SCC.141 Professionalism in Practice

Week 15: Digital Exclusion and Digital Divide

12th February 2025

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UK orders Apple to let it spy on user’s encrypted accounts

The demand has been served by the Home Office under the Investigatory Powers Act (IPA), which compels firms to provide information to law enforcement agencies.

Apple declined to comment, but **says on its website, external** that it views privacy as a "fundamental human right".

What is Apple's Advanced Data Protection (ADP)?

- A feature using end-to-end encryption where only the account holder can access stored data.
- Even Apple cannot access the data.
- It is an opt-in Service, users must activate it manually; it is not enabled by default.

Benefits & Downsides of ADP:

- Pro: Stronger data security.
- Con: If access is lost, data cannot be recovered.

User Adoption:

- The number of users opting in is unknown.

* https://www.bbc.co.uk/news/articles/c20g288yldko

** https://www.washingtonpost.com/technology/2025/02/07/apple-encryption-backdoor-uk/

Learning Objectives

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- **Define** digital exclusion and its impact on society
- **Identify** the contributing factors to digital exclusion (**Ability, Affordability, and Access**)
- **Define** digital divide and its contributing factors (**Age, Income, Geography,…**)
- **Investigate** the role of Robotics, IoT, and AI in addressing or exacerbating digital exclusion
- **Propose** practical solutions through inclusive design principles and policies

Agenda

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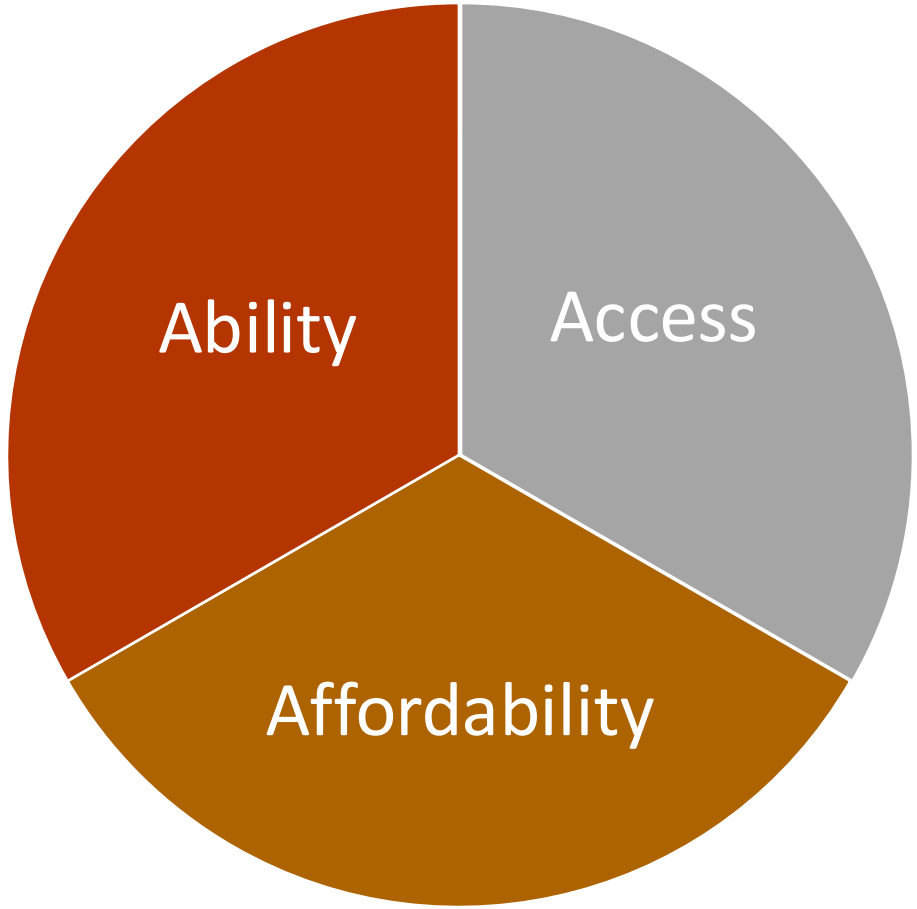
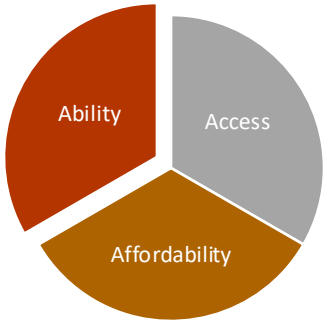
- Introduction to Digital Exclusion
- Emerging Technologies and Digital Exclusion
- Introduction to Digital Divide
- Bridging the Digital Divide
- Summary & Key Takeaways

Digital Exclusion

- Inability to fully participate in digital life due to **limited Ability**, **Access**, or **Affordability**
- Leads to **Social**, **Economic**, and **Educational** disadvantages



Digital Exclusion: Ability



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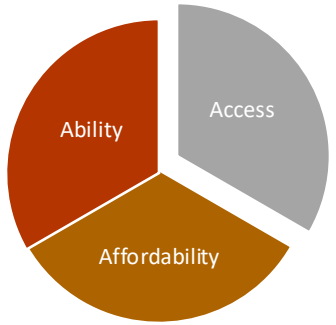
- The **skills**, **literacy**, and **confidence** needed to engage with digital technologies
- **What It Includes:**
  - **Digital Literacy:** Navigating software, apps, and online services
  - **Physical/Cognitive Factors:** Vision, hearing, dexterity, memory, or learning differences
  - **Motivation & Confidence:** Believing in the value of technology and feeling comfortable experimenting

- **Potential Solutions:**
  - **Training & Workshops:** Personalized instruction or community classes
  - **Inclusive Design:** Larger fonts, voice controls, screen readers, easy navigation
  - **User-Friendly Interfaces:** Clear menus, error tolerance, and accessible layouts

Digital Exclusion: Access



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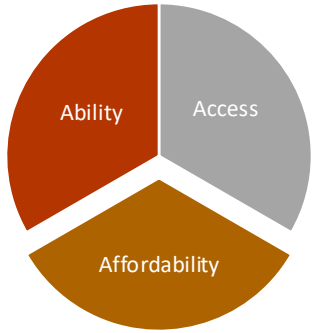
- The ability to obtain and use necessary **devices**, **infrastructure** and **reliable** internet or mobile **connectivity**
- **What It Includes:**
  - **Infrastructure:** Broadband coverage, mobile data networks, public Wi-Fi availability
  - **Devices:** Smartphones, tablets, laptops, wearables, or other hardware
  - **Availability & Reliability:** Stable connection speeds, consistent power supply

- **Potential Solutions:**
  - **Infrastructure Investment:** Expanding broadband to underserved areas
  - **Community Resources:** Public libraries with free computer and internet access
  - **Device Donations/Refurbishing:** Low-cost or donated devices for those in need

Digital Exclusion: Affordability

Often Overlooked



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- The **financial feasibility** of purchasing and maintaining devices, paying for internet, and covering ongoing costs
- **What It Includes:**
  - **Upfront Costs:** Devices (phones, laptops) and setup fees (routers, modems)
  - **Ongoing Expenses:** Monthly internet or mobile data plans, software subscriptions
  - **Hidden Costs:** Repairs, upgrades, data security, and electricity bills

- **Potential Solutions:**
  - **Subsidies & Discounts:** Government or NGO programs that reduce broadband/device costs
  - **Flexible Payment Plans:** Pay-as-you-go data, budget devices, community-run internet services
  - **Partnerships & Grants:** Collaboration with tech companies, local councils, or charities to make tech more affordable

From Digital Exclusion to the Digital Divide

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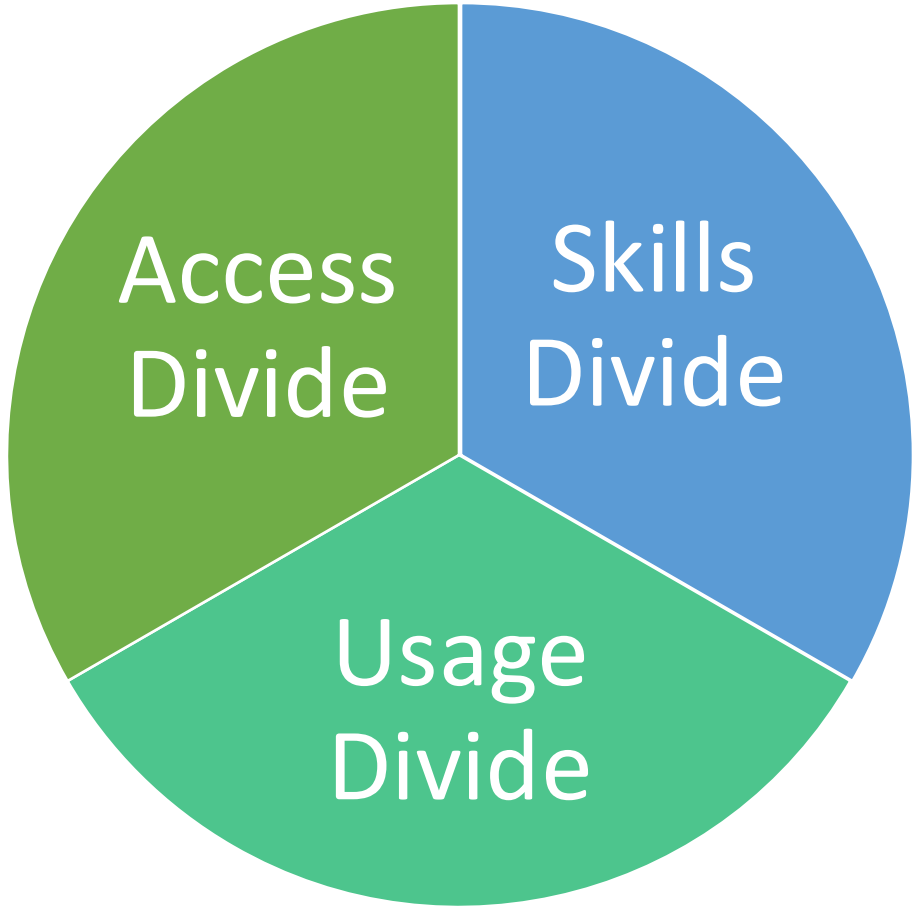
- Individual vs. Societal View
  - **Digital Exclusion:** Focuses on why individuals may not participate fully (Ability, Access, Affordability)
  - **Digital Divide:** Focuses on which groups/regions are left behind and how these disparities manifest

- Overlap & Reinforcement
  - Individual exclusion **can create** group-level divides
  - Group-level divides **can worsen** individual exclusion

Digital Divide

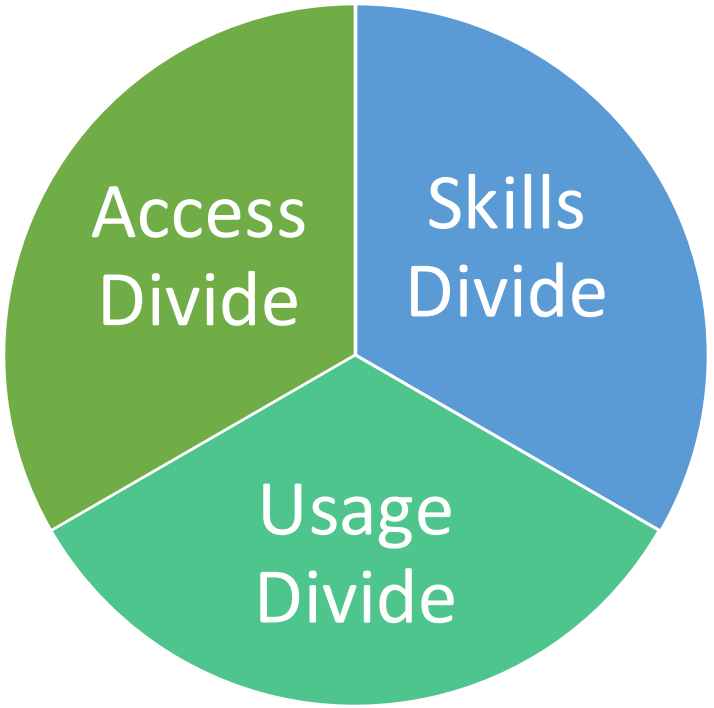
- The Digital Divide refers to inequalities in **access to**, **use of**, and **benefits from** digital technology

- Affects different groups based on:
  - **Age** – Generational differences in digital skills
  - **Income** – Economic barriers to technology access
  - **Geography** – Rural vs. urban connectivity
  - **Education** – Digital literacy gaps
  - **Disability** – Accessibility barriers in tech design



Three Layers of the Digital Divide

- **Access Divide** – Who has internet, devices, and infrastructure?
- **Skills Divide** – Who knows how to use technology effectively?
- **Usage Divide** – Who benefits from technology, and who doesn't?



- **Statistic:** Approximately 67 per cent of the world's population (nearly 5.4 billion) is now online,
- This means **2.6. billion** people aren't connected

* https://www.itu.int/itu-d/reports/statistics/2023/10/10/ff23-internet-use/

Generational Categories in the Digital World

- **Different generations** have a radically different relationship with technology:
  - **Digital Natives** – Born into the digital world (Gen Z, Millennials)
  - **Digital Immigrants** – Adopted technology later in life (Gen X, Boomers)
  - **Digital Pioneers** – Early adopters of the internet and computing (Older Millennials, Gen X)
  - **Generation Alpha (Gen Alpha)** – First fully AI-native generation
- **Discussion Question:** How does digital literacy differ between you and your parents or grandparents?

The Silver Digital Divide
(Older Generations & Technology)

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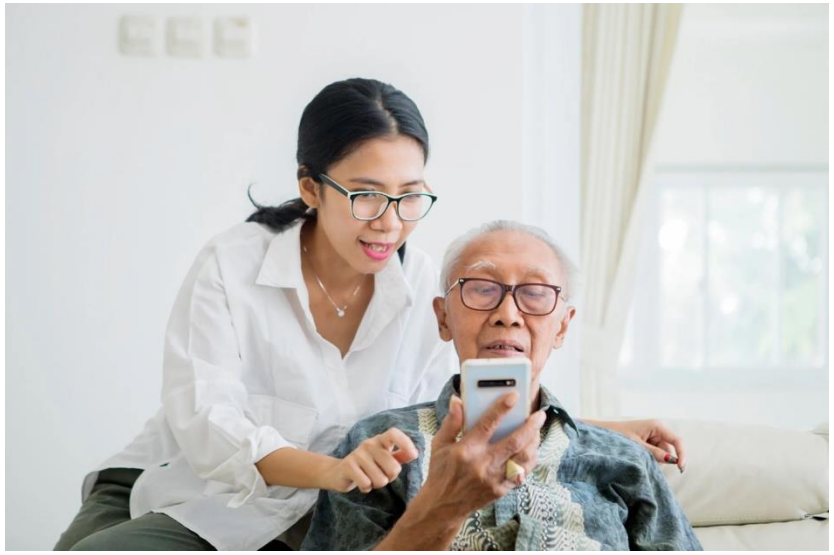
- **Barriers to adoption:**
  - Lack of digital skills
  - Trust & security concerns (phishing, scams)
  - Complexity of modern interfaces

- **Solutions:**
  - User-friendly tech design
  - Community training programs
  - Voice assistants & AI helpers



* https://blog.elliq.com/bridging-the-digital-divide-between-older-adults-and-technology

The Silver Digital Divide (Older Generations & Technology)

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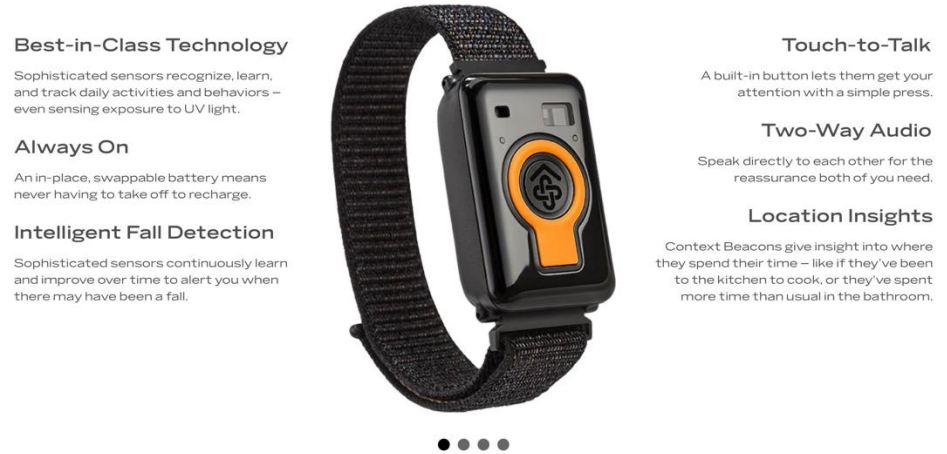
- **Examples:**
  - **ElliQ***, the AI companion designed specifically for the elderly
    - Offers conversation and entertainment
    - Provide reminders for health-related tasks
  - **CarePredict****, a wearable device that learns the daily patterns of its wearers
    - Alert caregivers to deviations from these patterns,
    - Ensure timely medical intervention



* https://blog.elliq.com/bridging-the-digital-divide-between-older-adults-and-technology
** https://www.carepredict.com

The Economic Digital Divide (Income & Affordability)

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- Tech access is expensive!
- Low-income communities struggle with:
  - Affording **smartphones**, **computers**, & **high-speed internet**
  - Data costs (mobile vs. broadband)
  - School & work digital requirements

- **Example:** Students in low-income households had less access to remote learning during COVID-19.

The Geographic Digital Divide (Urban vs. Rural)

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- **Urban areas:** Faster internet, more infrastructure
- **Rural areas:** Poor broadband access, fewer public Wi-Fi locations

- **Example:**
  - **The UK's rural broadband gap** – some areas still lack high-speed internet
    - **Policy Approach:** Government-funded fiber-optic expansion in underserved areas
  - **Google's Project Loon*** – initiated in 2013 by Google X, shut down in 2021
    - Due to high costs, technical challenges, and market realities

* https://blog.elliq.com/bridging-the-digital-divide-between-older-adults-and-technology

The Educational Digital Divide (Digital Literacy)

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- Digital skills are now essential for **employment**, **education**, and **daily life**
- **Challenges:**
  - **The Homework Gap:** Students in low-income areas often lack devices or stable internet
  - **The Skills Divide:** Many adults struggle with digital tools, limiting job opportunities
  - **AI & Automation Shift:** The digital economy demands new skills that aren't evenly taught
- **Example:**
  - **AI-based tutoring** in developed countries vs. **textbook shortages** in developing nations
  - Private schools use AI-powered **Khan Academy AI**, while public schools in underfunded districts lack smart learning tools

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- **Discussion Question:** Beyond access, how should schools teach digital literacy to prepare students for AI-driven careers?

The Disability Digital Divide (Accessibility Challenges)

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- People with disabilities face barriers to accessing technology:
  - **Lack of screen reader** compatibility on many websites
  - Inaccessible online learning platforms for **visually & hearing-impaired**
  - Job applications often require digital skills but **lack assistive technology** support

- **Example:**
  - Some CAPTCHA verifications exclude visually impaired users

The Disability Digital Divide (Accessibility Challenges)

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- **Assistive Technologies Bridging the Gap**
  - **Screen Readers & Braille Displays** – Convert digital text into audio or tactile Braille (e.g., JAWS, NVDA, Orbit Reader)
  - **Eye-Tracking Systems** – Allow users to control a computer with eye movements (e.g., Tobii Dynavox)
  - **Alternative Keyboards & Adaptive Mice** – Custom input devices for limited mobility users

* https://www.youtube.com/watch?v=bz_sbL1gU78

The Digital Privacy Divide (Knowledge Gaps in Online Safety)

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- Some groups are more vulnerable to online threats:
  - **Older adults** – More susceptible to phishing & scams
  - **Children & teens** – Lack of awareness about data tracking & cyberbullying
  - **Low-literacy users** – Struggle to navigate privacy settings & misinformation

- **Discussion Question:** Who should be responsible for teaching online privacy – individuals, companies, or governments?

The Gender Digital Divide

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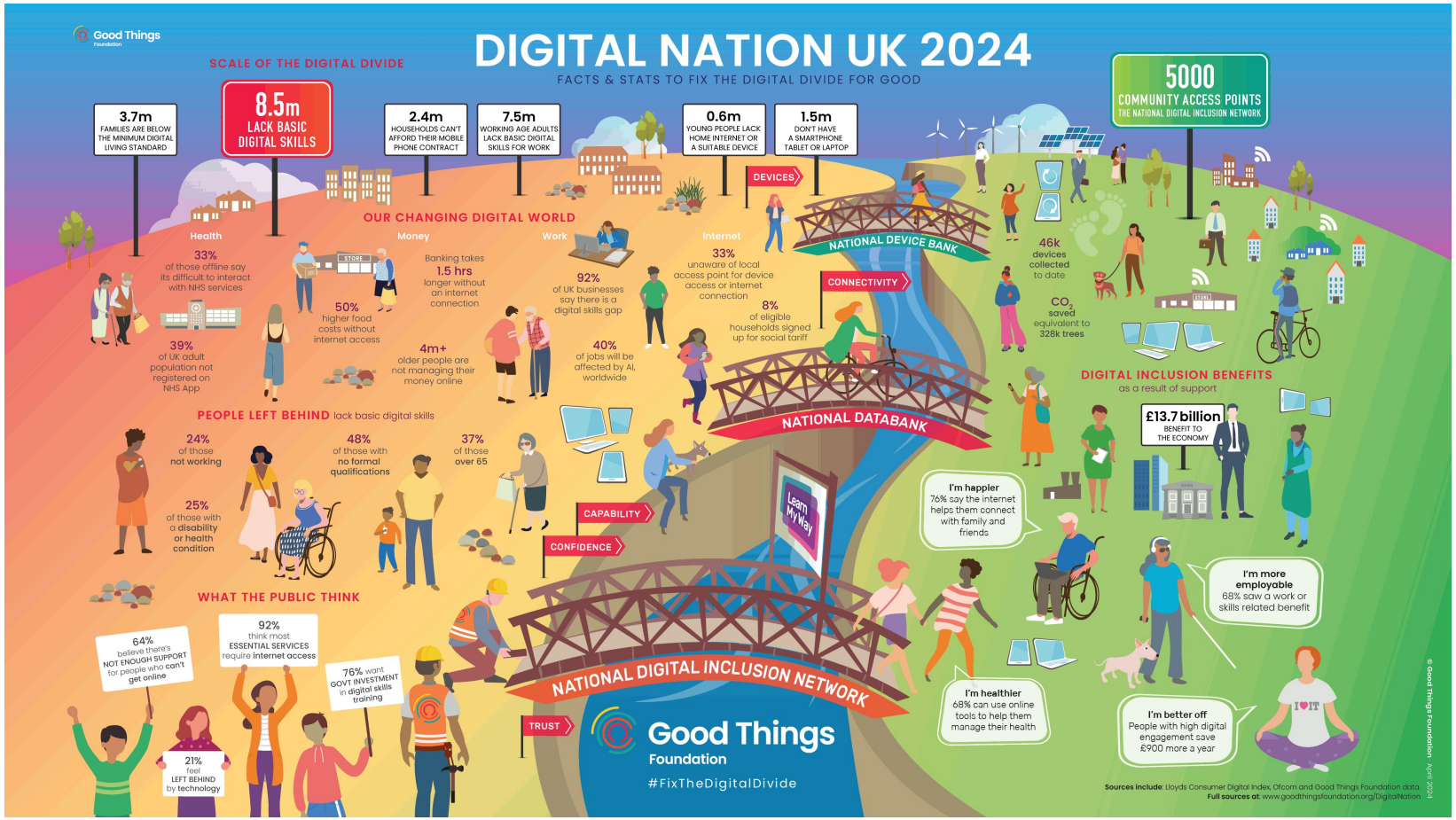
- Discrepancies in internet/device access, digital skills, and online benefits across gender lines
- **Global Gap:** Women in many regions have lower rates of device ownership and internet usage than men, these averages can differ significantly by region, so we should avoid broad-brush assumptions
- **Contributing Factors:**
  - **Cultural or social norms** (e.g., tech seen as ‘male domain’ in some communities)
  - **Economic barriers** (women may earn less or have less control over finances)
  - **Safety and privacy concerns** (online harassment, need for better safety features)
- **Impact:** Reduced educational and economic opportunities, lower digital literacy, and limited online participation
- **In STEM fields, female representation remains lower, affecting who builds technology and how inclusive it is**

Digital Nation 2024



* https://www.goodthingsfoundation.org/policy-and-research/research-and-evidence/research-2024/digital-nation

Good Things Foundation

DIGITAL NATION UK 2024

FACTS & STATS TO FIX THE DIGITAL DIVIDE FOR GOOD

SCALE OF THE DIGITAL DIVIDE

- **3.7m** FAMILIES ARE BELOW THE MINIMUM DIGITAL LIVING STANDARD
- **8.5m** LACK BASIC DIGITAL SKILLS
- **2.4m** HOUSEHOLDS CAN'T AFFORD THEIR MOBILE PHONE CONTRACT
- **7.5m** WORKING AGE ADULTS LACK BASIC DIGITAL SKILLS FOR WORK
- **0.6m** YOUNG PEOPLE LACK HOME INTERNET OR A SUITABLE DEVICE
- **1.5m** DON'T HAVE A SMARTPHONE TABLET OR LAPTOP

5000 COMMUNITY ACCESS POINTS
THE NATIONAL DIGITAL INCLUSION NETWORK

DEVICES

NATIONAL DEVICE BANK

OUR CHANGING DIGITAL WORLD

Health

33% of those offline say its difficult to interact with NHS services

39% of UK adult population not registered on NHS App

50% higher food costs without internet access

Money

Banking takes **1.5 hrs** longer without an internet connection

4m+ older people are not managing their money online

Work

92% of UK businesses say there is a digital skills gap

40% of jobs will be affected by AI, worldwide

Internet

33% unaware of local access point for device access or internet connection

8% of eligible households signed up for social tariff

CONNECTIVITY

46k devices collected to date

CO_2 saved equivalent to **328k trees**

NATIONAL DATABANK

PEOPLE LEFT BEHIND lack basic digital skills

24% of those **not working**

25% of those with a **disability or health condition**

48% of those with **no formal qualifications**

37% of those **over 65**

CAPABILITY

CONFIDENCE

Learn My Way

DIGITAL INCLUSION BENEFITS

as a result of support

£13.7 billion BENEFIT TO THE ECONOMY

I'm happier
76% say the internet helps them connect with family and friends

I'm more employable
68% saw a work or skills related benefit

I'm healthier
68% can use online tools to help them manage their health

I'm better off
People with high digital engagement save £900 more a year

WHAT THE PUBLIC THINK

64% believe there's **NOT ENOUGH SUPPORT** for people who **can't get online**

92% think most **ESSENTIAL SERVICES** require **internet access**

76% want **GOVT INVESTMENT** in **digital skills training**

21% feel **LEFT BEHIND** by **technology**

NATIONAL DIGITAL INCLUSION NETWORK

TRUST

Good Things Foundation

#FixTheDigitalDivide

Sources include: Lloyds Consumer Digital Index, Ofcom and Good Things Foundation data.
Full sources at: www.goodthingsfoundation.org/DigitalNation

Digital Divide Framing

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- **Digital Exclusion:**
  - Recognizes differences in technology use as **inequity (injustice)**
  - Implies **societal** or **structural** responsibility to address barriers
- **Digital Divide:**
  - Recognizes differences in technology use as **inequality (differences in outcomes)**
  - Remedy often framed as **"equal access,"**
  - Any remaining gap seen as **"merited"** or **due to personal choice/ability**

- **Neoliberalism:** Role of government is to create and sustain markets only
- **New Economy:** Build and prioritize digital innovation and efficiency
- **"Access doctrine":** Belief that providing basic tech access is enough to "pull" individuals out of poverty or marginalization

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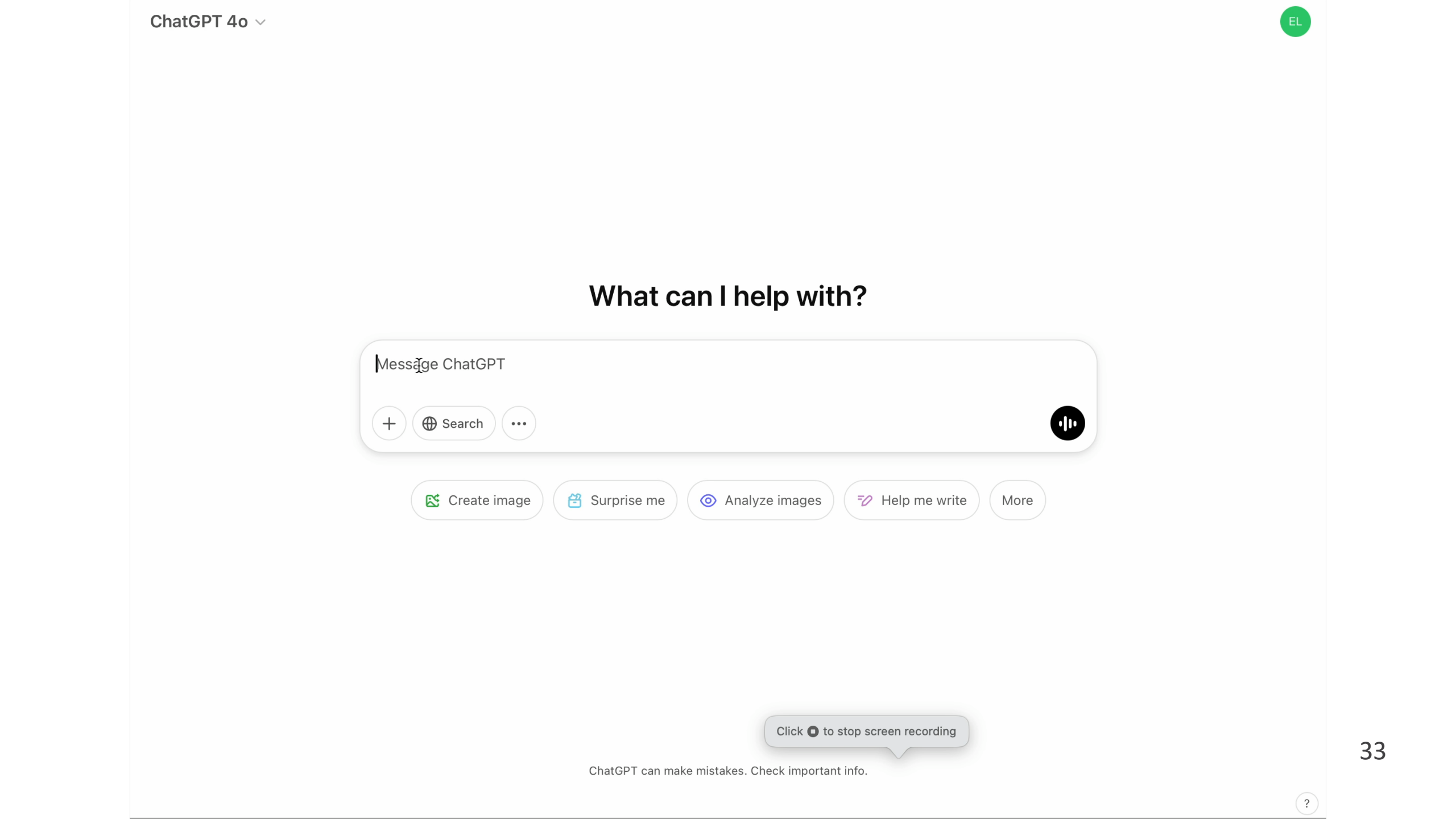
- **Political Effect:**
  - Can normalize "abandonment" of those who still face structural barriers, making inequality appear acceptable

* Greene, D. (2021). The promise of access: Technology, inequality, and the political economy of hope. mit press.

Case Study – The Cambridge Analytica Scandal

- How **digital exclusion** contributed to data misuse:
  - **Older adults** & **low-literacy** users were targeted with misleading political ads
  - **Privacy settings** were too **complex** for many to navigate
  - **Lack of digital literacy** led to **manipulation** through social media

- **Discussion Question:** Should governments regulate social media platforms to prevent **digital exploitation**?


ChatGPT 4o
EL
What can I help with?
Message ChatGPT
Search
Create image
Surprise me
Analyze images
Help me write
More
Click to stop screen recording
ChatGPT can make mistakes. Check important info.

Biases in AI-Generated Content: A Case of Digital Exclusion?

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- **Reinforcement Learning Bias:**
  - AI models prioritize common patterns in training data, leading to **exclusion of less frequent cases** (e.g., left-handed writing, watch times other than 10:10)
- **Data Representation Gap:**
  - Training datasets reflect dominant cultural and commercial practices, **reinforcing mainstream biases**
- **Mode Collapse & Algorithmic Defaulting:**
  - Overfitting to high-frequency examples leads to AI-generated content **lacking diversity and inclusion**

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- **Implications for Digital Exclusion:**
  - **Marginalized Users:** Diverse cultural representations, or non-Western aesthetics may be underrepresented in AI outputs
  - **Limited Personalization:** AI struggles to generate images reflecting diverse user needs, reinforcing the dominance of majority-represented groups
  - **Designing for Inclusion:** Addressing dataset imbalances and re-weighting reinforcement learning to diversify AI outputs is crucial for reducing digital exclusion

AI & The Future of Digital Inclusion

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- AI presents both **challenges** & **opportunities**:
  - **AI Assistants** – Can help older adults & low-literacy users navigate tech
  - **Algorithmic Bias** – AI tools often reinforce existing digital divides
  - **Automation & Jobs** – AI is changing the skills required in the workforce

- **Call to Action:** How do we ensure AI helps bridge the divide rather than widen it?

AI & The Future of Digital Inclusion

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- AI presents both **challenges** & **opportunities**:
  - **AI Assistants** – Can help older adults & low-literacy users navigate tech
    - Smart speakers (Amazon Alexa, Google Assistant) and conversational bots (like ChatGPT-based systems)
  - **Algorithmic Bias** – AI tools often reinforce existing digital divides
    - If that data isn't diverse or representative, the AI can discriminate against certain groups
  - **Automation & Jobs** – AI is changing the skills required in the workforce
    - AI-driven automation is already reshaping industries
    - The concept of 'upskilling' or 'reskilling' is critical

- **Call to Action:** How do we ensure AI helps bridge the divide rather than widen it?

Technical Solutions for Inclusive AI

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- Local-First or **Edge AI**
- **Federated Learning**
- **Explainable AI** (XAI) and Model Interpretability
- **Bias Detection** & Mitigation
- **Low-Resource Language** Support

Technical Solutions for Inclusive AI

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- Local-First or **Edge AI**
  - Reduces reliance on high-speed internet; processes data on-device
- **Federated Learning**
  - Models can train on decentralized data sets, improving representation without centralizing private info
- **Explainable AI (XAI)** and Model Interpretability
  - Techniques like LIME, SHAP, or integrated gradients help users understand AI decisions
- **Bias Detection** & Mitigation
  - Tools (Fairlearn, AI Fairness 360) to measure and reduce algorithmic bias
- **Low-Resource Language** Support
  - Transfer learning or domain adaptation to handle languages with limited data

Key Takeaways

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- The Digital Divide is **multifaceted**
  - Age, income, geography, education, and ability
- **Generational gaps** exist – from **Digital Natives** to **Digital Immigrants**
- **AI & automation** pose new inclusion and exclusion challenges
- **Bridging the gap** requires
  - Policy, education, and inclusive tech design

Future Outlook

- **Questions?**

- **Looking Ahead:** Next week—Digital Inequalities

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Thank you for attending, any questions?