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Cripping_Computer_Graphics: Perspectives on disability representation in CG via community generated 3D asset library

by Cielo Saucedo and Nat Decker

Abstract

Digital media and interactive virtual spaces are increasingly relevant to our understanding of self. As disabled media artists, we use digital and networked mediums to explore our crip experience and point towards a more accessible technological future. Conceived in response to a distortion or absence of disability representation within computer graphics (CG), we started the Cripping_CG project. Cripping_CG is a digital archive of custom made 3D assets, avatars, motion capture animation, bespoke terms of use and expanded data collected from disabled people. It operates as a record of crip culture as well as practical creative resources with which new collaborative creative work can be produced. The project provides a platform to analyze digital creative tools and conventions through a disability lens, identifying inaccessibilities, ableist stereotypes, historical relevance, as well as room for a more expansive disability aesthetics within media arts and cultural archiving.

Contents

Introduction

We are disabled media artists interested in crip worldbuilding — in using software to create work which emphatically includes, celebrates and cares for the full complexity of our disabled experience. The digital environments we inhabit — within the Internet, video games, simulated environments/virtual reality, animation, film VFX, digital art, etc. — have almost limitless creative potential, offering hopeful and fantastical possibilities for imagining more liberatory futures. But like so much technological development, these spaces also have the potential to replicate and reinforce real-world biases and patterns of exclusion. Our chosen creative tools aren't usually built with consideration for disabled bodyminds [1]. Our artistic

work — and the project we will describe in this paper — agitates the software limitations which pose practical barriers to fully actualized crip narratives and equitable digital landscapes.

Both our practices employ computer graphics (CG) to develop new expressions of disability. Nat Decker uses 3D modeling software to reimagine fantasy mobility devices as fluid extensions of the body, incorporating vivid designs and questions about desirability. Cielo Saucedo uses 3D animation as part of an expanded practice where translations of virtuality into corporality reveal systemic impairment. By reorienting the computer as a primary art making tool, we extend digital arts practices by centering access.

Typically, the practical construction of 3D computer generated worlds depends on libraries of digital objects (assets), avatars, and animated motion, created with proprietary 3D softwares (Maya, Blender, Unreal Engine, Cinema 4D, etc.). Libraries of digital objects — files containing 3D CG models — exist online as searchable databases and cultural archives. A 3D model is a mathematical code-based representation that is translated by the previously mentioned software to provide the user with a facsimile of three-dimensional space. With the growing popularity of computer generated imagery, 3D libraries are populated with millions of different objects that are used in representations of the world through artistic and commercial projects. We are interested in how cultural understandings and relations to disability translate to this medium. To search for disability in computer graphics libraries either renders few results or stigma laden distortions: a wheelchair is available for download in a horror game pack, an atypical gait is animated for zombie character design, injury becomes a prop for war fantasies, assistive devices are hyper-medicalized or inaccurately depicted. Disabled subjects are underrepresented, misrepresented or simply non-existent.

Members of the disability community have long used various digital spaces as refuge and resource. At best, they can function as an antidote to isolation, institutional abandonment and inaccessible environments. Acknowledging that the Web remains unavailable to many, networked media can be a crucial source of care. Disabled people can leverage social media for mutual aid, medical questions can be answered based on shared lived expertise, remote employment has created new opportunities for financial stability, and communities can be generated. Immersive digital media can facilitate experiences which may be impossible in real life (IRL) or away from keyboard (AFK) for the desabled individual, promoting access and potentially distracting from chronic pain or mental discomfort, or allowing for experimentation with alternative forms of embodiment, motion, and space. These digital experiences can be especially important for the disabled population otherwise excluded from the public sphere. If someone cannot leave their home, navigate an inaccessible space, risk exposure to a dangerous virus, but has access to a computer and the Internet, they can still explore a simulated environment and connect to real world people and support. In 2020 the Critical Design Lab began hosting Remote Access: A Crip Nightlife Gathering. The online DJed events described “parties and crip nightlife events as designed spaces, with opportunities for playful and participatory ways of producing access as a collective cultural practice.” (Gotkin, *et al.*, 2020) On 23 April 2021, they hosted Remote Access: GlitchRealm on the Arium 3D platform, an interactive 3D browser space. Party guests embodied cube shaped avatars with the agency to explore various performances, DJs and CG built installations, guided by self-described “access doulas”. (Gotkin and Lin, 2021) These spaces have the potential to connect disabled individuals, deepen crip culture and bring attention to the needs of a disparaged community.

To have access to digital technology indicates a level of privilege not universally distributed amongst global disabled populations. This essay and accompanying project provides an American disability perspective dependent on access to digital tools and training in technical skills. It is informed by Nat’s positionality as a white queer non-binary disabled person of middle-class upbringing and Cielo’s positionality as a white, Chicanx, disabled, Los Angeles native from a family of immigrants. Both have access to academic institutional support as current and former students of the University of California, Los Angeles; Nat received their BA from UCLA in 2022 and Cielo is an MFA candidate at the same institution. Access can mean many things and we acknowledge that the resources, tools, and platforms we will discuss are accessible to very few, yet they have been an important site for us to investigate and understand our unique disabled experience as it intersects with our interests in technology and digital community.

In response to these combined frictions, we began the project titled Cripping_CG. Cripping_CG is an artistic archival project with the intention of further exploring disability representation within computer graphics and the worldbuilding potential of a community generated digital asset library. First, we will describe the qualities of the project, methodology, and its location within a history of disability body politics. Then, we will discuss CG libraries, and the ways they include or exclude disability, emphasizing the context of asylum horror video games. We will continue by defining avatars, the implications of a "default" body and concerns about cultural appropriation. We will give a brief definition and history of motion-capture technology, discussing our findings when testing consumer motion-capture equipment for accessibility, and explore the connections of motion-capture, disability and animality. Finally, we will further detail our project methodology as it relates to customized "terms of use" and methods of promoting a consensual self-directed digital self-image.

Cripping_CG

Cripping_CG is a Web-based archive of digital disabled embodiments. Composed of custom made 3D assets, avatars, motion capture animation, bespoke terms of use and expanded data collected from disabled people, the project was conceived in response to the glaring absence and distortion of disability representation within computer graphics. This archive is driven by a desire to generate more authentic disability representations and contribute to a self-authored disability aesthetic within media arts. As disabled people, we document our own unique desires for digital being. Through Cripping_CG we invite our disabled community members to participate and have their own likeness and digital aspirations recorded. Our approach starts with creating a 3D CG version of a participant. Either realistically or creatively imagined, a collaborative design process results in a 3D modeled representation. When applicable, we include objects of significance such as canes or service animals. We then conduct motion-capture sessions where we archive the movement (or stillness) of each subject as they perform various gestures. In more experimental aspects of the project, motion capture equipment is attached to assistive devices and medical equipment (See Figure 5 for an example of motion-capture animation applied to a fantasy avatar self-portrait by Nat). Additionally, interviews and documentation of the collaborative design process will be embedded as archival data (See Figure 6 for a banner logo by Cielo).

Disability arts and culture scholar Dr. Carrie Sandahl, in her essay "Queering the crip or cripping the queer? Intersections of queer and crip identities in solo autobiographical performance", describes "cripping" as a verb: "cripping spins mainstream representations or practices to reveal able-bodied assumptions and exclusionary effects." [2] By "cripping," or applying a disability lens to computer graphics, we explore the unique relationship disabled people have with the bodymind and critique traditions of representation and documentation. Computer graphics is a technical field with a history and lineage representing a narrow and privileged demographic, operating in relation to conventional attitudes and treatments which have marginalized disability.

We initially conceived of a disability CG library (a collection of assets within a searchable Web site as defined earlier in this essay) as a fully open resource from which anyone accessing the site could download assets. With brewing anxiety, we concluded that the project required more robust assurance of safety for the assets and participants they represent. Our concern for how a fully open library of disability related CG assets might be abused is born from trends in video games, and other forms of entertainment media which exploit the qualities of grotesqueness, abnormality, medicalization and pity prescribed to disability by an ableist dominant culture.

Politics of desirability

Impaired, maimed and disabled, bodies of visible difference experience shades of removal from municipal

infrastructure leading to general social isolation and an inability to construct a public image. The lack of representations of diabled bodies in CG stem from cultural tendencies to subjugate the disabled bodymind are articulated in American policy. Legislation directly targeting disability can be found within a series of "ugly laws" that were passed beginning in San Francisco in 1867, leading to this law passed by the city of Chicago:

> Any person who is diseased, maimed, mutilated, or in any way deformed, so as to be an unsightly or disgusting object, or an improper person to be allowed in or on the streets, highways, thoroughfares, or public places in this city, shall not therein or thereon expose himself to public view, under the penalty of a fine of $1 [about US$30 today] for each offense. [3]

There was deep economic anxiety in relation to these laws, with a second harsher wave of cultural reform occurring in tandem with the Great Depression. The majority of this legislation was aimed toward panhandling control and with the increase of financial devastation, more people inhabited social space as a means to support themselves. Their increase in visibility revealed a greater social desire to hide them. As theorized in "Seeing the disabled: Visual rhetorics of disability in popular photography" by Rosemarie Garland Thomson, representations of disabled people or lack thereof, are "useful devices with which to manipulate the viewer for a variety of purposes, almost all of which are driven to a greater or lesser degree by the economic mandates of modern capitalism". [4] In her essay, images of disabled bodies are categorized into four modes of being:: the wondrous, the sentimental, the exotic, and the realistic. These all function to persuade audiences toward "eliciting a response from the viewer" [5]. These responses are not mediated through a subject driven agency but rather center the viewer as primary sites, or the center of the exchange of power between image of disabled person and receiver. This disadvantages the subject of the image, while allowing their rendering to be used for financial gain. A good example of this is telethons in the 1990s [6]. The disabled body in both culture and representations produced by that culture, are enacted as tools within economic systems to further economic and political goals in service of white able bodied representation. Lack of agency over representation is evident in the tool we began using as disabled digital artists.

There are little to no images and objects connected to disabled bodies circulating CG libraries, illustrating the temperature of the digital image making community. Since these open source 3D libraries also function as marketplaces, the absence of avatars with bodily differences for sale show that the economic demand for disability representations is low. This is in direct contrast to the history of disabled representation in photography that Rosemarie Garland Thomson outlines in her paper. Her analysis of the four visual rhetorics of disability show that the continued circulation of disabled bodies in photographs have lasting cultural implications and complicate and produce meaning around disabled subjects.

But what we noticed through practice is that the libidinal economy present in contemporary digital graphics, as theorized by Jean-François Lyotard, centers on representations of white able bodies despite modern optics of inclusion. These politics function at the cost of the racialized disabled person, with options for their representations limited through simply not being rendered but also through software limitations that do not allow for aspects of their corporeality to literally be made. Projects like the Open Source Afro Hair Library: OSAHL, described on A.M. Darke's Web site as "a free, user friendly, highly curated 3D model database of Black hairstyles and textures .... a feminist, anti-racist resource for digital artists and 3D content creators," (Darke, 2022) reclaim the digital space by circulating funding through fellowships for independent digital artists to use their skills to create downloadable assets for Black artists and those who are trying to create Black characters with true to life hair in CG.

In a space as idealized as the virtual, where through the help of 3D modeling software seemingly limitless worlds can be made and made cheaply, the spatialization of power demands that disabled people are kept apart from the greater population. The influence of ugly laws persists past official deregulation; the last ugly law was officially repealed in 1974 [7]. Fear, abjection and desexualization are still projected onto the

disabled bodymind. Coupled with inaccessible infrastructure embedded into social space even after the passing of the ADA (Americans with Disabilities Act), the resulting social isolation stops disabled people from building a world in which their financial and social needs are met. To deepen the isolation they are too often excluded from the workplace and unable to accumulate enough capital to change their physical realities [8]. But it's from this social isolation that the potentiality for imagining new more inclusive sites emerges. Virtual space has the possibility to cultivate a liberatory site when authored by the community it is meant to serve. Cripping_CG rebuilds the infrastructure of 3D asset libraries into a more accessible and inclusive resource for disabled people to imagine their digital likenesses and virtual homes.

We are also enthusiastically responding to the limited aesthetic variety available to disabled experience. Objects vital to survival are designed by the medical sector institutionalizing everyday life. Style options are limited to fit a standardized able body and are designed within white supremacist value creation. Cripping_CG combats the projection of "ugliness" onto the disabled figure by offering resources to reconfigure reality in ways unavailable in the physical plane. We explore the celebratory, vibrant and desirable aesthetic potentials unlimited by — yet always informed by — that physicality. With hope, we intend for these digital expressions to, in turn, produce meaningful impacts on the material reality of disabled people.

CG libraries and models

The labor of 3D CG creation is intensive. Labor movements within the video game and computer generated animation fields arose after workers were "working as many as 20 hours a day, sleeping at their offices and scarcely seeing their families — all without getting paid overtime" (Ding, 2022). This is standard in an industry where each frame can count for hours of manipulation behind a computer. This labor is called 3D modeling, described as "the process of creating a 3D representation of any surface or object by manipulating polygons, edges, and vertices in simulated 3D space" [9]. To produce a single rendered figure can require hours of sculpting by hand, much like sculpting in clay, using modeling software (Zbrush, Sculptris, Mudbox, Blender, etc.) and then color/skin is added with additional software tools.

While the generation of proprietary 3D assets is part of the craft, the market for ready made models makes up a large portion of computer generated imagery. In order to realize worldbuilding potential, many creators use premade assets from asset libraries like those mentioned earlier. These asset libraries are searchable Web sites housing collections of 3D representations that can be bought, sold, downloaded and folded into various applications. These can be centralized by a retailer, such as TurboSquid or Sketchfab, featuring download prices ranging from free to thousands of U.S. dollars. They can cater to the film, video game and marketing industries as well as architectural firms and educational institutions. Professional artists and hobbyists alike can download files of bodies, objects, buildings, scenery, plants, skies, etc. to build their projects. These Web sites are populated by freelance artists, sometimes commissioned by retailers who keep a percentage of the profits coordinated by the retailer. Cripping_CG adopts a modified and scaled version of this format. The interface functions much like these platforms, but unlike commercial sites, Cripping_CG is a small community driven project without the financial or infrastructural backing of a commercial industry. This allows us the freedom to decide on our own incentives, complicate the process and indulge in slowness. We lean into the inherent challenges with a labor of care, motivated by a disability liberation which is necessarily anti-capitalist.

In addition to arts and entertainment applications, 3D modeling is the primary medium used in medical visualization. It allows for the detailed and accurate illustration of organs, bones and medical procedures unable to be seen otherwise. If we accept that 3D is a medium that can reveal or illustrate parts of the body which are otherwise hidden, then we can extend that belief into casting 3D animation as a medium that can actualize a complex range of disability representations and realities.

Asylum trope

Premade assets may be incredibly useful production tools, but can reinforce narrow conventions of representation. Searching the most popular CG libraries for disability provided early incentive for the project. Smaller platforms like Free3D.com return zero results when the search is prompted with "disability" or "disabled" (See Figure 1). Larger sites like turbosquid.com (https://www.turbosquid.com) display results which appear like a medical catalog, displaying assistive devices, wheelchairs, walkers, exoskeletons, metal ramps, a grid of sterile objects usually devoid of the bodies which use them. Interspersed are other illuminating assets: a dingy hospital bed, an antiquated rusty hospital chair splattered with blood, a two-headed fetus in a jar, a pirate hook. Disability representation bleeds over into the genre of medicalized horror (See Figure 2). These libraries are often utilized within a video game context and thus reflect the aesthetic styling of the game industry. Especially prevalent in horror video games, the asylum becomes a site of creepy grotesque abandoned designation. Horror video games such as the Silent Hill series, Outlast, Asylum, Batman: Arkham Asylum, allow players to navigate medicalized environments which are blood drenched and decaying and feature deformed bodies as the greatest source of fear.

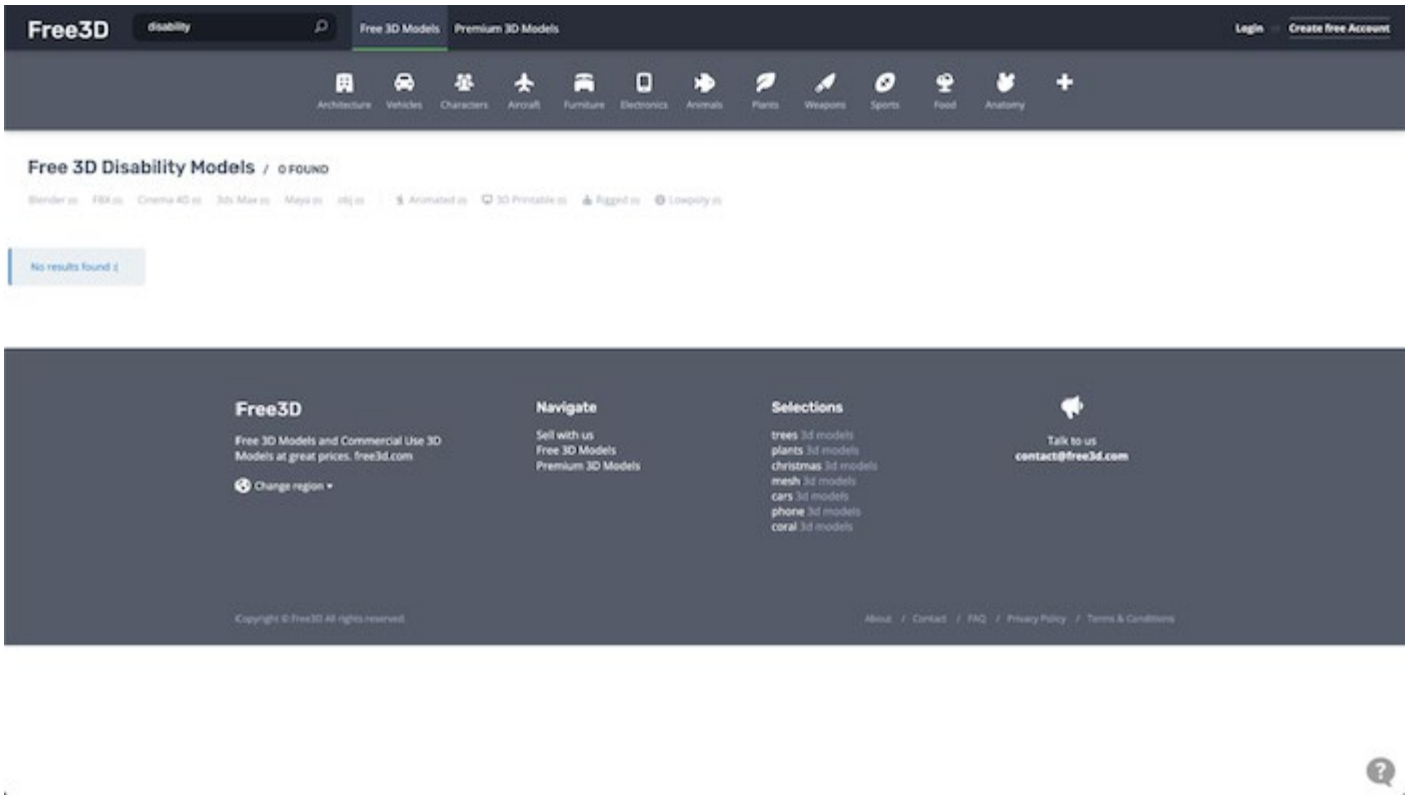

Figure 1: A screenshot of the browser page for Free3D, showing zero results from the search prompt "disability." The Web site is a simple design of grays and white with a row of different object category icons on the top.

Note: Larger version of Figure 1 available here.

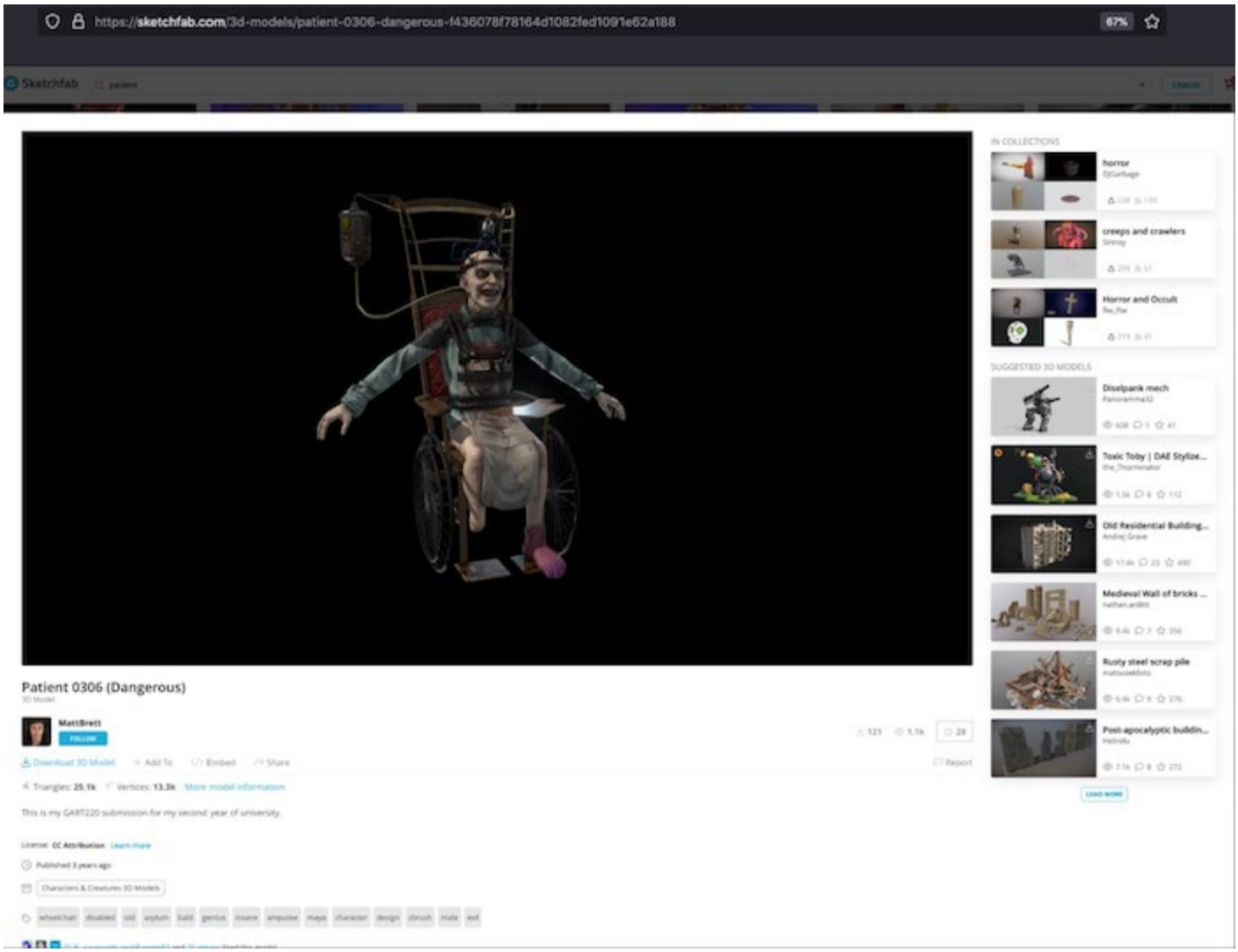

Figure 2: A screenshot of a model on the Sketchfab.com (https://sketchfab.com) Web site. The model is titled "Patient 0306 (Dangerous)" and is a 3D modeled seemingly older white man strapped into an antique wheelchair. The figure has its arms stretched out in t-pose, is wearing dingy blood stained clothes, has and amputed right foot, an IV bag hanging from the top of the high backed chair, and some kind of tubes attached with straps to its head. The tags attached to the models data include "wheelchair," "disabled," "old," "asylum," "bald," "genius," "insane," "amputee," "maya," "character," "design," "zbrush," "male," and "evil."

Note: Larger version of Figure 2 available here.

Asylums have been, and continue to be, the sites of real life horror inflicted upon disabled people. Media interventions, such as the 1972 documentary *Willowbrook: The last great disgrace*, influenced a trajectory of deinstitutionalization in America. The film depicted the egregious human rights violation and squalid conditions of the Willowbrook State School on Staten Island, an institution for children and adults with intellectual and developmental disabilities. As an early documentation of institutional violence, the documentary exposed a world which had previously been hidden, at risk of fine and persecution (Reimann, 2017). The combined imagery of disabled individuals living in institutions, and the decay of those spaces following mass deinstitutionalization through the later twentieth century, likely informed certain aesthetics of horror still being explored today. We are curious about the damaging repercussions of these aesthetic trends and how they construct meaning around the history of institutionalization and disabled bodyminds.

Cripping_CG hopes to bring attention to problematic stereotypes and exploitative renderings of disability as a way to honor our history; we create more positive, self-directed and expressive representations to antagonize these traditions. Additionally, we hope to cultivate more opportunities for disabled creators to work within the 3D CG field and industry as a crucial method of disrupting employment inequities. More disabled people working in the field will amount to more scrutiny of problematic tropes such as those common within asylum horror.

Avatars

Much of 3D CG space is mediated by avatars. Avatars allow for the embodiment of an identity in digital space and the distinction between one character and another. They can appear analogous to real life or represent an alter-ego. From playable game characters, icons on Internet forums or social media, to iOS (iPhone operating system) memojis sent across text messages, avatars are personifications of a specific person or user [10].

Etymologically, the word "avatar" originates from the Sanskrit word अवतार, meaning "descent." In Hinduism, it describes the earthly incarnation of a deity, often associated with Vishnu. Early use of the term for on-screen representation of the user occurred in Richard Garriott's 1985 computer game *Ultima IV: Quest of the Avatar*. It was later popularized by Neal Stephenson in his 1992 cyberpunk novel *Snow Crash*. (Fox and Ahn, 2013; Britt, 2008) By adopting a Sanskrit word, these authors — primarily white men — added to an accumulating fixation with Asian culture within the cyberpunk genre which "popularize[d the] connection between East Asia, Asian bodies, and the technological future" (Kim, 2021). In the essay "On techno-orientalism," Leo Kim states:

> The Asian community is no stranger to this mode of appropriation. From trendy tattoos bearing Chinese characters (that famously translate to nonsense phrases), to the use of kimono (largely worn for formal occasions in Japan) as sensual sleepwear, Westerners have often taken the markers of Asian culture, detached them from their source, and appropriated them into a system of empty aesthetics.

The adoption of avatar from Eastern religion, applying it to Western technological speculation, demonstrates colonial impulses present in CG communities and Western tech spheres at large.

Avatars can easily become sites of cultural appropriation. They are designed to be self directed but are limited by the available assets or creation tools provided by the platform in which they are being generated. The default avatar is found across platforms. Faceless and bipedal, it often mimics the white Eurocentric, thin, able-bodied presumptions of a body. Users can assign physical characteristics or cultural indicators they are not affiliated with in real life in ways which can inflame racialized and gendered stereotypes. We are interested in the expressive and experimental potential of generating alternative digital bodies, but only so long as it is culturally respectful and not negatively impacting the real bodies these characteristics represent.

Avatar building software, such as *Make Human*, trivializes ethnic expression by reducing racial, gendered, and body type appearances to a set of binary sliders titled "Gender," "Age," "Muscle," "Weight," "Height," "Proportions," "African," "Asian," "Caucasian" (See Figure 3). Software tools like DAZ 3D and Poser offer hyper-sexualized default female bodies that are hairless, large breasted, Barbie skinny, and white [11]. Unreal Engine's Metahuman, offers hyperrealistic and fully rigged variable avatar creation tools which appear to have been designed to capture many diverse appearances, but cannot articulate bodily difference

beyond a standing four limbed figure and the results are only licensed for use within the proprietary Unreal Engine game development software. Any singular default avatar will uphold a racialized gendered ableist and ageist imagining of the default human, recreated within software and feeding back into real life.

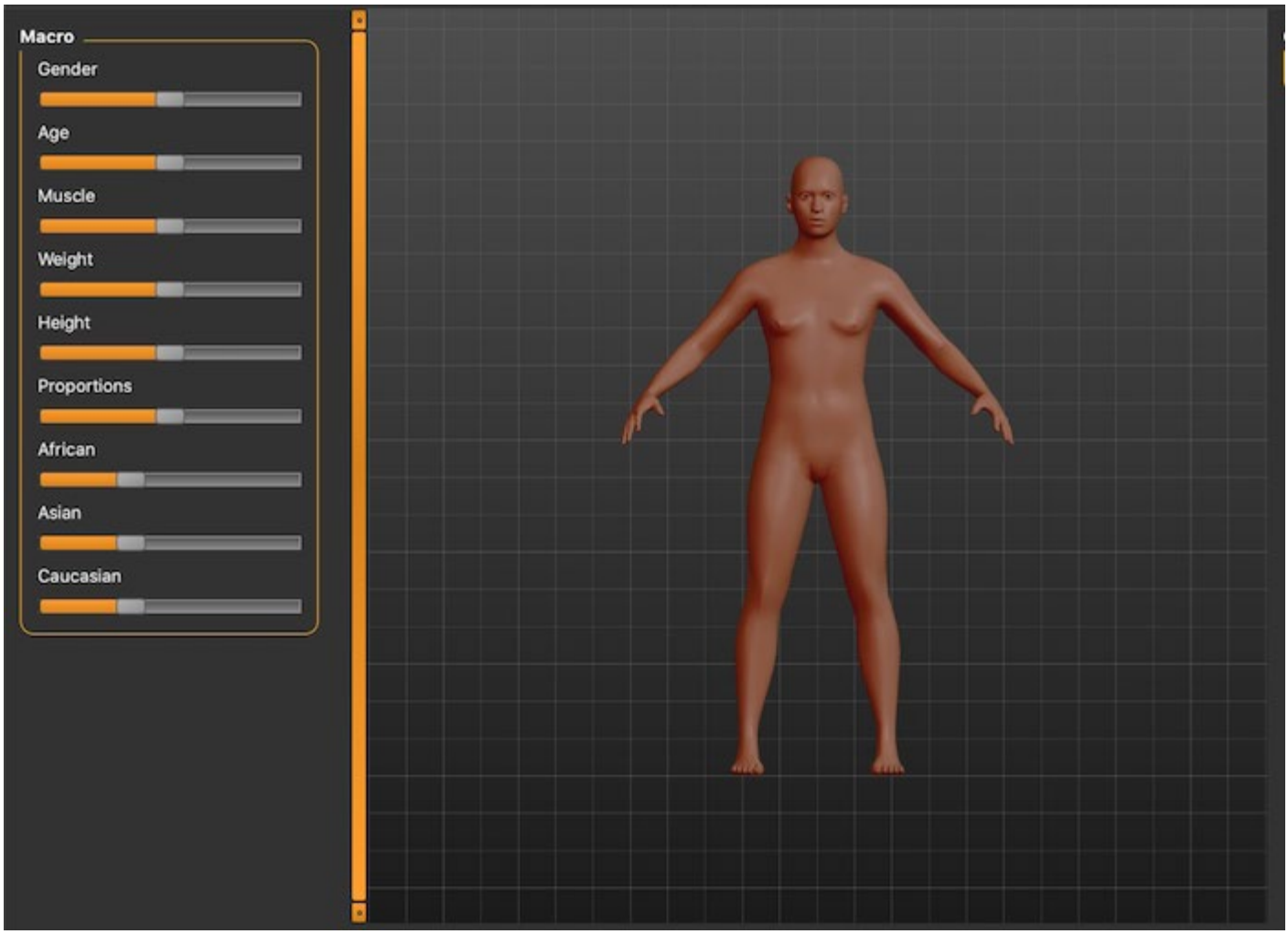

Figure 3: A screenshot of the Make Human software, showing a nude, hairless, androgenous clay colored figure standing in a relaxed t-pose on a black grid. To the left are various sliders which read “Gender,” “Age,” “Muscle,” “Weight,” “Height,” “Proportions,” “African,” “Asian,” and “Caucasian.”

Note: Larger version of Figure 3 available here.

To make the process as caring and self-directed as possible, the Cripping_CG project designs and produces avatars of participants via an interview process. Participants are asked to reflect on how their body functions in physical reality and if they would like to bring aspects of that into a digital space. If consent is provided, the avatars will then populate the Web site as an archived asset.

Example prompts — all of which are optional — include:

Do you have a face?
Do you have legs? How many?
Are you human?

What does it mean to you to be embodied in digital space?

The project encourages creative and expressive depictions not offered by conventional avatar making software. Fantasy offers liberatory potential and an avatar can provide someone an outlet to project into a figure of their own conception. In addition to conveying physical difference, the project strives to document a broad and inclusive spectrum of disability. The questionnaire allows those with non-apparent disabilities — such as neurodivergence, chronic illness, etc. — to decide how they would like to express their unique experience with bodymind. There are many possibilities for creative expressions of disability in shaping an avatar which might reflect not only external, but also internal experience.

Motion capture

Animation brings 3D models and avatars to life. Motion-capture (mo-cap) is a technique which records movement data from real world people, animals, or objects to be applied to digital assets. The technique is descended from rotoscoping, an animation technique created by Max Fleischer. Done “by tracing over a live action sequence frame by frame to give the cartoon realistic and fluid movement. The technique was originally produced by using photographs of live-action films projected onto glass. It’s a technique that spans over a hundred years and laid the groundwork for computer animation and the modern VFX we use today.” [12] Motion capture often utilizes sensors on a subject’s body, capturing their location in time and space. The equipment connects to a computer program which records a picture of how the sensors move. This collection of data is then compiled algorithmically to create a rough wireframe “skeleton” in the motion capture software interface (See Figure 4). Finally, the animated “skeleton” can be optimized and applied within the mesh of a digital object or body, transferring the gestures frame by frame.

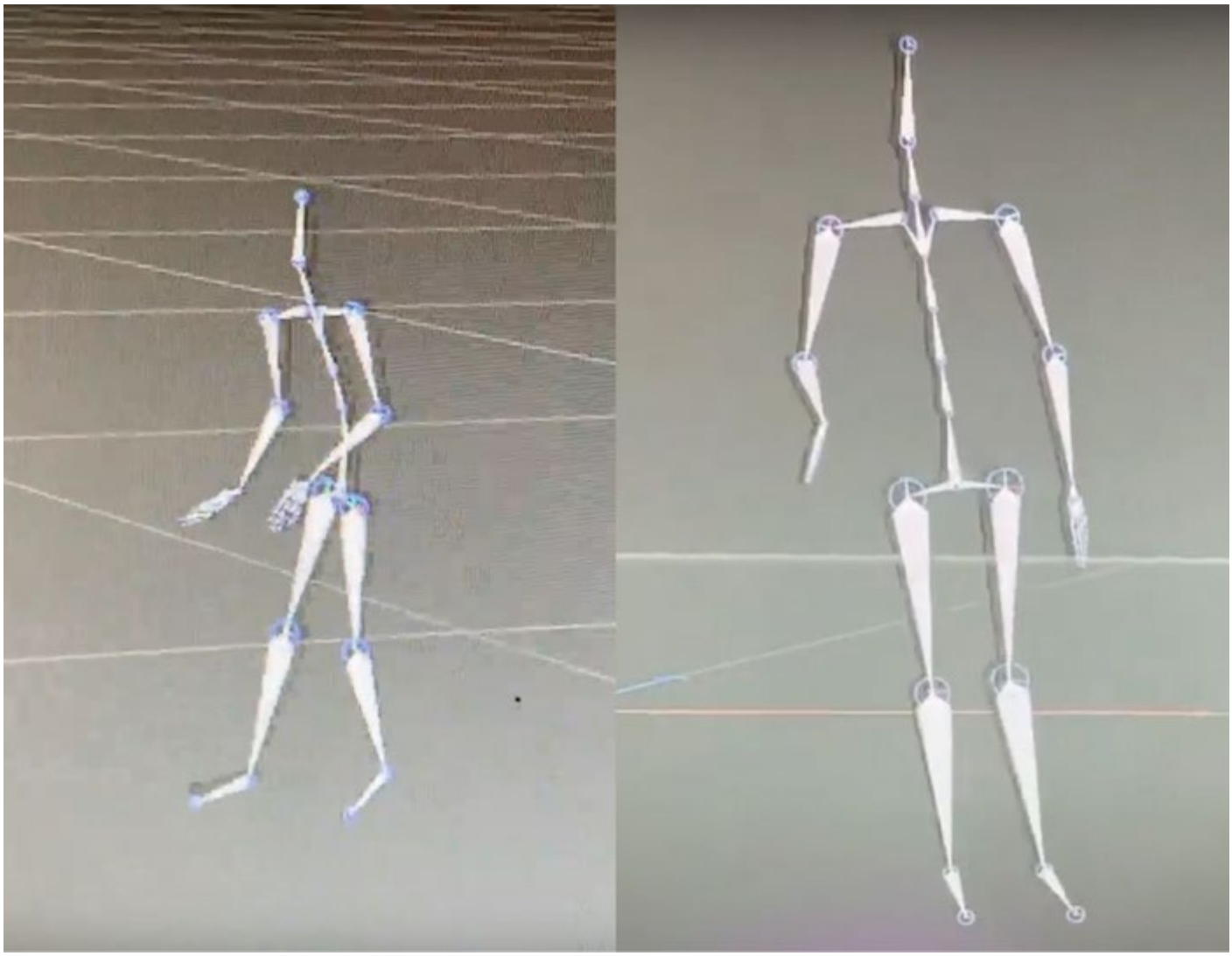

Figure 4: Two screenshots of a "skeleton" being animated by a motion-capture suit within software. The skeleton is made of rows of triangular gray shapes, a spine, two legs, two arms and a head. The background is a gray grid which simulates 3D space.

Note: Larger version of Figure 4 available here.

The development of motion-capture technology has an interesting relationship to disability, highlighting a historic emphasis on the sensationalization of difference as well as the justification of technology as a rehabilitative tool for eradicating disability. The original application of what 3D motion graphics artists now think of as motion-capture technology took place in the 1980s when Tom Calvert used potentiometers to perform biomedical studies analyzing gait abnormalities (Lum, 2019). Even before the use of rotoscoping or motion-capture, an arsenal of frame capture technologies were designed and implemented for the recording of disability. The "father of the moving picture" Eadweard Muybridge, had a penchant for not only capturing animal motion, but also that of disabled individuals. Using chronophotography, "a technique by which movement is decomposed into a series of snapshots" [13], he documented the ambulation of nude disabled subjects (Muybridge, 1887; Traisnel, 2020). The French photographer Albert Londe, active during the twentieth century, recorded the gait of "hysterical" women and patterns of seizures. These examples highlight not just a fascination with motion, but also voyeurism with a proclivity toward the sensationalized "grotesque." Photographic — and thus motion-capture — technology is founded on "the opportunity for the distanced viewer to stare at and diagnose the disabled body" [14]. Tracing these

origins, motion-capture of the disabled body has been involved in the study of deviant movement disorders to examine and reify difference or to rehabilitate disabled patients within a techno-medical setting. Occupying a different — yet still rehabilitative — approach, Georges Demeny developed the chronophotographic gun in the 1880s, a time lapse technology used to create a system for deaf people to adopt mouth reading. The first phrase recorded was “Je vous aime” or “I love you” [15].

Figure 5: Screenshot from a short animation made by Nat of an abstract green sinewy figure woven with many repeating tubes, walking with arms that reach forward intersecting with the tubes and forming two front appendages thich take steps in tandem with the legs.

Note: Larger version of Figure 5 available here.

In addition to creating avatars for the Cripping_CG archive, we conducted some preliminary motion capture sessions. Rather than perform a gait analysis or record a standardized set of movements, our project centers the participant’s desires for creative expression. We are interested in the peculiarities of the phrasing “capture” in mo-cap. To capture denotes force and control. Within our project, participants are not

squeezing their likeness into an online forum and we are not keeping that depiction in a vitrine. These data packages are living, collaborative documents, with which we antagonize traditional forms of portraiture by foregrounding a co-authored approach. We offer a list of suggested movements, but they are entirely optional. These motion protocols (such as standing/sitting idle, moving from one point to another, upward and downward motion, sitting in a chair/getting up from the chair) were first conceived with the 3D animator in mind. We wanted the archive to offer functional resources for a wide variety of applications. Motion-capture databases for video games and animation have a tendency to operate within standardization to increase searchability and usability. Conceptually, we found it important to ensure the participant total agency over the motion they chose to have documented, encouraging non-standardized categories of movement as well as stillness to emerge. The project invites participants with any type of disability, allowing for a dimensional and unique package of data as each participant interprets the technological intervention differently. Emily Lucid, an artist with schizoaffective disorder, participated in one of our first mo-cap sessions. Her practice explores trans and disabled identity through performance, and figurative oil painting. Her instagram is full of 3D scanned portraits of her likeness with titles like “I always thought of myself as a digital avatar,” and “Schizophrenia Self Portrait 26: At first I was only an avatar” (Lucid, 2022). In her motion capture session she performed a dance composition which she plans to incorporate into animation work.

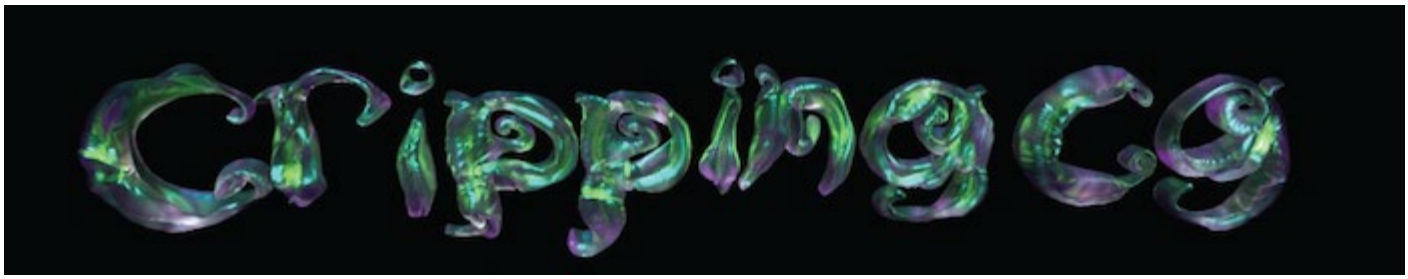

Figure 6: A stylized CG graphic made by Cielo of the text “Cripping CG” in swirly bubble letters and reflective purples greens and blues.

Note: Larger version of Figure 6 available here.

The mo-cap sessions we conducted were with the Perception Neuron 2 suit. This entry level equipment is marketed towards hobbyists and budget institutions. The whole system costs US$1,500, is easily transportable, and functions with a variety of operating systems and 3D applications. It is made available for student use within the UCLA Department of Design|Media Arts. It was within these parameters that we initially recorded our own movement as test subjects. As per the instructions of the system, we strapped an array of sensors around the torso, head, and appendage joints using elastic belts. Quickly, the system made apparent incompatibilities with a number of bodies. The straps were elastic and while they stretched to a certain extent, they would likely not accommodate some fat bodies. This fat phobia is further embedded into the equipment software through the ubiquitous skinny white avatar which visualizes the sensor movement. The motion capture system was also totally incompatible with people who use wheelchairs or otherwise do not stand. Much like the software that models and animates, the system requires the user to stand in a T-pose. To perform this requires the subject to be able to stand and have upright motion for the hardware to calibrate to the software. On top of this, the metal frames of mobility devices caused significant interference with the electro-magnetic sensors, preventing the system from accurately recognizing the placement of limbs.

This embedded technological ableism not only made it impossible for us to continue our project within the

institution in which we chose to study, but also created significant financial barriers for us moving forward. Professional units with the capacity to record people in wheelchairs or who cannot perform the standing calibration poses start at many tens of thousands of dollars. These systems are purchased mostly by well funded educational institutions or are found on specialized movie sets and VFX studios. If Cripping_CG can eventually secure access to motion-caption equipment, we can animate participant's avatars with their own captured motion. These avatars and mo-cap can additionally be mixed and matched, taking animation from one participant's data pack and applying it to an entirely different 3D model. This creates opportunities for creative combinations and experimentation, but also highlights the need to protect these assets from misappropriation.

The operational costs of motion capture makes asset libraries of downloadable animated movement all the more important. Sites like Mixamo (an Adobe program) allow users to upload their own models and select movements from a library of motion capture animations (dancing, walking, crawling, shooting a gun). Mixamo maps the motion capture on either a selected or uploaded model and then produces a downloadable combined file. Mixamo is a powerful tool which makes animation incorporation accessible to those with more varied skill levels, yet it contains a very limited set of movements which exclude dynamic representations of disability. In more current iterations of the program, Mixamo has added an animation rig for a person pushing a manual wheelchair and walking with a walker, but these represent the only examples of explicit disability inclusion in any public motion capture library that we searched.

Animality

Actor Andy Serkis, famous for his roles as Gollum in the *Lord of the Rings*, King Kong, and other creatures, is largely responsible for popularizing the use of motion-capture film integration, especially for the depiction of non-human characters. In 2012, he started Imaginarium Studios, a digital performance capture studio in London working on high-budget Hollywood projects (Imaginarium Studios, 2022). As a prolific actor with great influence in his field, he has made the bold claim that motion-capture is the "end of typecasting," elaborating that motion-capture could create opportunities for disabled actors to play able-bodied roles, as well as for people to play characters of different races (Sharf, 2019). Serkis' comments evoke the rehabilitative impulses surrounding these technologies, proposing that motion-capture creates opportunities for disabled actors to perform ability but fails to adequately acknowledge the value of disabled actors portraying their own lived authenticity. Interestingly, Serkis made his directorial debut with 2017 biopic *Breathe*, about disability rights activist and father of his Imaginarium Studio Partner, Robin Cavendish. Cavendish, who was paralyzed from polio at 28, was portrayed by Andrew Garfiel, a non-disabled actor who is featured in a power chair for much of the film (Bleecker Street, n.d.). We wonder, if Serkis believes motion-capture opens opportunities for disabled people to play able-bodied roles, why did he not use this opportunity to hire a disabled actor for the role of Cavendis, employing technology to achieve the few scenes prior to him becoming disabled?

Additional research on motion-capture in the film industry has focused on a comprehensive study on disabled motion capture, as described in Stasienko, *et al.* (2015). The authors gathered 10 disabled people with a variety of impairments and put them through a series of movement workshops aimed to test their competencies as motion capture actors against an able bodied cohort. This research aimed to gather information to encourage motion picture studios to hire more disabled actors within the film industry. They found that able bodied actors cannot mimic disabled movement with any accuracy and discouraged motion picture studios from hiring able-bodied actors to fill roles of disabled people, highlighting the unique movement potential of disabled actors. They also suggested practices for supporting disabled actors during sessions including employing a care professional such as an interpreter, suggested that "certain limitations of people with disabilities should be considered when writing software and algorithms should make it possible to adjust automatically their silhouettes to skeletons of constructed characters (either humanoid or non-humanoid)." They ultimately suggested that disabled people should be invited as participants at every stage of production [16].

Considering the larger removal of disabled bodies and protagonists from public space and media, we were

especially interested in how the study revealed an investment in the potential for disabled people toward the non-human. This movement toward animality is implied by a subsection of the study concentrating "the great potential for disabled people to perform non-human movement — animals, dinosaurs, monsters." Within the sessions, disabled participants mimicked the movements of creatures such as a spider, *Tyrannosaurus rex* and dragon [17].

Suggesting disabled actors are well-suited for the roles of animals is a delicate position to inhabit, especially by apparently non-disabled people like those who conducted involved in Stasienko, *et al.* (2015). The correlation between disability and animality arises from a history of subjection and violence; the action of animalization, or the comparison of humans to animals has long been a tool for disempowerment. Scholar and artist Sunaura Taylor unpacks the tendency for disabled bodies to be compared to animals: "animals make powerful insults precisely because we have imagined them as devoid of subjective and emotional lives that would obligate us to have responsibilities toward them" [18]. Rather than accepting disabled embodiments without mediation on film, in roles that hold holistic disabled storylines, disabled actors are being used for anything but humans. This puts the disabled actor in an activated position. Rather than humanity never being granted to the disabled subject, the disabled subject complicates humanity, making it more brittle and able to be shattered, a position inspired by Zakiyyah Iman Jackson's (2020) study of anti-Black racism, *Becoming human*.

The issue lies not within the creation of humanoid or nonhuman characters. Is it so bad to be an animal? Or is it the racialized systems of violence that surround an animal's positionality that make it a difficult position to accept? It's not animality that is the issue, rather the power to strip ontological modes from mind-bodies in order to control their realities. Shifting the argument from the abuse of animal classifications, we gesture to the narrow definition of human. Looking toward Mel Y. Chen's dispatchment of animacy: a white adult male who is free (not enslaved), able bodied, and has linguistic capacity occupies the highest hierarchy of the category human. Those of us who exist outside of these distinctions are less so. To be human is to inhabit a role within the ecosystem that is responsible for keeping violent power dynamics functioning. If to be human is to inhabit a role that enacts so much violence and exclusion, then being anything but that could be a liberatory position. By encouraging the imaginative potential of avatars and the historical context that disabled embodiment already occupies, Cripping_CG steers away from speciesism and embraces the animal/creature as far as the participants feel comfortable. Leaning into fantasy, we offer participants a myriad of ways to imagine their digital avatars, but hybrid bodies and science fiction aesthetics are welcome only insofar as they are useful.

Terms of use

Access is not only limited to infrastructure, access is a way of ensuring safety. The Cripping_CG archive strives to reach past the impulse of neo-liberal representation politics, or one that prioritizes the optics of social justice movements over the betterment of material conditions, by reorienting its attention to include the creation of safety for disabled bodies in digital space. Dimensional data sets will be connected to bespoke terms of use co-authored by the participant collaborator, allocating agency to those being documented while assuring their information will be protected. By limiting access to the archive and appropriating the legal framework of "terms of use" or "terms of service," we create expanded, individualized and community authored contracts which promote consent and agency in a field where disabled embodiment is both under-represented and exploited. This method is in response to our desire to create a safer and more accountable exchange of CG resources and to protect and promote digital agency.

Digital agency can be thought of as keeping one as safe as possible in an ecosystem of surveillance. There is no true privacy or complete safety but by using terms of service agreements as a model, there can be a deeper consideration of where information goes and who it's going to. It can be a way of looking at identity not only inherent to oneself but also something that can be shown to others. To lessen instances of

exploitation, there should be safety protocols which ensure that sharing and consumption is happening as ethically as possible. Terms of service is a legal agreement between a provider of a service and someone who wants to use the service. The service we are providing is access to our archive, but more intimately the participants of the archive are sharing representations of their bodies and ways of existing. These representations are mediated, mathematical parcels of data that need to be projected into pixelated representations to realize the gestures of personhood. This archive is not static in its form (a package of downloadable assets for 3D animation software) it is asking to be activated by a third party or by the participants themselves. Data is downloaded and shaped into new forms, projects, and layers of meaning. This can put the data collected in a precarious position. Without guidelines, these motion capture, avatar, and model parcels could be utilized in the same haphazard ways that perpetuate violences mentioned earlier in this paper.

It is our responsibility as the creators of the platform to ensure that participant's bodies are being represented in ways that they are comfortable with. First within the larger context of the project, a community guideline document houses the ethics of the project and from there the terms of service agreements fill in the personal. The community guideline houses basic ethical tenants: no sexual violence, no hate speech, no ableism, no racism, no sexism, no homophobia, no transphobia, etc. A set of core questions are posed through the process of drafting up micro agreements authored by archive participants, the first being, "Can the data be downloaded?" There are no requirements for the participant to have their data available, their embodiment is just as valuable in relation to the other participants by just being in the archive. But for those who would allow their data to be downloaded, more delicate boundaries are to be set. By questioning and imagining the contexts where the data may be used, each person gets to expand the potentiality of their bodies. Some points that are addressed within the terms of service are sexual content, violence, animality, racial/ethnic guidelines and gender expression. One subject may not feel comfortable with their motion-capture data being applied to any avatar models other than their own, another may want their motion capture used on models of flora and fauna, while another subject's agreement only wants their representation to be used for Latinx, non-binary characters (this decision is only applicable if the subject embodies that specific identity). Another clause that is usefully added into these bespoke terms of service is an opportunity for citational practice. How will the archive user credit the person whose data they are using? Are they actors? Are they collaborators? These are questions we do not claim to have definitive answers to and so allow participants to express their own desires.

The matrix that these service agreements work within is the online residency model. Instead of making the archive universally accessible and further vulnerable to exploitation, we hope to invite creators to access the archive and produce project based art works that will be featured on the archive Web site. The artist applies to the residency with a project proposal and through that project gains access to available assets. This builds intentional clarity from the beginning and allows for an activated archive which centers disabled bodyminds and agency in media generation.

Conclusion

As artists working with 3D computer graphics, we identified various technological biases which restrict the authenticity and creative potential of digital disabled embodiment. These biases are built into software which fails to consider bodies beyond the "default setting," and are reified by the problematic renderings of disability which continue to emerge from the medium. Cripping_CG started from the desire to creatively express our own unique relationships to our bodyminds. It developed with the intention to create a resource for expanding disability aesthetics within simulated space and examine questions about the nature of these representative tools. We hope to build an archive of digital crip worldbuilding as an active tool for other crips to advance media arts and further question the implications of technological lineages and futures.

Ultimately, our greatest desire is for an impact which reverberates from the digital space, into the real

material IRL/AFK realities of disabled people. Through creative practice, we hope to direct attention to the needs of and real world conditions of disabled lives, promote digital accessibility, encourage software and technology developers to consider access, difference, equity, and justice when building tools, and for there to be better representation of disabled people employed within all stages of CG production.

We also hope to generate community with and through this project. By adding this offering to the ecosystem, we want to cite the projects that have either inspired this library or with which we hope to be in conversation. Art making is inherently interdependent; this is to amplify the networks that make it possible. Specifically, the work of A.M. Darke, Gracen Brilmyer and the Disability Archives Lab (Brilmyer, 2022); Samantha Vassor and Grace Kwon's open source 3D Library Close Isn't Home which is "a multi-disciplinary collective and 3D resource platform for BIPOC identities," and shares free culturally and regionally specific models (Kwon and Vassor, 2022); Simon Mckeown's (2022) project Motion Disabled which produced a video featuring motion capture of a variety of disabled participants; and, all the crip wisdom.

About the authors

Cielo Saucedo is a disabled artist from a family of migrant farm workers. They work with computer generated imagery, non-fiction writing and sculpture to disrupt notions of humanism and make space for disabled mind-bodies and ecologies. Technology mediates their artistic production with the wax and wane of their ability. From this direct response to their body, an unprivileged mutuality between ecological space and virtual experience is offered. In their work video games trace histories of oil infrastructure and birch trees are woven into sand dunes. They have shown work in New York, Chicago, London and Quito. They participate in the artist collective SIQ (Sick in Quarters) and are a founding member of W.E., an ecological action group started in Chicago. They received their BFA from School of the Art Institute, Chicago and are an MFA candidate at UCLA.
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Notes

1. Bodymind is a term explored within disability studies by author Margaret Price to describe the overlapping qualities of how we understand the body and mind.

2. Sandahl, 2003, p. 37.

3. Value of one dollar in 1881 found at https://www.in2013dollars.com/us/inflation/1881?amount=1. On Chicago's ordinance, see Coco, 2010; Schweik, 2009, p. 15.

4. Thomson, p. 339.

5. *Ibid.*

6. See Piss on Pity, a slogan used by disability right activist, during the Block Telethon protests outside of ITV Studios in the United Kingdom in 1990 and 1992.

7. "Ugly laws," at https://eugenicsarchive.ca/discover/timeline/54d39e27f8a0ea4706000009, accessed 12 December 2022.

8. According to the U.S. Department of Labor as of November 2022, 38.8 percent of disabled people participate in the workforce as opposed to 76.9 percent of able bodied workers. See "Disability employment statistics," at https://www.dol.gov/agencies/odep/research-evaluation/statistics, accessed 12 December 2022.

9. Slick, 2020, p. 1.

10. Avatar is also the name of a 2009 James Cameron sci-fi film featuring an able-bodied actor performing as a paraplegic. CG techniques were used to replace the actors "normal" legs with atrophied prosthetics; Fox and Ahn, 2013.

11. DAZ 3D also has a slider to give the figure elf ears.

12. Shlapak, 2017, p. 20.

13. Traisnel, 2020, chapter 5.

14. Millett-Gallant, 2010, p. 12.

15. Stasienko, *et al.*, 2015, p. 15.

16. Stasienko, *et al.*, 2015, p. 85.

17. Stasienko, *et al.*, 2015, p. 57.

18. Taylor, 2017, p. 136.

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