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Machine ex machina: A Framework Decentering the Human in AI Design Praxis

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Abstract

Artificial intelligence (AI) design typically incorporates intelligence in a manner that is affirmatory of the superiority of human forms of intelligence. In this paper, we draw from relevant research and theory to propose a *social-ecological design praxis* of machine inclusivity that rejects the presumption of primacy afforded to human-centered AI. We provide new perspectives for how human-machine communication (HMC) scholarship can be synergistically combined with modern neuroscience's integrated information theory (IIT) of consciousness. We propose an integrated theoretical framework with five design practice recommendations to guide how we might think about responsible and conscious AI environments of the future: symbiotic design through mutuality; connectomapping; more-than-human user storytelling, designing for AI conscious awakenings; and the revising of vernaculars to advance HMC and AI design. By adopting the boundaries HMC scholarship extends, we advocate for replacing ex machina mentalities with richer understandings of the more-than-human world formed by interconnected and integrated human, human-made, and nonhuman conscious machines, not superior or inferior but each unique.

Keywords: artificial intelligence (AI), actor network theory (ANT), human-machine communication (HMC), integrated thought theory (ITT), design framework, consciousness

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"Computers arose from the mud, and code fell from the sky."
—George Dyson

Introduction

Nature has its own algorithms that curated ways of living long before humans learned to emulate them. Artificial intelligence (AI) is such a derivation of nature; a human creation built to extend the means of human capabilities. And yet its design typically incorporates intelligence that affirms the superiority of human forms, often at the expense of other, diverse modalities of intelligence. Intelligence, or the systems and structures that enable the ability to select, process, adapt to, and shape information environments, is not unitary (Sternberg, 2023). It is true that appealing to humans and enabling the diffusion of commercial AI must make clear how diverse AI are meaningful to human beings. Commercialization, however, need not be divorced from a responsible AI approach. Such an approach aligns machine with machina, instead of pitting one against the other. It further centers on the benefits of AI without engaging in excessive commodification of intelligence in ways that reinforce false binaries between artificial and human.

In this paper, we propose a framework for decentering the human in AI design. Our approach aims at including human, human-made, and nonhuman actors occupying Earth to advance beyond confining the capabilities of AI to the human realm. Decentering the human in design does not imply not catering to the human, which is often a selling point of advanced technology. On the contrary, we argue that decentering the human permits the design of AI to evolve in ways that compliment, augment, and amplify, but do not substitute human ability.

Physics has long been guided by the Copernican principle, or the idea that no scientific theory should grant superior status to humans or assume that human intelligence is central to the cosmos (O'Gieblyn, 2021). The crafting of human-centered AI often negates this governing principle across all sciences. Foundational human-machine communication (HMC) research deviates from this assumption. We argue that humans' intelligence is working in tandem with nonhuman intelligence to form the consciousness of Earth's sociotechnical system. Consciousness, the integrated information that constitutes Earth's sociotechnical system, is impacted by human-centered AI creations (Tononi, 2008). We expand this approach by articulating the necessity and benefits of responsible AI design, which incorporates the intelligence of human, human-made, and nonhuman actors.

Drawing from relevant research and theory including *actor network theory* (ANT), *human-machine communication theory* (HMC), and *integrated information theory* (IIT), we argue that AI design should focus on understanding and emulating both human and nonhuman intelligences, which constitute the consciousness of Earth's sociotechnical system. If AI designers were to push AI beyond a human-centered model, it would provide humans with the potential to better understand and enhance the quality of consciousness for Earth's sociotechnical system and all its inhabitants. In mapping our framework, we propose a responsible, ecologically conscious AI design praxis, which rejects the presumption of superiority afforded to human intelligence, consciousness, and communication.

The study of HMC holds promise to bring the more-than-human world from the margins of the discipline (Plec, 2015; Spence, 2019). This exploration is of great social

significance for a multiple of reasons. First, in its current human-centered design state, AI is disconnected from the living and the natural and thus potentially harmful to all occupants of Earth's sociotechnical system (Crawford, 2021). In its current human-centered design state, we argue AI irresponsibly risks harming the consciousness of Earth's sociotechnical system and thus all those that inhabit it. Production facilities utilizing various modalities of AI run at an energy cost not sustainable for Earth (e.g., Bronner et al., 2021; Heikkilä, 2022; Itio, 2019). The operational logic of AI manufactures and becomes a worldview, an industry, an infrastructure, and a way of operating in the natural world. Yet, as disembodied computations, or *ex machina,* AI systems are anything but abstract. Rather, AI sets a physical infrastructure by reshaping Earth and the flow of life for all that inhabit it. It is necessary to conceptually reconsider how AI can responsibly contribute to the consciousness of Earth's sociotechnical system.

Second, decentering the design praxis of AI from human intelligence to the intelligence of the more-than-human world will better connect AI with the natural world and fuse relations of mutuality. Recent research emphasizes approaches that view various morphologies of intelligence as symbiotic (Jones, 2018; Neff & Nagy, 2018). There are other forms of intelligence within Earth's sociotechnical system, which could inspire a more advanced approach to AI (Cowls et al., 2021). Decentering the human in AI design can empower both human and nonhuman actors through human-made (or artificial) means.

Third, recent HMC scholarship highlights what can be gained from investigating the opportunities and risks of machines that can communicate (Prahl & Edwards, 2023). We argue the principles of HMC, ANT, and IIT combined enable a new perspective regarding the greater impact of AI and human-AI communication. Specifically, these concepts provide AI designers with direction with how to design a responsible AI, which will impact the consciousness of Earth's sociotechnical system. In addition, these concepts provide opportunities for AI designers to explore HMC, nonhuman intelligence, and consciousness, which will inspire collaboration across disciplines.

Were AI design adapted to understand and emulate nonhuman intelligence, the resulting systems will not then compete with or seek to substitute human intelligence. In what follows, we outline principles for such an advanced design praxis, one that acknowledges that there is nothing artificial about forms of intelligence often labeled AI. We demonstrate that AI designers and stakeholders are not just crafting neutral objects, but social actors who are stunted by a limited human-centered design outcome. We articulate existing evidence of AI's participation in shaping of the consciousness of Earth's sociotechnical system by drawing connections to ANT, HMC, and IIT theory. In this manner, we craft an integrated theoretical framework with specific design recommendations for responsible AI environments of the future. To begin, we first address humans' and nonhumans' positionality within Earth's sociotechnical system.

The More-Than-Human Network of Humanity

The theoretical principles of HMC and the work of feminist STS scholars are influenced by Bruno Latour's "actor-network theory" or ANT. ANT conceptualizes AI and other forms of technology as a part of a social network of relations or a sociotechnical system constructed from the interactions taking place among human, human-made, and nonhuman actors

(Latour, 2005). Sociotechnical systems can vary in scope and size and often overlap, but the social interactions among actors within each constitute a collective and integrated system. In a sociotechnical system, humans and nonhuman actors codetermine one another, and the social information generated jointly by its actors is greater than the sum of the information generated by each actor independently (e.g., human information). A sociotechnical system involving a multitude of human and nonhuman actors will generate a large network of integrated information.

On Earth, human and nonhuman actors' interactions form a host of sociotechnical systems. If humans were to attempt to capture the human and nonhuman interactions that constitute Earth's greater sociotechnical system in data, the result would communicate a complex network of integrated human and nonhuman intelligence. Earth's sociotechnical system reflects a commune of intelligent interactions. In other words, Earth's meaning, its social living conditions, are derived from the informational relationships, the various intelligences, the inputs and outputs of the human and nonhuman actors inhabiting the system.

As members of a sociotechnical system, actors have agency and the ability to impact the Earth's integrated network of information. When humans insert objects such as human-centered AI into Earth's sociotechnical system, this alters the system and forces it to operate with unbalanced dependency and effect (Crawford, 2021). While AI is not able to act or evoke its agency completely independent of human intervention, following the principles of ANT, AI has the power to limit, extend, or redirect human, human-made, and nonhuman acts. As is the case of human-centered AI, humans often create objects without the consideration of their impact on Earth's sociotechnical system. For example, like AI, automobiles hold agential power, as they emit carbon dioxide into Earth's atmosphere and increase the heat of the planet through human adoption and use. This action of cause and effect impacts not only human actors, but it holds power over all actors within Earth's sociotechnical system. Humans are beginning to see the ramifications of these actions in what is conceived as climate change. As the climate changes, the information of the sociotechnical system is altered, producing profound consequences for all. While this is just one example, it provides perspective regarding how human-centered AI can irresponsibly privilege humans' role in Earth's sociotechnical system and negatively impact the system itself. Furthermore, concepts within philosophic, HMC, and feminist STS scholarship support the notion humans are not central, but rather one actor within Earth's more-than-human sociotechnical system.

Thinking Beyond a Human-Centered Sociotechnical System

Posthumanism, a philosophical perspective that is loosely associated with the principles of ANT, reconceptualizes humans as not autonomously sovereign, but rather intimately connected and inseparable from their environment, technologies, and other living things (Adams & Thompson, 2016). The philosophical and theoretical themes of the works of Deleuze, Derrida, Guattari, Latour, Meillasoux, Whitehead, Wittgenstein, and many others point to the need to overcome humanism and dissolve boundaries founded upon anthropocentric dominance. Aligned with ANT, these philosophers' works further the idea that humans are integrated into a web of social relations with nonhuman actors. In sum,

posthumanism decenters the human from the center of Earth's sociotechnical system, which affords attention to human and nonhuman actors' role and responsibility to system itself.

Like posthumanism, ANT does encourage a thinking beyond human community. However, ANT is limited in its experimentations with natural and nonhuman cultures outside of Western orders of thinking. Jensen and Blok (2013) extend the philosophical aspirations for ANT beyond Western science and dominant modernist ways of dividing up the world. They argue that like ANT and posthumanism, the Eastern philosophies of Shinto cosmology and Japanese techno-animism inspire a rethinking for responsible human and nonhuman social relations.

Shinto cosmology relies heavily on animism or the notion that humans, spirits, animal worlds, and the material are imbued with life and agency. Conceptually related to ANT, Japanese techno-animism finds humans and nonhumans are immanently connected. This connection ignores boundaries between the human, nonhuman, and extra-human realms. These ideologies combined facilitate critical engagements with the relation-making capacities for living with—rather against—nonhuman actors. Shinto techno-animism inspires ontological conceptions of the Earth's sociotechnical system in which *nature* and *cultures* are mutually constituted, which warrants attention to different conceptualizations of human-nonhuman cohabitation (Eisenstadt & Aizenshtadt, 1996; Jensen & Blok, 2013).

Similarly, North American and Oceanic Indigenous epistemologies find everything in creation has spirit and sociality (Hill, 2008). Further evocative of ANT principles, Indigenous ontologies and cosmologies view the world as an interconnected and integrated system (Lewis et al., 2018). They focus on building ethical and responsible social networks by acknowledging the oncological status of nonhumans as not inferior to that of humans. Indigenous practice involves acting responsibly and building relationships within diverse and more-than-human social networks based on mutual respect. Indigenous communities interact with nonhuman actors within Earth's sociotechnical system by establishing thoughtful communications and forming covenants with nonhumans founded on mutuality.

HMC adopts a similar perspective through its acknowledgment of nonhuman interlocutors and communicators. In HMC, an individual's interaction with a communication partner depends on their conceptualizations of the other communicator (e.g., Goffman, 1967, 2005; Guzman, 2019). Research within HMC desires to understand technology as a communicator rather than limiting its role to that of a mediator, which has been noted as the default conceptualization of technology within late communication theory (see discussions in Gunkel, 2012; Guzman, 2019; Nass & Steuer, 1993). Foundational HMC research finds meaning making is not limited to human communication. Boding to ANT, HMC challenges who or rather what has the power to communicate, or rather which actors have a voice in Earth's sociotechnical system. As Guzman (2016) notes, HMC calls for thinking beyond human exceptionalism, technological instrumentalism, and all the other-isms that have helped humans make sense of Earth's sociotechnical system and humans' place within it. In effect, HMC calls for a thorough reconceptualization of who or what should be considered a legitimate moral subject, pushing ethics and responsibility outside the domain of the human and toward a more diverse approach.

In addition, the work of Haraway, Suchman, Turkle, and other feminist STS scholars push boundaries by drawing upon ANT and HMC scholarship. Feminist STS scholarship

challenge the assumption of human superiority by calling attention to the influence of human social constructs. For example, Haraway's influential "Cyborg Manifesto" questions and seeks to dissolve the boundaries between humans, machines, and other living things. As Haraway (1991) argues, humans are not separate but rather *cyborgs* influenced by their relations within a sociotechnical system. More recently, Suchman (2023) builds on these core themes in her work and describes human tendencies as indicative of a closed world approach. She argues for a different situational awareness that works against dominant imaginaries of omniscience. Like ANT, feminist STS scholars draw attention that humans are not unique and separate, but rather merely one part of a more-than-human social system.

In sum, all actors, human and nonhuman, are eminently connected and integrated and constitute Earth's sociotechnical system. In the next section, we propose the notion that all actors of Earth's sociotechnical system participate in a making meaning process known as consciousness. We utilize a leading theory of consciousness to describe how the consciousness of Earth's sociotechnical system is collaboratively constructed by its human and nonhuman actors' symbiotic intelligences. Acknowledging that both human and nonhuman actors dictate the consciousness of Earth's sociotechnical system further advocates for responsible AI design. To begin, we address what consciousness is and how human and nonhuman actors' intelligence coupled with communication forms the consciousness of Earth's sociotechnical system.

Understanding System Consciousness

In the various scientific and philosophical fields dedicated to the study of consciousness, there is little to no consensus among researchers about what defines consciousness (Zeki, 2007). What consciousness is, how consciousness is formulated within and outside of humans, how nonhumans experience consciousness, and how consciousness is generally expressed remains entirely unsettled. However, one of the current and leading contemporary theories of consciousness known as *integrated information theory* (IIT) finds consciousness is coupled with intelligence or rather with how information is "integrated" in a system (Tononi et al., 2016). Consciousness is dependent on information, which is classically defined as the reduction of uncertainty and the ability to discriminate among many alternatives. At a fundamental level, consciousness is the scalable and intelligent integration of information (Tononi, 2004, 2008). Information integrates when it cannot be localized and instead is positioned within a web of highly complex connections across different regions of a system. The shaping of these connections map out, reflect, and communicate the consciousness of a system. The more integrated information a system has, the more conscious it will be. The consciousness of a system is produced via a cyclical and networked communication process.

In the human brain, it is the information produced by the different regions of the system that integrates to form consciousness (e.g., frontal lobe, thalamus, cerebral cortex, etc.). For example, the brain's frontal lobe generates information related to emotions, critical thought, and movement. This information is then communicated and integrated into the information communicated by the other regions of the brain to form human consciousness.

In other words, if a region of a system intelligently generates new information into the integration, the system's consciousness will be evolved beyond its original conception.

IIT finds that any system, human or nonhuman, capable of generating integrated information will have consciousness. Consciousness is not an all-or-none property, rather the quality of conscious experience is dependent on a system's integrated intelligence. While IIT was conceptualized to describe how consciousness is formed and experienced at the scale of the human brain, we argue the principles of IIT can also be applied to describe the consciousness of a sociotechnical system. In what follows, we use IIT to explain how the intelligence of human and nonhuman actors communally constitute the consciousness of Earth's sociotechnical system, which supports alternative ways for how consciousness and intelligence are defined, labeled, and designed.

New Considerations for Consciousness and Intelligence

As articulated, consciousness reflects a system's intelligently integrated information. By combining the principles of IIT with ANT, we increase the applicable scale of consciousness and redefine consciousness as the information integrated by the human and nonhuman actors constituting a sociotechnical system. The consciousness of a sociotechnical system is the communicative result of a network of human and nonhuman intelligence working independently and in relation to one another to form an integrated system of information. It is the human and nonhuman actors, the intelligence of cities, forests, road systems, bodies of water, human cultures, animal cultures, and so forth that generate and integrate the information that forms the consciousness of Earth's sociotechnical system.

The integrated information of Earth's sociotechnical system is continuously evolving. For example, as humans create and insert nonhuman actors like AI into the system, it adds additional actors, which then generate information for integration thus altering the consciousness of Earth's sociotechnical system. As such, consciousness can be described as a meaning-making process taking place as intelligent human and nonhuman actors exist, interact, and evolve as a consequence of their relations to each other within a sociotechnical system.

The process in which human and nonhuman intelligence integrate the information of Earth's sociotechnical systems is a purely quantitative, yet unobservable, process, a mere mathematical exchange. Nonhuman things intelligently participate in the consciousness of Earth's sociotechnical system in ways totally unlike humans. From the tides and currents of oceans to the complex pollination system operated by bees to vast networks of ants, insects, fungi, and trees, nonhuman actors intelligently generate information, which is then integrated into Earth's sociotechnical system's network of information. This is not a new concept—Indigenous persons have been advocating and articulating the intellectual power of the natural world for centuries (Maitra, 2020). Regardless of the scale of each individual actors' intelligence, it is the combined intelligences of human and nonhuman actors that constitute the consciousness of Earth's sociotechnical system.

AI is in fact further demonstrating that intelligence can be of nonhuman and of material means (Orange, 2013). Our conceptualization of Earth's sociotechnical system's consciousness explains the mathematical exchange and information processing computing machines

like AI were designed to take part in. Like mathematics, the conception of computers was founded upon the notion that Earth is an enormous informational system described purely in terms of integrated logic, patterns, and probabilities, which can be processed, communicated, and understood (O'Gieblyn, 2021). However, the capabilities of AI's information processing and AI's contribution to the consciousness of Earth's sociotechnical system is unique. Unlike other actors within Earth's sociotechnical system, AI can be designed to search for, find, and communicate the connections, which form and paint the consciousness of Earth's sociotechnical system.

AI's Communication of Earth's Consciousness

Humans have already begun to tap into the power of using AI to understand the consciousness of Earth's sociotechnical system through the development of algorithms. Algorithms are complex equations that can process the integrated information of system. Belief and reliance on algorithms imply the integrated information forming human-systems and even Earth's sociotechnical system sit outside of humans and can be tapped into by nonhuman means. This idea gave birth to dataism, which currently has a cult following in Silicon Valley.

Dataism or the belief and reliance on AI computation affirms the premodern notion that the Earth is a mechanistic place of order, laws, and rules where what happens produces cause and effect, which is dependent on connections of meaning. Algorithms work to process, reorganize, adjust, and to some ability predict the integration of information. Advocates of dataism say "Human intelligence is limited" and rather "Listen to algorithms—they can understand and process what humans cannot." Algorithms are active participants of meaning construction when they categorize and ascribe meaning by assigning and producing if, then logic and Bayesian probability. For example, algorithms rely on data and information that some scholars say trap humans within the mirror of their outputs or what Google researcher Vyacheslav Polonski calls "algorithmic determinism" (O'Gieblyn, 2021). In other words, algorithms' mapping of integrated information constructs meaning by drawing parameters around what is and what is not. When algorithms communicate information to humans, it then impacts the information humans use to process, operate, and exist within Earth's sociotechnical system. Algorithmic determinism is one example of how nonhuman intelligence coupled with human-nonhuman communication can intervene and impact the consciousness of Earth's sociotechnical system.

AI Actors Impacting Consciousness With HMC

AI acts as an active symbiotic meaning-maker that can alter the consciousness of Earth's sociotechnical system. Specifically, HMC affords perspective and provides explanations for the meaning-making process, the informational exchange, the alteration of consciousness that can take place between two actors within Earth's sociotechnical system. We argue HMC acts as an intervention where humans' communication with AI shapes and shifts the consciousness of Earth's sociotechnical system. This concept positions HMC as not an anomaly of communication, but instead provides enriched context for the discipline of HMC and its greater contribution for advancing understandings of communication and consciousness.

The principles of IIT provide new insights and challenges for the field of HMC. First, the principles of IIT and HMC combined highlight the necessity for AI designers to work with HMC scholars. If AI designers better understand the impact of HMC, design can evolve to focus on how AI can responsibly participate in the consciousness of Earth's sociotechnical system. Specifically, HMC explains how human intelligence and AI can communally impact the consciousness of Earth's sociotechnical system. Following the meaning-making power of HMC, it is easier for AI designers to conceptualize the importance of AI's ability to understand the intelligence of other nonhuman actors and communicate its findings with humans. Next, we argue it is necessary to HMC scholarship to explore the human-inflicted limitations of AI intelligence and communication. In its current design state, human-centered AI learns from human intelligence and communication and focuses only on the algorithms that exist to communicate human-based system. Following IIT, AI currently operated with little consideration and concern for how HMC impacts the consciousness of Earth's sociotechnical system. If AI were designed to follow the principles of IIT and HMC, it would provide avenues for humans and AI to reach new communicative potentials and responsibly engage with and alter the consciousness of Earth's sociotechnical system.

Moving Toward Ecological-Conscious Machines

We draw inspiration from these arguments to make the case for moving beyond simplistic renderings of AI as automated intelligence. This distinction can help advance morphologies of AI beyond mimesis of human qualities, described richly in Turkle's (2021) analysis of pretend empathy. By blurring the boundaries between human and nonhuman, these philosophies and frameworks work to undo dominant assumptions surrounding human-superiority. This does involve processes of unlearning and reimagining, so as to create responsible and trustworthy AI models (Hine et al., 2023). Were AI designers to conceptualize human and nonhuman actors as interconnected and integrated, they could advance more quicky toward a responsible, inclusive, and symbiotically driven AI tropes of being.

Feminist STS advocates for AI designers to confront and address imbalances of power in the relations between AI and the natural world (Wagman & Parks, 2021). By removing constraints pre-determining what communication is and who or rather what is considered an interlocutor, HMC has also paved the way for us to challenge how things are or should be. HMC challenges humans to reconsider how they want to interact with Earth's sociotechnical system. As such, building from Wagman & Parks's (2021) "social machine model" we call for a design of a social, responsible, and inclusively considerate AI or what we term *social-ecological machine actors*.

By opting for a less predetermined orientation that is considerate and conceptually inclusive of the intelligence of all actors, humans will allow space for AI to adopt a responsible role within Earth's sociotechnical system. As social-ecological machine actors, AI will work to understand the intelligent, informational, and communicative contributions of nonhuman actors before inserting their agency on Earth's sociotechnical system. This will create a system that is more inclusive, mutual, and equitable for all involved in the consciousness of Earth's sociotechnical system. In other words, as social-ecological machines, AI decenters the human, thus creating reciprocity. In what follows, we provide a radical

approach to responsible AI design through recommendations that demand the agency, intelligences, and meaning-making power of all actors be considered.

1. Symbiotic Design: AI and Mutuality

To create a more responsible AI, designers should rigorously reflect upon and engage with the relations of mutuality in their work. The guiding principle of mutuality is symbiosis. Mutuality directs designers away from design outcomes seeking to substitute. It further abandons any effort to reproduce hierarchies of intelligence. Mutuality aims to create social-ecological machines that can responsibly contribute to Earth's consciousness in symbiotic ways.

To create social-ecological machines, designers can implement actionable design interventions. To do so, it is necessary for designers to interrogate every step of the AI design process. Data collection, data labeling, data training, model design, and decisions on how to responsibly integrate an AI into Earth's sociotechnical system will require the implementation of an investigatory framework. Every step of the framework should question and analyze the AI design pipeline. At each step, designers must audit their processes and ask: Is every design decision embracing the diverse modalities of human and nonhuman intelligence and communication constituting to the consciousness of Earth's sociotechnical system? Is AI utilizing HMC in ways that are considerate of human-AI communication's impact on the consciousness of Earth's sociotechnical system? This proposed critical design process will require reflection and attention at every angle of making, designing, and iterating.

An example of this practice can be found in how designers are beginning to apply the principle of kinship to thinking about practices of reciprocal learning (Lewis et al., 2018). Many disciplines consider kinship or "mutuality of being" to be a cultural and social construction. Kinship bonds form interpersonally through "intersubjective belonging" as kin are "intrinsic to one another's existence" (Sahlins, 2011, p. 2). Following ITT, kinship networks establish the integrated information of Earth's sociotechnical system. Like consciousness, in kinship networks, what one does or suffers also happens to others. This intersubjective belonging has warranted Lewis et al. (2018) to advocate for the acceptance of AI as kin and for the inclusion of Indigenous practice into design. AI design praxis could benefit from Indigenous practice, which embraces human and nonhuman kinship and acting responsibly within diverse and more-than-human networks founded on mutuality.

However, to best implement an investigatory framework guided by a lens of mutuality, designers will need to establish an investigatory community to responsibly determine the mutual needs within Earth's sociotechnical system. Not one person or single entity should be responsible for meaning-making in a community fostered on mutuality. HMC scholars, nonhuman experts, and interdisciplinary scholars are needed to aid AI designers as they interweave nuanced understandings of HMC and various forms of nonhuman intelligence into the design of a social-ecological machine. Through communal design that operates to acknowledge the needs of a system of diverse actors, AI can more responsibly alter the consciousness of Earth's sociotechnical system. To best determine the breadth of representation needed for a social-ecological machine's communal design community, it is first necessary to map out the kinship networks constituting the consciousness of Earth's sociotechnical system.

2. Connectomapping as Connective AI

AI designers can gain a better understanding of Earth's sociotechnical system if they were to engage with the task of connecting and mapping out how human and nonhuman intelligence are connected and integrated on Earth. This process is referred to by Orange (2013) as "connectomapping," where designers map out "connectomes" or the intelligent connection points between human and nonhuman actors. Connectomapping communicates a global map of connections, a network, which can help designers decipher the ubiquitous intelligent entanglements, intentions, actions, and communications forming the consciousness of Earth's sociotechnical system. Connectomapping will reveal what forms of intelligence constitute Earth's consciousness, what gaps social-ecological machines and HMC can fill, and how designers might responsibly govern human influence and intention in AI design.

Connectomapping reveals a cyborg of interrelations, which constitute the consciousness of Earth's sociotechnical system. As such, connectomapping can provide inspiration for AI design beyond a human-centric lens. This principle resurfaces in the work of MIT roboticist and AI developer Rodney Brooks, whose work lends support to our framework. Brooks (1991) argues that to best facilitate artificial intelligence, it is necessary to move past the notion that human intelligence is superior and all-knowing. Brooks advocates for and produces AI design that utilizes nonhuman actors' intelligence, including plant and insect intelligence. In addition, Íñiguez (2017) a robot developer for the U.S. government, has moved past the limitations of using a human brain as a model for achieving artificial intelligence. Íñiguez instead prioritizes the value of octopi's distributed approach to problem-solving for AI design. Similarly, the collective intelligence of forests is inspiring AI designers to imagine new potentials for neural networks and AI (Wang et al., 2018). These examples of AI moving beyond human intelligence highlight what can be gained if AI designers utilize connectomapping as design inspiration. Following IIT, if AI can better understand and utilize the intelligence of nonhuman actors, AI can better understand the consciousness of Earth's sociotechnical system.

Specifically, connectomapping enhances feminist STS agendas which promote multi-species flourishing (Haraway, 2016) and more responsible, inclusive, and respectful human and nonhuman relations. All actors within Earth's sociotechnical system are embedded in material conditions and power structures, or what Haraway (2016) refers to as the *informatics of domination*. Connectomapping will reveal the human and nonhuman actors that AI's current human-centric design most affects. By peeling back and looking at the layers of AI's potential influence, designers can identify the enormous ramifications of a human-centric AI design and its impact on the consciousness of Earth's sociotechnical system.

Connectomapping has tremendous implications for AI design, and the scope of such a project will take a significant amount of effort, skill, insight, collaboration, and creativity. Shifting the AI design perspective from human-centered to rather an integrated web of human and nonhuman intelligences affords designers the ability to construct not only a tool or device, but rather a responsible networking relationship. This is a huge undertaking. Connectomapping requires shifting the priorities intended for AI design to instead possibilities of greater mutuality, inclusion, and diversity.

3. More-Than-Human AI Storytelling

It is necessary for AI designers to consider their own identity, perspective, values, intelligence, and positionality as well as those of the social-ecological machines they seek to design. When designing a responsible AI, it is important not to fall into the habit of designing AI in a single image given it will find place in a complex and integrated web of human and nonhuman relations. As is a common practice in design, the designers of a social-ecological machine will need to develop actor or *user* stories to redirect AI designers' human-centered focus. User stories will help guide designers as they conceptualize an AI that will responsibly impact the consciousness of Earth's sociotechnical system.

Like connectomapping, user stories are collaborative design tools (Cohn, 2004). User stories are short, specific, and goal oriented. User stories help AI designers focus on producing concrete and tangible outcomes for a diversity of users. By shifting design focus from the *human* to the *more-than-human,* a diverse set of user stories create a guiding project mental model. When developing AI user stories, it's important for designers to consider AI as its own actor that intelligently contributes to the consciousness of Earth's sociotechnical system. The user story format forces AI designers to think about nonhuman actors and keep nonhumans' contributions to consciousness in focus. Designers must consider all of what could go wrong with a social-ecological machine. What harm could come to the consciousness of Earth's sociotechnical system if nonhuman intelligences are not considered in the AI design process? What harm could come to Earth's sociotechnical system if nonhumans' intelligences and contributions to consciousness are considered second to humans? As such, the development of more-than-human user stories requires AI designers to engage in dialogue with their creation at all stages of their design process. By adopting HMC theory and methodologies, designers can engage in meaning-making discourse with their AI creations and assess if their design outcomes can responsibly contribute to the consciousness of Earth's sociotechnical system from a position of mutuality.

Again, this is a huge creative undertaking. What will AI conceptualized beyond human-centered design think like, sound like, or look like, and what kind of presence will it evoke? The development of a communal design community, connectomaps, and user stories provide some of the necessary support and creativity needed to produce such an outcome. However, to create a more responsible AI for the Earth's sociotechnical system, it is also necessary for designers to explore, experiment, and expand the space of AI potentiality.

4. AI Consciousness Awakenings and Art

To evolve AI, some scholars call for and recommend designers consider a new category of classification for AI (De Graaf, 2016; Edwards, 2018; Kahn Jr et al., 2011). A new category of classification for AI could free AI from the limited scope of AI's current human-centric lens and some human power dynamics at its inception (Wagman & Parks, 2021). As we have described, consciousness is beyond human, but humans' limitations require effort to accept and engage with the nonhumans' contributions to conscious experience. In addition, the principles of IIT imply it is possible to construct highly conscious artifacts. A new category of classification could highlight and account for how nonhuman intelligence can constitute consciousness in nonhuman systems like AI (e.g., ChatGPT). If designers approach AI

following the principles of IIT, it would provide humans with a tool to explore how it might be possible to create and adapt conscious systems. Furthermore, enriched understandings of consciousness would encourage discussions of the responsibility of AI and how to best hold Al accountable for their impact on Earth's sociotechnical system.

The intentional development of a new category of classification for AI will require a creative methodology, extensive research, and design practices aimed at creating conscious systems. Such projects will require AI designers to collaborate with both HMC and IIT researchers. Research-driven art provides the collaborative space for intent-driven research and critical exploration to take place. Developed by design researcher and digital anthropologist Caroline Sinders (2018), research-driven art starts with an intent like creating a new category of classification for AI, and then uses art as a tool to enable the research and exploration around an idea. A research-driven art outcome explores and uncovers hidden possibilities and truths. Through research-driven art AI designers can explore the potential of HMC and IIT synergistically combined. In sum, research-driven art provides a lens to focus on how the current human-centric limitations for communication, consciousness, and the categorization of AI impact AI design outcomes and humans' understanding of conscious systems.

To launch a research-driven art project, AI designers need to intentionally question what the design of a social-ecological machine will require. Specifically, research-driven art is accomplished in three stages. First, designers set their intention and research their idea. In this stage, AI designers set the intention to research the possibilities for the intelligence and consciousness of AI beings. Designers must research what consciousness is and how consciousness is impacted by communication and intelligence. Designers must ask what it would be like to lack consciousness, and how consciousness is experienced by AI and other nonhuman actors within Earth's sociotechnical system. The middle stage of the research-driven art methodology focuses on shaping and crafting an idea. In this stage, designers must follow where their research and exploration lead. Here designers will explore the potentials and the boundaries for a new category of classification for AI. In the final stage, designers communicate the body of knowledge they've accrued. The design outcome or art produced is shaped primarily by the research accrued and the question designers are ultimately seeking to answer: How might a new category of classification for AI create opportunities to create conscious and responsible AI systems? A research-driven artwork can be a workshop, a presentation, a class, and/or a conference that manifests research and knowledge. The goal of research-driven art is to create a dialogue exploring possibilities, and the result is a breadth of new potentials.

In its current state, it is easy to say a conscious AI is an impossible reality. Rather, we hope to encourage designers to birth new design possibilities and practices by challenging why a conscious AI is impossible. However, perhaps it is possible AI designers will be unable to conceive a conscious system, a social-ecological machine, separate from anthropomorphic elements given designers' embeddedness in human language and cultural meanings. Perhaps a new category of classification for AI will require new vernaculars to better embrace and regulate a responsible AI. To better connect with the more-than-human world as the disciple of HMC seeks, we advocate that AI designers and HMC scholars alike would benefit from the creation and adoption of more-than-human linguistic terminology.

5. Trans-Post-Human Epistemic Vernaculars

It is important to remember AI designers cannot take on the task of creating something new by using the same kind of thinking or terminology of the past. It is difficult to recognize, articulate, and measure AI's contribution to the consciousness of Earth's sociotechnical system with vernaculars that favor human intelligence, communication, and conscious experience. As Albert Einstein (1946) noted when he introduced a new conception for how psychists approach the structuring of the universe—we need new terms in order to embrace new ways of thinking. Coding languages, terminologies, and classifications produce and limit ways of knowing and being in the world. As Geoffrey Bowker and Susan Leigh Star (2000) find classifications and labeling embed working political infrastructures in a manner that is relatively invisible but warrants powerful consequences. If humans wish to embrace that Earth's sociotechnical system is conscious, that humans and AI impact consciousness via HMC, and that AI can be designed to responsibly impact consciousness, it is necessary to adopt new vernaculars to express new ways of thinking.

All terminology contains a worldview, and our current AI vernacular impacts the potential of AI design (Crawford, 2021). As such, designers cannot seek to create a social-ecological machine founded on principles of mutuality, one that is free from the purview of human classification and labeling without creating new vernaculars to better embrace the role intelligences, AI, and HMC play in constituting the consciousness of Earth's sociotechnical system. These new vernaculars can be inspired by the epistemologies of cultures that already respect the more-than-human world. For example, a core belief of many Indigenous epistemologies is that man is not the center of creation. Indigenous communities worldwide utilize languages, protocols, and ways of knowing to engage in dialogue with nonhumans. These intelligible discourses acknowledge Earth as a conscious sociotechnical system, which is mutually inclusive of human and nonhuman actors. Vernaculars developed via Indigenous cultural frameworks would drastically shift the social and communicative potentiality of AI and HMC.

In addition, posthuman vernaculars place humans intimately inseparable from the complex web of intelligently integrated information, which constitutes the consciousness of Earth's sociotechnical system. For example, Braidotti & Hlavajova's (2018) *Posthuman Glossary* works to "de-segregate the different and highly specialized spheres of knowledge production" by drawing connections to different generations of scholarship and users of human and nonhuman technologies (p. 5). Like the investigatory design community we advocate for in our first design recommendation, the *Posthuman Glossary* brings together thinkers, experts, and practitioners who might not otherwise conceptualize connections with each other. As a result, the *Posthuman Glossary* can help establish new terminology for both AI designers and HMC scholars as they attempt to approach the task of creating and communicating with a social-ecological machine.

Conclusion

In this paper, we argue AI designers must recognize and correct a flawed logic presuming the superiority of humans' role within Earth's sociotechnical system. In so doing, we combine ANT, philosophy, HMC, and STS research traditions with the work of IIT scholars

to construct the foundation for this argument. We further draw from past and ongoing research to present examples of AI design that advances the notion of AI's ability to impact the consciousness of Earth's sociotechnical system. These examples help build understanding that designing AI as substitutes for human functions or intelligence is a practice that underestimates the relevance of nonhuman intelligence and communication.

We propose five design practices that must guide how humans think about the future of responsible AI: symbiotic design through mutuality; connectomapping as connective AI; more-than-human storytelling; designing for AI conscious awakening; and revising our design vernacular to advance language that opens new possibilities and helps address human-centered limitations. The core principles underlying these practices recognize that no actor is superior, and that Earth's sociotechnical system is comprised of intelligences that are multimodal but integrated. *Mutuality* thus invites constant and consistent exercises in reciprocity. These gradually pave the way to design practices that are ecologically responsible and not just human, but also humane. We do not expect change to be instant, but rather build for gradual and durable change to occur about stable and just foundations. *Connectomapping* permeates design and architecture mentalities as it is. We do not seek to make a new point, but rather to center and normalize a practice that is often an afterthought. By rendering connectomapping the foundational step in a design approach, we build a reflexive yet sturdy foundation. Focusing on the *stories of nonhuman being* impacted by AI creates new demands for responsible design to compliment human and commercial needs. Such a foundation can support mutuality and guide toward more-than-human and responsibility-driven approaches. Here, the measuring test for *consciousness* eschews the human to progress toward more inclusive definitions of what is conscious and what is not. Moreover, consciousness and intelligence are understood as nonbinary concepts. Therefore, humans do not construct bi-modal tests that measure the absence of presence of either, but rather the modality, the texture, the tonality, the physicality, and in general, the form that consciousness takes on (and by consequence, the form intelligence embalms itself in). Finally, advancing and possibly creating new vernaculars (or languages) that can be shared between human, human-made, and nonhuman agents presents an egalitarian approach to communication that further decenters the human. Code could be presumed to be one such example of language if it advances to incorporate the form and manner of other communication mechanisms encountered in nature. Here, we propose both a vernacular for design that de-emphasizes human prevalence and the subsequent cultivation of new languages that permit communication that advances orality to include imagery, tactility, and a broader spectrum of mechanisms for listening and speaking with the world surrounding us.

In closing, we challenge the validity of claims to artificiality and intelligence. In speaking with engineers when we collaborate, we often hear a justified complaint that AI is not intelligent enough yet. Perhaps it is not intelligent enough, but if that is the case, then neither are humans, for humans are the ones who designed it. We have made the point in this paper, and elsewhere (Papacharissi, 2015), that there is not much artificial about artificial intelligence. Crawford (2021) further proclaims that AI is neither artificial nor intelligent. Perhaps people are the ones with artificial, human-made blinders on, ones that prevent humans from evolving out of creating things in human-likeness. Yet it is by designing for the other that humans will be eventually able to come out with self-destructive and discriminatory logics that term certain things intelligent, certain artificial, and some neither.

Designing for the other, in the broadest sense of that big word replacing out *ex machina* mentalities with richer understandings of a world populated by all, the human and nonhuman, as sentient machines, or better yet, living, complex, and interconnected organisms, not superior or inferior but each unique.

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