



Anthropology & Aging

Journal of the Association for Anthropology & Gerontology

DEBATE

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Anthropology & Aging, Vol 45, No 2 (2024), pp. 82-89

ISSN 2374-2267 (online) DOI 10.5195/aa.2024.553



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Introduction

In “Future Kinship and the Study of Culture,” Marilyn Strathern (1995) encapsulates that throughout history, artifice frontiers evolved out of the intermingling between human and technology, and nature and culture. In this debate piece, I am making a case in favour of Strathern’s central statement that

“Technological innovation invites us to think innovatively about how persons are born and the relatives to whom they are born. Yet instead of the potential, the creation of unique individuals and unplanned effects, the future seems increasingly trapped by present choice. It is as though creativity were trapped by artifice” (434).

The premise of her work is critical for discussing the dystopic prognosis that technology will enslave nature and turn it into a humanized enterprise. It appears that technology has emerged as the neo bio-power that manufactures kins and families, and thus determines the future of care. Body and machine have been each other’s metaphors throughout the 20th century but can no longer be because of their increased hybridity. The shifting and hybridizing relations between what is given and what is the result of human enterprise and the related ambiguity between creativity and artifice will certainly continue to affect kinship practices and imaginaries.

Strathern’s work has steered me to explore two interconnected critical directions. I develop my first set of arguments on the broad range of gerontechnology from the frugal to the complex, with a particular focus on the sociomateriality of anthropomorphic care robots for older adults. Today, innovations in care technology are geared towards fuelling intimate-affective relations, and mitigating isolation, dependencies, and vulnerabilities. They are furthermore framed as solutions for a care crisis across the life course and as alternatives for ‘traditional’ kin-based intergenerational care. However, whereas theoretically technology has made care accessible to all with disregard of specific physical, social, and kinship situations, the development of care technologies has similarly established care as a scarce resource, the division of which exacerbates existing socio-economic inequalities. This warrants attention to care as inextricably tied to the location of the subject. For example, third-agers with access to care technologies tend to derive symbolic power from the use of these technologies, as against those with barriers in accessing technology. Interestingly, Strathern does not mention the discursive power of technology in exacerbating social inequalities. By casting light on the digital divide in accessing technologies, I posit a more fundamental question – for whom, or for which category of the elders, will technology be a facilitator?

Arguments in the second thematic cluster are developed primarily in view of Strathern's expressions that "technology appears not as a service to industrial production, making machines work, but as a service to human reproduction, making bodies live. In its benign aspect, it enables people to fulfil their desires" (431). She continues her argument by stating that "Such intervention is 'artificial', but far from creating an autonomous domain of enterprise (as an industrial production), it is presented as directly responsive to fundamental natural process" (431). Herein, I weigh the pathway of fertility monitoring and fertility extension technologies (FMETs) situated at the intersections of demographic changes, late parenthood, reproductive aging, and infertility. The technological stretching of the sphere of kinship through assistive reproductive technologies (ARTs) and lab-produced kins attests to a paradox. On the one hand, these technologies are enabling women to prolong their fertility window and offset the stigma of reproductive aging. On the other hand, reproductive technoscience also reinforces the ideal of compulsory parenthood, for both conjugal fulfilment and to strengthen affinal, kinship, and conjugal relations under the pressure of kin and personal networks (Franklin 2013b).

In her provocation, Strathern confirms that while artifice encroaches the 'natural' and 'cultural,' the artifice, in turn, is conceived out of the constant re-entanglement between nature and culture (Franklin 2013a; Katz and Hashiloni-Dolev 2019). This diagnosis of the co-becoming of human and technology through artifice marks a shift in ontological interest from a humanist and anthropocentric agenda to post-humanism and other-centredness (Hasse 2022). As such, we can read Strathern's statement as one of the precursors of critical science and technology studies (STS) scholarship on transhumanism and posthumanism, which advocates for decentering humans, reconceptualizing the *Anthropos*, and attending to the expanding boundaries of what it means *to be a human*. Extending Strathern's statement, I draw on insights from the field of feminist technoscience (Lie 2022; Martin, Myers, and Viseu 2015; Puig de la Bellacasa 2011; Roberston 2022) and posthumanist theory (Braidotti 2006; 2016; 2017) to look affirmatively at this process of stretching, and the negotiation of boundaries in light of changing kinship futures.

Gerontechnology, Mediated Intimacies, and the Future of Old-Age Care

In the everyday parlance, the human body is compared to a machine and the machine stands as a metaphor for existence (Brencio 2023). Modern civilization is now witnessing a new wave of datafication characterised by wearable technologies for monitoring and collecting data (Hjorth and Lupton 2021). This evolution further complicates the metaphoric relation between body and machine, as cyborgization and the creation of 'bionic bodies' becomes extensions of the body-care system (Helman 2007). This complexified human-technology-environment is shaping digitized caring intimacies. Assistive gerontechnology, such as assistive ambient living (AAL) or smart home technology, are attuned to the push for 'aging in place' considered to benefit older adults to remain in their familiar environment and retain their personhood.

Gerontechnology is not limited to frugal (spectacles, hearing aids or dentures) or high-end wearable technologies (pacemakers, prosthetics or smartwatches). It also includes complex care robots that are roped in to streamline quality of care. Japan, for example, is one of the earliest adopters of anthropomorphic care robots to support its elders (Wakui 2023). The development of anthropomorphic care robots is a biotechnological response to tackle the demographic transition, dwindling fertility rates, and the aging 'crisis' in a post-modern, information-based, and advanced economy (Robertson 2007). Humanoid robots were designed to foster interpersonal relations hinged in the social ethics of mutuality (Robertson 2007). Jennifer Robertson (2022), in line with feminist STS, states that the design and production of technology cannot be dissociated from the larger socio-political and historical contexts. Technology evolves in a moral landscape; it is both 'constructed' and 'constructionist' (Hamblin and

Lariviere 2023). Robertson (2007) argues that Japan's push for household robots is steeped in an imagineerism that concerns the imagining of future institutions based on an idealized past-centred narrative. Household robots are designed and promoted to resolve the lack of companionship and care that result from changes in 'traditional' kinship realities. In short, these humanoid robots are techno-kins that are meant to provide a sense of belonging and homeliness that resembles those of an idealized kinship past, while in the meantime their integration also has the potential to transform kinship imaginaries and the role of technology in these realities. This indicates that posthuman subject-material entities are in a state of continuous construction and reconstruction.

Discontents and anxieties follow the integration of robotic technologies into old age care. Firstly, scepticism is strong as these technological innovations may encourage some family carers to relinquish care obligations towards their elderly kin. Secondly, the emotional attachment that might develop between human and their care robots could complicate matters as robots cannot reciprocate or understand the human emotion or its nuances. Furthermore, this technological shift in care provision may reinforce existing inequalities and introduce new ones based on the consumption of care technology (Moyle 2019). It evinces the digital divide in accessing the technology, and this divide evolves out of the existing inequalities amplified by gender, caste, income, race, and ethnicity. The uncritical view that technology invades human lives fails to consider the graded lives of older people, and technology representing a capital for those with access and support.

This human-material synthesis could further reify older adults as a social problem, fortify their image as senescent and fragile, and glorify technology as the solution (Ertner and Lassen 2021). Technology is always-already political: as anthropomorphic care robots were developed to compensate for scarcity in human care labour and improve quality of life, development, access, and availability are determined by government support.

ARTs, Fertility Politics, and Boundaries of Life and Care

In rhythm with the first section that focused on gerontechnology and mediated intimacies as a biotechnological response to the demographic transition, the second section presents another demographic trend – fertility decline. The nature-culture-artifice nexus is also being articulated in fertility politics. In its alarmist approach, the metaphor of 'biological clock' or 'ticking clock' is often invoked to fuel fear around declining fertility and discourage late motherhood (Bühler 2022; Majumdar 2021). This discourse can impact how and if women embrace reproductive technologies to create 'biological relatives' for caring for and being cared for by. In a twist, age is now subjected to medicalization and technologization, extending beyond the onset of menopause. New-age reproductive technoscience offers a range of alternatives to mainstream reproduction like egg freezing, assisted reproductive technology (ART), and infertility medicine. Merete Lie (2022, 108), in "Feminist Technoscience and New Imaginaries of Human Reproduction," argues that "assisted reproduction comes with a naturalisation of technologies" and a "culturalisation of the process of reproduction" oriented towards the age "after nature." This bio-politics of fertility management is aimed at turning the degeneration principle and functional aging on its head.

Oocyte vitrification, commonly known as egg freezing, allows elective cryopreservation of oocytes. It is embedded in the anticipatory logic of lengthening the fertility window and begetting a genetically related child (Bühler 2022). Age-based infertility and deferring childbearing is factored by academic pursuit, careerism or economic uncertainty (Jones et al. 2018). As ovarian reserve and oocyte quality decreases with age, fertility preservation through social egg freezing is a radical and empowering tool

for women to synchronize conflicting timescales of biology, extend the fertility timespan and career, and plan late motherhood (Mintziori et al. 2019).

In principle, much like hormonal contraceptives, this temporalization of nature through tweaking the cellular time, enables women to enjoy ownership and autonomy over their bodies. The benefits of ARTs are not limited to women. ARTs have also enabled the otherwise marginalized sexual minorities to create a family (Franklin 2013b). It has opened doors to pregnancy and parenthood for same-sex adoption, and in turn, mixed or blended families. While constructed in a 'biological clock' and 'fertility decline' narrative, ARTs have thus also retooled the public and private discourse on reproduction and kinship (Franklin 2013b, 64).

Cryopreservation of gametes and embryos has also made noncoital posthumous reproduction possible. However, legal experts deem it a murky terrain as children posthumously conceived through assisted reproduction may not be incorporated within the purview of inheritance rights (Ahluwalia and Arora 2013; Barać 2023; Knapp et al. 2011; Stechschulte 2014). Considering property and resource transfer towards the downward generation is part of the 'natural' intergenerational care-pact, the artifice of posthumous reproduction (PHR) disconcerts the boundaries of life, death, immortality, and sexuality. PHR marks the intertwining of marriage and procreation underpinning the principle of right to reproduction, and the yearning to have children of one's own and expand family. Reproductive technoscience, therefore, is leveraged to continue lineage and memorialize relationships with the deceased by stretching and manipulating the unattainable. Hence, it can be argued that technology affirms existing kinship norms – of producing progeny and extending the bloodline. However, following the death or absence of a spouse, the ability to reproduce a child subverts that physical and real-time presence of both the partners is necessary for procreation. This lends reproductive assistive technology as Janus-faced – it is constructionist and constructed.

The question of whether ARTs provide women – especially middle-aged – with the opportunities to use these technologies to their advantage or whether the availability of ARTs makes it even more difficult to tread the childlessness route and keeps women ensnared in compulsory reproduction, is a question that cuts right through Strathern's concerns. Reproduction is subject to social control to complement the social structures as iterated by Strathern, "Nature becomes a department of human enterprise, and we discover that it was never autonomous" (430). In a nod to Strathern's statement, Sarah Franklin (2013b) points out that the desire for children is rooted in the conformity to social norms as children bring social returns and become the 'missing link' in a couple's life. There are social penalties for childlessness that can lead to exclusion and alienation. Another predicament in the wake of ART is that of pre-conceptive sex and race selection amplifying the nexus between racism and sexism. Hence, technological innovations can not only perpetuate social inequalities but also reaffirm prejudices (Berkowitz and Snyder 2002). Rather than discarding the technology as 'violent' or/as 'unnatural,' these issues should make us sensitive to the paradox of ARTs.

Hybrid Kinship and Posthuman Families

Together, these issues in reproductive technoscience and gerontechnology hint at the tensions encompassing innovation and futurism. These tensions conceal the moral landscape in which technology is imagined, produced, and circulated. In the process of being mobilized to resolve human crises, technologies mediate intimacies to the extent that kinship requires reimagining in posthuman terms. Posthumanism is a critique of anthropocentrism and of the human as the universal subject (Braidotti 2006; 2016; 2017). It marks an end to the opposition between humanism and anti-humanism. Pursuing an affirmative ethics, posthumanism is concerned with the fluidities across categories due to

partial connections, with finding renewed ways of imagining community and belonging and practising accountability – or response-ability – and with speaking truth to power. A feminist STS (Martin, Myers, and Viseu 2015; Puig de la Bellacasa 2011; Robertson 2022) and posthumanist framework addresses the contradictions and predicaments tacit and immanent in human-technology assemblages.

Technology breached and pushed the boundaries in redefining life and care, to the extent that modern biology, as envisaged by anthropologist Sarah Franklin (2013a), has emerged as a synonym for technology. This culturing of nature manufactured through synthetic biology and genetic engineering produces the relatively biological that borders on the leakage between humans and non-humans. New realities of intimate networks are fostered and expanded through transactions of the substance code (Taguchi and Majumdar 2021). The dichotomy between the genetic and the gestational speaks of the remaking and unmaking of the biological. Similarly, the entry of the humanoid care robots into the care network of older people obscures the boundaries between the human and non-human, the biological and non-biological, and the material and non-material. These entanglements enact and thus produce the world and have political implications (Ertner and Lassen 2021). Gerontechnology and aging are emergent and co-becoming in everyday practice.

The dual premise of posthumanism and feminist STS warrants attention to the consequences of technological ‘solutions’ for embodied care for older lives, to the intrusive nature of reproductive technology, the disaggregation of body parts, and the denaturalization of aging. Decline and aging are, as of yet, an inevitable part of circularity of human life. Different attempts to overcome aging processes and construct older people’s independence as desirable through deeper involvement of technology broaches a profound dilemma. As envisaged by Strathern, covert evolutionism suggests that the artificial is encroaching on the natural, rendering the natural world more subject to the artificial management (430). In this ethico-political climate, sociotechnical developments can reinforce stereotypes, further stigmatize aging selves, bodies and processes, and add on to the obsolescence narrative towards aging.

While the ART paradigm is prone to reflecting and reinforcing human prejudices and structures, gerontechnology – in particular humanoid care robots – may perpetuate extant gendered, racialized, and sexualized material-discursive practises and participate in the social reproduction of inequalities (DeFalco 2020). For example, Amelia DeFalco (2020), through her posthuman analysis of speculative fiction on humanoid care robots, shows that as long as these robots are being designed according to humanist standards and operate in a moral landscape entrapped in its own cultural ideals, machine-human entanglements will work to underpin the power relations that are rearticulated through these artifacts and reproduce gendered and racialized hierarchies.

Alternatively, a posthumanist re-imagining of human-technology entanglements can make us concerned with anthropomorphic care robots with sentient-like behaviour as a “practice in alterity as Otherness” and support the creation of post-human ‘others’ through self-imagery (Hasse 2022, 155). The relational ethics of feminist STS can cultivate a sensitivity to a post-human care: a care that is not bound by instrumentalism and rationalism, but rather encompasses flourishing and long-lasting relations (Puig de la Bellacasa 2012). In view of this, I would state that the desire for fostering relations along the shores of the ‘filial’ and ‘kinship’ influence and shape interactions and expectations in human, non-human, and more-than-human encounters. Unlike the projections of transhumanism that technology will determine the future (Doede 2009), a complete takeover of technology and limitless entanglements is unlikely as humanoids are not capable of humaning (Hasse 2022). Elements of emotional, embodied, relational and emplaced care labour tend to mitigate an absolute substitution or monopolization by technology. A posthuman inspiration foregrounds vulnerability and

interdependency as foundational to the human-technology assemblage. The human-technology entanglement is a moment to acknowledge the complex and rhizomatic assemblage founded on symbiotic relations with different forms of life, to think beyond human and more-than-human care webs, strive for non-exploitative co-existence, de-centre and invert anthropocentrism, and assess the implications for the posthuman and posthumous families. A sensitivity to human vulnerabilities, aspirations, and imaginings can be a posthumanist starting point to design and innovate care strategies, technologies, and arrangements.

Rather than, as Strathern's provocation invites for, affirmatively participating in emergent posthuman assemblages for careful futures, it is still common to approach cyborg technologies as a threat to human-based families, and 'real' care and connection. Futuristic care narratives and new techno-kinship are embedded in the traditional moorings and performed within the normative moral idioms. These narratives invoke imaginings of doing family, renewal of values, renovation and continuing legacy through posterity. I counter Strathern's premonition of a reified existence of technology, and I present artifice as a mimesis to the nature-culture crossover. Human-centredness is dominant in conceptualizing, designing and circulating technologies to meet specific ends, and the deeper nexus between humans and their locative stance. Against the backdrop of these 'conservative' future narratives, revisiting Strathern for thinking with technology, kinship, and care, is more important than ever.

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