Today’s elders are technogenarians; that is, science and technology are integrated into the everyday life experience of old age (Joyce and Loe 2010). Science and technology are major forces in the social construction of ageing, and ageing is an often unacknowledged component of technoscientific imagination and practice. Joyce and Mamo’s (2006) call to ‘gray the cyborg’ asks scholars to critically examine the relationships between science, technology and ageing. This chapter focuses on two cases—pharmaceuticals and ambient assistive technologies—to explore how cultural contexts shape these technologies and how these technologies in turn shape the culture and experience of ageing. The chapter highlights the global north, in part because this is where the percentage of old people over 65 already does or imminently will account for 20% of a nation’s population (Kinsella and He 2009) and because this has been the focus on social science research published in English.

Social scientists have long recognized the centrality of biomedicine in defining ageing, with pharmaceuticals as a primary intervention of science and technology in elders’ lives (Loe 2004, Marshall 2010, Williams et al. 2012). In the European Union, North America and Japan, the potential markets and challenges of ageing populations are inspiring new technological development aimed at elders and their caregivers. Nations, industries and universities are investing significant resources to develop technologies that manage ageing bodies and minds.

Five cultural themes emerge from the literature on science, technology and ageing: medicalization, ageism, the desire for control, social inequality, and understandings of independence. This chapter introduces these cultural contexts as they relate to gerontechnologies, and then critically analyzes them in relation to pharmaceuticals and ambient assistive technologies. Technogenarians remain central to the analysis by examining how they reify, re-appropriate and resist cultural assumptions about old age in their use or non-use of technology.

Cultural contexts

Medicalization of ageing

Medicalization, or the process by which non-medical processes are defined as medical problems, creates new definitions of health and expectations of normality and markets (Clarke
et al. 2003, Conrad 2007). As part of this trend, more and more aspects of ageing are defined as disease or pre-disease (Estes and Binney 1989). The line between normal ageing and disease is further blurred as anti-ageing medicine and paradigms of successful ageing challenge previously accepted ideas of the normality of decline in old age (Fishman et al. 2008, Mykytyn 2008, 2010). With new definitions of ‘natural’ ageing in circulation and social norms that legitimize medical intervention, the possibilities for biotechnologies of enhancement become a moral matter where ageing requires intervention.

Ageism

Ageism is discrimination against old people and ageing; it takes place in social structures and institutions (Calasanti 2003), as well as on a personal level through internalization and interactions (Brooks 2010). Ageism acts on stereotypes of old people as frail, lonely, dependent, and technologically illiterate (Loe 2010). Hegemonic ideas of ageing make these stereotypes and the stigmatization of the old seem natural and taken for granted. Critical gerontologists challenge this by highlighting the historical and cultural specificity of current forms of ageism.

Of particular interest to social scientists are the recent trends of anti-ageing medicine and the cultural narrative of ‘successful ageing.’ While these paradigms of ageing resist many of the negative stereotypes associated with old age, they also encourage ageism by reifying the undesirability of old age. Furthermore, they make it an individual’s responsibility to actively resist growing old through technology use. With old age framed as a techno-scientifically mediated choice, old people who do not resist signs of ageing or do not have the means to resist may experience more intense ageism (Brooks 2010).

Control

The desire for control may be understood through Foucault’s (1977) thesis on biopower, which identifies the body as a primary site of social control, and through theories of technocracy, where all authoritative knowledge is reduced to rational technoscientific understanding (Reynolds 1991). The desire to manage the body through science and technology can be traced back to Descartes and the elevation of mind over body where a project of mindful, calculable control aims to organize the chaotic sensuous world. While these ideas have existed for centuries, recent advancements in biomedicine and technology increase the possibility for technoscientific interventions that aim to dissect, separate, and control nature, or in this case old bodies and ageing (Romanyshyn 1989). These interventions take place in a context in which old people are particularly vulnerable to surveillance and control. For example, old people may have caregivers who are granted decision-making power over the types of interventions old people are given. The issue of control is also important to old people themselves, who struggle between the desire for autonomy and the confidence of safety. The fear and denial of death doubly contributes to a desire for control of the body as one approaches life’s end.

Inequalities and the intersection of difference

While ageism and technocracy affect the entire population, the implementation and effects of technologies vary across differences such as gender, race, nation, class and sexuality (Calasanti and Slevin 2001, Joyce and Mamo 2006, Kinnunen 2010). The intersection of ageism with difference produces unique local embodiments and meanings. An examination of inequality, intersectionality and gerontechnology is important for locating vectors of power in the process.
of technology creation, use and meaning. Critics argue that intended users are often narrowly assumed to be white middle-class heterosexuals with disposable income and the desire to defy old age (Calasanti and King 2005, Mykytyn 2010). Those who are structurally or culturally marginalized by hegemonic ideals face consequences of seeming inferior, cast as ‘old’ in a negative light, or blamed for their ‘decline.’

**Independent or interdependent?**

Gerontechnology is often designed for the isolated atomized individual as opposed to an individual interconnected in a community. This perspective locates solutions at the individual level rather than the social or structural. The focus on individual solutions takes place within a broader philosophy of liberalism that ‘holds that individuals have an intrinsic inclination towards self-sufficiency and separateness,’ rather than focusing on the health and wholeness of communities (George and Whitehouse 2011, 592). Research that focuses on elders’ use of technology reveals more socially bound meanings, suggesting a mismatch between designer and user understandings of independence and interdependence in old age.

**The case of pharmaceuticals**

The pharmaceutical industry is central to the biomedicalized construction of ageing. While early theorists viewed physicians as the primary drivers of medicalization, today the pharmaceutical industry is crucial to the creation and definition of disease through its dominance over clinical research and scientific scholarly knowledge, direct-to-consumer advertising and lobbying power (Bell and Figert 2012, Conrad 2007, Hawthorne 2005). Pharmaceuticalization, or the ‘translation or transformation of human conditions, capabilities and capacities into opportunities for pharmaceutical intervention,’ often works in tandem with medicalization, but it has the potential to reach beyond it (Williams et al. 2011: 12). The expansion of the pharmaceuticalization of old age occurs through various mechanisms, such as lowering the diagnosis thresholds for conditions such as osteoporosis (Welch et al. 2012), expanding the terrain covered by cognitive enhancement (Williams et al. 2012), the creation of completely new pathologies such as erectile dysfunction (Conrad 2007, Fishman 2007, Loe 2004), and by transforming normal life experiences into ‘undesirable,’ but ‘manageable’ states such as menopause (Bell 1987, Utz 2011).

The expansion of pharma’s role in defining life’s problems is confounded by what Courtney Everts Mykytyn (2010) calls the ‘culture of liberation,’ whereby individuals liberate themselves from undesirable social or biological forces. This ultimately leads to a ‘culture of perfectibility’ where people have the freedom and responsibility to pursue consumerist solutions to health problems, including the spiritual, emotional and physical dynamics of life. In the context of ageing, these ideas overlap with ageism and the pharmaceuticalization of old age to make pharmaceutical consumption a ‘personal health responsibility.’

Ageing individuals are bombarded with messages about how to use pharmaceuticals to discipline their bodies to alleviate disease, manage risk and produce optimum functioning. New pharmaceutical interventions change norms of old age, and old people are expected to live up to new expectations of virility and youth. While some old people find the societal expectation that one should extend youthful capabilities and characteristics into old age empowering, others find that it encourages feelings of guilt for not managing their old age in the ‘right’ way (Brooks 2010, Calasanti and King 2005). This particular ‘pharmaceutical imagination’ views the world from a certain race, class, gender, sexuality and age lens, which has potentially oppressive consequences for those on the margins (Calasanti and Slevin 2001).
Researchers analyzing the pharmaceutical imagination highlight the shifting representations of old age as new biotechnologies hit the market. Calasanti and King (2005) find that media representations of masculinity in the United States changed with the introduction of erectile dysfunction drugs and anti-ageing ‘virility’ therapies. In the 1990s, old men in the media were portrayed as loving grandparents who enjoyed old age as a time to relax from gender role expectations and express feminized characteristics of sentimentality and care. By the 2000s, the ideal emphasized ‘playing hard’ and ‘staying hard,’ where old men must endlessly maintain a hyper masculine youthful vigor grounded in ‘male dominance and physical prowess’ (Calasanti and King 2005, 10).

Sociologists also investigate how the pharmaceuticalization of erectile dysfunction is shifting sexual norms in old age (Calasanti and King 2005, Loe 2004, Marshall 2010). Loe (2004) argues that the ‘Viagra phenomenon’ reduces sex to penile performance, then equates penile performance with masculine identity, where a man’s self-worth and social standing are reduced to the hardness and sustainability of his erections. Viagra is an early example of a blockbuster anti-ageing drug that exemplifies the ‘medicalization of discontent,’ wherein complex socio-psychological problems are reinvented as simple medical conditions. Loe shows how, in order to create the market for Viagra, impotence is reinvented as erectile dysfunction and frigidity as female sexual dysfunction. In each case, the identified problem is shorn of its social, cultural, emotional and psychological elements, leaving a core physiological dysfunction that is intrinsic to the individual and independent of society. This can be ‘cured’ with a specific medical treatment. In short, the problem is designed to fit the treatment, not the reverse. In the case of Viagra, this ‘cure’ exacerbates the wider problem, ensuring the continuing growth of the condition, the treatment, and the profits from drug sales. In the United States, this medicalizing of discontent was facilitated by the passage of legislation permitting direct-to-consumer drug advertising, online drug sales and the entanglement of health professionals and drug marketers.

The pharmaceuticalization of menopause is another area of study. Comparing narratives of menopause and ageing across mother and daughter pairs (mothers born 1920–30s, daughters born 1950–55), Utz (2011, 148) notes, ‘The mothers defined menopause as a developmental transition and considered it a time of self-evaluation and priority setting.’ In contrast, the daughters defined menopause as a problem of estrogen deficiency. The daughters grew up in an era where pharmaceutical technology was used to manage their reproductive health through their whole lives, a significant difference from their mothers. Yet it is not only the shift in the pharmaceuticalization of reproductive health that affects the daughters’ narratives. Daughters also understood menopause in an ‘anti-ageing’ perspective where ageism, pharmaceuticalization, ideas about individual control and gender converged to form the meaning of menopause and ageing in their lives.

Abigail Brooks (2010) obtained similar results in her interviews with older women about anti-ageing interventions. She explains, ’Aesthetic anti-ageing surgeries and technologies project a new paradigm of ageing, one that echoes the successful ageing directives of individual responsibility, effort, and work on the body, but also intensifies and expands these directives’ (251). Women’s use of technology is part of their practice of doing gender, race and class in old age. Women who refuse anti-ageing technologies have feelings of frustration and guilt in the face of shifting norms, and some women of color resist white versions of feminine ageing and subscribe to their own ethnic cultural meanings (Brooks 2010).

As people who are already used to controlling their health with drugs age, the opportunities for pharmaceutical intervention will only expand (Bell and Figert 2012). Biotechnology is not limited to treatment of disease, but expands into lifestyle enhancement and towards prevention of risks and inevitable ‘symptoms’ of growing old. Going forward, social scientists can investigate the consequences of new norms for ageing as well as how social and economic inequalities shape individualized consumer solutions.
The case of ambient assistive technologies

Technologies created for old people range from simple everyday devices, such as a telephone with hearing or visual enhancements, to ambient systems that equip the home with electronic technologies that respond to people and their actions. We here focus on two ambient assistive technologies: sensors and robots. Sensors, which can be placed in the home or nursing home, track movement, actions and biometrics and are monitored by experts, and at times caregivers, in remote locations. Unlike earlier medical alert technologies that required the person to push a button as a call for help, modern sensor technology aims to create a passive agent; that is, the design itself does not require the person being monitored to do anything for the technology to work. Robots designed for elders serve a range of functions, including monitoring of wellness, lifestyle management and assistance with daily tasks, cognitive engagement, telecommunication, companionship and therapy.

Governments, industry and public-private hybrids are researching and developing both sensors and robots for eldercare. Nectarity (2013), a 4-year European project, for example, tested sensors that measure elders’ mood status; their eating, exercise and social interaction habits; and vital signs. While sensor technology can be used independently, it is increasingly designed for use with other ambient technologies. CompanionAble, a EU-funded project, integrated sensors with Hector, a fully autonomous robot assistant. Designed to be a companion and to help with things such as taking medication and household tasks, Hector works with sensors to monitor a person’s physical and emotional wellbeing, offers interactive games and provides a video connection to family and health care providers. While earlier robots designed for elders serve mainly therapeutic purposes and are primarily used in hospitals and nursing homes (e.g. Paro), the robots currently in development are surveillance, companion and task oriented and are designed for private homes (e.g. Carnegie Mellon’s HERB and Honda’s ASIMO).

Michael Millenson (2013) addresses social control and privacy concerns related to ambient surveillance technologies. While some old people find security in knowing that their every move is tracked, others are alarmed by this degree of information gathering. This might be especially true for elders who have suffered systematic discrimination and have less trust in authority. Research has shown that elders do prefer to remain at home for ‘normalcy, continuity in self-identity, autonomy, and control’ (Loe 2010, 320), but that feeling unsafe in the home and struggling to perform everyday tasks are primary reasons for moving to assisted living facilities (Petersson et al. 2012). At the same time, for some elders the threat of privacy and personal identity loss is greater than the risk of physical injury or even death (Brittain et al. 2010, Wigg 2010). When does the risk of health overpower the risk of privacy and the sacrifice of autonomy? Who should decide if surveillance technologies will be used, the elders themselves or their caretakers?

Furthermore, although ambient assistive technologies are said to assist elders who are forgetful and unable to independently manage their health regiments, some old people intentionally reject their ‘personal health responsibilities.’ Venn and Arber (2012) found that refusing to take medication is one way that older adults restore and embody autonomy. With sensors and robots monitoring medicine use, this self-determination may be taken away, and it raises the question whether there will be consequences for ‘non-compliance.’ Surveillance technologies are often employed for reasons of safety, security and independence of older persons, though they are also used to monitor and manage behavior. With governments committing millions to develop these technologies, we must critically question what assumptions about safety, health and well-being are built into the technologies and what elements of life are systematically eliminated. For instance, could the increase in data from constant surveillance lead to overmedicalization?
What might be the consequences of medicalizing the home? What would be lost if technology replaces human care networks?

When research focuses on how elders use technology, it reveals multiple meanings of ageing and speaks to the complexity of the cultural dimensions of technology (Loe 2011, Twigg 2000). Louis Neven’s (2010) research on the consumer testing of IRio, a companion robot designed for elders in the Netherlands, found that participants refused to domesticate the technology. All participants said the robot was fun and useful, but not for them; the participants felt the intended user was ‘housebound, old, lonely, feeble and in need of care and attention, and they did not want to be equated with this person’ (341). Neven argues that ageism prevented elders from adopting the technology; the robot symbolized an ‘old’ undesirable other. The Georgia Institute of Technology (USA) conducted a study in 2012 into how people aged 65–93 felt about using a robot in their homes; participants were enthusiastic about having the robot perform tasks such as emptying the trash and doing the dishes, but they did not want a robot performing personal care tasks such as bathing or for social activities (Smarr et al. 2014). These results suggest that there are complex symbolic meanings attributed to these activities and the involvement of technology in them.

Exploring old people’s creative technological solutions to the challenges of ageing illuminate why elders accept or reject technology use. Technology in the everyday life of old people shows that elders come up with simple solutions to ensure safety, such as telephone trees, where a friend or family member calls someone else every morning to check in (Loe 2011). This allows elders to maintain social relationships, privacy and security, and is affordable. In contrast to ambient assistive technology, a phone tree builds on interconnection rather than independence. George and Whitehouse’s (2011) research on ‘brain fitness’ technologies presents a strong critique of technology developed for the isolated individual. Supporting previously explored criticisms of gerontechnologies as individualized and exclusive consumer solutions to the medicalization of ageing, they argue that health is a community and social issue where interdependency is essential; they run a community-based intergenerational program to engage elders with youth through the use of technology together. An interdependency model highlights how younger people gained mentorship and meaningful intergenerational relationships through interaction with elders, and transforms elders from being viewed as community burdens to assets.

Despite the idealization of independence in old age, research has revealed older people’s emphasis on interdependent autonomy. A study on elders’ perceptions of assistive technology installed in their homes in Sweden found that ‘their reliance on the social environment was considered a prerequisite for feeling safe and for being able to use and benefit from technology’ (Petersson et al. 2012, 808). In other words, technology that was created for independence was only embraced by elders who had people they could depend on. Petersson et al. found that these elders differentiated between independence and autonomy, and prioritized the latter. While the robot Hector offers video streaming communication, most ambient assistive devices focus on the physical rather than social environment, and almost always on private spaces. Centering elders’ perspectives calls for interventions that increase social interaction and access to community spaces, and maintain autonomy (Brittain et al. 2010, Petersson et al. 2012). The emphasis on ageing in place (and the technological innovations being created to make it happen) thus requires critical analysis to identify which values and perspectives are privileged.

Conclusion

Technology, science and ageing cannot be isolated from analysis of cultural contexts. The two work in tandem, co-producing the design and use (or non-use) of technologies and scientific
knowledge (Joyce 2006, Oudshoorn 2003). Building on work that brings ageing to the sociology of science, technology and biomedicine (Joyce and Loe 2010), this chapter investigated two cases—pharmaceuticals and ambient assistive technology—to demonstrate how cultural contexts shape these technologies and how these technologies in turn shape the culture and experience of ageing. Through turning a critical eye on gray cyborgs (Joyce and Mamo 2006), the role of technology in the social construction and lived experience of ageing is analyzed, revealing power and taken for granted ideas about ‘normal’ ageing, health and quality of life. Investigating the cultural contexts of ageing, science and technology demonstrates how medicalization, ageism, a desire for control over the body and ageing, social inequalities and notions of independence co-produce gerontechnology innovation, development and use in the global North. More research is needed to better understand how cultural contexts, ageing and technology are co-produced in a broader range of nations.

Elders’ negotiation of technology highlights their agency in deciding how technologies will or will not be used. Revealing how old people use technology creatively also challenges the ageist assumption that old people are technologically illiterate (Joyce and Loe 2010). However agential they might be, research also shows old people to be subject to hegemonic ideas about ageing that shape norms, values and expectations. The body of work reviewed here demonstrates that new technologies are shaped by cultural contexts and motivations for profit and technocracy; in turn, these new technologies have the potential to help re-define the experience and meaning of old age in powerful ways. The social, political and economic forces of these changes do not happen universally, but with variance across social location in terms of access and meaning. As technogenarians reify, re-appropriate and resist technologies, their meanings and actions shape the culture of ageing that technologies support and exploit. As governments and industry place an increased emphasis on research and development of pharmaceutical and technological solutions to manage ageing populations, critical analyses of the interplay between cultural values and gerontechnologies are needed.

References
Kelly Joyce, Meika Loe and Lauren Diamond-Brown


