No Going Back: Un-Fixing the Future of De-Extinction

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Abstract: 'Extinction is a colossal problem facing the world' proclaims the Colossal Laboratories & Biosciences website, adding, 'And Colossal is the company that's going to fix it'. For Colossal, this involves combining the science of genetics with 'the business of discovery' in order to bring back the woolly mammoth, which will not only help 'rewild' lost habitats, but also contribute toward 'making humanity more human'. De-extinction is the process through which extinct species can be brought back into existence, often with the goal of reintroducing species to the wild and restoring ecosystems. While still in its nascent state, the science of de-extinction is currently expanding and advancing through, for instance, projects like Colossal's, raising numerous ethical, social and technological debates about what defines a species, and thus its regeneration; how such definitions shape conservation paradigms; and, ultimately, what we mean when we talk about life, death and species extinction. With their commitment to 'reversing climate change' while also 'advanc[ing] the economies of biology and healing through genetics', Colossal's work has not only been deemed 'game-changing' in terms of "saving" endangered species, but also in terms of 'future proofing' the environment by reshaping how the world thinks about the power of genetics for solving pressing challenges in the life sciences today, including the challenge of extinction. In this de-extinction example, then, the problem of extinction is actualized in relation to solutions aimed at enacting further control over the planet, this time by 'rewinding' and 'reversing' ecological destruction, so as to fix the human-caused disaster, and in so doing, fix the future. In this essay, I trace the line between 'the business of discovery' and 'making humanity more human' in order to draw out what I see as some of the broader refrains and fixations that have come to infect future-oriented ecological discourse in these times of dying. Looking to the example of Colossal, I examine the ways in which extinction, and the corollary project of de-extinction, has become at once a territorializing force that works to re-install monohumanist fantasies of planetary control, and a potentially deterritorializing force for letting go and giving up.

Keywords: De-extinction; extinction; genetic engineering; climate change; capitalism; Anthropocene

1. Colossal Problems

'May prehistory thunder forward' proclaims the Colossal Laboratories & Biosciences website, an online space dedicated to sharing information about the science of de-extinction as it is being developed through the company's signature launch project, which involves 'combining the science of genetics with the business of discovery' in order to bring back the woolly mammoth ('De-Extinction'). Alongside this species regeneration, the firm also aims to 'rewind' and restore the plant root systems that mammoths fed on, which, they claim, will have the added benefit of pulling carbon from the atmosphere in cold climates, in turn revitalizing and 'rewilding' ecosystems impacted by climate change. As Colossal puts it, the goal is to 'reawaken the lost wilds of Earth… [s]o we, and our planet, can breathe easier' ('De-Extinction'). Founded in September 2021 by Harvard genetics professor George Church and tech-entrepreneur Ben Lamm, Colossal's 'regenesis'[i] projects are pitched (and as we shall see, sold) as pioneering initiatives committed to developing a 'practical, working model' of de-extinction by operating at the 'leading edge of genetic engineering and restorative biology' ('De-Extinction'). In addition to their landmark project of resurrecting 'Earth's old friend and new hero' – the woolly mammoth – Colossal has recently added the thylacine or Tasmanian tiger, and the dodo bird, another classic figure of extinction, to their index of species selected for regenesis.[ii] Dedicated to 'restoring earth, one species at a time' through 'thoughtful disruptive conservation',[iii] Colossal sees de-extinction as an integral project for 'reversing climate change' – for 'turn[ing]' back the clock' – in order to heal our planet and, ultimately, create 'a better world' ('A Better World').

In this essay, I dig into the science of de-extinction as it is being developed by companies like Colossal to draw out what I see as some of the broader refrains that have come to infect future-oriented ecological discourse in these times of dying. In more specific terms, I look to this example of de-extinction and its framing of the *colossal problems* raised by today's mass extinction events as just one weird site for probing how extinction has become, at the same time, a territorializing force that works to re-install monohumanist fantasies of planetary control *and* a deterritorializing force for letting go and giving up. As such, I aim to investigate how de-

extinction, even in its current nascent state, remakes the very meaning of extinction, in turn raising unthought questions about the existential conditions of both animals and humans in an era of extinction.

De-extinction, also called resurrection biology or species revivalism, is the process through which extinct species can be 'brought back' into existence, often with the goal of reintroducing species to the wild and restoring ecosystems. The term de-extinction is relatively new, first gaining significant public interest in March of 2013 thanks to both a series of live-streamed TEDTalks and a cover story in *National Geographic* magazine (Novak 1; Schuster 198). Since then, de-extinction projects have grown in both number and scope, with early flagship projects such as 'The Great Passenger Pigeon Comeback'[iv] and the regeneration of the world's last Pyrenean ibex[v] now accompanied by initiatives, such as Colossal's, which are framed as a means to 'undo' historic extinctions by restoring new versions of extinct species to their former habitats. The growing interest in de-extinction has, in turn, spurred numerous ethical, social and technological debates in the media and among scientists, raising questions about, for instance, what constitutes a species in the first place; how such definitions shape conservation paradigms; and, ultimately, what we mean when we talk about species extinction.

Indeed, the very language of de-extinction is itself misleading, and thus up for debate. After all, the goal of de-extinction is not exactly to revive or resurrect species for which no viable members remain, but instead to create *proxies* of extinct species. Or, as the International Union for the Conservation of Nature (IUCN) describes it, the goal is to create a 'functional equivalent' of original species that, while not 'faithful replicas', are capable of restoring ecological functions or habitats that might have been lost as a result of species dying out (IUCN 1). This proxy-creation process typically involves the deployment of one of three methods: back-breeding, somatic cell nuclear transfer (cloning) or genome engineering (IUCN 1; Novak 2). Whereas back-breeding involves selectively breeding existing animals that exhibit desired physical and behavioural characteristics with the aim of creating an approximation of lost species, cloning involves implanting cell nuclei into host receptor cells to bring cloned animals to term in the uterus of a closely related species (Schuster 201). In the case of genome engineering, the method used by Colossal, the proxy-creation process involves reconstructing a

full or partial genome of an extinct animal in a lab before implanting the nucleic material into a surrogate for gestation (Schuster 201). In each case, the aim is not necessarily to 'bring back' species that have died out, but instead to develop an ecological replacement of an extinct species so as to restore ecological functions in the name of sustaining dynamic and resilient ecosystems.

For Colossal, this proxy-creation process involves resurrecting one of the classic figures of extinct charismatic Megafauna – the woolly mammoth – or more accurately, altering the genetic code of endangered Asian elephants to resurrect a cold-resistant elephant with all of the core biological traits of the woolly mammoth ('Science & Technology'). In this example, Church and his team of 'world renowned genetic scientists' intend to sequence both the woolly mammoth and Asian elephant genomes in order to identify cold weather genes and prepare multiplex gene edits to create test-tube embryos that can be implanted into endangered elephants, or rather, surrogate, artificial wombs, to grow 'mammoths' that can thrive in cold climates like their ancestors ('Mammoth'). As Colossal makes clear, the aim of their de-extinction projects is not just to revive the mammoth, or rather its proxy, but to leverage genetic engineering in order to 'rewind vital landscapes', which in this case involves reintroducing 'a large cold-tolerant mammal grazer to the tundra regions of the Earth', one capable of 'stirring up the ice-locked surfaces of the landscape, stomping out thin, low-oxygen trees, and exposing healthy, carbon-trapping grasses' ('De-extinction'). As the website outlines, some of the core goals for reviving the mammoth include decelerating arctic permafrost melt, preventing greenhouse gas emissions, and fostering ecosystems capable of adapting to and defending against climate change.

The goal of seeing the 'Woolly Mammoth thunder upon the tundra once again' ('De-Extinction') is just a starting point for Colossal, which also aims to develop a de-extinction library that will house genetic DNA and embryos from endangered animals. This cryogenic conservation project is accompanied by other 'thoughtful disruptive conservation' efforts aimed at, for instance, protecting the now endangered Asian elephant and African Savanna elephant species, which, as Colossal reports, are in 'dire need of a science that will save them' ('Elephant Conservation'). With such projects in mind, other core goals of Colossal's de-extinction initiatives include establishing 'proven links' between genetic sciences and climate change while

also driving advancements in bioscience technologies, such as in multiplex CRISPR genome editing. Devoted, in the words of Colossal, to 'engineering a new wave of wild', the company purports itself to be a revolutionary pioneer in new software (computational biology and bioinformatics platforms), hardware (lab technologies) and wetware (AI-supported bio-technologies), all of which hold the 'power to solve critical problems for all life on Earth. Including humans' ('Science & Technology'). As Colossal makes clear, de-extinction is about not just bringing back extinct animals or enacting disruptive conservation, but also reshaping how the world thinks about approaches to advancing human health and the power of genetics to solve pressing challenges in the life sciences today.

With their commitment to 'reversing climate change' while also 'advanc[ing] the economies of biology and healing through genetics,' Colossal's work has not only been deemed 'game-changing' in terms of 'saving' endangered species, but also in terms of 'future proofing' the environment, which, as their slickly designed website outlines, must now contend with the 'destructive force' of anthropogenic climate change. For Colossal, what must be overcome or 'proofed' against now more than ever, is the problem of *extinction*, or 'the dying out or extermination of species', which is framed above all else as a distinctly *human problem*. As the website puts it: '[o]f all the root causes of modern extinction, the most concerning and hyperactive factor is that of *human causation*' ('De-Extinction'). This assertion is backed up by a long list of staggering statistics.[vi] From tallies of number of species driven to extinction every hour (6), day (150), and year (30,000) to estimates of future extinctions based on predicted habitat loss brought on by, for instance, deforestation and rising CO_2 levels in the atmosphere, the message is clear: the problem of extinction 'is a human one. And the solution is a *human* one too' ('De-Extinction'). Within this framing, human agency is positioned as both threat *and* salvation: if humanity has damaged the planet to the point of species extinction, then it is this same force that must now harness all its power and ingenuity to solve the current crisis. In this example, then, the problem raised by extinction is not, for instance, how to let go and give up on those systems of domination and modes of relation – systems of production and consumption, modes of living and dying – that got 'us' here in the first place. Instead, the problem of extinction is actualized in relation to solutions aimed at enacting further control over

the planet, this time by 'rewinding' and 'reversing' ecological destruction so as to *fix* the human-caused disaster, and in so doing, *fix the future*. 'Extinction is a *colossal problem* facing the world' the website states from the get-go, adding: 'And Colossal is the company that's going to *fix* it' (my italics, 'De-Extinction'). For Colossal, this future fixing, which is key to 'heal[ing] this planet and creat[ing] a better world,' is framed as a *duty*: '[f]or the first time in the history of humankind, we are in control of a science with the power to reverse and prevent biodiversity loss on a large scale. […] This is not an option for us. It is an obligation known as thoughtful disruptive conservation' ('A Better World'). The sense of obligation raised here is in line with broader de-extinction discourse wherein scientists and conservationists who champion de-extinction consistently claim that reviving extinct species is not only ecologically beneficial, but that humans have a *moral obligation* to revive species whose extinctions were caused by anthropogenic activity (Schuster 200).

Despite its framing as a human problem, however, conspicuously missing from Colossal's online materials is any mention of *human* extinction. While species extinction now occurs at 1000 times the 'background rate', where we have now entered a new era of 'biological annihilation' (Ceballos et al. 2017), today's already-occurring extinction events not only mark disastrous biodiversity loss, both in terms of scale and variety, but foretell the end of the genus *Homo*. As such, today's mass extinction events mark the end of the Sumatran rhino, the Spix's macaw and the Catarina pupfish, while also bringing forth the unthinkable realization that 'there will be, perhaps sooner rather than later, not merely a speculative imagination of a time without humans but an actual experience of ending' (Colebrook and Weinstein xii). It is this experience of ending that is left out of Colossal's projected facts and figures, offering just one example of how the 'colossal problem' of extinction does not mark any sort of projected end, but has become yet another fulcrum for humanity to imagine itself anew. In the example of Colossal, then, extinction is not only framed as a 'massive' problem that can and should be met with the solution of de-extinction, but also offers a way for humanity to redeem and relaunch itself through fantasies of overcoming the threat of its own non-existence. For Colossal this entails 'combining the science of genetics' with 'the business of discovery', not only to 'jumpstart nature's ancestral heartbeat,' but to 'make humanity more human' ('De-Extinction'). In what

follows, I trace this line between 'the business of discovery' and 'making humanity more human' in order to investigate the weird and weirding example of de-extinction as just one site for experimenting with unthought practices of letting go and giving up in an era of extinguishment.

2. The Business of Discovery

Central to Colossal's proposal for de-extinction is an economic logic, one wherein today's era of mass extinction can and will be solved via the *business of discovery*. This focus on the 'business' of de-extinction is in large part necessary for a project like Colossal to exist, given its extensive financial costs. Indeed, de-extinction is not cheap. The technical stages of proxy species creation, which not only involves creating the first few specimens but also managing a captive population, requires a lot of funding. And funders are eager to invest. With its promise of calculated regenesis aimed at payoffs in the future, it is perhaps no surprise that de-extinction and the technologies it has advanced have already attracted numerous investors and major venture capital. With a reported valuation now estimated at over $1 billion dollars before even being listed on the stock market, Colossal has recently been given 'unicorn' status in the investment world (Seeley). As of summer 2023, Colossal has raised over $225 million dollars, $150 million of which was injected in January 2023 through an oversubscribed Series B financing round led by United States Innovative Technology Fund (USIT), with participation from influential investors such as Breyer Capital, WestRiver Group, Bob Nelsen, Animal Capital, Victor Vescovo, Animoca Brands, Peak 6, BOLD Capital, Jazz Ventures, and In-Q-Tel, a nonprofit venture capital firm funded by the CIA. In-Q-Tel's investment, which follows in the CIA's increased interest in biotechnology and DNA sequencing more generally, is just one example of the power-players who are embracing, through funding, de-extinction projects in order to steer global developments in the technology. Or, as an In-Q-Tel blog post from September 2022 put it, '[s]trategically, it's less about the mammoths and more about the capability. The next wave of progress in synbio will lead to advances in our ability to shape both form and function in organisms at the macroscopic level' (O'Connell and Chiu). Arguably, the sense of capability referenced here pertains not only to potentials for controlling technological advancements in the biosciences, but also to the project's *financial* capability, that is, the

capability for this speculative venture to make a lot of money. As Gemini crypto exchange co-founder and one of the project's main investors, Cameron Winklevoss, has put it: 'Although it's a moonshot, one probably fraught with risk and a ton of technical challenges, if [Colossal] succeed[s], there is the potential for a very outsize return' (cited in Quarmby).

Beyond providing risky, and thus potentially lucrative, investment opportunities, Colossal's *business of discovery* involves harnessing the power of patent law to guarantee even further financial payoffs in the future. While the deployment of patent law in the biosciences is not new (for instance, different mice have been patented for use in scientific research), most legal systems make it impossible to patent things that occur in nature: '[y]ou can't patent an animal or plant simply because you found it first; you need to prove that you've *invented* something' (Reynolds). Therefore, de-extinction projects raise unprecedented questions about the legal status of regenerated species, questions that must contend with where to draw the line when it comes to establishing proprietary rights over 'nature'. For Colossal CEO, Ben Lamm, who is confident that a mammoth is patentable, this line is not so hard to discern. After all, Colossal is not in the business of de-extincting the mammoth itself, but rather, through proxy-creation, aims to de-extinct genes in order to *invent* a new breed of cold-tolerant elephant. Within this scenario, patenting not only stops other companies from intruding on the same research terrain while providing exclusive rights to any animals that have been 'invented', but also provides yet another way to entice investors with the promise of exclusive future licensing revenue. As Lamm himself asserts, the goal with Colossal is not to monetize the mammoths themselves, but to patent and license other technology that the company develops along the way (Reynolds).

It is in this way that de-extinction initiatives, once again, provide a 'mouth-watering opportunity for a new round of capital accumulation based on generating, and acquiring intellectual property rights over, living organisms' (Dawson 79-80). Within this space of biological production, one wherein molecular biology can be harnessed under a new biopolitical regime of accumulation that nevertheless relies on risky financial investments, technologies such as biological patents 'allow a company to own an organism's principle of generation, its genetic code, rather than owning the organism itself' (Dawson 80). Under this biocapitalist regime,

living organisms are increasingly viewed, in the words of George Church himself, as 'programmable manufacturing systems' (Church and Regis 4) which can and should be patented, thereby transforming biological production into capital's primary means for generating surplus value. This transformation is evidenced by Colossal's de-extinction library, which is just one example of a 'frozen zoo' or a form of 'gene banking' made possible via cryogenic conservation. The frozen zoo, like Colossal's *business of discovery* more generally, is underscored by an economic logic: as the metaphor of the 'bank' indicates, this conservation effort involves 'depositing' germ lines of endangered species so that they can be 'redeemed' at a later date (Schuster 202). It is also inflected by the language of computation: as Colossal asserts, the aim is to 'back up species' by constructing a DNA database or what they think of as 'a repository of the recipe for living creatures, so that none face the theft of their existence' ('A Better World'). Through its computational language and economizing logic, frozen zoos such as Colossal's de-extinction library not only align with (speculative) banking models, but also work to rewire life itself in ways that can be recuperated within dominant systems of power and control. The issue raised by this example of de-extinction, then, is not just how investments in the bioscience company bolster the irrational rationality of capitalism or draw attention and resources away from other conservation efforts, but how Colossal's *business of discovery* relies on the thoroughgoing division, manipulation and commodification of 'nature' in order to provide yet another opportunity for capital accumulation.

By relocating life itself onto DNA, which can, in the case of Colossal's de-extinction library, be stored and manipulated in computational or cryogenic archives, the lives of animals are framed as collections of disparate parts – data points – that can be brought in and out of existence at will. Within this scenario of 'life-on-demand', where animal life might come in and out of extinction depending on human needs, desires and bottom lines, life itself is turned into a series of programmable codes (Schuster 217). Where de-extinction technologies ultimately 'aim to make the risky and existential processes of birth, life, care, and death increasingly pliable, marketable, and upgradeable', life, including animal life, becomes a prime site for the creation of new forms of (bio)value (Schuster 215). As such, life is only valuable, and thus worth counting, let alone conserving, insofar as it serves human, or more accurately, economic

interests. This all-too-human valuation is evidenced by the lack of discussion of actual animals within contemporary discourse around de-extinction science. Despite all the talk of 'saving' endangered species and 'protecting' the planet, the actual lives and welfare of living, breathing animals are rarely mentioned in Colossal's glossy communications. This strategic exemption is in line with broader de-extinction projects and discourse wherein questions and concerns about animal welfare – i.e., the various forms of violence and suffering caused by captive rearing, embryo implantation, ecosystem reintroduction or the health problems associated with cloning – are most often left out of the discussion (Browning). Such omissions underscore how, through de-extinction, the 'colossal problem' of extinction is framed as one that can be overcome by making and remaking species and ecosystems, and further, how the death of animals within such framing is not seen as limit or a problem, but as part of the *solution* to un-doing the mess 'we' have made. By generating and acquiring data protocols and property rights over the 'building blocks' of life itself, Colossal approaches the problem of extinction as that which can be fixed by harnessing data, in this case genetic code, and directing it toward some 'better' alternative. Or as Winklevoss expressed in one excited tweet, Colossal is 'solving for the future by bringing back the past' and thus their de-extinction mission will 'undoubtedly change the course of history and build a *better* future' (cited in Quarmby).

Through its business of discovery, then, de-extinction offers not only an exciting new financial venture while setting the groundwork for proprietary legal precedents, but also an innovative solution for *fixing the future*. De-extinction projects such as Colossal's bolster the fantasy that today's irreversible ecological conditions are, in the end, under our control, that 'reversing' something like climate change is not only possible, but an *obligation* by which 'we' must abide. As such, de-extinction technologies project a future that is 'de-ecological and de-existential', a future wherein the 'precarious and finite interrelated conditions of existential ecology [are replaced] with a view that these conditions are programmable, controllable, and improvable at will' (Schuster 214-215). Importantly, this programming logic, and thus the ability to control the parameters of life and death, are powers that go far beyond the case of de-extinct animals, implicating all life on Earth, and thus intertwined with broader issues of social and ecological justice. Where advancements in biosciences continue to define and value the

determination of life itself, segregating humans from non-humans while concomitantly reifying damaging hierarchizations, the actual problems of collaborative survival raised by today's mass extinction events, including the threat of extinction of the human species, have been obscured and sidelined in favour of projections of a redemptive, fixed and fully fixable future. What, then, is being 'discovered' through Colossal's 'business of discovery'? Novel scientific methods and technological innovations? Sure. Untapped frontiers for capitalist expansion? That too. Innovative solutions to actualizing a 'better' world, a 'better' future? Perhaps. But more than these 'discoveries', what is perhaps found, or better, *invented,* through de-extinction initiatives like Colossal's is *a new vision for humanity*, one wherein techniques of genetic engineering not only confer godlike capacities on the human species (yet again), but project an undeniably positive, or 'hopeful,' future for 'us'. In this optimistic narrative, 'if 'we 'discover ourselves to be an agent of destruction, then 'we 'must re-form, re-group and live on' (Cohen and Colebrook 9). Colossal's 'business of discovery' in this way operates through an ultra-humanism that not only works to rewire and over-code conceptions of life, but, importantly, offers a mode for humanity to *invent itself anew*.

3. Making Humanity More Human

Foundational to Colossal's de-extinction initiatives is the assumption that the root of today's eco-catastrophic scenario lies in some general capacity of human beings to destroy the natural world. As Tom Chi, founding partner of At One Ventures and Colossal investor, asserts, '[s]ince the industrial revolution we've been on an ever-quickening pace of ceaseless taking from nature. Now is the time to start learning as a civilization how to return and care for what we have taken' ('A Better World'). This centring of human agency – where once again, humanity is positioned as both threat *and* salvation – is also at play in some of the more popular accounts of the sixth mass extinction, including in Elizabeth Kolbert's 'unnatural history' of species death. In this journalistic take, Kolbert argues that extinction is what happens when the world's flora and fauna cannot adequately adapt to the accelerated rate of change and planetary transformations imposed by human beings. Not unlike broader Anthropocene stories, Kolbert's

narration of the sixth mass extinction affirms that the qualities and capacities that make 'us' human and empower 'us' to transform the world, for instance, our creativity and our communicative abilities, are also what endanger the ecologies on which we necessarily depend. Within this narrative, then, we see not only a sweeping universalism characteristic of much Anthropocene discourse, in which humanity is represented as a unified and undifferentiated species equally responsible for current extinction events, but also the affirmation of an Anthropos capable of controlling and manipulating planetary realities, this time to the point of mass extinction.

This narrative of a destructive, but also redemptive, humanity is central to Colossal's very rationale for de-extinction. As the website asserts, advancements in science and technology have 'led to our benefit while dramatically harming species around us' and thus '[i]t is time humanity adopts a collective "we" when addressing the long-term effects of our industrial and agricultural revolutions' ('A Better World'). This desire for collectivity is, of course, questionable, especially when considering the way in which Colossal's *business of discovery* contributes to the very conditions that have led to today's ecological decimations. As Ashley Dawson explores in his own radical historicization of extinction, today's mass extinction events are not the result of some innate 'human' condition, but more accurately an index of the concerted 'attack on the planet's commonwealth, one in which capitalist interests target the world's remaining stores of biodiversity' (176). As Dawson asserts, there is perhaps 'no clearer example of the tendency of capital accumulation to destroy its own conditions of reproduction than the sixth extinction' (14). This is to say that today's era of extinction is not a result of our species' biology or creative capacities but has been brought on by the long-distance and violently slow destruction of landscapes, ecologies and cultures via colonial petro-capitalism and its logic of expansion, extraction, dispossession and accumulation (Moore). Colossal's desire to develop a collective 'we' is thrown even further into doubt when considering the company's lack of consultation with the various human communities who might be most impacted by proposed 'rewilding' efforts. In the example of the recently introduced thylacine regeneration project, for instance, the company has already come under fire for lack of public consultation, including with Indigenous communities. Environmental scientists have asserted that Indigenous Australians

should be involved in discussions of rewilding and regeneration now, especially Tasmanian Aboriginal peoples, who were themselves hunted by white settlers in the 19th century. As Kamilaroi environmental scientist Bradley Moggridge puts it, '[Indigenous communities] may have ideas; they might need to get [their traditional lands] ready for this species. That could take a long time' (cited in Evans 2022). With these collective contentions in mind, the sixth mass extinction need not be framed as a product of some general human capacity for despoliation of the planet – as we see in the work of journalists like Kolbert, as well as in projects like Colossal – but rather 'as the product of a global attack on the commons, a capitalist frenzy as the planet tilts toward increasingly intense environmental catastrophe' (175-176). The role of capitalism and colonialism, let alone the question of their abolition (!), is, of course, not a part of Colossal's public-facing communications. Instead, the 'better world' that Colossal imagines is one wherein humanity is able to harness (highly-funded) technologies in bioscience to reverse climate change and, ultimately, make humanity *more* human.

The example of de-extinction, in this way, takes part in broader (Good) Anthropocene narratives of saving the planet, characterized as they are by 'messianic undertones and masculinist-solutionist ambitions' (Zylinska 15). Where the Anthropocene not only signals our presently unfolding planetary emergency but proceeds through a re-installation of a standardized and perpetual humanism that prioritizes (some) human life and agency over other life-forms, it now offers a 'planetary analytic' (Yusoff 13), an 'epistemological filter' (Zylinska 3) through which humanity can see itself anew. In line with these broader narratives of (Good) Anthropocene redemption, Colossal's de-extinction projects fail to recognize how their own discursive tropes and points of reference 'bring forth a temporarily wounded yet ultimately redeemed Man who can conquer time and space by rising above the geological mess he has created!' (Zylinska 12). In this ingenious saga, one wherein species extinction has become the very horizon for rehabilitating, or better, *upgrading*, Man's singular ontology, the current state of planetary degradation is that which merely requires a 'technical fix,' and thus, Anthropos himself is also 'fully fixable' (Zylinska 18). With this fixation on fixing in mind, it is perhaps no surprise, then, that Colossal's de-extinction initiatives align with broader advancements and projections within transhumanist movements. In addition to providing a site for risky

investments and potential payoffs, Colossal's claims of 'reversing climate change' and 'rewinding' nature have drawn the attention of those venture capitalists, bitcoin billionaires, tech moguls and 'celebrity scientists' interested in 'curing death' through the development of, for instance, new technologies aimed at human life extension and upgrading physical and mental capabilities (Schuster 209). George Church is himself very clear about his transhumanist desires, asserting that he 'sees de-extinction as one tool in the larger toolbox of technologies to pursue longer lives and genetic enhancements for animals and humans alike' (Schuster 208). Extolling the possibility of 'civilizing, taming, and domesticating the basic processes of life' and 'maximizing evolution' (Church and Regis 89), Church's commitment to *regenesis* (the title of his book with Ed Regis) promotes the integration of conservation and life extension as not just an obligation given the state of the planet, but as 'an Earthly and cosmic triumph' (Schuster 208).

With Church's exultations in mind, when Colossal says they want to make *humanity more human,* they are referring to a quite literal extension of humanity, one that can live better and longer, even, or perhaps especially, given presently unfolding extinguishments and extinctions. This fantasy of remaking and ultimately redeeming humanity follows on from a longer line of thinking wherein the human is not only defined in relation, or opposition, to non-human bodies or to its capacity for so-called rational thought, but *in relation to the threat of its own non-being*. As Colebrook develops in various essays[vii] that think through extinction in the age of the (so-called) Anthropocene, 'Anthropos has *always* been defined by existential threats, that he is set apart from all life in the world by his existential fragility, by the always present possibility that he may not be' (*The Future is Already Deterritorialized* 346). By projecting humanity past the extinction, albeit through fantasies of some untouched, pre-historic time, Colossal envisions 'a better world' where humans find their proper mode *after* overcoming annihilation and thus the future becomes the territory, once again, for vanquishing existential threats though the affirmation of an Anthropos both in need and worthy of saving. It is in this sense that extinction, and its proposed reversal, offers yet another mode of ultra-humanism, another fulcrum for intensifying the modern sense that the parameters of reason that define and delimit distinctions between being and non-being are always already correlated to *human* life. As Colebrook writes:

> [o]nce humans think of themselves as a life-form, and then as a life-form with the exceptional capacity of thinking or reason, it becomes possible that the potentiality for thinking could cease to be, and that such a non-being of thinking is what must be averted at all costs and without question. (*Extinction* 152)

Here, the notion of non-being is at odds with typical understandings of extinction and its assertions that everything might end. That is, extinction here does not figure the *end* of life, but instead figures the *affirmation* of life, one that takes the form of a distinct, not to mention exceptional, human species that is defined, above all, by the rational vanquishing of its own non-being.

Where, in the case of Colossal, de-extinction is positioned as a way to make *humanity more human,* it also aligns with a utilitarian motif, one that 'haunt[s] questions of extinction and capacity' and informs decisions regarding lives worth living (Colebrook, *Lives Worth Living* 152). After all, and as Colebrook outlines, the very question of who and what survives within discussions of extinction is always-already a utilitarian, *offensive* question. The sense of offensive Colebrook deploys here references the idea of a military offensive, one that actively works to 'value the worth of some lives over others, […] thereby waging violence (however slow) against some forms of life' (*Lives Worth Living* 155). It is through this violent valuation that an 'anthropological and calculative "we" emerges by way of technologies that generate and calculate the worth of "a" life', which is always-already correlated to the life of the human (*Lives Worth Living* 170). Here, the human is not only defined as that which exists separate and distinct from 'nature' but is also characterized by the very capacity to calculate something like the right to life in the first place. In the case of Colossal's de-extinction projects, this cruel calculation is made possible by computational and economic rewirings in which life is broken down and manipulated to conform to the dictates of corporate profit, all of which is meant to serve the quest for 'a better world,' which, in the end, means a better world for (some) humans. As Colossal states, once again, given current threats of extinction '[i]t is time humanity adopts a collective 'we'' ('A Better World'), an obligation that can and will be taken up through the *business of discovery*, which is committed, above all else, to the production of new forms of (bio)value that ultimately define which lives are worth living, worth saving. Through this strategic valuation, which is

always linked to speculative payoffs in the future, de-extinction contributes to the claim that 'some lives ought not be lived, […] reveal[ing] the *offensive* (combative, polemical, violent, barbaric, sacrificial) nature of what has called itself civilization' (Colebrook, *Lives Worth Living* 156). Where this sense of civilization is, in this era of dying, now facing its own extinction, the pressure to 'weigh lives', a pressure that is only building, points to the way the question of life – how it is defined and by whom – is now an integral site of ecological and political struggle.

In addition to addressing the offensive valuations through which definitions of life and death are leveraged in the name of dominant systems of human power and control, the question of life today must now contend with a range of weird phenomena that frustrate boundaries between the so-called 'natural' and 'unnatural' world. Today's extinction events are not only characterized by the extinguishment of various species, but also mutated ecological conditions that hold the potential to upend typical approaches to, for instance, conservation efforts. As just one example, the oft-cited Great Pacific garbage patch or Pacific trash vortex, has made scientific news once again based on a new study that confirms the existence of a 'thriving' ecosystem living amid the soupy garbage (Haram et al). A recent study in *Nature Ecology & Evolution* outlines how the garbage rafts located in the North Pacific Subtropical Gyre (NPSG) have created a new kind of floating ecosystem that is capable of sustaining (coastal) life that typically cannot survive in the open ocean. While 'rafting', or the affiliation of organisms with floating debris, is itself not new – natural rafts consisting of buoyant, floating vegetation or pumice have been an inferred mode of species dispersal since the nineteenth century – these 'natural' rafts, and the ecosystems they enable, are often 'relatively short-lived, decomposing at sea over a matter of months or a few years, becoming waterlogged and sinking, or being biodegraded or consumed by marine animals' (Haram et al. 687). The aqueous cluster of swirling plastic that makes up the NPSG raft, on the other hand, is much more durable and buoyant than natural materials, making it an optimal substrate for long-distance and long-term dispersal of marine life.

Plastic is, in fact, ideal for surviving harsh ocean conditions due to its recalcitrant nature. For, as Heather Davis writes:

> although plastics photodegrade and break apart, they do not biodegrade. That is, the pieces may get smaller and smaller, but they do not turn into something else. They do not go away. The molecules themselves remain intact, holding onto their identity. (*Life & Death in the Anthropocene* 352)

It is for this reason that 'microplastics' – plastics that are less than five millimetres – are now one of the main concerns when it comes to petrochemical pollution; microplastics are now everywhere, in water streams but also blood streams, as well as amidst 'garbage patches' in the ocean, which are now home to biodiverse ecologies for many kinds of bacteria and viruses. The vibrant communities that make up the 'plastisphere', a site where more than a thousand species might exist on a single piece of microplastic (*Life & Death in the Anthropocene*), exist within and alongside the 'floating communities' forming in the North Pacific, which, as the recent study outlines, are now home to barnacles, molluscs, sea anemones and 484 marine invertebrates from 46 different species (Haram et al). Against the questionable claim that this example is proof positive that 'nature', or life itself, can and will 'find a way', this phenomenon instead puts pressure on those unquestioned assumptions that have come to define lives worth living when it comes to conservation efforts. Here, typical demands for environmental stewardship, such as those put forward through imperatives to 'clean up' ocean garbage patches, must confront the difficult realization that such calls are also calls to decimate a now thriving ecosystem. Further, any sort of clean-up effort must also reckon with the recalcitrant matter of plastic and its 'undead molecules', which, given its incredible longevity, might be understood as a 'non-filial human progeny, a bastard child that will most certainly outlive us' (Davis, *Toxic Progeny* 232). What this example of toxic progeny and its entangled ecosystems highlights, then, is the need to develop a very different sense of responsibility for, or *obligation* to, our nonhuman kin, one that recognizes that their very existence is 'predicated on the extinguishment of multiple other forms of life: humans, animals, plants, and bacteria alike' (*Toxic Progeny* 245).

This sense of responsibility is, however, very different from the sense of obligation put forward by Colossal. Not unlike plastic, de-extinct animals can also be seen as form of non-filial, queer progeny,[viii] one that raises questions about, in Foucault's famous formulation, 'making live' and 'letting die' (271–272), questions that 'extend not just to what we do *to* non-human

beings, but also to what we do *for* them' (Wolfe xiv). After all, any attempt to 'speak for the other', any address that comes from a human animal is inherently anthropocentric, no matter how nuanced, attuned or critical that position may claim to be (MacCormack 'Gracious Pedagogy' 13). The project of de-extinction, in this way, offers an experimental site for asking difficult ethical questions wherein we might conceive of nonhuman life in terms of liberty and flourishing without pre-determining or calculating the validation (which is always an *offensive* attack) of what life must *be* to vindicate its existence (MacCormack 13). De-extinction, in this way, is more than just an example of ultra-humanism, one that can and should be critiqued, but also offers a 'practical, working model' for investigating weird questions about life itself: questions about what constitutes life and what lives are worth saving; questions about queer progeny and un/natural affiliations; and, ultimately, questions about unthought potentials for letting go and giving up on the obligatory fixations that undergird today's fantasies of making *humanity more human*.

The Treachery of Letting Go and Giving Up

For Colossal, the quest to create 'a better world' – one in which the planet is healed, and humanity is redeemed – is positioned as a moral obligation. Colossal thus aligns with dominant conservation paradigms, which are often underscored by a sense of morality founded on the obligation not to render species extinct (IUCN 3). While this obligatory stance may now be commonplace in conservation circles, it remains unclear whether this logic should be extended to a moral obligation to resurrect species that have died out (IUCN 3). Colossal, in contrast, clearly asserts that resurrecting extinct animals is, indeed, a moral obligation, especially given the powers and capacities now enabled by genetic engineering. De-extinction offers a way to right the wrongs caused by human activity, an opportunity to take 'control of a science with the power to reverse and prevent biodiversity loss on a large scale' so as to 'turn the clock back to a time when Earth lived and breathed more cleanly and naturally' ('A Better World'). Within this fantasy of reversal, the very thought of letting species disappear when there is an 'option' to bring them back is seen as a moral failing (Schuster 215). Again, de-extinction is not an option, according to Colossal, but an obligation, one founded on a 'loyalty to the world around us' ('A

Better World'). Colossal's appeal to loyalty – '*for* the planet, *for* the animals, *for* the future' – not only correlates the life of animals with the offensive calculations made possible through an anthropological 'we', but also falsely assumes a certain sense of allegiance between humans and the so-called 'natural' world.

The quest to 'save' species from extinction, and thus to 'save' the world, is, after all, contingent on the assumption that animals need us. But the harsh truth is, as Patricia MacCormack writes, '[a]nimals do not need us, except as a direct result of what we have done to them through domestication or destruction of habitat' (*Gracious Pedagogy* 16). This is evident within even Colossal's framing of extinction, where the animals in 'dire need' of saving are *especially* a concern given the anthropogenic nature of their demise. However, and as evidenced by their dedication to the *business of discovery,* at the same time that Colossal claims 'loyalty to the world', the bioscience company nevertheless continues to dominate, exploit and otherwise manipulate animal life in a parasitic fashion that is far from reciprocal. The argument that animals need saving is, in this instance, always-already flawed based on how life itself is conceived through all-too-human concepts of power and control, thus exposing the limits of Colossal's claim to loyalty. For, given the weird and weirding nature of today's extinction events, to be 'loyal to the world around us' would not only mean facing up to the deleterious legacies of capitalism and colonialism, but would require recalibrating to concepts of life that are able to account for those unnatural relations and queer progeny that increasingly characterize planetary existence. In short, loyalty here would necessitate, somewhat paradoxically, a certain kind of *treachery*.

In the case of plastic oceans and the 'thriving' communities making garbage rafts their home, for instance, to be 'loyal to the world' would mean betraying long-standing, albeit increasingly out-of-synch, conservation paradigms and 'clean up' efforts. Here, solidarity with nonhuman life is itself a form of treachery based on how it embraces unlikely alliances that require us to become 'traitor to our species' while also becoming 'disjunctive to the natural world for which we care, but caring nonetheless' (MacCormack, *Ahuman Manifesto* 174). Importantly, the direction of this treachery matters. Far from being a nihilistic response to the pressing issues and mass suffering raised by today's extinction events, the call for treachery is

also a call for unthought practices of care. As MacCormack outlines in her ahuman manifesto, the encroaching event of extinction, and especially *human extinction*, is one that holds the potential to conjure experimental modes of care, but only if extinction itself is reframed in ahuman terms.[ix] For MacCormack, while extinction is a reality today, it need not be thought of as a problem to overcome. As she writes, while prospects of human extinction often appear 'unthinkable because the idea of a world without humans is understood as an apocalyptic end rather than an opening of the world' (*Ahuman Manifesto* 48), extinction might be otherwise encountered as a forceful concept for grappling with approaches to ecosophical ethics that necessitate unthought modes of existence, practices of care and strategies for leaving alone and letting be. An ahuman approach to extinction, then, is one that works to think of 'ways beyond and ways out, not for ourselves, but for the world' (*Ahuman Manifesto* 2).

Where de-extinction is founded on the moral obligation to 'go back' to a time when the Earth could breathe easier, the ultimate act of treachery is to no longer see species revival as an unquestioned duty, but *as an option we can refuse*. This act of betrayal is one that acknowledges how the demands made by Colossal – demands for 'loyalty to the world,' demands to 'care for what we have taken' – are not exempt from the biopolitical manipulation of life toward ends that actually work to 'break the existential links between life, care, and finitude shared among humans and nonhuman species' (Schuster 217). While de-extinction projects may, one day, pay off with pseudo-mammoths roaming tundras, pitching in on the fight against climate change in their own special way, this payoff will be the result of a necessary negation of those conditions of care that comprise our shared planetary condition As Joshua Schuster writes:

> [w]hile de-extinction might point the way toward undoing the loss of recently lost species, it also undoes the fundamental conditions of care. Assisting the flourishing of human and animal lives does not require technological control over their existential structure. *Never letting go is not the same thing as sustainability*. (217, my italics)

With this in mind, the example of de-extinction offered here not is not just positioned as a site to critique the economizing logic of Colossal's *business of discovery* and the ultra-humanism subtending it, but as an experimental site for deploying unthought practices of letting go and giving up. Where we lack even the most rudimentary theory of giving up, and further,

where attempts to rethink the human remain largely incapable of embracing 'the grace in not knowing and in leaving be' (*Ahuman Manifesto* 13), un-fixing the future of de-extinction requires both a radical refusal of fantasies of 'going back' *and* ongoing experiments with the parameters of reason that construct perceived problems, including the problem of extinction, in the first place. After all, extinction is one of the most human *and* inhuman of concepts. As Colebrook writes, while

> extinction is as natural and inevitable as emergence [...] it may be that when extinction can be witnessed from within 'a' life that this aspect of existence opens a new way of *problematizing the limits of thinking* and what it might mean to mourn or save a form of life. (*Extinction* 150, my italics)

This problematizing approach to extinction necessarily involves speculative acts of grace and experimental gestures aimed at letting go and giving up so as to unthink the human alongside the leaving be of the nonhuman (*Gracious Pedagogy* 13). What is being let go of here, then, is not only the imperative to endlessly optimize and redeem the human, but also the conceit that the world is 'ours' to save. It is by giving up on this obligatory stance that we might begin to experiment with unthought practices of collaborative, ahuman survival.

This treacherous refusal is, at least for me, highly destabilizing. In many ways, it is hard to be *against* something like de-extinction. This is not only because its stated goals are, at first glance, in line with desires to see a multitude of species flourish (does being *against* de-extinction mean being *for* extinction?!), but also because being *against* de-extinction means grappling with vexing, some might even say *unthinkable*, questions about the limits of *human reason* as it is situated in today's era of ecocatastrophe. De-extinction, even in its speculative formations, remakes the meaning of extinction, in turn raising critical questions about the very definitions of life and death. While in the early stages still, Colossal's de-extinction projects nevertheless provide one site to examine 'how ecological concerns about conservation can shift quicky into the most dire questions concerning how much control humans should have over life itself and how the crisis of extinction can be used to legitimate such powers' (Schuster 200). The issues raised by extinction, and its proposed antidote of de-extinction, are, in this way, both disastrously *determinate* – anthropogenic violence of different kinds is killing whole species at a terrifying rate

– but also, as I have endeavoured to unfold here, theoretically *indeterminate*. This terrain of in/determination is, in my mind, the very site of struggle for those who desire to take seriously the 'colossal problems' associated with today's mass extinction while refusing the redemptive fantasy of 'going back' to the past in order to guarantee a 'better' future.

Notes

[i] 'Regenesis' is a neologism coined by George Church and Ed Regis in their 2012 book *Regenesis: How Synthetic Biology Will Reinvent Nature and Ourselves* and refers to the regeneration of species through processes of synthetic biological engineering.

[ii] Similar to the plans for resurrecting the mammoth, Colossal's TIGRR lab (Thylacine Integrated Genetic Restoration Research) plans to use preserved thylacine embryos and young specimens in order to sequence the genome with the aim of using computational biology to establish compatible cell lines with the thylacine's closest relatives for embryo surrogacy and gestation ('Thylacine'). And, in the case of bringing back the dodo, Colossal is starting by creating high quality avian genomes (informed by comparative analyses, computational biology, machine learning and empirical methods) in order to gain insights on how mutations affect adaptation and speciation in Genotype and Phenotype predictions ('Dodo').

[iii] Disruptive conservation is defined, on the Colossal website as 'the ethical use of next-generation technologies to accelerate animal and ecosystem preservation' (Ord).

[iv] 'The Passenger Pigeon Comeback' is a project led by California-based nonprofit biotechnology company *Revive & Restore* and is one of many initiatives aimed at bringing biotechnological innovation to conversation biology with the mission of enhancing biodiversity through 'genetic rescue' of endangered and extinct animals.

[v] The Pyrenean ibex was the first taxon to ever become de-extinct when, in 2003, a Franco-Spanish team used interspecies nuclear transfer cloning to bring the wild goat 'back to life'. While the baby ibex died shortly after birth, the experiment has been used as important 'proof' that an extinct species can, indeed, be brought back from extinction (Dawson 177-178).

[vi] Colossal references statistics from the IUCN, Panda.org, BiologicalDiversity.org and the IPCC.

[vii] See, for instance, *Extinction; Lives Worth Living; Extinction, Deterritorializaion and End Times;* and *The Future is Already Deterritorialized.*

[viii] For a more in-depth look at the example of de-extinction as it relates to queer progeny see the chapter titled 'De-Extinction' in *The Routledge Companion to Gender and Animals* where I explore the science of de-extinction as it plays out in the fictional world of *Jurassic Park*. In this essay, which overlaps with the current text, I extend the conversation of de-extinction and the data-fied dominion of ancient animals through a discussion of queer clones and non-reproductive futurity.

[ix] Central to MacCormack's ahuman manifesto is a series of abolitionist calls that propose forms of activism that involve direct calls to 'forsake human privilege, practice abolitionist veganism, cease the reproduction of humans and develop modes of expression beyond anthropocentric signifying systems of representation and recognition [so as to generate] care for this world at this time until we are gone' (10).

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