tropes of rotoscoping is its potential for something called “boiling,” a term used to describe a rotoscoped figure bridging the form of its outline, vibrating out of a steady containing line we come to recognize in live action.

[iv] Rotoscoping has a complex history, offering to animated film a normative trace of live-action footage and satisfying a general audience’s disdain for the clunky, jerky movement of cartoons in the 1910s. The patent for rotoscoping contains an “embodiment,” a document which describes the fluidity of the bodies that its creators, the Fleischer brothers, had in mind.

[v] Interestingly, the most difficult liquid scenario to simulate is the interaction of one liquid with another; for this reason, this effect is rarely seen in film.

[vi] Consider, for example, the aesthetic micro trends that occur in graphic design when a designer has made a novel discovery. As a result of this quick consumption and downstream flow, it has become increasingly difficult to claim ownership over a new style. In the words of Toby Shorin: “These designers are faced with a choice: abandon the allure of an original practice, or double down on the importance of originality and innovate further in order to maintain a competitive margin.”

[vii] By “style” I don’t mean to suggest the sense of marking a unique tendency of an artist or mode, but rather its opposite: replicable effects fused into images which operate as distinct entities.

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