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AGING AND DISABILITY IN THE 21ST CENTURY: HOW TECHNOLOGY CAN HELP MAINTAIN HEALTH AND QUALITY OF LIFE

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Statement to the US Senate Special Committee on Aging

Joseph F. Coughlin, Director, Massachusetts Institute of Technology AgeLab

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Thank you, Chair Collins, Ranking Member Casey and Committee Members for the opportunity to discuss the challenges and promises of technology-enabled innovation to improve the lives of older people and their families. My remarks are informed by the extraordinary research of my MIT AgeLab colleagues, students and countless collaborators I have had the privilege to work with worldwide – any incompleteness, or errors, are entirely my own.

Massachusetts Institute of Technology AgeLab (agelab.mit.edu)

In 1900, life expectancy for much of United States was under 50 years old. Today, living well into one's 70s, 80s and beyond can be expected. Perhaps the greatest achievement of humankind is longer life. We must now build a society that can fully exploit our 30-plus year longevity bonus. Longevity, however, requires new thinking.

The MIT AgeLab is funded by businesses and NGOs worldwide to invent new ideas and to creatively translate technologies into practical solutions that improve the quality of life of older adults and those that care for them. Equal to the need for novel ideas and new technologies is the belief that innovations in how products are designed, services are delivered, or policies are implemented are of critical importance to improving quality of life.

The MIT AgeLab works in interdisciplinary research teams drawing upon expertise in engineering, the social and behavioral sciences, as well as design, marketing, and medicine to address challenges in transportation and community development, health and caregiving, housing, retirement, and the workplace.

Today, I would like to address seven issues in my remarks today:

1. Our Current Old Age Story
2. Technology Industry Bias & User Stigma
3. Users, Women & Transcendent Design
4. A New Vision of Old Age & Technology
5. Technological Inequality & Rural Access to Digital Infrastructure
6. Bridging the Nation’s Aging & Technology Gap
7. Regional Longevity Economy Clusters: Aging As Competitive Advantage

Our Current Narrative of Old Age

The oldest and most powerful technology is the story. Stories, or narratives, help us make sense of the world. Our narratives explain cause and effect, why something is important while other things are not. Stories also define in, and out, the range of the possible.

As I observe in my book, *The Longevity Economy: Unlocking The World's Fastest-Growing, Most Misunderstood Market*, our current *story* of old age is, in fact, made up.[1] What objectively should be viewed as an amazing achievement, old age, is most often referred to around the world as everything from a virtual "gray dawn" that portends a coming apocalypse for national pension and health systems to the planet's "ticking time bomb". Instead of celebrating longevity, the story of old age has made older people problems to be solved rather than a societal victory and opportunity.[2]

Old age, as we know it today, has not always existed. Older adults, elders, or seniors were an important and productive part of society even in ancient history. However, in the 1800s the British medical community developed the theory of vital energy. The theory explained that a person was born with a limited amount of vital energy. And, over time – or if expended on what the Victorian era deemed as less than appropriate behaviors – a person's energy would simply be depleted. "Old" was simply what happens when you run out of vital energy, explaining everything from certain poor behaviors or mental states, to explaining why a younger person is more likely than an older person to survive a serious illness. Old age was no longer something to be revered, or a source of wisdom, but instead was redefined as a half empty container of lost vitality. This story of old has resonated through the decades and is reflected in our language and institutions, e.g., to be old is to be over the hill, tired, requiring one to re*tire*.

Technology Industry Bias & User Stigma

Stories of lost vital energy still have an impact today. The very institution of retirement keeps many older adults out of the workforce and the technology innovation value chain.

According to a 2014-15 PayScale study of technology companies, only 3 of the top 18 firms reported a median age of workers over 36 years old, while the nation's median workforce age is over 42. However, the tech sector reflects more than an age imbalance; some technology industry icons reflect a distinct bias.

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[1] Joseph F. Coughlin, *The Longevity Economy: Unlocking the World's Fastest-Growing, Most Misunderstood Market.* New York: Public Affairs (2017).

[2] See, for example, Peter Peterson's book, *Gray Dawn: How the Coming Age Wave Will Transform America – and the World*. New York: Three Rivers Press (2000).

Facebook founder Mark Zuckerberg has been quoted saying that "Young people are simply smarter."[3]

Without many older workers providing insight into how technology can be developed to improve the lives of all people, regardless of age, however, many technology firms are left defining old age around stories and myths that are simply accepted as fact. These stories include:

Older adults don't like technology;
Older people simply don't understand or even able to learn anything new;
or,
Older adults spend their entire day managing their health.

Because older consumers are rarely part of the design process, these stories influence the thinking of even the most well intentioned technology researchers, developers and marketers. Some developers rely on personal points of reference (typically an older loved one) or on a handful of interviews. The result of this flawed process is often products with maladroit usability and an absence of style. Devices with font type too small to see. A crowded field of small multicolor buttons frustrating nearly every user – except perhaps for the young designers/engineers themselves. And, in keeping with the myth that older users' lives revolve solely around health problems, an abundance of applications to monitor bodily functions and medication use.

The dominant story of old age, combined with the dearth of older users integrated into the technology innovation value chain, has resulted in most products developed for older people to be big, beige and boring.[4] Even products developed applying the principles of universal design are often packaged in medical blue plastic, more at home on an emergency room crash cart than on a family room table.

What Does a Product Say about You? Technology, Aging & Stigma

A secondary effect of big, beige and boring devices is that they often stigmatize the user. Products are as much about what they do for the user as what they communicate about the user. Personal emergency response services, or PERS, for example, are profoundly rational, and for many, a lifesaving necessity. These wireless systems allow the user to call for help by pressing a button on a pendant or bracelet. Unfortunately, many of these devices also symbolize the frailty of the user.

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[3] See *Fortune Magazine*, "Tech Industry Job Ads: Older Workers Need Not Apply," July 19, 2014, http://fortune.com/2014/06/19/tech-job-ads-discrimination/

[4] Joseph F. Coughlin & Luke Yoquinto "Technology for Older People Doesn't Have to be Ugly," *Wall Street Journal*, October 14, 2018 https://www.wsj.com/articles/technology-for-older-people-doesnt-have-to-be-ugly-1539546423

PERS have exceedingly low adoption rates by the very people who need them. Of the 65-plus year old frail population, adoption rates of PERS systems remain in the single digits. Even in nations where the services are partially, or fully, subsidized by government, adoption rates are below 20 percent. Users who do have a PERS system report that they often leave the device on a table in another room while they shower, use the bathroom, or are occupied elsewhere in their home. According to a 2009 Pew poll, only 35 percent of Americans over 75 reported feeling "old." But 100 percent of people know that PERS, and other big, beige and boring products, are for *old people*.[5]

However, there is cause for optimism. Slow progress is being made. Advances in artificial intelligence and devices, such as smart speakers, e.g., Amazon Echo, Google Home, that enable users to control many home functions by voice commands, are making interfaces ageless. The explosion of wireless earbuds and earphones, worn by people of every age, are making it possible to age and manage hearing loss without stigma and, effectively, to age by stealth.

Users, Women & Transcendent Design

Technology developers and marketers must not only understand older consumers' needs and wants, they must strive to exceed them. That is, rather than simply developing technologies to assist with basic tasks, they should envision entirely new lifestyles. Products and services must transcend simple functionality, basic usability, and innocuous form, and seek to excite and delight users. When was the last time any developer started with the premise of *thrilling* the older user? Engaging users and applying radical empathy in the design process can advance this heady goal.

Understanding who the user is may not be as clear as it appears. There is greater health, disability, economic, educational, cultural, and geographic diversity among older Americans than nearly any other age cohort. Moreover, what is old was defined by political consensus, not biology or the laws of physics. It is unclear to many developers what an older consumer is – for most people oldness is typically 15-20 years older than their current age. For the very young tech industry, at Amazon, for example, where the average employee is 31 years old, old age might start at 46 or 50 years old.

<u>The Future Is Female</u>

While the focus on the older user is necessary, it is critical to understand who may be the key influencer. In most cases, this is a woman. As I note in my book *The Longevity Economy*, the "future is female." She is not only likely to live longer, she is also most likely to be the primary caregiver of an older adult. In fact, the oldest adult daughter, particularly if she has a partner without a sister, is likely to have far more parents to care for than children. Women, predominantly

[5] See Coughlin, *The Longevity Economy* (2017) pg. 73-75.

middle-aged women, are also the principal buyers of healthcare products, consumer goods, home improvement supplies and other related products and services. She effectively serves as the chief consumer officer and gatekeeper of any product or service to be used in her older loved one's life. While certainly not fair, aging and caregiving are disproportionately a woman's issue, and she, along with the older user, must be integrated into the technology design and development process.

Many research and innovation centers around the world are successfully integrating the user in the design process. Surveys, ethnographic studies and focus groups are common methods, but some groups are going beyond these approaches. For example, the MIT AgeLab manages consumer panels with older adults and caregivers from around the world. One panel is the AgeLab's 85-plus Lifestyle Leaders, which provides unique insights from the oldest old regarding product and service design. AARP's Hatchery offers a platform to startups not only to learn from AARP's wealth of institutional knowledge, but also to learn from older users directly. San Francisco-based Aging 2.0 also matches startups with older users to ensure that there is a fit between the would-be consumer and the product idea. Leading Age, the voice of the non-profit senior housing industry, manages the Center for Aging Services & Technology, which connects technology companies with senior housing operators and residents.

While it is necessary to include older users in the design and development process, it is also incomplete. Many users, including older adults, are susceptible to editing their true experiences and feelings. It is hard for many to admit difficulty with what most people may find easy or to voice frustration with the loss of function. Moreover, most older users and caregivers are not familiar with what design and technology innovations are possible. Therefore, in addition to asking older users to report on their experiences and perceptions, the MIT AgeLab applies radical empathy in its research.

MIT AgeLab's Age Gain Now Empathy System, or AGNES, is equipment worn by a student, engineer, designer, marketer, developer or planner to gain a modicum of experience of what it might be like to be older and to manage selected chronic diseases, e.g., arthritis.[6] AGNES includes equipment from head to toe that impairs the user's vision, flexibility, dexterity, gait, balance, and more. While it is impossible to replicate what an older user experiences entirely, AGNES enables a designer or engineer to walk in the shoes of an older adult to feel the friction, frustration and fatigue often associated with using products and navigating everyday spaces. AGNES and the corresponding research processes used with 'her' enable innovators to identify challenges often unarticulated by or even

[6] Walking a mile in another's shoes: The impact of wearing an age suit, https://www.tandfonline.com/doi/abs/10.1080/02701960.2015.1079706?casa_token=fi73V-X_sZwAAAAA:CaUeaZ3-OUJxTXHW_L8JBTYMrVeZTah3ZVSRgyGa3KQcY2M3CbRoAt0qG_R5IDRXdxroyjZ1mNvRaQ

unrecognized by older users (especially as many of them develop workarounds that they no longer notice). The system has been used to generate insights and innovations for auto manufacturers, transit operators, electronics companies, retailers and consumer packaged goods companies worldwide.

A New Vision of Old Age & Technology

Senator Casey, you may recall a distinguished resident of the Lehigh Valley in your home state of Pennsylvania, Sarah Knauss. Ms. Knauss lived to the remarkable age of 119 years old. On her 115th birthday she was asked by a journalist if she enjoyed her long life. She replied that she enjoyed her life because she "has her health and can do things".[7] In that short reply Sarah Knauss crystalized an ideal vision of quality aging – a vision that is not just about health alone, but health *with* the ability to do things.

Technology-enabled innovation to facility quality aging must include health but must also extend to all domains of a full life, including transportation, home, work, social connectivity, and even fun. Advances in information communications technology, artificial intelligence (AI), robotics, virtual reality, and other fields are producing promising applications to address the needs, as well as wants, of older adults.

Below are selected examples that suggest a promising technology-enabled future for life tomorrow:

<u>Health & Safety</u>

- AI Home Companions – AI home care companions are becoming more common. Some are designed for social support, others assist with specific health related tasks. Many devices are blending anthropomorphic interfaces (smiling faces or gestures) while providing automated medication or nutrition management systems controlled by voice. Moreover, these systems often enable family caregivers to monitor a person's medication and healthcare schedule without interrupting an independent lifestyle.

- Smart Toilets – Toilet manufacturers are producing smart toilets that are not only easier to physically access, but also monitor various health conditions, such as diabetes.

- Wireless Monitoring – Low-power wireless technology is likely to supplant wearables, tracking everything from physical movement to physiological signals through walls without wearing a device.[8]

[7] *Los Angeles Times*, December 31, 1999. https://www.latimes.com/archives/la-xpm-1999-dec-31-mn-49362-story.html
[8] https://www.technologyreview.com/s/612055/dina-katabi-emerald-walls/

Mobility

- Robotic Wheelchairs – Wheelchair technology has been steadily advancing. Technology enabling self-navigating wheelchairs to assist older adults and the disabled in their homes, community and even to navigate the donnybrook of airport terminals will soon be widely available.[9]

- Autonomous Vehicles – Driverless cars certainly offer the promise to improve the safe mobility of older adults and the disabled. While the technology is on the horizon, more work needs to be done to understand how the technologies can be learned, trusted and safely adopted by all ages.[10]

  Caveat: Despite the promise of autonomous vehicles, the first and last 50 feet of travel to enter and exit the vehicle remain a major technical and service challenge that may blunt the benefits of autonomous vehicles for older adults and the disabled. A person too frail, physically disabled or cognitively impaired to drive or use current public transportation alternatives is not likely to use a driverless car easily, nor will many family caregivers be easily convinced to put a frail loved one in a vehicle alone.[11]

Home

- Home Logistics – There is a convergence of smart devices in the home with services provided in the sharing economy to transform the home from simply a place to the home as service platform.[12] Services for older users and family caregivers may now be coordinated through smart appliances and connected devices throughout the home, i.e., the Internet of Things. A smart refrigerator may detect that it is running low on a resident's favorite ice cream (or vegetables) and proactively order groceries. Home monitoring systems may arrange for maintenance of heating, hot water, and other systems in the home before critical failure. Technology-enabled conveniences, or life by app, created primarily for Millennials, may, in fact, facilitate a new virtual assisted living for older adults and serve as a family caregiver's partner.[13]

[9] https://news.panasonic.com/global/topics/2019/68529.html
[10] http://agelab.mit.edu/avt
[11] https://www.nae.edu/208348/Planning-Designing-and-Engineering-Tomorrows-UserCentered-AgeReady-Transportation-System
[12] http://agelab.mit.edu/c3-connected-home-logistics-consortium
[13] See Coughlin, MarketWatch, This New Tech Can Turn Any Home Into A Retirement Home, May 21, 2019. https://www.marketwatch.com/story/this-new-tech-can-turn-any-home-into-a-retirement-home-2019-05-21

Work

- e-Learning/MOOC – Online learning platforms are no longer just for those who wish to take a single class or to address a casual interest. Massive Open Online Courses (MOOCs) now provide platforms for young and old to remain competitive in the workplace. The MIT Center for Transportation & Logistics, for example, offers the MicroMasters credential in Supply Chain Management, consisting of five courses and a final exam online. The MicroMasters credential is the equivalent of a full semester's coursework at MIT, and it can be applied for credit as part of a full master's degree at dozens of institutions worldwide. Over 280,000 learners from 196 countries have taken at least one MicroMasters course, and 16 to 20% of each run is over 40 years of age.[14]

- Robotics & Cobotics – While some observers worry that robots may take jobs from humans, some robotics may actually enable many people to remain in the workplace longer. Cobotic and exoskeletal systems (best thought of as wearable robotics) are already in use in many workplaces, and new systems are in development. Worn by the user, these systems assist with repetitive and physically demanding tasks, thereby reducing the chances of injury and extending the physical capacity to work.

Social Isolation

- Social Robotics – Robotic applications to provide social support are booming. Social companion robots, such as Paro, a robotic harp seal, serve as a pet substitute but also provide feedback that has been shown to reduce irritability in Alzheimer's patients and to relieve some of the stress associated with loneliness. Other social robots, such as Pepper, have a more humanoid form and can remind users to take their medication, assist with navigation, or even tell jokes.

- Social Media – Life online is not just for kids anymore. While the digital divide between young and old is not closed, it is greatly narrowed. According to AARP, 70 percent of adults 50 years old and older are now on social media, and 91 percent of them report that social media is an important means to stay connected with friends and family.[15] Social media platforms are developing specifically for older adults. One such example is Stitch, which unlike popular online dating sites hosts an online community of people 50-plus seeking companionship.[16]

[14] https://scm.mit.edu/micromasters
[15] https://www.aarp.org/content/dam/aarp/research/surveys_statistics/technology/info-2018/atom-nov-2017-tech-module.doi.10.26419%252Fres.00210.001.pdf
[16] https://www.stitch.net/about-us/

Fun

- Online Gaming – Online and video games are typically considered to be the sole domain of youth, but fun is ageless. Wii leagues and other online gaming communities are now popular for older adults. For example, the National Seniors League collects statistics and organizes Wii bowling matches between senior and community centers nationwide, engaging older adults to compete, form community and have fun. Another example is the Old Timers Guild. The Old Timers Guild's own description sums up the promise of online gaming for many older adults: "we are a guild of mature gamers who have bonded together to seek out two things we are all passionate about: fun and gaming."

- Virtual Reality – Virtual reality (VR) offers new possibilities for older adults to travel (virtually), have fun, and, in some instances, share those experiences with others. One startup, Rendever, is bringing VR experiences to older adults in assisted living and nursing care who can no longer travel. Findings from an MIT AgeLab project with Rendever and Benchmark Senior Living found that older adults playing with VR not only had fun, but reported less depression and engaged in more active conversations with other residents.[17]

Technological Inequality, Digital Infrastructure & Disadvantaged Populations

Technology offers extraordinary potential to improve the lives of older adults and caregivers. However, the challenges ahead may be more complex than the technology itself.

Technology Inequality Gap

New technology is expensive when first commercialized. Technologies that were once the toys of the affluent are fast becoming the necessities of everyday living, e.g., smart phones, streaming services, WiFi. The quality of living independently or caring for a loved will become increasingly reliant on technology and related services, portending the emergence of a new technology inequality gap.

Over time technology does become affordable as sales volumes increase; note the decline in the cost of flat screen televisions and computers over the past decade. Perhaps one way to accelerate the decrease of cost of technology, particularly home-based technologies, however, is to leverage the procurement power of all levels of government to integrate selected products or services into public housing, creating greater demand and thereby lowering the market cost of technologies to improve the lives of less affluent older Americans and caregivers.

[17] https://www.springerprofessional.de/en/impact-of-virtual-reality-vr-experience-on-older-adults-well-bei/15929752

Rural Access to Digital Communications Infrastructure

While I have already mentioned the challenges that poor design can present to the adoption and use of new technologies by older adults, Chair Collins, you are particularly aware of another accessibility barrier. Here I speak of rural populations. While many in the tech sector speak of the need for speed, rural populations, such as those in your home state of Maine, often do not even have access to the cellular service and broadband necessary to deliver many of the innovations already available today, e.g., home monitoring, telemedicine, teletherapy. This accessibility gap is unacceptable. As the nation contemplates investment in infrastructure, we must arrive at a new national consensus that infrastructure is no longer just pipelines and pavement: it includes the digital infrastructure to ensure that all Americans have access to those services that support quality living and caring.

Smart Buyer

Finally, there is a third barrier to leveraging existing technologies. There is currently a market failure in the provision of information about products that can enhance the lives of older adults or reduce the burden of caregiving. While many technology websites may include these devices, consumers do not know what they are looking for. There is no smart buyer authority to instruct older Americans and families on what to consider, what characteristics to look for, where to buy devices or services, and how to apply these innovations to meet their aging and caring needs. The explosion of startups in the aging and technology field is a grand reason for optimism, but the dearth of public knowledge, trusted advice and ultimately distribution of these innovations is a major challenge to unlocking the promise of technology today.

Bridging the Nation's Aging & Technology Innovation Gap

The nation's aging is unprecedented. While we have always had older people, we have never had this many, with more education and with more experience watching rapid technological innovation throughout their lives. The Baby Boomers are now turning 73, one nearly every seven to eight seconds. In their youth they introduced the concept of a generation gap, primarily around lifestyle. In their older age, however, they are presenting a new generation gap – that of expectations. The new generation of older adults will be neither nearly as patient nor as polite as previous generations. Throughout their lifespan schools were built, technologies developed, communities redesigned, and more. It is highly unlikely that their appetite for innovations in living will ebb just because their ages have increased.

Presently there is no department, agency, bureau, or podium to articulate a comprehensive vision of aging and innovation to meet this growing expectations

gap. There are individual examples within the government of this kind of innovation. For example, Health & Human Services and the National Institutes of Health are engaged in amazing efforts to extend life and to address the medical dimension of aging. The Veterans Administration and the Department of Education Rehabilitation Engineering Research Centers are doing exceptional work in specific assistive technologies for the disabled. But by and large, existing institutions are built upon yesterday's definitions of aging and upon yesterday's available solutions.

The recently released report by the White House's National Science & Technology Council provides a comprehensive discussion of aging and technology, but within a narrow, principally heath-related frame. For example, learning or education was only mentioned six times, primarily related to health education, rather than in the context of supporting an older worker or lifelong engagement. In fact, older workers and older adult employment are hardly mentioned. The word "fun" does not appear, and play is only discussed as a transportation destination rather than an activity that older people do. Given the importance of family in quality aging, it is surprising that caregiving only appears six times. Moreover, a discussion of how technology might support the critical role of women as the nation's primary caregivers and as the majority of the nation's older population is absent. In fact, the words "female", "woman", or "women" are absent.

These observations are not a criticism; this report reflects that our institutions are unprepared for an aging population that has new and different dimensions and expectations. One possible strategy to address this gap may be the formation of an interagency advisory committee on technology and aging that includes industry, NGOs and the university research community. Whatever form this might take, it should be located within the federal structure where it might have significant visibility and power to be an agenda setter, identifying and assembling all interested stakeholders in domains that include but extend well beyond defining aging solely as a health issue.

Longevity Economy Clusters: Aging As Regional Competitive Advantage

Aging by most governments is seen as a need or problem to be solved. However, the aging population is a call to innovate. Selected governments around the world are beginning to transform their aging "problem" into an opportunity to improve the lives of their citizens and as a global export.

Singapore, Hong Kong, Newcastle, Tel Aviv and other global regions have launched aging innovation, or "silver economy," initiatives to build an infrastructure to support and leverage an aging society. Governments in each of these regions have served as catalysts to bring together researchers and businesses to address their own populations' needs, while seeking to develop a new business around old age.

In the United States two regions stand out. Louisville, Kentucky formed a coalition of health companies headquartered in that region seeking to develop innovations around healthy aging. In Massachusetts, Governor Baker launched an initiative last year to develop Massachusetts as a global leader in the longevity economy. Leveraging not just the world-class health resources in the Commonwealth, but reaching across all domains including education, finance, housing and more. This public-private collaboration involves not just startups, but will engage leading universities and major Fortune 500 companies at the C-Suite levels to develop new products, services and experiences to improve the lives of older people and their families in Massachusetts, while developing a new vision and business to export to an aging world. Inc. Magazine already recognized this work naming Boston as one of the top 20 places to start a new business because of this novel approach to translate aging into economic opportunity.

Quality Aging as a New Endless Frontier

It is my firm belief that a new endless frontier is before us – where great advances in technology are now converging with extended lifespans making it possible not just to extend life, but to improve the quality of life. By igniting a national commitment and partnership between business, non-profits, and all levels of government, we can translate inventions in the laboratory into innovations in living that will improve the wellbeing of all older adults and their families. We must view our nation's, and the world's, aging not as a problem to be solved, but, instead, as a global opportunity to write a new story of life tomorrow.

Thank you for inviting me to participate in this hearing. I look forward to providing any additional information that will ensure that all Americans live longer, better.