HCI and Older Adults: The Critical Turn and What Comes Next

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Abstract

Human-Computer Interaction (HCI) has long studied the design of technology for older adults. A critical turn problematizing how older adults were being framed gained momentum in the 2010s. The literature comprising this critical turn offered insights for what researchers should avoid in their work as well as high level future directions. Past work was critiqued for positioning older adults as incapable technology users, the same as one another, and chronically ill and in need of care. In this monograph, we summarize some of the research that followed and responded to the critiques that began this critical turn. We focus our review on three spaces: technology use, intersectionality, and care. We describe how researchers have fruitfully drawn upon other disciplines including feminist and critical studies, gerontology, social computing, and disability studies to further break down myths, generate knowledge, and open new research spaces. We include our view of the gaps that remain and what should come next.

1 Introduction

Recently, a colleague said that the fourth wave of our field seemed to be “Critical HCI”. This is from an individual housed in a prestigious computer science department, whose highly technical work has been shaped by critique in what he says to be positive ways. Critiques related to social justice concerns seem to have touched nearly every subcommunity in our field. For example, concerns around the body of research with underserved communities around the world (HCI4D or ICT4D) [ref, ref] included how the notion of designing for “undeveloped countries” can position these nations as “essentially powerless and unable to ‘develop’ without intervention” (quote from ref, cited in ref). Similar themes on the imbalance between designers and the targets of technology interventions came up in a big way in 2019 at the ASSETS conference. A critical convergence included a critique of technology solutions in a keynote by anthropologist Karen Nakamura [ref], an article touching on power structures and subordination of

disabled people in HCI research [ref], and social media posts by disabled people critiquing conference discourse .

The community of HCI researchers working with older adults was no exception to facing a convergence of critique. While there had been critiques made prior, a number of arguments emerged around the same time (2012-2015) arguing broad ways in which existing research had problematic foundations. This included writing and talking about older adults as if they were a homogenous group, a strong emphasis on deficit and decline, and stereotyping views when it came to technology use.

The research that constituted this critical turn impacted the work of each of the authors of this monograph. Like many others in our field, these arguments shaped the ways that we reviewed, read, and conducted research. In this monograph, we present the arguments made during the critical turn on research with older adults in HCI and how the research that followed responded to those arguments. In terms of the articles that we selected for this monograph, we included articles that have been influential to us and conducted keyword and reference searches for others aligned with the focus areas of this monograph. Our review was not systematic – the exclusion of a paper should not be taken as a signal that the work is not relevant, but rather as a limitation of our approach. We kept our review largely to papers from the last decade, so that we could understand trends of and following the critical turn. Literature on older adults in HCI which might otherwise fit the themes we found, but fall outside this date range, were mostly excluded. Finally, our own background inevitably shapes the ways that we describe and frame research – we are researchers based in the US and UK and as such, we are likely missing important nuances of cultures and countries outside our own. The monograph is structured as follows:

In **Section 2, "Older Adults and the Critical Turn in HCI,"** we provide the necessary background for the remainder of the manuscript. We discuss how researchers are framing and conducting research with older adults in different disciplines, including in

the field of HCI. We describe the body of work that emerged in the 2010s calling out problematic trends in research with older adults. Trends that were critiqued included positioning in terms of technological capability, homogenizing, positioning in terms of "burdens" in regards to healthcare needs, and "othering" in the design process. The following sections delve into each in depth (with the exception of "othering" in design, which is outside of the scope of this monograph).

In sections 3, 4, and 5, we focus on where HCI research has gone, and still needs to go, since this critical turn. These sections take stock of research that has emerged with and since this critical pushback, largely in the last decade. We answer questions including, How do projects address the critiques from the critical turn? How have researchers moved our understanding of this domain forward? How does research, and ways forward for the field, look different in the different domains identified as problematic by past research?

Section 3, "Older Adults and Technology Use," describes research responding to the oversimplified framing of older adults as incapable or incompetent technology users. We review research that shows how older adults' can be active technology users, but also that technology non-use should at times be recognized as intentional rather than as due to barriers that need to be overcome.

Section 4, "Older adults and Intersectionality," encompasses research responding to the tendency to frame older adults as a homogenous group. We describe the arguments made by researchers that older adults can not be considered as a monolith, and that aging cannot be studied without considering intersecting identities with historically marginalized groups. And, these other characteristics can rarely be studied without including aging.

Section 5, "Older adults and Care," includes research in response to the myth that older adults are a care burden on society, and that technology alone can alleviate this

"burden". We describe research that shows how care is bidirectional between older and younger people, is collaborative, and that receiving care technologies takes work.

In Section 6, the conclusion, we reflect and synthesize what we learned from the prior chapters, focusing on three main directions for future research.

2 Older Adults and the Critical Turn in HCI

In this section, we cover necessary background to provide context for the focus of this monograph. We begin by establishing the way that we are using the term "older adult". Given that HCI researchers come from many different disciplines, we then discuss research from disciplines outside of HCI and discuss how they motivate the study of older adults and the aging process. We then narrow in and provide a parallel account for the field of Human-Computer Interaction (HCI). Once we set this context, we introduce what we consider to mark the critical turn in research on older adults in HCI. Understanding the arguments made in this critical turn sets the stage for the research that has emerged since, discussed in the remainder of this monograph.

What is older adulthood?

Defining who is an older adult is complex. Consider the range of the definitions that follow. The World Health Organization defines an older adult as someone over the age of 60 (*Ageing* and Health, 2022). Pew Research, a U.S.-based think tank, surveys older adults over 65 (Faverio, 2022). AARP advocates for its members ages 50+ (AARP, n.d.). The ADACAS Older Persons Advocacy Team in Australia provides resources to older people over 65 but adjusts this age for its First Nations population to support people aged 50 years or older (ADACAS, n.d.). Other organizations like AgeUK, the Age Nigeria Foundation, or the Older Persons Advocacy Network in Australia acknowledge supporting "older people" or "aged care" but do not specify an age cutoff.

Within HCI, we have observed that researchers often describe an older person as someone over 60 or 65.

Why study older adults?

Older adulthood has long been of interest across numerous disciplines because of its associations with change in various dimensions of experience. Underlying biological mechanisms of aging produce changes in cells and tissues which can impair biological function and eventually lead to death (Harman, 2001). Evolutionary biologists study aging to understand how deterioration in physiological machinery reduces adaptation for survival and increases mortality (Flatt, 2012; Rose et al., 2012), whereas growing risk of disease associated with these changes is studied within geriatric medicine and epidemiology (Ferrucci et al., 2008). Predisposition to rates of consequential deteriorations is studied by geneticists to understand differential outcomes in health and longevity (Harman, 2001) (the proverbial 'nature' component), though many disciplines have explored environmental correlates of individual level biological change over time (B. Bell et al., 1972) (i.e. 'nurture'). Psycho-geronotological research explores the complex interplay between biological and psychological factors in individual experiences of aging, for example, showing that holding negative attitudes toward aging is associated with older subjective age (how old a person feels) (Kastenbaum et al., 2019; Kornadt et al., 2018) and, consequently, reductions in cognitive performance (Levy et al., 2016; Schafer & Shippee, 2010; Stephan et al., 2014), mental health (Westerhof & Barrett, 2005), and physiological health and longevity (Westerhof et al., 2014).

Sociological research, by contrast, is interested in socio-economic inequities in producing differential outcomes among individuals, including how individual resources accumulate (or not) across the lifecourse (Dannefer, 2003). Other disciplines, such as human development and social gerontology, focus on how people move through the lifecourse, and in particular examine the social accomplishment of successful aging (Martinson & Berridge, 2015). Interactional, organizational, and cultural processes also contribute to individual aging in complex ways, and individual aging is increasingly studied it terms of multiple biological, psychological, and motivational developments

across the lifecourse and how these are embedded within the various socio-economic contexts a person navigates (Kendig et al., 2016) (see, e.g., biological anthropology (Crews, 1993). Such interdisciplinary approaches may also leverage longitudinal datasets (e.g. the English Longitudinal Study of Ageing (Steptoe et al., 2013), the Baltimore Longitudinal Study of Aging (Shock, 1984), and the Berlin Aging Study (Baltes et al., 1993) to better understand the population scale interactions between physiological aging and socio-economic, educational, and psycho-social factors as they unfold across the lifecourse to make sense of the vast heterogeneity of individual aging.

Population ageing, on the other hand, is concerned with the causes and consequences of demographic change (Kendig et al., 2016). Human life expectancy has generally risen as social and medical conditions have improved, altering population age structure in ways that interest social demographers (e.g. shifting mortality rates, changing family support structures, and a growing proportion of retired people) (Wilmoth & Simpson, 2013). The field of economics is also concerned with such changes, as population aging has major macroeconomic implications, most notably an anticipated labor crisis stemming from a shortfall in workers for the productive economy alongside rising demand for social reproductive labor (Wright, 2023), i.e. the care work needed to reproduce and maintain bodies (Bhattacharya, 2017; Federici, 2015). As a result, much of the research on aging and gerontology attends to the practical matter of how to effectively care for a growing number of people aging (Johfre & Saperstein, 2023), giving rise to pursuits in gerontechnology (Moreno et al., 2024). But there are also important political consequences of population aging, including the development of social policies for distribution of resources and against age discrimination (Uhlenberg, 1992), and conflict between age groups around such policies (Schoeni & Ofstedal, 2010). For example, political scientists and social psychologists have observed that even individuals who value racial and gender equality often endorse ageist beliefs that older people should step aside (e.g. from the workplace) to free up opportunities for younger people (Martin & North, 2022). Such conflict was particularly conspicuous

during the Covid-19 pandemic, where social dynamics relating to population aging had important public health implications (Clair et al., 2021).

Societal aging centers around questions of how societies develop and utilize the concept of age in their treatment of people (Kendig et al., 2016). Age categories, such as ‘adolescent’ or ‘older adult’, are socially constructed, which is to say they are imbued meaning by a culture. Historians examine how age constructions evolve over time (Hareven, 1994, 2019), whereas anthropologists explore differences in age constructions across cultures (Clark, 1967). Psychology and gerontology are concerned with how individuals shape their self-understanding around these social categories (i.e. how a person’s age identity informs their behavior and makes them accountable to certain norms) (North & Fiske, 2013; Terry et al., 1999); and this is complemented by sociological work that examines how rights and responsibilities of people differ according to age categories (Johfre & Saperstein, 2023; Laz, 1998; Neugarten et al., 1965). Recently this work has proposed age as a system of inequality that structurally disadvantages certain age groups in terms of social status and material resources (Barrett, 2022; Johfre & Saperstein, 2023), while also interacting with other systems of inequality (such as race and gender) (Bettie, 2014; Johfre & Saperstein, 2023; Silver, 2003).

There are important differences in how disciplines themselves conceptualize old age which relate to measures of interest. If examining physiological changes, for example, some will become salient at much lower chronological ages than others, and perhaps much younger than the socially recognized category of ‘older adult’. It is also worth noting differences in the underlying goals of the research across these approaches to aging. Individual aging is largely oriented around life course interventions to prevent declines in capacity (Kendig et al., 2016) and extend functional life span (Harman, 2001); population aging is concerned with matters of tracking and managing people; and societal aging is motivated to understand and ideally disrupt inequalities to produce

more equitable outcomes. That said, these are not entirely discrete pursuits, and indeed there are calls for more multidimensional work on aging (Johfre & Saperstein, 2023).

Human-Computer Interaction's Interest in Aging

Older adults have received special attention within HCI for several decades (Vines, Pritchard, et al., 2015a), originating in first wave HCI concerns about functional abilities and interactional competencies of users, both of which were assumed to negatively correlate with age (Righi et al., 2017a). This then morphed into exploring the application of technology to fixing problems associated with aging (Righi et al., 2017b; Vines, Pritchard, et al., 2015a), aligning with a research funding landscape oriented toward addressing problems of an aging population (Petrie, 2023a) and mirroring mainstream social gerontology's concern with a loss of equilibrium. Consequently, HCI has long been interested in the role of technology in mitigating detrimental effects of age-related physical and/or cognitive decline (Vines, Pritchard, et al., 2015a). Mainstays of the field include:

- Disease screening technologies which improve diagnosis and early detection of physical (Barry et al., 2022; C.-Y. Hsu et al., 2017) or neurocognitive disorders (Ding et al., 2022; J. Hu et al., 2024).
- Healthy/active aging technologies designed to help older adults self-manage physical, cognitive, and emotional health (Jovanović et al., 2021). Interventions include promotion of physical activity (Antony et al., 2023; Bradwell et al., 2024; Nurain & Chung, 2023), and exergames to slow physical/cognitive decline (Du et al., 2024; Mostajeran et al., 2020; Qian et al., 2024) and to rehabilitate following illness or injury (P. Wang et al., 2016; X. Zhao et al., 2018); as well as mitigating loneliness (Baker et al., 2021; Sas et al., 2017; Vargheese et al., 2013; Xing et al., 2024; Xu et al., 2023) among older people living alone and encouraging meaningful engagement with life (Lazar & Nguyen, 2017; W. Zhao et al., 2024) to improve well-being.

- Technologies to support aging-in-place, i.e. living independently in one's own home for longer. This includes assistive living technologies (Khosravi & Ghapanchi, 2016; Vines, Pritchard, et al., 2015b) such as memory support aids (C. R. Bennett et al., 2024; Ramos et al., 2016) and medication self-management solutions (M. L. Lee & Dey, 2014; Wolters, 2014); and enabling (and understanding the social dynamics of) monitoring of the older adult by remote family (Czech et al., 2023; McNeill et al., 2017).
- Inclusive design for individuals experiencing barriers to using technology that might benefit their lives. The literature has explored accessibility issues created by declining eyesight (Leonard et al., 2005; While et al., 2024), hearing (Hong et al., 2017), and motor abilities (Worden et al., 1997), and usability issues stemming from declining working memory (X. Li et al., 2024; Yu et al., 2023), cognitive inhibition (Du et al., 2024), sensory perception (Alldridge et al., 2020; Petrovčič et al., 2018), and sensory processing (Kim et al., 2023); as well as development of age-appropriate training and tech support (Batbold et al., 2024; Dai et al., 2015; Jin, 2024; Pang et al., 2021; Tanprasert et al., 2024).
- Supporting (and understanding technology appropriation (L. Li et al., 2023) of) individuals in providing both formal (Siriaraya & Ang, 2014; Ullal et al., 2024; Yuan et al., 2022) and informal (L.-J. Hsu & Chung, 2024; J. C. Zhao et al., 2015; Zubatiy et al., 2021) care to older adults.

Alongside enduring interest in these paradigmatic areas, HCI's remit has expanded in the last decade to more extensively consider the life-worlds and technology experiences of people in the later stages of life. This stage features not necessarily more, but different, transitions of consequence to HCI. Most notably, many older adults transition into retirement, which shifts digital technologies from the realm of work to the realm of leisure (Rogers et al., 2014), freeing individuals to allow certain digital skills to atrophy (Knowles & Hanson, 2018a); prompts a re-organization of finances (Vines et al., 2011) and impacts other non-fungible resources (time, social support) in ways that may affect technology adoption (Karaoğlu & Subaşı, 2021; Knowles et al., 2021; Loup et al., 2017); and often prompts identity work that can be accomplished through technology (Rudnik

et al., 2024; M. Yang & Moffatt, 2024). Other life stage transitions relate to states of increased or decreased independence—e.g. living alone for the first time following death of a spouse, or being monitored or cared for by another—which can, respectively, increase or decrease motivation to maintain technical skills, and may dramatically affect technology confidence (Rudnik et al., 2024; M. Yang & Moffatt, 2024). Also relevant are transitions in family role, for example becoming a grandparent, or becoming the oldest in the family, which can incentivize adoption of tools to support family connection (B. Chen & Li, 2024; Gutierrez, 2015; Wei et al., 2023; Welsh et al., 2018) but may also disincentivize tech skills development (i.e. if younger family members provide tech support) (Gutierrez & Ochoa, 2016a).

HCI has also begun to explore how a person's generation (or chronological cohort) informs characteristic values and ways of living that affects one's approach to and perspective on contemporary technologies. There has been significant interest in generational differences in values and such differences transform technology into a site of cultural/moral conflict (Barros Pena et al., 2021; Knowles & Hanson, 2018a; Petrie, 2023a); but also how having a longer history of technology experiences can leave older adults with habits and sensibilities that are ill-suited to the latest technologies (Nicholson et al., 2019; Sun et al., 2015a; P.-J. Yang & Ding, 2016). With time can also come a greater wisdom, including a sense of self-efficacy that may create hesitance to adopt new tools to replace well-established ways of doing; and assertiveness in rejecting technology that does not add value to one's life (Pang et al., 2021; Trajkova & Martin-Hammond, 2020; Waycott et al., 2016). This, in turn, has spurred significant exploration of the activities and interests of older adults (R. Brewer et al., 2016; Kim et al., 2023; Upadhyay et al., 2023; W. Zhao et al., 2023, 2024), to create a better alignment with technology offerings and, thus, increase their appeal.

A Critical Turn in HCI

In the early 2010s, scholars began to critique what they saw as problematic aspects of much technology design and research. Rogers and Marsden drew attention to a "rhetoric of compassion" (Rogers & Marsden, 2013a) that dominated the research with older adults. Neglecting the ways that older adults contribute to society, this rhetoric framed older adults as "merely a vulnerable segment of the population that needs looking after" (Carrol et al 2012) or as uniformly "worse off" than others (Rogers & Marsden, 2013a). Around the same time as these articles were published, a review of the HCI and gerontology literature located and challenged six myths about older adults and technology (Durick et al., 2013). They similarly described the myth that older adults were a burden on society, along with five more myths (and counternarratives) that had permeated technology research and design.

Myths	**Reality**
Older people are the same,	Older adults are diverse,
socially isolated and lonely,	have meaningful relationships,
a burden on society,	contribute to society,
chronically ill,	"manage age-related illness while maintaining wellbeing",
incapable of learning new, mainstream, technologies, and	can learn new technologies, but may not need them,
unable to use technology	"can use technology, but 'how' and 'how often' is determined by design processes and societal attitudes"

Myths and challenges from (Durick et al., 2013)

In 2015, Vines et al.'s discourse analysis of over 600 papers confirmed what others had begun to note about trends in research with older adults (Vines, Pritchard, et al., 2015a). This work, studying 30 years of research on aging in HCI, showed that research on the topic is growing. At the same time, the authors uncovered problematic aspects to some of the way that this research was being done and written about. This was described in terms of four discourses that were found in the literature review (Vines, Pritchard, et al., 2015a):

- Discourses of health economics - where HCI research is the source of potential solutions that can defray the massive economic and social burden that the growing aging population is "causing". Research in this vein targets solutions that can save costs on healthcare. This can include supporting people in living independently for longer, managing health conditions, and preventing negative events such as injuries or accidents.
- Discourse of socialization - where most HCI research seeks to remedy what is perceived to be a shrinking social world of aging individuals. When older adults are seen as part of a family network, they are depicted to be outside of the main focus, which is the home and activities of younger people. Technology here is largely used as an intervention to connect older people with others, and only sometimes recognized to be already existing in many people's practices.
- Discourse of homogeneity - older people are mostly referred to a single group, with little discussion of the ways in which they differ. This is very visible when researchers conduct evaluations that attempt to study age-related differences in the use of technology.
- Discourse of deficits - underlying each of the prior sections is the discourse of deficits. Aging is associated with high costs and stresses on society, poor socialization, and a set cognitive and physical changes. HCI research then seeks to understand how to address these deficits through technology that is more accessible for older adults.

Like Durick et al. (Durick et al., 2013), the authors reflect on how these discourses are not unique to HCI, but can be seen also in the gerontology literature (Vines, Pritchard, et al., 2015a).

Another paper during this time period disseminated this kind of critical messaging about how research is overly focused on deficit models of old age into what a subcommunity of Human-Computer Interaction. Light et al. (2015) argued that computer supported cooperative work (CSCW) scholars should move away from a view of old age as a state, which tends to result in seeing older adults as a "single vulnerable group with uniform needs that remain static" (Light et al., 2015). The authors argue that CSCW could instead fruitfully conceptualize aging as a process. This shift in thinking yields opportunities, then, to study the work involved in preparing for and managing new life stages.

The papers that comprise this critical turn argue that aging is seen as a problem in HCI. They link this view of aging to larger design, social, and economic trends, which lead to technology often being designed as a solution to the "problem" of aging (Durick et al., 2013; Vines, Pritchard, et al., 2015b; Rogers & Marsden, 2013a; Blythe et al., 2015). Research from social and critical gerontology and social psychology research is brought in by these authors to unpack stereotypes and show the complexity, and humanity, of older adults (e.g., (Durick et al., 2013; Vines, Pritchard, et al., 2015b)). And, alternatives to the deficit model of aging are proposed or used to situate the authors' work. This includes advocating for the "rhetoric of engagement" rather than a "rhetoric of compassion" (Rogers & Marsden, 2013a) as well as active (Light et al., 2015), positive (Nassir et al., 2015), and successful (Blythe et al., 2015) aging – alternative frameworks to explore as a way to replace deficit-centered views. With the critical turn pushing back on problematic trends and offering some high-level directions for researchers to go, the field had much work to do in correcting its path.

In this monograph, we describe some of the work that has emerged since the critical turn, largely within the last decade, and the ways that scholars are responding to the critiques formulated during the critical turn. We do so by carving out three focus areas of HCI research with older adults that map to some of the problematic discourses identified during the critical turn (see Table 2 for the relationship between identified discourses and the chapters of this monograph). The three foci include literature on technology use, intersectionality, and care.

"Problem" in HCI literature	**Discussed in the critical turn as**	**Literature that responds to this critique**
Positioning in terms of technological capability	● older people erroneously believed to be incapable of learning/unable to use technologies *(Durick et al., 2013)*. ● the discourse of deficit (Vines, Pritchard, et al., 2015b)	Section 3, "Older adults and Technology Use"
Homogeneity	● the myth that "older people are all the same" (Durick et al., 2013) ● the discourse of homogeneity is one of Vine et al.'s problematic discourses (Vines, Pritchard, et al., 2015b)	Section 4, "Older Adults and Intersectionality"

Positioning in terms of health, with corresponding societal burden	• that older adults can be defined broadly as socially isolated and lonely and a burden on society (Rogers & Marsden, 2013) and as chronically ill (Durick et al.). • the discourses of health economics and socialization (Vines, Pritchard, et al., 2015b), • that older adults are positioned as in need of care (Carrol et al 2012, Rogers, Y., & Marsden, G. (2013a))	Section 5, "Older adults and Care"

Table 2: The problems discussed in the critical turn with which the literature in this review engages.

3 Older Adults and Technology Use

This section describes research that responds to the critique that HCI research too often frames older people as incapable technology users *(Durick et al., 2013;* Vines, Pritchard, et al., 2015b)**. The research described here argues that a closer look reveals nuance to use and non-use.**

Older adults are often described as incapable technology users. However, while there are differences in how many younger versus older people own devices such as smartphones or use certain applications, some of the gaps appear to be shrinking (e.g. in the US [Faverio, 2022]). And yet – the differences that do exist do not mean older adults are using technologies in "worse" ways than those younger than them. This

section will summarize literature in HCI and social computing that shows how older adults are active and engaged technology users, even when engaging in certain types of technology use that might on the surface appear to be passive. We also show how when older adults are not using technology, it cannot be simply attributed to being incapable, but rather may involve intentional critical refusal practices.

Understanding the ways technologies are being used by older adults in practice can lead to different design directions. For example, if it is assumed an older adult is unable to use a technology, a researcher might work to enable access – but if it is understood that this individual has no use for technology, or is concerned about privacy, other possibilities may make more sense. We provide examples that show how HCI researchers have uncovered the ways that older adults are active technology users, reframed what is often considered to be passive technology use, and understood decisions to not use technology as intentional and reasonable.

To ground the work we discuss in this section, we first describe the concept of the digital divide and confront the question of why it is important to study older adults' technology use and non-use. Next, we provide detail on how researchers are studying aging and technology use in ways that challenge the view of older adults as incapable technology users. Then, we reflect on the strengths of this work and where more work can be done.

Defining Key Terms

What is the digital divide?

Old age has long been a significant predictor of digital exclusion (Friemel, 2016; House of Lords & Committee, 2023), defined as an inability to access or use digital technologies. Although the percentage of individuals over the age of 65 using the Internet has steadily increased decade after decade (Faverio, 2022; Jones et al., 2009), they continue to lag behind younger adults in terms of frequency and breadth of use. Statistics from the UK, for example, show that daily Internet use has increased from

28% in 2010 to 58% in 2019 for people aged 50–74, but remains far lower than daily use for 16–24-year-olds (95%) (OECD, 2020). And in 2023, 43% of people aged 65 and older in the UK are “narrow” Internet users, undertaking 1–4 out of 13 common Internet activities (Ofcom, 2023) and only 19% using all four types of online communication platforms (i.e., social media, messaging, video sharing, live streaming), compared with 28% and 87% of 16–24-year-olds, respectively. Exploring this divide through the commonly used lenses of access, ability, and affordability:

- 25% of UK adults 65 or older do not have Internet access in their homes, which is a dramatic spike from 7% of people 55-64, itself a significant jump up from 2% of 45–54-year-olds (Ofcom, 2023);
- individuals aged 65 or older are more likely to be lacking “essential digital skills” for life (and to the lesser extent, for work), showing an even more pronounced skills gap among those aged 75+ (Bank, 2022), with more than half of individuals with “zero basic digital skills” being the older-old (House of Lords & Committee, 2023);
- 20% of older adults not online say this is because of concerns about cost (Ofcom, 2023); however, a much more common reason was not wanting or needing to be online (69%).

The digital divide between young and old has prompted concern as i) contributing to social exclusion and attendant health problems associated with loneliness, ii) precipitating loss of independence due to challenges with increasingly digitally-mediated activities of daily living, and iii) creating age-based inequality in access to public services (Knowles et al., 2019; Neves et al., 2018; Shinde & Martin-Hammond, 2024; Tsai et al., 2015).

Why older age and technology use/non-use?

To address the digital divide, HCI researchers have explored threefold accessibility, usability, and motivational barriers to use for older adults. Aging can (though does not always) lead to a decline in functional abilities, such as eyesight, hearing, motor skills,

haptic control, and sensory perception, which can make it harder for people to use technology, and HCI has produced a vast body of literature on how to accommodate individuals facing these accessibility barriers. Age-related cognitive changes, including declining working memory and fluid intelligence, are thought to inhibit successful interaction (Yu et al., 2023; Yu & Chattopadhyay, 2024) and make learning to use new technologies harder for older adults (Batbold et al., 2024; Desai & Chin, 2023; Felberbaum et al., 2018). This can be exacerbated by anxieties older adults have about their cognitive abilities and digital proficiency (Waycott et al., 2022) stemming from internalized negative stereotypes. And yet, research shows that when older adults experience a motivational "trigger", i.e. a clear need for use, they can be quite capable of learning to use technology (Gibson et al., 2010; Upadhyay et al., 2023). Indeed, lack of motivation appears to be a much greater factor in older adult non-use than any accessibility or usability issues (Choudrie et al., 2018; Knowles & Hanson, 2018a; Selwyn, 2004). Proposed reasons for the limited appeal of technology to older adults are the predominance of tools premised in negative stereotypes of aging (Vines, Wright, et al., 2015); the lack of understanding younger developers have of the life-worlds of older people (Petrie, 2023a) and poor "life-fit" of the resulting technologies (Selwyn, 2004); and, relatedly, a mismatch between the values of older generations and the values guiding mainstream tech development (Barros Pena et al., 2021; Knowles & Hanson, 2018a). Key life stage transitions in later life, e.g. to retirement or assisted living, can also radically undermine motivation to engage with digital technologies, explaining why older adults are more likely to stop using digital technologies than other age groups (Berkowsky et al., 2015).

Despite the persistence of age-patterned differences in technology use, the fact that not all older adults are digitally excluded, narrow, or unskilled users proves that old age does not preclude technology use as a natural fact. Some difference can be understood in terms of generational effects, specifically that older generations will not have grown up with technology in the home and are less likely to have peers who are highly skilled in using technology—these being two factors that predict digital exclusion among younger age groups (Bank, 2022). But numerous factors determine an older person's

ability and interest in engaging with technologies in later life (Friemel, 2016; Neves et al., 2018), including not only physical/cognitive health, but also marital status, social support, history of employed work (and use of technologies in that work), financial resources, personal interests, and whether a person self-identifies as an 'older adult' (i.e. thinks of themselves as 'too old' to use technology). And further, social inequalities – which relate to one's intersectional position (see section 4) and can lead to digital exclusion at any age – cumulate across the life-course, leading not to inevitable exclusion for older adults, but instead polarization within this age category (Dannefer, 2003). This means that some people will face a compounding of barriers to engaging with digital technologies as they age (Knowles et al., 2025; Knowles 2025). In such instances, non-use may not be a choice, and can thus be understood as an inequity. Others may not experience the same barriers to engagement, but may still choose not to use technologies. Here, non-use is a reflection of agency being enacted, and is not only not inherently inequitable, but arguably should be structurally accommodated rather than treated as yet another problem for HCI to 'solve' (Vines, Wright, et al., 2015).

Older Adults and Technology Use in HCI

Below, we describe HCI research responding to inaccurate categorization of older adults as technologically incapable that has pervaded HCI literature *(Durick et al., 2013;* Vines, Pritchard, et al., 2015b). Researchers are showing how older people are active technology users, but also that use that tends to be labeled as "passive" can be in fact active. Concurrently, researchers are pushing back on the idea that active use should always be the goal, showing when older adults' decisions to not use, stop, or lessen use are reasonable decisions.

Older adults are active technology users

In reaction to the dominant discourse of older adults as non-users or incompetent users of technology, researchers have set out to show the ways that older adults are able to

adeptly use technology. This includes the study of older adults engaged in active tech production, often in expressive or creative pursuits – blogging, radio production, programming, crowdworking, hacking and making. Sites of digital content production, and sometimes making with hardware, serve as counter points to framings of older technology users as passive consumers. The research we describe below is organized into three sections that show different ways that this argument is made: by showing how, with appropriate support, older adults can be supported in using new technologies; that older adults are already using technologies, similar to other age groups; and that older adults are using technologies in unique and creative ways that are distinct from others.

Older adults can be supported in using new technologies

Some of the research demonstrating how older adults are active technology users supports older people in engaging in technology activities that are rarely thought of as being for this user group. This research often reveals the benefits that older adults and other communities can experience as a result of being included in technology use. For example, Rogers et al.'s paper showed how older adults were able to master a technology toolkit during a set of workshops (Rogers et al., 2014). They describe how this mastery of the technology led to rich design conversations and high-level reflections on technology trajectories. The authors then make a case for how older adults can be drawn into technology design with appropriate scaffolding, and design can benefit from the inclusion of older adults (Rogers et al., 2014).

Other papers in this vein show how older adults can learn to use new researcher-developed technology and technology environments, such as a media-sharing tablet-based application (Waycott et al., 2013), radio production tools (Reuter et al., 2019), and a makerspace (Carucci & Toyama, 2019). One example of a paper in this group was titled "Older Adults as Digital Content Producers" (Waycott et al., 2013). It made a provocative argument that older adults were often overlooked in the rich HCI research on user-generated content. Waycott et al. explained that rather than being supported in

producing content, design for older adults more typically concerned consumption of content. Through deploying tablets with an application that supported media creation and sharing, the researchers concluded that with appropriate sociotechnical systems, people in the “oldest old” demographic group can produce digital content (Waycott et al., 2013).

In addition to pushing back on assumptions of older adults as unable to learn to use new technologies or use technologies actively, and framing a paradigm shift from content consumption to content creation for older adults, this body of work shows the benefits that older adults can experience themselves in using these new technologies. Benefits included self-expression and building new social connections (Waycott et al., 2013). Benefits can also extend to others beyond the older users: with research showing that some motivations to engage with new technologies are to benefit people other than themselves, for example creating gifts for others in a makerspace (Carucci & Toyama, 2019) or ideating how to make the world better for future generations (Rogers et al., 2014). In demonstrating that older adults can defy stereotypes by using new technologies, these papers encourage the HCI community to expand the kinds of technology they design for older adults, beyond access to technology as consumers and into support for content production.

Older adults are using mainstream technologies in mainstream ways

While the above studies bring older adults novel technology environments, other research examines active sites of technology production to challenge homogenous assumptions in HCI of what older adults’ existing technology use looks like. Multiple projects have examined older adults’ making practices in established or older adult-led DIY communities (I. Anderson & Vyas, 2022; R. Hu et al., 2024) as well as digital content production in mainstream online spaces (R. Brewer & Piper, 2016; Harley & Fitzpatrick, 2009; X. Tang et al., 2023). These studies argue for an expanded view of how older adults are using technology. For example, one study of older adult bloggers showed how while HCI research on aging has traditionally framed older adults’

technology use in terms of engaging with family members and known contacts, older adults were using technology to establish new connections (R. Brewer & Piper, 2016).

Papers in this category are showing how older adults are already using technologies, rather than creating and introducing custom-made technologies like the prior section. However, they engage in similar framing, also striving to push back on assumptions that older adults are passive technology users by showing active use. For example, one paper shows how, in contrast to assumptions that older adults' activism largely takes place "on the ground," there is an active group of "elderbloggers" engaging in collective action around ageism through online technology (Lazar et al., 2017).

This body of research speaks to the literature described in the prior section highlighting that older adults can be supported in using new technologies. Guo et al. describe how their work "follows a progression in this literature (on older adults' use of technology) from studying older adults first as consumers of technology, then as producers of digital content, and now to potentially becoming producers of new technologies via computer programming." (Guo, 2017). In other words, they describe how the initial framing of older adults as passive users was followed by literature showing older adults could actively produce things using technology (as described in the prior section, e.g., with (Waycott et al., 2013)). They situate their work surveying over 500 older individuals learning programming as the next step in this progression, which would be supporting older adults in creating their own applications (Guo, 2017).

These papers often focus on why and how older adults engage with these newer technologies, and sometimes the barriers they experience. For example, Hu et al. and Anderson and Vyas (Anderson, I., & Vyas, D. (2022)) both describe the interpersonal and material aspects that were key for the older maker communities that they studied (R. Hu et al., 2024; Lazar, Pradhan, et al., 2021). Some of this work also describes how researchers can further support use or learners in leveling up, such as Tang et al.'s interface designs that could support the role transitions from lurker to established

contributor on short-form video sharing platforms with older adult content creators (X. Tang et al., 2023).

Older adults are using technologies in unique ways that enrich our worlds

The last strand of research that shows older adults' active technology use that we will discuss also comes from researchers examining stereotype-defying sites of older adult technology use. Like the other research in this section thus far, this research often focuses on content production and DIY/making. However, rather than showing that older adults can use technologies like other age groups as in the prior subsection, this body of work is showing unique and valuable ways that older adults are interacting with technologies.

The two examples we discuss here have researchers examining sites of novel technology production to understand the values that older adults have that may differ from younger people, even when using the same technologies. One project employed a variety of data collection methods with crafting communities to surface three values central to older crafters' inclusion of technology in their practices: belonging, quality, and creativity (Kalma et al., 2020). Work in this space can go beyond the individual to show how values fit into a larger political, economic, and cultural landscapes. To show an alternative to traditional views of making as towards individual empowerment, Sun et al. describe observations from their ethnography with Chinese older adult electronics hackers (Sun et al., 2015b). The paper draws out links between motivations to engage in hacking and the values during the politico-economic climate in China when participants were coming of age. Participants saw electronic hacking as a way to preserve important values such as resourcefulness and reuse, which were under threat of being lost in modern China (Sun et al., 2015b). Both of these papers note how older individuals are interacting with technology to keep tradition alive (Sun et al., 2015b) (Kalma et al., 2020).

Together with the papers in the prior two subsections, this body of work is pushing back on the myth that older adults are not incapable and incompetent technology users by featuring active older technology users. Much of this argument is made by showing the ways that older adults are active in content production and DIY/making. This emphasis may reflect the esteem around content production and DIY/making when these papers were published.

Recasting “passive” technology use

So far, this section has focused on active technology use. Researchers in HCI have also discussed how older adults adopt technology, transitioning from non-users to users. For example, researchers have gathered empirical evidence of how older people adopt video-sharing platforms and social media (Hage et al., 2020; Jung et al., 2017; X. Tang et al., 2023); most recently spurred by older adults adopting communication technologies/platforms in new ways during the COVID-19 pandemic (Lopez et al., 2021; Richards et al., 2021; Sixsmith et al., 2022; W. Zhao et al., 2022). When we only have the perspectives highlighting and working towards active use by older adults, we miss the presence and importance of less visible forms of engagement. Here, we describe research that recognizes that use is a spectrum and passive technology use is important to understand – adding nuance to how HCI researchers are framing and understanding older adults’ technology use.

Older adults continue to be portrayed as passive technology users who are disinterested in technology or lack digital skills, particularly compared to other demographics (Brandtzæg et al., 2010). For example, reports frequently describe how older adults lag behind technology ownership and social media use rates of younger adults, or even describe tech usage differences between microgenerations of older adults (M. Anderson & Perrin, 2017; Hunsaker & Hargittai, 2018). Older adults are often framed as “lurkers” online, with lurking or observing digital behaviors positioned as something to avoid or transition out of (Preece & Shneiderman, 2009; X. Tang et al., 2023). Yet, this can be understood as a deficit-based lens on less visible forms of use.

As other social computing scholars have done with younger adults (Antin & Cheshire, 2010; Greif et al., 2012), we argue that passive use can also be beneficial for older adults.

Passive participation can reflect generational cultural norms and communication preferences. It can also serve as an effective strategy to protect one's well-being or preserve relationships. For example, older adults describe how they are reluctant to participate in certain aspects of social media culture because complex social norms established by younger adults exist, e.g., taking selfies (Bossio & McCosker, 2021). Older people may also prefer direct and less publicly visible communication channels due to generational norms about privacy (Bossio & McCosker, 2021; S. Wang et al., 2024). After analyzing older participants' social media behaviors, Brewer and colleagues (2021) suggest older adults may limit visible platform interactions to preserve close relationships (R. N. Brewer et al., 2021). Other scholars have shown how passive use can be an intentional strategy to avoid social media addiction and encourage offline engagement (S. Wang et al., 2024). Specifically considering use type, researchers have found that older adults' passive social media use is correlated with fewer depressive symptoms compared to younger adults (Lewin et al., 2023). Older adults may also have different goals for using technology. For example, those who intentionally use social media to stay updated about family members and friends, may be satisfied with using Facebook to view photos or share content by "inviting others to look at the computer screen" (Jung et al., 2017). Overall, this work (R. N. Brewer et al., 2021; X. Tang et al., 2023) argues that HCI researchers should better recognize varying forms of technology use and online participation, including passive use.

When decisions to not use technology are intentional and reasonable

The narrative of the digital divide and discourses surrounding tech use and non-use often imply that older adults who do not use technology would be better off using it. The job for researchers, then, is to find ways to support older adults in getting on board with technologies that are seen as able to improve their lives. A body of research in HCI is showing how older individuals are making informed decisions to not use technology. This shifts the role of the researcher to understanding reasons for non-use and, where appropriate, calling for the redesign of technologies to address older people's concerns.

The finding that older adults can be avid and skilled users of technology, as described above, suggests that the conventional focus on barriers to use is not fully explanatory. A number of motivational factors have been proposed to account for older adults who decide not to use technology. One aspect relates to poor fit of technologies to the life-worlds of older adults (Hirsch et al., 2000; Petrie, 2023b). Technology designed by and for younger people may not afford enough value to older people to justify investing in learning to use them (Knowles & Hanson, 2018a; Pradhan, Jelen, et al., 2020; Trajkova & Martin-Hammond, 2020). In some cases, older adults are wary of adopting technology that might destabilize their competence in the accomplishment of various practices of daily living (Vines et al., 2012), having long-since established nondigital means of achieving the same ends. Literature has also highlighted potential differences in preferences with regards to ways of communicating and socializing which are unsupported by the technology, leaving older adults to choose alternatives and/or reject particular features within a tool they otherwise use (R. N. Brewer, 2022; R. N. Brewer & Piper, 2017). In particular, the literature notes a preference among some older adults for heavyweight and material forms of communication (Hope et al., 2014; Lindley, 2012; Lindley et al., 2009), and for deep and meaningful connections more easily

accommodated in face-to-face interactions (Knowles & Hanson, 2018b; Nurain et al., 2021a; Richards et al., 2021).

Beyond failing to see a reason to adopt technologies, older adults also more actively reject technologies. It is frequently noted that feeling stigmatized can provoke rejection. Older adult variants of technology may make people feel conspicuously old in ways they would prefer not to. Assistive tools can, if not designed carefully, create feelings of shame in the older adult for their need for assistance (Hirsch et al., 2000), drawing unwanted attention to physical or cognitive abilities that may be perceived as declining (Barros Pena et al., 2021), or damage one's sense of self-confidence and autonomy (Coghlan et al., 2021). Also noted is the problematic tendency of technology designed by people who hold negative stereotypes of aging (Petrie, 2023b) to infantilize older adults (C. N. Harrington et al., 2019), and in doing so, undermine their independence and agency in ways they may quite reasonably resist (Barros Pena et al., 2021). Some older adults have also been found to reject technology designed to stand in for human companionship (Coghlan et al., 2021; Lazar et al., 2018). Overall, the literature advocates careful examination of the assumptions underlying proposed solutions to avoid introducing new problems that lead to rejection (Waycott et al., 2016).

Other cases of non-use can be characterized as refusal. Refusal is typically driven by a perceived mismatch between the older person's values and the values embedded in and reinforced by the technology. Feigning difficulty using technology (Barros Pena et al., 2021) or claiming to be 'too old' to use it (Knowles & Hanson, 2018b), can be a strategy for enacting this refusal. While much of the HCI literature points to important differences in the values of older and younger people – notably the importance of purpose, belonging, competency, contribution, independence (Leong & Robertson, 2016), privacy (Hornung et al., 2017; Knowles & Hanson, 2018a; Quan-Haase & Elueze, 2018), connection, and authenticity (R. N. Brewer & Piper, 2017; Coghlan et al., 2021; Lazar et al., 2018; Lindley et al., 2009) – more work is needed to understand whether these differences relate to generational norms or age/aging itself. It has also been proposed that values are not so different between age groups after all, and that

older adults are rejecting aspects of technology that most people find objectionable (Knowles & Hanson, 2018a). This could be due to different expectations for technology use for age groups, giving older adults greater freedom to reject technology (Knowles & Hanson, 2018b); or (or in combination with) differences in psychosocial skills, e.g. self-confidence and self-efficacy increasing with age.

In contrast to non-use by younger people, which is typically viewed as the enactment of personal preference, non-use by older adults is often viewed as a problem to solve, particularly when the technology is offered as a solution to a problem identified and defined by people other than the older adults themselves (Waycott et al., 2016). But, negative attitudes of older adults toward technology can signal deeper issues beyond any individual technology that deserve attention. In some cases, it reveals a problematic tendency to design technologies aimed at older adults but which solve problems of other stakeholders (Pradhan, Jelen, et al., 2020; Waycott et al., 2016), for example mitigating a ‘care crisis’ with family members or carers (Caldeira et al., 2023; Waycott et al., 2016). In this sense, older adults are not resisting technology as much as they are resisting how they are being ‘managed’. This has inspired several key design principles, including the need to balance assistance and independence (Caldeira et al., 2017), supporting agency, dignity, and autonomy (R. N. Brewer, 2022; Coghlan et al., 2021; Nurain et al., 2021a; Trajkova & Martin-Hammond, 2020), and empowering users (Nurain et al., 2021a; Waycott et al., 2016). Cases of refusal can illuminate the hegemony of ‘younger’ values within tech innovation, and the ways in which technology contributes to the negative stereotyping and/or marginalization of older people in society (Knowles et al., 2021). Ultimately, non-use reminds us that decisions about what technology is designed, what problems are solved, and how, are an expression of power; and likewise, choosing not to use technology is the pushing back against this power by the less powerful (Ambe et al., 2020; Knowles & Hanson, 2018a). Finally, as noted by Waycott et al (Waycott et al., 2016), while there is a healthy body of literature exploring attitudes that underly older adult non-use, more research is needed to understand the consequences of intentional non-use on the daily lives of older adults, particularly in light of the rapid infrastructuralization of digital technologies in society.

Reflection

Current State

The research we describe in this section challenges the stereotype of older adults as incapable technology users in three ways. First, researchers are showing how older adults are active users of technologies. This includes conducting studies where older adults are able to master new technologies, revealing that older adults' current technology use is mainstream, and showing how older adults are becoming proficient with technology in ways that allow them to do things that other populations are not. Second, researchers are showing how use that is often seen as passive (and likely attributed to poor skill or disinterest) can actually be beneficial. Third, we describe research that takes a step back from the idea that technology use is always to be supported, realizing how older adults are intentionally rejecting or limiting their technology use for good reasons. This work has been important to show the intentionality that can be involved in older adults' technology use. There is still room to understand the heterogeneity of technology use beyond preference (e.g., how histories of technology use affect one's interest in and ability to learn to use technology). We are also missing ways to discuss and support people who are interested in using technologies but face barriers, as opposed to those who are not using technologies intentionally. Below, we discuss these two possible research directions in more detail.

Counterproposals

In this section, we describe some of the current ways that aging and technology use is being described in the literature, as well as where there are gaps. We offer counterproposals to existing discourses and studying older adults as homogenous technology users and insights for how we can study barriers to use without resorting to deficit-oriented language.

Tracing and dispelling erroneous narratives

It will be imperative to follow the lead of researchers from the critical turn to continue to understand the discourses surrounding technologies for aging (Haslwanter & Fitzpatrick, 2013; Vines, Pritchard, et al., 2015a) as they evolve. One recent project in this space studied media portrayals of older adults' voice interface use, comparing them to the academic body of work on the topic (Sin et al., 2023). Findings include that some claims are consistent with academic literature, some are in opposition, and many lack evidence. The authors stress the importance of understanding the validity of media messaging given that it has concrete impacts on older adults' perceptions and adoption of voice user interfaces (Sin et al., 2023). Another study engaged in a critical discourse analysis of the onboarding for a health monitoring smart home system (Czech et al., 2023). While many studies examine older adults' perceptions of technologies, this study examined older adults' perceptions of the onboarding process. The authors show how participant ideologies did not align with the onboarding process, and the system could have an opposite effect than was intended or promised in promotional materials. For example, the system advertised independence (that it would "empower older people to keep their independence at home") but introduced dissonant concepts (when collaborative care was the existing mode people were operating in but the system sought to provide independence *from* a carer) or caused the inverse to the intended outcome (when participants required frequent assistance from others to use the system) (Czech et al., 2023). These projects share an understanding that factors beyond the interface, in this case technology discourse, have real impact on use and intention to use.

There is also merit to continue reflecting on the discourse around technology and older adulthood in HCI. While this monograph shows the ways that our field has shifted in response to critiques, we need to continue to work towards more accurate understanding and better technology design (or non-design). For example, we have observed and participated in a research trend motivated in part by attempting to understand how older adults might use the latest technologies, arguing that this has not been studied before (e.g. Lazar et al. 2021; Pradhan et al. 2020). While these studies

are valuable, they can also be understood as subscribing to a discourse that active technology use is to be esteemed and that non-use is a problem to solve. Recognizing this implicit value system opens opportunities for researchers to consider whether something should be intervened upon or whether there is critical/intentional non-use at play. Proceeding with research within *both* of these paradigms can lead to a more balanced body of research.

Acknowledging technology ability without shifting into deficit mode

A critical turn in HCI has, as discussed in this section, pushed back on the notion of older adults as incapable technology users. Despite all the benefits of this shift in discourse, it may have inadvertently contributed to the state we are in, where we lack language to discuss variance in older adults' technology skills or abilities (Colbourne et al., 2021). The challenge here is in talking about technology ability without resorting to deficit-laden characterizations of older adults. In other words, how can we talk about real challenges that older adults may have with technology, or discuss where things are going wrong, without seeing older adults as "worse off" or in need of fixing (Rogers & Marsden, 2013b)?

That older adults' technology use can look different than younger people's cannot be disputed. Even Vines et al.'s article reckoning with ageism in HCI research notes that discourses of older adults as more hesitant or less familiar with technology are not always untrue (Vines, Pritchard, et al., 2015a). However, the authors follow up on this sentiment noting that these discourses should not be claimed to be universal. This indicates that technology hesitancy and unfamiliarity is an important topic to study, but there is an open question on how to do this without slipping into a deficit framing.

One way that researchers are finding ways to discuss technology ability without resorting to deficit-focused language is by examining and accounting for older adults' technology histories and how these impact current technology use and interest. For example, Barros Pena et al. studied what they referred to as the "technology life stories" of 20 older adults. In doing so, they characterized issues participants were facing with

using technologies in ways that portrayed how these were entirely rational and due to technology changing, rather than incompetence on the part of the user. For example, one of their findings sections includes accounts of people having a hard time memorizing and following instructions to use technology. The authors unpack how this can be traced to participants having become used to mechanical machines earlier in their lives. With mechanical machines, such as a varityper (which a participant described as a large typewriter) it was possible to see and understand how a device worked. Technologies that emerged after these mechanical devices relied on a different kind of logic. A computing device like a desktop, then, is seen as "a closed box whose components and mode of operation could not be fathomed through day-to-day use" (Barros Pena et al., 2021). Another project looks at how different older peoples' life milestones (such as school and work) map onto the emergence of digital technologies. Whether someone used a PC or typewriter in the office, for example, is important for a researcher working with that individual to know (Petrie, 2023b).

These projects are doing important work by defamiliarizing (G. Bell et al., 2005) the ways that people interact with contemporary technologies (e.g., how we learn through trial and error rather than understanding (Barros Pena et al., 2021)). This change in framing relocates blame for the issues older users encounter away from the user. Instead, we can recognize how changing designs, the very young technology industry (Daley, 2019), and the absence of older adults in research and design of digital technologies (Mannheim et al., 2019) play a part in the situation in which we have come to find ourselves. By showing how modes of interaction change over time, we are reminded that where we are now with technology is not inevitable, nor is it permanent. We would be well served in studying how we can, as the societal level, adopt new technologies and modes of interaction without creating friction for large groups of people – or the researchers of today will find themselves disenfranchised in the decades to come.

4 Older Adults and Intersectionality

Overview

The HCI community has faced critique for describing research with older adults as though they are a homogenous group (Durick et al., 2013; Vines, Pritchard, et al., 2015b). While these descriptions can help to distinguish older people from those younger than them, they fail to recognize the heterogeneity within this demographic, particularly intersecting identities beyond disability that can make experiences with technologies unique. We highlight this heterogeneity in regards to technology use in the previous section when discussing differences in older adults' use of technology (including non-use).

This section will describe HCI research that draws on disability justice and feminist scholarship to explain how aging is intersectional. Older age cannot be separated from other identity characteristics like race, ethnicity, disability, socioeconomic status, or gender (Finlay, 2021). For example, an older person's experiences with technology may differ if they are older and experiencing cognitive impairment (e.g., using reminder apps or using technology with a caregiver) or older and not experiencing cognitive changes. Similarly, the digital experiences of a Blind older adult (e.g., screenreader use) may differ from a sighted older adult. HCI researchers have begun to explore how to design to support technology use across older adults' intersecting identities. Yet, this work often focuses on how older age intersects with disability without considering the full spectrum of aging diversity.

This section describes research that dispels the myth that older adults are a homogenous group *(Durick et al., 2013;* Vines, Pritchard, et al., 2015b) **and argues that intersecting identities beyond disability must play a role in how researchers study and design for older adults.** Studying how to design for intersecting identities will be vital for creating technologies appropriate for older adults belonging to

marginalized identity groups. And, it is critical to reflect this nuance in design. We will present examples of how HCI researchers have considered intersecting identities throughout the research process including framing research narratives, making methods decisions during data collection, and when designing technologies.

In this section, we use social constructionism and its focus on cultural differences to emphasize the importance of intersectionality in aging and design. We continue by defining intersectionality and confront questions of why it is critical to study older age from an intersectional approach. Next, we present how HCI researchers have studied aging and intersectionality. Lastly, we reflect on what the community is doing well and how we might envision counterproposals for intersectional aging research.

Defining key terms

What is intersectionality?

Intersectionality is a framework originating from Black feminist studies. It describes how power and privilege affect lived experiences, particularly of people with intersecting identities who have experienced systemic oppression. Coined by Crenshaw in the 1980s, intersectionality originally described how Black women's experiences in contexts like employment or violence are rooted in "preexisting vulnerabilities" linked to a history of racism and sexism in the United States (Crenshaw, 1989, 1991). Similar to defining aging, recent constructive approaches to intersectionality describe how one's identity is dynamic and how one's relationship to power and privilege can change over time (e.g., Prins, 2006). Importantly, intersectionality focuses on identities on axes of oppression, meaning it does not describe any axis of difference or intersecting identity (e.g., white and man). Instead, identities impacted by intersectionality describe "privilege, domination, or oppression" (e.g., (Erete et al., 2018)). Examples may include those affected by sexism, racism, classism, ableism, or ageism.

Until recently, intersectionality was not well-discussed within HCI (Schlesinger et al., 2017). Within HCI, researchers have incorporated intersectionality to inform methods (Erete et al., 2018), analysis (Andalibi et al., 2022; Hedditch & Vyas, 2023), and design (Kumar & Karusala, 2019; Wong-Villacres et al., 2018). For example, an intersectional approach to study design incorporates an awareness that traditional HCI methods like prototyping or co-design may be affected by limited technology exposure or digital skills due to intersecting identities. Using an intersectional lens may mean interpreting participants' experiences with knowledge of how systemic oppression affects technology use or non-use. Intersectional computing applied to design that rejects a universal design approach can result in designing for differences that impact vulnerable communities.

Although intersectionality focuses on oppressed identities and "oppression" has a negative connotation, incorporating intersectionality can be positive. Crenshaw notes that "delineating difference [...] can instead be the source of social empowerment and reconstruction" (Crenshaw, 1991). Within HCI, scholars state intersectionality can "acknowledge the dignity of individuals and communities" (Wong-Villacres et al., 2018). Acknowledging dignity, empowerment, and uniqueness through difference can lead to meaningfully designing for historically marginalized users. As such, we cannot ignore one's relationship to power and privilege (Crenshaw, 1991) when studying or designing technologies in HCI, particularly where older age intersects with other oppressed identities.

Why older age and intersectionality?

Scholars who contend with intersectionality in their work acknowledge that it has been a well-studied phenomenon for certain identity intersections. Kumar and Karusala (2019) argue that we need to attend to "different kinds of difference" (Kumar & Karusala, 2019). Older age and disability (Bailey & Mobley, 2018; Erete et al., 2018; C. N. Harrington et al., 2023) are components of intersectionality that have been studied far less than others like race, gender, and class (Schlesinger et al., 2017). Yet, older adults also

experience inequality and systemic oppression (e.g., ageism), particularly those whose identities intersect with other groups “distinguished by other inequities such as race, class, … and sexuality” (Calasanti & King, 2015:194; Steward et al., 2023).

However, we recognize that this stigma towards older age could be cultural. Older age is highly stigmatized in Western societies where much focus is on the individual and personal accomplishments. In contrast, Eastern cultures can prioritize interdependence and “relational harmony” (Nisbett, 2004). Yet, more modern aging studies across cultures suggest that individualistic societies have more positive attitudes toward aging (North & Fiske, 2015). Together, this body of work suggests understanding how older adulthood intersects with regional differences is important to unpack, particularly as it can affect how to design technologies to support aging.

As age-related disability is common, dominant perspectives in research portray older age as a phenomenon primarily marked by decline and weakness. This emphasis on decline and frailty has resulted in systems where older adults and their desires are made less visible. For example, research describes how societies dismiss older men for a perceived lack of productivity and older women experience sexual rejection (Applewhite, 2019; Calasanti & King, 2015a; Crampton, 2011). Such erasures also affect upward mobility (O’rand, 2018) as financial security in global North and Western societies benefits the majority - “white, middle class, heterosexual men” (Calasanti & King, 2015a) - meaning that older adults outside of these identity groups experience further invisibility as they age.

Although aging is not synonymous with disability (Knowles et al., 2021), we draw upon similar themes within the disability studies community to emphasize why we should study older age and intersectionality. Specifically, age justice, which emphasizes the “social marginalization” and “systemic issues of ageism” (Burghardt et al., 2022) draws from tenets of disability justice. Disability justice highlights how most disability studies work “centers white experiences of disability” and does not tap into intersections (Sins

Invalid, 2020; Sum et al., 2022). Similarly, age justice highlights how we study aging through a “whitened lens” and how “issues are magnified by dynamics of race, ethnicity, and immigrant status” (Burghardt et al., 2022). This work highlights how studying intersectionality and aging is an urgent research agenda that remains understudied. In the remainder of this section, we turn to Human-Computer Interaction and how HCI researchers have incorporated aging and intersectionality in methods and design.

Older Adults and Intersectionality in HCI

The HCI community has discussed intersectionality and aging in three ways - how intersectionality (1) frames and motivates research, (2) informs recruitment and data collection methods, and (3) affects design implications and future impact. We provide examples of this work in the remainder of this section.

Framing Intersectionality

In contrast to research describing the older adult demographic as a monolith, aging researchers in HCI have called attention to this age group and how it is not homogenous (Righi et al., 2017a; Vines, Pritchard, et al., 2015b). Righi and colleagues (2015) conducted a five-year research-through-design ethnography with aging researchers in Europe. They critiqued the “discourse of homogeneity” prevalent in the broader HCI community and their initial assumptions before starting the project. They found that diverse attitudes, interests, family structures, and disability affected older adults’ perceptions of a particular technical interest, gaming (Righi et al., 2017a). While these are not specific identities that align with the axes of oppression, the researchers propose alternatives for better representing older age and being inclusive of the older adults’ overlapping identities that are not solely prescribed based on age.

Designing for overlapping identities can seem like a strength, as this is an argument advocating for diversity in design. However, Oudshoorn et al. (2016) argue framing research with a focus on diversity in aging is limited because it originates from a deficit-

based framing of older age and disability. Focusing on diversity is similar to framing work based on axes of difference, whereas framing based on intersectionality focuses on axes of oppression. Framing research from an intersectional lens considers the nuance of how older age can intersect with many historically oppressed identities, or not. From conducting three case studies with people whose identities intersect with age and/or gender, findings show how developers framed technology design using stereotypical tropes of how older age intersects with disability rather than older adults' values.

Similarly, Harrington and colleagues (2022) argue that research positioning older adults at intersections often leads with deficit-based or problem-centered language. Doing so further emphasizes systems of "colonial power" and "dominant cultural codes" that, if embedded into how we frame research questions may affect each stage of the project, including participant recruitment, system development, and the design process (C. N. Harrington et al., 2022).

Studying Older Age from an Intersectional Lens

Intersectionality also affects how researchers recruit participants and collect data to inform technology design. Researchers have intentionally recruited older adults at the intersection of older age and ethnicity (e.g., R. N. Brewer et al., 2023; C. Harrington et al., 2022; C. N. Harrington et al., 2019, 2022), disability (e.g., R. N. Brewer & Piper, 2017), and socio-economic status (e.g., C. N. Harrington et al., 2022; Pradhan et al., 2020). For example, Brewer et al. (2023) recruited Black older adults to envision equitable conversational AI tools (R. N. Brewer et al., 2023). Harrington et al. (2022) recruited low-income Black older adults for design workshops about tools to support their health (C. N. Harrington et al., 2019). Pradhan et al. (2020) recruited older adults living in a low-income residential community for a field deployment with a voice assistant (Pradhan, Lazar, et al., 2020).

Findings from this work show how certain identity groups may affect technology adoption and use. For example, Black older adults emphasized race more than older age when discussing speech technology use (R. N. Brewer et al., 2023), and blind and low-vision older adults emphasized nonvisual communities that promoted shared disability experiences over shared aging experiences (R. N. Brewer & Piper, 2017), and low income older adults described how internet reliability was a major factor impacting smart speaker adoption (Pradhan, Lazar, et al., 2020). Such findings reveal how initiating a study assuming that older age is "the primary aspect of an individual's identity" may not be valid (R. N. Brewer & Piper, 2017).

Further, intersectionality may impact research methodology. In a study where participants' identities were at the intersection of socio-economic status, race, and older age, researchers found that traditional community-based research methods needed to be modified (C. N. Harrington et al., 2019, 2022). Specifically, (1) distancing the individual from feedback and seeking community perspectives, (2) providing options for people to have autonomy in decision-making, and (3) considering how one's identity might affect the study location was useful. Additionally, traditional community-based design methods revealed a tension where simplistic ideation materials were perceived as infantilization.

Different identity characteristics may be present in other work, but reporting on demographic characteristics beyond age and gender is rare, in HCI more broadly (C. Harrington et al., 2022). Harrington and colleagues (2022) describe how few HCI papers have reported on disability, race/ethnicity, and health status. Even fewer report education, income, or multiple identity characteristics (C. Harrington et al., 2022). This work calls for understanding intersectionality beyond participant compositions to unpack how systemic oppression might impact use. Similarly, AI fairness scholars have shown that age and other demographic data about older adults (e.g., disability types) are not represented well in large datasets, which could have negative effects on older adults' use of algorithmic technologies (Kamikubo et al., 2022; Park et al., 2021). Further, more

intersectional HCI is needed to avoid discussing and designing for aging as a homogenous experience or ignoring older adults altogether.

Designing for Intersectionality

Incorporating intersectionality also affects how technology is designed as certain aspects of one's identity may be heightened depending on the digital context, designing for a homogeneous aging experience can lead to non-use, and the designed artifact can embed negative tropes about older age.

As we emphasize that older adults may be members of multiple historically marginalized identities, research shows how these identities may not equally impact design outcomes. For example, Brewer and Piper (2017) conducted a study with blind and low-vision older adults where they deployed a voice blogging community and evaluated its use. During this deployment, participants expressed interest in hearing additional blogging content. However, they also emphasized the importance of this content coming from other blind individuals, rather than other sighted older adults (R. N. Brewer & Piper, 2017). This example shows how older age was not "the primary aspect of a [participant's] identity" and how designing for disability was more meaningful.

Similarly, Brewer et al. (2023) engaged Black older adults in workshops to understand their perceptions of equitable speech technologies. During workshops, participants expressed concern about age-related factors that could affect voice technology use such as (1) disclosing age to systems that could be exploitative (e.g., higher insurance premiums) and (2) generation-specific phrases being misinterpreted by conversational technologies. However, most participants focused their discussion on how technologies could be more authentic when representing the range of Black-sounding voices (R. N. Brewer et al., 2023).

Range also relates to diversity in the aging experience. Harrington et al. (2022) conducted a literature review of health technology design for older adults. In a meta-analysis describing this research, the authors analyzed how researchers reported demographic data about their participants. Findings show that most researchers report on age and gender, yet few report on factors such as disability, race/ethnicity, and income. Notably, few papers reported on the intersection of more than two multiply oppressed demographic variables. The authors call for more intersectional HCI research to avoid (1) discussing aging as a homogenous experience and (2) designing technologies for one demographic group (C. Harrington et al., 2022).

Designing for older adults as one group often reflects stereotypes about a singular aging experience. In one study, researchers interviewed developers and staff in long-term care communities about technologies to support older adults in assisted living. They found that staff and developers gave “simplistic” descriptions of older adults’ tech interest and use, characterizing older adults as uninterested, “technophobic”, and “incompetent.” Researchers linked these depictions of aging and tech use to sociotechnical ageism where design is primarily based on stereotypes about older adults as a homogenous group (Neves et al., 2023) rather than older adults that have a range of technology desires and preferences based on intersecting identities. We argue that these stereotypes can be exacerbated if the older adults belong to overlapping systemically oppressed identity groups and developers or other stakeholders with power in the design process do not. However, another study showed how making assumptions about intersectional digital experiences is also problematic. Oudshoon et al. (2016) describe how designers designed based on stereotypical tropes at the intersection of older age and disability, using physical and social markers of older age rather than older adults’ feedback (Oudshoorn et al., 2016).

Collectively, these examples show how design is impacted by not considering the perspectives of older adults at the intersection of historically marginalized groups. These impacts can include design artifacts based on stereotypes or design that

hyperfocus on an aspect of one's identity that is less relevant to a particular digital context. We argue that an intersectional lens on design can mitigate these harms.

Reflection

In this section, we discuss how we can better confront and transform aging and design with a strong intersectional perspective. We begin by reflecting on how well the HCI community has incorporated intersectionality in aging research. We end by suggesting counterproposals for intersectional aging research that better incorporate intersectionality throughout the research and design process.

Current State

The research we summarized throughout this section extends research on considering older adults as a heterogeneous demographic in the research and design process, calling for more attention to marginalized identities that intersect with older age. However, much of this work highlights how studying intersectionality and older age is uncommon. Specifically, most research on intersectional aging experiences focuses on how age intersects with one other identity (i.e., disability, race, socioeconomic status) rather than multiple identities (e.g., disability, race, *and* socioeconomic status). Additionally, this work tends to focus on disability, race, *or* ethnicity. We argue that to be truly intersectional in the technology design process means considering (1) how the intersection of multiply marginalized older adults experience the world and (2) intersecting structurally oppressed identities beyond disability, race, and ethnicity.

Counterproposals

In this section, we draw from how intersectionality and older age are currently discussed in HCI, disability studies, and aging research communities to offer counterproposals to framing research, conducting research, and designing artifacts for older age.

Framing Intersectionality beyond Deficit

Earlier in this section, we discussed how researchers often frame narratives of older age and intersecting identities with deficit- or crisis-based arguments that motivate the research agenda (Light et al., 2016; Moffatt, 2013). Instead, we argue that the HCI community can include alternative narratives that focus on envisioning, creativity, interrogation, and transformation. Additionally, how might we frame research as designing for our future selves? We could also support older adults in designing for their future selves, particularly younger older adults (e.g., ages 60-65). For older older adults, we could frame research with how they would design for future generations of older adults.

Another narrative might include one of generativity, as we discussed in the prior section "Older Adults and Technology Use." Similar to assets, strengths, or joy-based approaches in community-centered work (To et al., 2023; Wong-Villacres et al., 2020), researchers could frame new lines of inquiry that ask how systems might provide older adults with space to be generative or creative. Examples of this include older adults being shown as makers and creators in makerspaces and crafting communities (e.g., Carucci & Toyama, 2019; Kalma et al., 2019; Lazar et al., 2021; Rogers et al., 2014). Much of this work contrasts older adults as passive contributors to being active contributors to physical spaces. As such, another narrative might ask how research can illuminate the realities of current experiences, or dispel harmful tropes about older age (e.g., Anderson & Vyas, 2022; Lazar, Brewer, et al., 2021). However, as in the prior section, we caution researchers from solely framing aging through a generative lens as this risks a form of reverse-ageism, in other words, framing older adults research in HCI as what they might contribute towards future generations. In doing so, valuing passivity as a rightful alternative narrative becomes lost.

Reflecting on Demographics When Studying Older Age

Reviewing how researchers collect and report data about older age and identity shows that intersecting identities are rarely reported, and are not reported consistently (C. N.

Harrington et al., 2023; Park et al., 2021). An obvious counterproposal to this would mean encouraging researchers to be more inclusive when recruiting participants and more transparent in reporting participant demographics. This transparency might align with a model cards or datasheets approach in machine learning where researchers would detail the existing sample *and* describe limitations and what demographic details are excluded (e.g., Gebru et al., 2021). For example, HCI researchers might report demographic data about age and ethnicity, but describe how a limitation is excluding (or not collecting) data about disability. However, the research community has differing opinions on the appropriate amount of participant detail in project reporting. Describing factors such as one's age, gender, *and* disability can have negative privacy implications, particularly if a paper/presentation includes location information of the authors or community organization from which participants were recruited. Additionally, some identity categories (e.g., race, ethnicity) may not be historically appropriate depending on the region (Y. T. Chen et al., 2023; Kaneshiro et al., 2011).

As such, we propose not only being transparent but also justifying why older age and other identities matter when reporting intersectional demographic data. Similar to questions one might ask about why/how to include race and ethnicity (Y. T. Chen et al., 2023), questions researchers might consider when considering intersectional data collection and reporting might include:

- What demographic characteristics am I including? Why? How might the intersection of these characteristics impact use/non-use?
- How can I describe intersectional demographics while preserving privacy?
- What demographic characteristics am I excluding? Why? How might these characteristics impact use/non-use?

These questions could also be useful before starting recruitment and when initially planning the research study.

Designing Considering Identities and Impacts of Oppression

We offer counterproposals to avoid designing for a singular aging experience. Human-centered research and design are central to HCI as a field, but this can too easily lead to asking older adults for feedback on an artifact after it has been designed. Instead, we encourage researchers to be attentive to how identity might impact system design. Rather than ask “How usable is my system?”, researchers can observe what older adults currently use. What works well? How do their identities impact (non)use and general attitudes toward technology? Rather than adopting stereotypes about one image of older age in the design process (Neves et al., 2023), we also propose more meaningful involvement from developers and other technology stakeholders in research. How might developers be included in design workshops and focus groups with older adults?

Lastly, an alternative narrative central to core tenets of intersectionality could ask how might we use design to transform oppressive *structures* that affect older adults at the intersections. For example, how might research outcomes inform discriminatory housing, employment, or healthcare policies that affect older adults from historically oppressed identity groups? Similar to emerging empathy training tools to mitigate racial discrimination (Roswell et al., 2020), how might research support older adults in identifying intersectional structural ageism? Taken from Crenshaw’s call for intersectionality to also spark “social empowerment and reconstruction” (Crenshaw, 1991), interrogating change would be a counterproposal to deficit-oriented narratives of oppressive systems.

5 Older Adults and Care

Overview

In the context of health and older adulthood, **the HCI community faced critique during the critical turn for positioning older adults as chronically ill, passive recipients of care, and a burden on the healthcare system** (Rogers & Marsden, 2013, Durick et al, Vines, Pritchard, et al., 2015b, Carrol et al 2012). With this positioning, only younger generations were seen as potential caregivers, and care was seen as simple to deliver and therefore easy to support with technology. These assumptions have prompted important research; however, they neglect the complexity of the directionality of care and older adults' active role in receiving *and* offering care. Oversimplified views of care and the stated urgency of the caregiving crisis may have led to technologies that seek to make caregiving easier, but in practice create friction due to being designed for simplified versions of complex and collaborative contexts.

This section will describe HCI research that draws on feminist research and gerontology to show the complexity of care and aging. Care is not a simple service to deliver from an active carer to a passive care recipient. New technologies do not seamlessly fit into existing care practices, but require careful integration and new routines. And, people do not simply receive an intervention, even interventions that seem to have a simple role for a user (e.g., to wear a fall pendent around their neck). Rather, the recipient of a care technology shapes the use and meaning of a technology.

This section describes research that respond to care myths about older adults: that older adults are as a whole socially isolated, lonely, and ill (Rogers & Marsden, 2013, Durick et al.) **and chronic care recipients who burden the healthcare system** (Vines, Pritchard, et al., 2015b, Carrol et al 2012). We describe examples of how HCI researchers have pushed back on these myths in three ways. First, researchers have shown how older people are not only recipients of care, but engage in care work themselves. Further, studies have revealed how caring for older adults is collaborative and can include multiple kinds of roles and relationships – and,

older adults are active participants in this collaboration. Finally, researchers are showing that assuming older adults passively accept care technologies does not match how people appropriate technologies to better match their needs.

This section begins by characterizing care and caregiving using descriptions from HCI literature that include older adults and other groups. Then, we situate the focus on older adulthood and care by describing the dominant logic that drives much technology research, and how feminist and political theory has structured HCI arguments that push back on this narrative. We then describe how HCI researchers are challenging dominant narratives of care. We end by reflecting on opportunities for counterproposals.

Defining Key Terms

What is Care and Caregiving?

To distinguish between different kinds of care and caregiving, researchers have often adopted the widespread practice of framing unpaid family members and other social contacts as "informal caregivers," and paid workers as "formal caregivers" (Piper et al., 2016; Soubutts et al., 2023; A. L. Toombs et al., 2018). Toombs et al., however, note the blurred boundaries between these two categories, for example when people self-organize to provide for the basic needs of those in their community (A. L. Toombs et al., 2018). Applebaum argues that describing family and friend caregivers as informal is damaging in that it understates the significant responsibilities that these caregivers take on (Applebaum, 2022). And as recognition grows for the enormous amount of value family caregivers provide to their countries, some programs provide financial compensation (e.g., State policies in the United States (Miller et al., 2022)) – meaning that defining informal caregivers as "unpaid" will not be an adequate distinction.

Care work has been defined broadly as "the maintenance of people, environments, and communities" ((Glenn, 2012), citing (Karusala et al., 2021a)). The specific kinds of work involved in care for older adults have been defined for computer-supported cooperative work researchers by Bratteteig and Eide (Bratteteig & Eide, 2017). Their work extends past categorizations (Corbin & Strauss, 1985) to describe seven types of work in which

homecare workers and other members of the care network engage as they work with clients (Bratteteig & Eide, 2017). We describe each of these below to offer a sense of the breadth, complexity, and skill involved in caregiving:

- Illness work - having to do with the treatment of a condition and prevention of acute event
- Everyday life work - daily, weekly, and seasonal tasks, such as household chores
- Biographical work - coming to terms with an illness as part of one's life trajectory or biography
- Information work - gathering, processing, and selecting relevant information for that day's work
- Discretion work - exhibiting consideration, respect, and sensitivity during support for the intimate activities that are often a part of homecare work
- Relation work - creating good relations with the client and their family
- Life-changing work - supporting clients in accomplishing tasks required for living independently in their homes, and helping them come to terms with their needs for support in doing so
- Articulation work - coordinating tasks and services and filling the gaps between them

While care is often thought of as in the context of healthcare, researchers in HCI have drawn attention to the ways that everyday interpersonal or social care has often been neglected (A. L. Toombs et al., 2018). This framing of smaller care acts paves the way for findings related to how older adults contribute to each other and their society described further in this section.

It is important to note that care roles and care work for older adults vary tremendously regionally and culturally. This is reflected in work in HCI, though more is still needed to understand care in different contexts. For example, one study provides background that it took place in Norway, where homecare was a free service organized by the municipality (Bratteteig & Eide, 2017). Other research situates itself in a collectivist Latin American context where family obligation is stronger, and children are primary caregivers rather than paid homecare workers (Gutierrez & Ochoa, 2016b). Studies of

caregiving platforms and technologies in the United States provide context by discussing a startup culture of “disruption” (Lazar et al., 2018) as well as the industry of for-profit services for older adults (Rudnik & Brewer, 2023). The political economy and societal beliefs deeply impact how care is offered and received.

Why Older Age and Care?

Researchers frame much research on older adults with statistics about the growing number of older people – and the widespread shortage of caregivers. High care costs are brought up, and technology is introduced as a way to reduce the financial impact of our imbalanced care landscape.

However, researchers, including in the field of HCI, are showing how the story is much more complex. For example, researchers are coming together to argue how the latest technologies being used in care work for different populations, such as gig work platforms and AI tools, do not solve old problems in new ways (Karusala et al., 2021a). Rather, these “novel technologies are reproducing the logics that devalue caring labor and justify a lack of care infrastructures for marginalized communities” (Karusala et al., 2021b). To make these points, researchers are drawing on political and feminist theorists such as Joan Tronto and Maria Puig de la Bellacasa. This includes researchers studying technology for older adults, as we describe further below.

Older Adults and Care in HCI

Below, we describe how HCI researchers are pushing back on the myth that care is simply delivered from a younger person to an older one. Researchers are showing how older people are not only recipients of care, but also engage in care work themselves. Studies are revealing the extent to which caring for older adults is collaborative and involves different roles. And, research is showing the ways that older people appropriate and react to care technologies rather than receiving them passively.

Older people are also providing care

In 2013, an *interactions* article titled “Older-adult HCI: Why Should We Care?” argued that

> “... it is important to acknowledge that older adults are not solely care recipients… older adults today are healthier, better educated, and more financially secure than any group of elders before them… As such, they have more time and energy to devote to their families, and correspondingly require less financial or care-giving support from younger generations, or require it much later. Although relatively little research has explored how technology can harness the abilities of older adults to provide support, some projects have indirectly begun to touch on this” (Moffatt, 2013).

This perspective and other work in HCI paved the way for the work we describe in this subsection, particularly through findings that pushed back on the dominant discourse of older adults as solely care recipients, and young people as solely caregivers. This early research often happened in the context of smart home and distributed technology research in the first decade of the 2000s. For example, a 2003 study deploying technology probes with multigenerational, distributed families showed the need for coordination in families – including between grandparents and parents to provide childcare to the youngest generation (Hutchinson et al., 2003). Other work showed how older people were reciprocally caring for each other (Riche & Mackay, 2010). Lindley et al.’s 2008 paper formalizes some of the emergent findings at that time in a paper summarizing themes from gerontology, HCI, and Human Factors. They reveal how gerontology researchers have found that in contrast to dominant assumptions, older adults are often involved in (or prefer to be involved in) asymmetrical rather than reciprocal relationships with their younger family members (Lindley et al., 2008b). This does not mean that they do not receive support from their family, but rather that they prefer to be giving more than they are receiving, whether through financial support, home maintenance, or caregiving for grandchildren (Lindley et al., 2008b). Further, when older adults are in care configurations where they are primarily on the receiving end, their self-efficacy and even self-worth can be damaged (Lindley et al., 2008b)). These findings from gerontology were found to be consistent with HCI and human

factors papers that have deployed monitoring technologies, where “elders seem to be more interested in the goings-on of their children than vice versa.” (Lindley et al., 2008a).

Researchers have since turned their attention to studying older caregivers, which challenges the assumption that it is always younger people providing care for the older. This important research includes examining caregiving experiences (Schorch et al., 2016), including how people seek social (Tixier & Lewkowicz, 2016) and caregiving support (L. Li et al., 2023). This research is motivated by explanations that this often overlooked group of older caregivers may use or prefer to use care technologies differently than younger groups.

Older adults are caring for others across a range of relationships and mediums. Brewer et al. show how older adults’ social media use, often framed as passive (“lurking”) involves care work (R. N. Brewer et al., 2021). This includes older adults refraining from interacting with controversial content online, such as political posts, and using other mediums, such as phone calls, to discuss that content. That is, what is considered to be passive social media use actually can include intentional acts of caring (R. N. Brewer et al., 2021). Nurain and Chung’s study of how older adults keep track of information describe how older adults in their study were motivated to track in ways that involved caring for others (Nurain & Chung, 2023). This included examples such as marking medications to support caregiving for a spouse as well as recording the process of raising caterpillars to share with others as a kind of volunteer work (Nurain & Chung, 2023). These papers show how older adults are motivated to care not only for close family members, but for their broader communities.

Researchers are also showing how care receivers and care providers are not static categories. Nurain et al. describe how older adults would shift between these different roles during the pandemic (Nurain et al., 2021a). In particular, they describe how older adults provided tangible and emotional support to those they perceived as older and more vulnerable than themselves as well as young family members, peers, and their

local community. They conclude by recommending “considering older adults as resources instead of physically vulnerable individuals during the challenging time of the pandemic” (Nurain et al., 2021b).

Another way traditional conceptions of caregivers and care recipients, and the relationship between them, are being challenged is through the concept of interdependence. Extending the early work described above that shows that older adults may yearn to care for younger people and be cared for, Soro et al. introduce an interdependence lens to research with people receiving care. Their work pushes back on a landscape where independence is associated with minimal care from others. They show how older people in their research would talk about independence, but not in ways where they were trying to “sever the bonds that one person has to their carers” but rather to “try to level the power imbalance of dependency” (Soro et al., 2019). Their recommendation for technologies for vulnerable populations was to let go of striving for independence in terms of eliminating dependence on others for care. Rather, researchers can design for interdependence and richer relationships (Soro et al., 2019).

The research in this section calls attention to forms of care work older adults are engaging in that have been rendered invisible in the past. This includes how Brewer et al. describe older adults’ online (in)visibility and how it can be understood through feminist theories of care (R. N. Brewer et al., 2021). The authors draw parallels between the ways older adults’ online behaviors have been viewed as passive and the ways that older adults have been seen as passive recipients of care (R. N. Brewer et al., 2021). Nurain et al. situate their counter-narrative to portrayals of older adults as wholly vulnerable in the face of Covid-19 in gerontology research that uncovers the often unacknowledged, but vital, roles that older adults play in society (Nurain et al., 2021a). And an interdependence lens, as employed by Soro et al. (Soro et al., 2019), shows how people framed as receiving assistance or care are actually actively contributing to accomplishing shared goals *with* the individuals framed as providers of care/assistance (C. L. Bennett et al., 2018).

Care is Collaborative

Researchers are showing the ways that care for older adults is collaborative, including how formal and informal caregivers take on different kinds of roles. These roles require significant collaboration between different kinds of caregivers – as well as collaboration with care recipients. Here, we summarize HCI and CSCW research that describes the different roles caregivers (and care recipients) play, and the coordination work that takes place between these parties.

The complexity of care is evident in studies of paid care workers. One example in the context of formal care comes from Procter et al.'s research with four telecare call centers (Procter et al., 2016a). These call centers provide 24-hour care when pendant alarms (devices worn by clients to detect or provide a way to call for help during emergency events such as falls) are triggered. Through analyzing a number of extracts from their fieldwork, the authors show how the workers who take calls in the call center are doing a tremendous amount of coordination and collaboration. The workers are coordinating with a client in addition to their managers, colleagues co-located in their call centers, healthcare workers such as general practitioners or emergency service providers, family members and friends of the client, and employees of the clients' residences where applicable (Procter et al., 2016a). The authors conclude that telecare work is not a replacement for in-person care, as is traditionally assumed. Rather, these workers draw on their deep knowledge of clients and a trusting relationship that they build to "act as the 'glue' providing the all-important link between otherwise fragmented services and networks" (Procter et al., 2016b).

Similar levels of complexity have been found for informal caregivers such as family members. In a study of family caregivers in Latin America, Gutierrez and Ochoa break down a number of roles that participants in their study played (Gutierrez & Ochoa, 2017). They note that informal caregivers do not all play the same role for the people that they care for. Rather, they can include roles such as:

- Assistants, who live in the same residence and provide continuous and responsive monitoring, care, and assistance. Some of the work that assistants do can be invisible and overlooked.
- Monitors, who typically do not live in the same residence. Monitors maintain an awareness of older adults and may engage in support activities in coordination with the assistant.
- Helpers, family members, neighbors, or close friends who support lower effort, shorter commitment instrumental duties.
- Outsiders, who are family members who do not assume caregiving duties except when persuaded by others to do particular tasks over short time periods.

The authors analyze how these roles exist in a collectivist context where family members are the ones who are expected to and do provide significant support to older family members (Gutierrez & Ochoa, 2017). They also describe how, in their study, there was minimal coordination among these roles. This was due to a variety of factors, including demands on people's time and the tendency for conflicts to arise during attempts at coordination (Gutierrez & Ochoa, 2017).

Soubutts et al. provide a different breakdown of kinds of caregiving roles that they found in their UK context (Soubutts et al., 2021a). Like Gutierrez and Ochoa (Gutierrez & Ochoa, 2017), they account for roles of informal caregivers such as family members or close friends, but also include roles for the older adults receiving care as well as care from professionals. They argue for the importance of accounting for different roles by noting how much research on their topic (low-tech home modifications like stairlifts) focus on the primary user of the technology (i.e., an older adult). They show how different actors across four distinct levels have diverging interests. They build on past work to articulate four roles involved in each household's "unique care support around the stairlift". These four roles include the primary resident, who is the older user of the care technology; secondary residents, who can be spouse or other family members living in the household; tertiary residents (frequent visitors who provide informal care); and quaternary professional roles who assess needs for, install, and provide social support related to stairlift installation (Soubutts et al., 2021a). Further, like Gutierrez and

Ochoa (Gutierrez & Ochoa, 2017), the authors find that collaboration is key for researchers to consider – to the extent that they label stairlifts and other similar domestic health technologies as “collaborative and social” – but also that this collaboration can generate conflict (Soubutts et al., 2021a).

In addition to showing the complex and collaborative nature of care by demarcating different roles that caregivers and care recipients play and the coordination required accordingly, Hsu and Chung describe the invisible labor involved in the same caregiver shifting between different roles while caregiving for their older relatives or spouses (L.-J. Hsu & Chung, 2024). Individuals in this study had to manage roles which at times conflicted, such as when a role of a caregiver making decisions was at odds with the role of an obedient child. Roles that had to be navigated could also come from other commitments, such as being in school or as a spouse (L.-J. Hsu & Chung, 2024)).

Researchers are also challenging the notion that older adults’ self-care (the management of one’s own health conditions) can be seen as a solely individual practice. This includes in studies with people with progressive neurodegenerative conditions such as Parkinson’s Disease (Nunes & Fitzpatrick, 2015a; C. Tang et al., 2024) and dementia (Dixon et al., 2021; Hwang et al., 2020), where older care recipients may be considered even more as passive recipients than others their age. Nunes and Fitzpatrick’s fieldwork with participants over the age of 60 who had Parkinson’s as well as their carers revealed that “Patients and carers collaborate in every care activity that can be considered to be part of self-care” (Nunes & Fitzpatrick, 2015b). This finding has extended to older adults without a specific diagnosis, such as in a study that provides an in-depth look into care practices in Continuing Care Retirement Communities (residences that provide progressive levels of care from more independent living to significant assistance) (Caldeira et al., 2017). This work shows how health management comprises both self-care and collaborative care – and that these forms of care are interdependent. The significance of this is that the line between self-care and collaborative care can be blurry. They provide the example of how self-tracking, which is often seen as self-care, was often employed to share data with

clinicians– which would fall under collaborative care (Caldeira et al., 2017). These studies challenge design practices which design distinctly for caregivers or care recipients as sole users (Nunes & Fitzpatrick, 2015a) – it may not be possible to assign a given technology solely to one category or the other.

While papers show collaboration between older adults and those involved in care, the division of activities in this collaboration does not necessarily remain the same over someone's lifetime. This includes research with people with diagnosed conditions that are more likely to occur with age, such as Parkinson's Disease. Nunes and Fitzpatrick explain how as Parkinson's Disease progresses, people with the condition and their carers continue to collaborate. However, the division of care work is adjusted, with carers taking on more or different self-care activities for the person with the condition (Nunes & Fitzpatrick, 2015a). Caldeira et al.'s analysis of interviews with people who did not share any specific health condition, over the age of 65 and living in rural communities, resulted in a stage-based understanding of acceptance of aging in place technologies (Nunes & Fitzpatrick, 2015a). They argue that individuals are more accepting of technologies that provide more assistance when they require more care.

Together, work in this space shows that older adults' care is complex and involves different, collaborating roles. This collaboration is not always smooth – many of the papers in this section describe some form of tension, whether between different caregivers (Caldeira et al., 2017; Soubutts et al., 2021a) or caregivers and older adults, with older adults resisting perceived threats to their independence (Caldeira et al., 2017). We expand on this latter theme of how older adults navigate tensions that care technologies introduce in the section that follows.

Care technologies are not passively received

Researchers have challenged the narrative that technology is being delivered to a passive care recipient. A 2022 workshop called out this problematic trend of conceptualizing care as "being 'provided to' older adults" (Wilson et al., 2022a). With

this framing, “Older people are often passive recipients of technologies that tend to monitor or observe them from a distance, without enquiring about their rich experiences (their thinking and feeling on design which impacts them) or supporting them to shape these experiences” (Wilson et al., 2022a). The workshop positioned exploring older adults’ inner worlds and agency in the context of care technologies as pushing back on this problematic trend (Wilson et al., 2022b).

Researchers are examining the rich inner worlds of older adults to show how active technology acceptance actually is. The user of the technology does not passively receive it but rather emotionally comes to terms with it (or does not – for more on technology rejection, see section 2). One example of this rich inner world comes from Soubutt et al.’s work on the adoption and impact of stairlift installation (Soubutts et al., 2021a). They describe the emotional experiences of participants in their study, which participants had to consider over the course of accepting the home modification of a stairlift installation. This included:

- Attachment to the home as it was - people must come to terms with modifications that will change the layout of the home or sometimes damage that occurs during installation
- Concerns about what others would think about the technology in their home – affecting decisions to accept the technology
- Adopting a stairlift signifies having needs or a health condition that is a certain level of severity that they prefer not to have – the physical presence of the stairlift in the home would serve as a continuous reminder of something that they might not want to accept

The authors draw out these inner experiences to show how the journey to acceptance and adoption of this care technology is not as simple as care providers initially told them (“beginning with a request being made to the city council and ending with a stairlift installation” (Soubutts et al., 2021b)). Rather, the user plays an active role in negotiating, being negotiated with, and coming to terms with the changes that this technology brings to or signifies for them (Soubutts et al., 2021a). Other research shows how more high-tech or ubiquitous technologies similarly are received with rich emotion.

This includes tracking technologies being more (negatively) emotional for older adults than younger ones due to their similarity to a medical device (Vargemidis et al., 2021) and monitoring systems being seen as discouraging due to their focus on deficit and decline (Caldeira et al., 2017; D'Haeseleer et al., 2019).

The above examples show how HCI researchers are highlighting the agential ways that participants navigate the introduction of care technologies. Rather than passively receiving a given technology, participants let them in (or keep them out) with complex inner experiences and evolving thought. Other research that challenges the assumption of care technology recipients as passive shows how people transform care technologies that are not satisfying to them into ones that are. Lazar et al. revealed how older adults engaged in tactics to try to get more symmetrical relationships with healthcare workers that were operating a remote homecare technology (Lazar et al., 2018). Another study uncovered the ways that everyday things and technologies were used, and misused, towards a design approach that moved away from seeing older adults as frail and passive. An example in this paper includes someone utilizing a smart bracelet – given to them by their son to keep them safe – as an object to jam closed a cupboard that tended to open on its own (Nicenboim et al., 2018). Other research, including in Science and Technology Studies, has further unpacked how older adults make care technologies work for them, often in ways that deviate significantly from designers' intentions (López Gómez, 2015), (Finken & Mörtberg, 2014).

Reflection

Current State

The research in this section challenges the myth that care is simply delivered, and from a younger caregiver to an older individual, in three ways. First, research shows that older people also provide important care work, whether to other older people such as spouses or to their larger communities and society at large. Second, care is collaborative, involving people in different roles and requiring significant coordination

between these roles. Those involved in care include healthcare professionals, family, and friends, but the individual who is often termed the care *recipient* also has active roles to play in the care collaboration. Finally, research is showing how care and care technologies are not simply delivered to a passive older recipient. Rather, the older person actively responds to the presence of a care technology, whether through navigating the emotions associated with adoption and use or the adjustments to make the technology work for them. In dispelling these myths, researchers are showing how boundaries are blurry between the distinctions of formal and informal caregiving, self-care and care from others, and how people may move between different caregiving roles or the categories of care giver and recipient. This work has been essential for re-orienting researchers in a space that is of great interest to government funders, industry initiatives, and public interest. There is a need to continue to recognize and support older adults' active role in coming to terms with care technologies, look into and work on societal issues in the caregiving space, and also to consider whether the framing of a care crisis is necessary or appropriate at all. We discuss these directions further below.

Counterproposals

Recognize the work involved in adopting and using care technologies

While technology is often heralded as a way to address issues associated with caregiving, researchers are showing how care technologies themselves introduce new forms of work. For example, the process of coming to terms with needing an assistive technology as described in this section can be understood as emotional work. Soubutts et al. detail additional forms of work that they found in their research in five households which each included an individual age 60 or over with chronic conditions before, during, and after the adoption of smart home technologies (Soubutts et al., 2023). In addition to emotional work, they detail how the introduction of smart home systems created or shifted work related to learning and setting-up systems as well as maintenance work, interaction work, data work, and care work.

Technologies are continuing to be developed and rolled out to support caregivers and care recipients, including at national scales. To be more judicious and realistic with these large-scale technology initiatives, we need to continue developing our understanding of the impact of new technologies in terms of the new forms of work that they generate and the existing forms of work that they shift.

Understanding the work that these new technologies necessitate can also help us design technologies that minimize unwelcome forms of work. For example, emotional work has been perhaps most well studied of the different forms of work that new technologies engender. In Soubutt et al.'s study, this dimension included anxiety management for a caregiver who had to intervene to make sure her spouse was not concerned from continuing to see a dashboard that featured data on his health condition (atrial fibrillation) collected from smart home sensors (Soubutts et al., 2023). Brewer examines how end users themselves responded to standard approach of tracking and monitoring older adults' negative health indicators such as falls or irregular heartbeats, noting that older participants preferred more "positive, strengths-based forms of health data" (R. N. Brewer, 2022). By understanding these reactions, Brewer was able to show that people wanted positive and relational health representations – offering future directions for design (R. N. Brewer, 2022). At times, studying emotional work opens up thorny research questions, such as how to design data visualizations for older adults' who may benefit from comparing their activity levels to others less active than them – without reinforcing internalized ageism that prizes the active older adult (Caldeira et al., 2023). There is much future work needed to tackle the research questions that open when we take seriously the emotional work that technologies can necessitate.

The other forms of work that new care technologies introduce for technology recipients have been less well studied in HCI (this topic may be better studied when it comes to the impact of work on caregivers, e.g., (Vines et al., 2013; Waycott et al., 2022)). The full range of impacts on and changes to the routines of older adults with the introduction and adoption of care technologies are important to study. HCI research can carefully unpack the work new technologies necessitate, which may lead to fruitful collaborations

with Human factors and research which bring complementary expertise in designing instruction and training to support older adults' work in navigating new technologies (e.g., (Czaja & Sharit, 2017)).

The research cited in this subsection that unpacks work introduced by care technologies reference feminist perspectives, whether to note the gender imbalance in caregiving and associated labor in their findings and society at large (Soubutts et al., 2023), offer alternatives to current representations of older adults' data (R. N. Brewer, 2022), or draw inspiration to frame a research problem (Caldeira et al., 2023). The following subsection further argues for the importance of feminist perspectives in this space.

Framing societal issues in caregiving

While we center the older care recipient in this review of HCI research, their experience is invariably impacted by issues that affect the caregiver. And these are immense. For example, in the United States, care workers such as nursing home aids are underpaid and minimally trained, and frequently dissatisfied with their jobs (Berridge, 2012a). This role is ranked as one of the most dangerous jobs but with few benefits that recognize that (Berridge, 2012a). Berridge argues that "a one-dimensional concept of care work as gendered masks the racial division of labor" (Berridge, 2012b). In other words, focusing only on gender discrimination to explain issues in how caregivers are treated neglects how oppression of marginalized racial groups is clearly involved. Thus, intersectional feminist perspectives are necessary to include the ways that oppression by gender, race, and class, among other characteristics, affect our care landscapes (Berridge, 2012a).

Currently, HCI researchers are responding to these issues broadly (considering populations aside from older adults) through calls for further work and building communities of researchers (Karusala et al., 2021a; A. Toombs et al., 2018). Specific research on caregiving for older adults is also fostering our ability to address societal issues by studying how care is enacted in practice. This has included utilizing a care ethics lens to understand how aged care staff create an environment where residents

can use virtual reality (Waycott et al., 2022) and understanding how moral frameworks are used to give meaning to metrics, algorithms, and organizational practices involved in technology platforms that coordinate and manage care workers (Rudnik & Brewer, 2023). Further work in this vein may yield an understanding of how to design with an awareness of, and ideally address, some of the societal issues in our caregiving landscape.

Questioning the care crisis framing

The third counterproposal problematizes the premise of much of the work described above. That is, that the "care crisis" is not to be taken for granted but can be understood as a specific framing that paves the path for certain kinds of decisions to be made. The narrative that traces the world aging population and too few caregivers to the care crisis – widely used to situate research with older adults in HCI and other fields – is not as stable as it appears: 'By naming something, we create its existence. Without thinking and language, the care crisis would not be visible as a political problem' (p 20, Dahl, 2022, cited in (Cozza, 2023)).

Neven and Peine in Science and Technology Studies describe how a crisis account of aging, which invokes the impossibility of any healthcare system or budget coping with the enormous number of aging people, paves the way for technology to be framed as savior (Neven & Peine, 2017). In this dominant rhetoric, technology innovation yields three winners: society, through significant reduction of care costs; older people, due to better quality of care; and the economy, with exportable high-tech and associated jobs (Neven & Peine, 2017). They argue that in reality, there are real downsides to the care crisis framing. This includes in legitimizing technologies that may not actually be needed and relying on a deficit-centered view of older adults. Further, the users of the technologies are able to sense who the intended user is (a frail person) and are likely to reject it (Neven & Peine, 2017). Questioning the crisis of care framing may lead us out of some of the places we have found ourselves in terms of the deficit-centered nature and perception of care technologies.

6 Conclusion

This monograph is our assessment and interpretation of the literature on older adults in Human-Computer Interaction that constitutes and responds to what we have labeled the critical turn (~2013-2015), up to the present. This body of work responds to the critiques about how HCI research too often considered older adults to be a technologically incapable, homogenous group with simplistic care needs that could be delivered to a passive recipient through technology. Our focus on the literature from this time period does not mean that every argument made during the critical turn was new to the field, or to discredit the research that has come before. Rather, the goal of this monograph was to present a cohesive account of the trends we have found to be notable in our research space over the past decade.

Across the chapters, we note where more work is needed to point to future directions for research. Here, we offer a final set of reflections and recommendations, synthesized across the different focus areas that we reviewed.

After the critical turn, researchers hastened to buck stereotypes of older adults, showing the ways that older adults were in fact active and capable technology users. This opened up an alternative way of viewing the older adult population – as a contributing, vital group rather than a deficient burden. This is visible in each chapter- in a recognition of older adults as active technology contributors (section 3), the importance of intersectionality beyond deficit or crisis and towards expression, generation, and contribution (section 4), and that older people are caring for others and cleverly appropriating care technologies (section 5). This work has been vital to challenge stereotypes. In our view, this research has been effective, to the extent that we posit that describing older adults as using a new technology contrary to what people might assume is no longer a substantial contribution. Much more work, however, is needed to advance our understanding of and counteract other harmful discourses of aging. This includes:

Framing aging beyond vulnerability and crisis. One of the important roles of HCI research in spurring social change is drawing attention to longstanding problems it is being brought in to solve (Abebe et al., 2020). This includes continuing to uncover harmful discourses of aging, and in particular, grappling with the “othering” that seems to be tied to working with a “subpopulation”.

Nuancing and going beyond use/non-use. If we can recognize that people vary in their technology use, and these differences matter, then we need language to talk about these differences. However, it is delicate to do so without slipping into deficit mode. More work is needed to bring nuance to how to talk about and work with older adults who are not part of the early adopting or proficient group (e.g., discussed in sections 2 and 3). In addition, only studying use and barriers to use means that we are only recognizing “using” or “trying to use” as valid states. This means that our research will be focusing on, for example, the push to help older adults integrate better with an increasingly digitized society – rather than questioning this shift or understanding where there are areas to push back. Design considering a range of identities in this way may be key to designing to transform oppressive structures

Acknowledging the work involved in older adults' tech experiences. Not taking digitization initiatives or technology interventions as inevitable also requires showing the work involved in adopting technologies. Just as has been shown in other technology research, technology often shifts work rather than replacing it. Keeping the focus on who is doing this work and what it looks like (and who it excludes) will help erode the narrative of cost saving and seamless technology that drives many initiatives.

The full complexity of this research space cannot be captured in a single monograph. Above all, what the critical turn has done for the field is to demonstrate that age interacts with technology in ways we are only just beginning to get a handle on. What we intend is for this overview to provide a sense of the directions of a rapidly maturing field and an informed perspective on where we may be heading.

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