The Future Is Faster Than You Think

The Future Is Faster Than You Think: How Converging Technologies Are Disrupting Business, Industries, and Our Lives

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Recommended by: Emily Moses (via John Starcher)

Part 1: The Power of Convergence

Part 2: The Rebirth of Everything

Part 3: The Faster Future

Some thoughts

This book casts a wide net of bleeding-edge innovations and was a fairly comprehensive (and accessible) tour of the state of technology (as of 2019). It was interesting to look up some of the ventures the authors were excited about, only to find those ventures went under or have been bought by “bigger fish.” It’s probably worth mentioning that this book was written and published before the global COVID-19 pandemic, which (1) reshuffled money and efforts, and (2) shone light on the wealth distribution gap.

The first part of the book left a sour taste in my mouth, at least from a United States perspective. A common trope was “rich and powerful people /companies using exponential technology to gather up even more wealth and power.” Pretty dystopian. Unless we have some major sea change culturally and politically, I don’t have much hope for average folks (myself included).

Chapters 12 and 13 left me more optimistic that we’ve invented some technological deus ex machinas to solve the water and food problems that are virtually guaranteed to worsen as humans (mostly exploitative corporations) continue to screw up the planet.

The primary author (Diamandis) comes from privilege; take a look at his Wikipedia page if you want the details. He can afford to be more optimistic, because he’s riding the wave while the rest of us have to figure out how to swim or be drowned by it. He even acknowledged in the afterward that the rich will reap the benefits of all these innovations before they become commoditized enough for the masses.

Lastly, maybe it’s the anti-capitalist in me speaking, but why are all of these crises (read: “opportunities”) only worth solving because there’s money to be made? I want to live in a world where there’s clean water, clean energy, and healthy food for **everyone**, not just for those that are lucky enough to be able to afford them.

Overall the book left me tentatively optimistic. The technology is there. The need is there. The momentum for improvement is there. We just need to act in our collective self interest instead of our personal, short-sighted interest. The game’s not over yet, and it’s also ours to lose (and most signs point to that the majority of us will lose). I hope I’m wrong.

Ch 1: Convergence

- Flying cars
- Converging technology
- More transportation options
- Hyperloop
- Rockets
- Thinking about the future
- Avatars

Note from Geoff: I’m sure transportation will look very different in the next 10 years; however, the innovations presented here will likely only be available in major metropolitan cities. For example, there are only about 20 electric charging stations in Knoxville (Aug 2021).

Flying cars

- Uber Elevate (https://techcrunch.com/2018/05/18/ubers-chief-product-officer-is-out/) – aerial ride sharing (flying cars) led by Jeff Holden.
- Lots of money going into this; it's possible. Car ownership = $0.59/mile. Helicopter = $8/mile.
- eVTOL = electric vertical takeoff and landing (https://en.wikipedia.org/wiki/EVTOL)
- Uber's stated goal: make owning a car irrational. They're working with companies that can deliver eVTOL vehicles and are trying to develop a traffic control system; also need "skyports". Uber want to lease them, not own them.
- Why now? Convergence.

Converging technology

- Definition: tech that doubles in power while dropping in price on a regular basis (e.g., https://en.wikipedia.org/wiki/Moore%27s_law)
- Ray Kurzweil – whenever we digitize something, it gains the multiplier of Moore's law (e.g., designing computers with computers) https://en.wikipedia.org/wiki/Accelerating_change#Kurzweil%27s_The_Law_of_Accelerating_Returns
- For flying cars, the requirements are safety, noise, and price.
    - Helicopter = loud, dangerous single rotor
    - Distributed electric propulsion (DEP) - https://en.wikipedia.org/wiki/Distributed_propulsion. Convergence of ML advances for flight simulation, material science breakthroughs, and manufacturing techniques such as 3D printing.
    - You need computation to have faster-than-human response times for processing gigabits/sec of sensor data.
    - You also need enough power density and duration in batteries.
    - Current bottleneck is production of aircraft. Need computer aided design (CAD), composite materials, faster 3D printing.
- Human brain developed locally (everything you needed was < 1 mi away) and linearly (rate of change was slow generation to generation). We live in a global and exponential world; our hardware isn't designed for this scale or speed.

More transportation options

- Internal combustion engine + assembly line + petroleum production = goodbye horse-and-buggy business
- What about autonomous cars? Waymo (formerly Google) seems like a front-runner. The more they drive, the better they get.
- We're moving toward "car as service" instead of "car as possession".
- A given car is only driven 5% of the time (very inefficient). We won't need as many new cars, so expect consolidation of car brands.
- Consumers don't care about the brand of vehicles – clean and reliable (and cheap) is what matters.
- Parking lot land area is huge in the US; these will be repurposed somehow.

Hyperloop

- Magnetic levitation of pods in vacuum tubes (faster than commercial jets). Not a new idea (Goddard did this in 1909), but convergences were required (just like for flying cars).
- "The Boring Company": Elon Musk claimed he was going the make a tunnel to deal with the traffic on I-405.

Rockets

- Sept 2017, Musk talked about "anywhere on Earth in under an hour".
- (This section doesn't seem to have panned out, given the book was published in Jan 2020 – and thus written in 2019.)
- (Also, this section has some optics problems given the environmental impact of rocket travel – e.g., CO_2, space debris. See also: https://www.theguardian.com/science/2021/jul/19/billionaires-space-tourism-environment-emissions)

Thinking about the future

- The brain treats the person we're about to become as a stranger. People have a tough time staying on a diet or getting regular screenings: The person that benefits from those is "another person."
- Bad: Inability to adapt to change. AI + robotics could severely impact the workforce unless they are re-trained. Established orgs will have a difficult time adapting because they were designed in another time for a different purpose. Education is also outdated (designed in the 1800s to prepare children for factory labor).
- Good: The changes could create more opportunities than they replace.
- (I think his comment about divorce rate being higher because we live longer is tenuous.)
    - We have a culture where we don't bother committing to anything because we're in an environment where we stay put until something better comes along.
    - Planned obsolescence is built into our products to keep us consuming.
    - Yes, these advances are the tide lifting all boats; but many of those boats are being lifted much higher than the rest (rich getting richer). Many of those gains are built upon a system that optimizes for infinite/exponential growth that lives in a finite system. Our future selves are strangers that have not yet paid the price for this.
    - We're busy building new features into our software without a way to transition because our hardware isn't up to the task.
- **Goal: Be able to see around the corner of tomorrow and be agile enough to adapt to what's coming.**

Avatars

- A digital second self via virtual reality. Robots are another form.

- See also: https://www.xprize.org/prizes/avatar
- Individual car ownership ride sharing autonomous vehicles flying cars Hyperloop avatars

Ch 2: The Jump to Lightspeed: Exponential Technologies Part i

Quantum computing

- You need near-absolute-zero temperature to hold a qubit in superposition.
    - Bit – 0 or 1
    - Qubit (quantum bit) – multiple states at once (like a spinning coin)
- Context: IBM Deep Blue analyzing 2M chess moves per second; quantum = +1T moves per second.
- Moore's Law is slowing down; physics is the limit for transistor growth. There are several ideas in the works: carbon instead of silicon, specialized chips, 3D processors.
- Rose's Law is Moore's Law for quantum computers. We don't really know what the limits are because of the exponential capabilities.
- Example application: discovery of new drugs for cancer research can be simulated rather than requiring physical labs (expensive, slow).
- https://www.rigetti.com/
- https://www.youtube.com/watch?v=QuR969uMICM Quantum computer is not just a more powerful computer; that's like saying if you build more powerful candles you'd end up with a light bulb.

Phases

- **Digitialization** – once a technology can be put in 0s and 1s, it "hitches a ride" on Moore's Law
- **Deception** – early progress is slow, lots of time failing to live up to the hype
- **Disruption** – products, services, markets, industries; 3D printing threatens the manufacturing sector
- **Demonetization** – money isn't part of the equation (e.g., photography)
- **Dematerialization** – individual products disappear and are absorbed into something else (e.g., smart phones, Wikipedia, iTunes)
- **Democratization** – mobile phones that are clunky and expensive now everyone has one
- User-friendly interfaces democratize technology. Ex: Mosaic was the precursor to Netscape.

Artificial intelligence

- 2014 chat bot from Microsoft (Xaioice) – https://en.wikipedia.org/wiki/Tay_(bot)
    - Built with neural nets
    - 30B convos with 100M humans
    - Why did the authors not call out that this project was shut down because it learned to be racist????
- Big data – finding obscure patterns in lots of information; likely stuff a human wouldn't notice
- Cheap social media data + cheap GPUs AI encroaching on everything
- **Machine learning** = supervised algorithms learn from structured data, then make predictions (e.g., Netflix suggesting movies)
- **Neural networks** = unsupervised learning from structured data
- **Reinforcement learning** = ML that learns from actions it suggests
- Five tasks of the service economy (80% of US GDP): looking, listening, reading, writing, integrating knowledge.
    - Looking: classifying images, signs, ZIP codes, lip-reading, movement tracking
    - Listening: Amazon always-listening devices
    - Reading: Amazon talk-to-books where answers are based on intent rather than keywords
    - Writing: Forbes business reports are auto-generated, Gmail smart compose
    - Integrating knowledge: game play (Go)
- 2018 and later smartphones have AI neural net chips built-in

Networks

- In 1844, we got Morse Code (Washington DC to Baltimore).
- In 1887, we got the telephone. Higher information throughput, plus no need to learn Morse code.
- Nearly everything is wired/connected now.

5G, balloons, and satellites

- G = generation
- Alphabet has Loon LLC (formerly Project Loon) to put balloons 20km above the earth's service to provide 4G LTE. https://en.wikipedia.org/wiki/Loon_LLC **As of Jan 2021 this has been shut down.**

- Greg Wyler (engineer) – OneWeb (2000 satellites to bring 5G to everyone) https://en.wikipedia.org/wiki/OneWeb
- Amazon's Project Kuiper (3236 satellites) https://en.wikipedia.org/wiki/Kuiper_Systems
- SpaceX's Starlink (12000 satellites) https://en.wikipedia.org/wiki/Starlink

Sensors

- Sensor = something that measures a physical property and transmits it to somewhere else
- Oura Ring to measure sleep quality: https://en.wikipedia.org/wiki/Oura_(company) . Sensors are now small enough and cheap enough to be put into a ring you wear on your finger.
- "Internet of Things" – interconnected smart devices
- Prediction: By 2020, we'll have 1 trillion sensors connected to the Internet. (Keep in mind an average smart phone has about 20 sensors.)
- Lower cost, lower weight, higher performance
- Another example… First commercial GPS in 1981, 53 lb, $120K. In 2010, it's a $5 chip that sits on your finger.
- https://en.wikipedia.org/wiki/Smartdust
- These sensors generate an astonishing amount of data every day.

Robotics

- In 2011, the Fukishima reactor prompted the use of robotics to assess the damage, which failed miserably.
- Honda's Asimo https://en.wikipedia.org/wiki/ASIMO was sent in, but it also failed; PR nightmare.
- DARPA robotics challenge was created to address the need. Humanoid robots are thought to be critical because we live in a humanoid world (2 eyes, 2 hands, etc.). This was also a disaster (blooper reel); 2015. Boston Dynamics's Atlas was the star. https://en.wikipedia.org/wiki/Atlas_(robot)
- In the last decade, we've gone from an embarrassing state to several robots that are disaster-ready.
- It's likely that we'll see robots performing more tasks as they become more mainstream and more reliable.
- Drones are becoming more prominent.
- (Personally, I'm in favor of having technology supplement our abilities, or to perform tasks that are beyond our ability. I'm not in favor of having technology replace people because it's cheaper or just to boost profits.)

Ch 3: The Jump to Lightspeed: Exponential Technologies Part ii

- Virtual reality and augmented reality
- 3D printing
- Blockchain
- Material science and nano-technology
- Biotechnology

Virtual reality and augmented reality

- Virtual reality -- simulated sensory input
  - **Presence** – the brain can't distinguish virtual from physical
  - This technology has been around for a while; see https://en.wikipedia.org/wiki/VPL_Research#The_EyePhone
  - Video hardware plus AI software converged to make this practical with consumer-grade technology
  - Facebook spent $2B to acquire Oculus Rift https://en.wikipedia.org/wiki/Oculus_Rift
  - We now have 360-degree audio capture, so visuals and sounds are immersive. We have haptics to emulate touch as well.
  - Behavior change idea being explored: using VR to simulate what it's like to be a different person (e.g., homeless black person in Baltimore) to build empathy.
- Augmented reality – traditional senses with overlaid sensory input
  - 2016 - Pokemon Go
  - Over 1800 AR startups found on Angel List
  - Entry ranges from $100 to $3000 (Microsoft Hololens)
  - Heads-up display in cars
  - Teaching simulations (e.g., how to fly planes, home tours, surgery)

3D printing

- On-demand manufacturing. You now don't need as much inventory (space, transportation).
- Problem to solve: getting parts to the International Space Station takes months and $10K per pound to lift it up.
- First ones were in the 1980s – slow, fragile, clunky, only plastic, expensive. You can now print in metals, glass, concrete, organic cells.
- You can now purchase these for under $1000. It also allows companies to prototype new products in hours instead of months.
- 3D printing can make batteries, solar cells, wind turbines
- GE has been able to construct turbine engines that are simpler and lighter.
- Biotech – printed prosthetics; 2002 Wake Forrest researchers 3D printed working kidney tissue; 2010 Organovo created blood vessels (predicted organ market in 2023)
- 2014 China company created ten single-family homes in < 24 hours, each costing less than $5K. 2017 57-story skyscraper in nineteen days (https://www.youtube.com/watch?v=N6f_sayw0mM) (Note from Geoff: I think this is because of modular construction, not 3D printing.)
- 2019: robotics + material science; 1/10 labor cost, 3x cheaper than industry standard (https://mightybuildings.com/)

- Another example: https://newstorycharity.org/

Blockchain

- Came about to enable digital currency; first proposed in 1983, but how do you prove you're *giving* it to someone instead of *copying* the 0s and 1s? (double-spending problem)
- Bitcoin started anonymously in 2008; exchange cash without the need for banks
- Blockchain is a ledger
    - Distributed – shared database, everyone has a copy
    - Mutable – any change is distributed to everyone else
    - Permissible – anyone can use it
    - Transparent – everyone can see every transaction (solves double-spending)
- Typical financial transaction: a bank is a trusted third-party to ensure the money exists. Blockchain: every computer validates it, then bundles the change into a block and added to a record to all prior blocks to create a chain.
- Allows people that aren't eligible for a bank account to use it; everyone gets an ID
- Transferable between countries with less overhead from companies like Western Union
- You can also use blockchain to validate identities (e.g., your engagement ring isn't a blood diamond, land titles)
- Many major banks are starting to think about cryptocurrencies at scale (https://en.wikipedia.org/wiki/Initial_coin_offering)
- Bridges between worlds… https://en.wikipedia.org/wiki/Non-fungible_token. You can embed information about an object, like where all the components came from.

Material science and nano-technology

- We can now use simulations to run experiments. Material science is historically slow because there are so many combinations of elements to evaluate.
- (It doesn't look like the promise of 66% solar cell efficiency from perovskite mentioned in the book is bearing fruit: https://www.energy.gov/eere/solar/perovskite-solar-cells)
- Self-replicating nano-machines (on the atomic scale). Example applications: fabrics that resist wrinkles and staining, nano-films to make windows self-cleaning, nano-coatings to capture solar energy, contact lenses with a resolution 6x that of today's smartphones, medicine delivery nano-bots for fighting cancer, CO2 to carbon nano-fiber.

Biotechnology

- Gene therapy = using the mechanisms viruses use for replication in order to repair faulty genes
- Biotech = using biology as technology
- Prior problems… decoding DNA, and then once decoded figuring out what the sequences meant
- In 2019, it takes only few days and less than $1K to decode a human's genome.
- Main technologies…
    - Gene therapy – replaces defective or missing DNA inside a cell
    - Gene editing – repairs/rewrites DNA inside a cell; https://en.wikipedia.org/wiki/CRISPR
    - Stem cell – replace the cell entirely
- Biggest potential conversion is customized medicine – https://en.wikipedia.org/wiki/N_of_1_trial

Ch 4: The Acceleration of Acceleration

- Saved Time
- Availability of Capital
- Demonetization
- More Genius
- Communications Abundance
- New Business Models
- Longer Lives

Three amplifiers… computing power, technologies converging, additional seven forces that this book discusses (note from Geoff: how is this "three" when one of those has seven??)

Saved Time

- Example from an early Apple computer… If you make it boot 10 seconds faster, then multiply that by 5M people that have them, you've saved 578 days worth of time each day.
- The search engine is another time saver. Before it was functional, you'd spend hours in a library.
- Other examples… online shopping, watching a movie, booking a plane ticket
- Society needs free time (i.e., time not spent subsisting) to make these changes and drive innovation. Technology solves this.
- Electricity and appliances have taken housework from 58 hours/week in 1900 1.5 hours/week in 2011
- Travel… NY to Chicago was 4 weeks by stagecoach, 4 days by train, 4 hours by plane.
- We can test new materials via simulations than a laboratory. 3D printing makes manufacturing more efficient.

Availability of Capital

- 1957 Soviets launched Sputnik I into orbit, then 1961 they had someone orbit the earth. This ignited the space race, which we fought back with cash.
- “Nothing accelerates technological development like money.” This money is coming from digital technology.
- Crowd-funding – make a pitch to a large digital audience; this democratizes funding
    - Loan (peer-to-peer lending), equity investment, advanced purchase of the product/service
    - Example: https://en.wikipedia.org/wiki/Pebble_(watch)
    - Expected to reach $300B by 2025
- Venture capital ($8.1B in 1995 to $99.5B in 2017 in the US)
- Initial coin offerings (ICOs) – https://en.wikipedia.org/wiki/Initial_coin_offering
    - The amount of money raised is increasing; the number of ICOs is increasing
- Sovereign wealth funds - $8.5T in assets (https://en.wikipedia.org/wiki/Sovereign_wealth_fund)
- https://en.wikipedia.org/wiki/SoftBank_Vision_Fund – mentioned by the book after describing sovereign wealth funds; however, this is venture capital

Demonetization

- Innovation demands research, and the cost of that research needs to come down. The principle is that if you have $1M, you’d be better off doing one million things at $1 each, then one thing for $1M.
- We all walk around with phones that would have been considered supercomputers 20-30 years ago
- (I don’t buy the authors claims of getting basically infinite growth from solar power. It doesn’t matter how efficient the solar cells are; there’ s only a finite amount of energy Earth receives on the ground from solar radiation.)

More Genius

- https://en.wikipedia.org/wiki/Srinivasa_Ramanujan
- Think of how much genius has been squandered because you weren’t born wealthy and male (to get noticed, to get educated).
- Class, country, and culture are being leveled by an increasingly connected world.
- Near-term – neurological basis for innovation; see also https://en.wikipedia.org/wiki/Thinking_outside_the_box#Nine_dots_puzzle
- Long-term – technology to improve cognitive function; neuroprosthetics, brain-computer interfaces (which we have some of already with cochlear implants, help for paralysis victims)

Communications Abundance

- Letting minds connect with other minds; coffeehouses did this in the Enlightenment (https://en.wikipedia.org/wiki/English_coffeehouses_in_the_17th_and_18th_centuries)
- Cities also provide this hub/network (population density with differing ideas)
- The Internet has allowed for global connection

New Business Models

- Business model = systems and processes a company uses to generate value
- Old way of doing things… Take the same business model as a competitor, but execute it “better”; once in a decade cadence. Examples: bait and hook (razor/razor blades), franchise, hypermarkets (Walmart).
- Things like cryptocurrency and crowdfunding change how capital is raised
- Goal: shorten the time between idea to profitable business (also called “Concept to Cash” http://www.agilereleaseplanning.com/concept-to-cash-cycle-c3-in-agile/)
- Disruption is increasing
    - **Crowd economy** (ex: AirBnB is the largest hotel chain in the world, but they don’t own any hotels)
    - **Free data economy** (free to use, sell the data about the users)
    - **Smartness economy** (take an existing tool and add “smarts”, just like the old take an object and add electricity)
    - **Closed-loop economy** (the waste of one thing is the input of another)
    - **Decentralized, autonomous organizations** (autonomous taxis with no human involvement)
    - **Multiple world models** (AR/VR lets us “inhabit” other worlds)
    - **Transformation economy** (pay to have your life transformed by an experience, e.g., Burning Man, Crossfit)
- Business models need to be designed for speed and agility

Longer Lives

- Ada Lovelace met Charles Babbage and saw the Analytical Engine (first programmable machine) https://en.wikipedia.org/wiki/Analytical_Engine. She died before seeing her first program execute.
- What if people lived long enough to get their ideas implemented? We’re the most knowledgeable, wise, and connected in our later years.
- Early humans only lived for 25 years. It didn’t reach an average of 40 until the 19th century. Germ theory, clean water, sanitation lower childhood mortality. By 2000, the average age is 76.
- Sept 2013 (Google/Alphabet) – https://en.wikipedia.org/wiki/Calico_(company) to study anti-aging

- https://en.wikipedia.org/wiki/Senolytic Normally cell division is capped at a certain number; this process aims to stop that.
- https://en.wikipedia.org/wiki/Young_blood_transfusion (this is considered pseudoscientific)
- https://en.wikipedia.org/wiki/Stem_cell

Ch 5: The Future of Shopping

Sears

1870s rail expansion meant that people could travel great distances, but needed to know the time. Richard Warren Sears (https://en.wikipedia.org/wiki/Sears) took some watches a jeweler refused and sold them for cheaper than a jewelry store, basically inventing discount shopping. They also invented mail order catalogs (which was a confluence of postal law changes and the automobile's entrance). In the 1920s, urbanization happened (people moving to cities), so Sears opened up retail stores. This was a confluence of communication tech (postal service), new sources of energy (cheap Texas oil), new modes of mobility (automobile). In 2018, they went bankrupt basically because of Walmart using their own discount store concept against them. Walmart's land was cheaper, paid their workers less, and sold cheaper goods. Also, Walmart used digital technologies earlier to understand what shoppers were buying. Amazon blended the postal service with communications tech that is pinching Walmart. Brick and mortar stores are going bankrupt.

AI and the retail experience

From desire to purchase: What is the exact right thing to buy? Voice-activated, AI-assisted commerce: Amazon Alexa/Echo, Google Assistant, Apple Siri, Alibaba Tmall Genie. Note, none of these are retailers – they are platforms.

Google Duplex: https://en.wikipedia.org/wiki/Google_Assistant#Google_Duplex You have to make phone calls to solve problems, so this digital assistant does that (restaurant reservation, haircut appointment).

https://en.wikipedia.org/wiki/Beyond_Verbal AI customer service coach; integrated into human call centers. The system can tell what kind of shopper the person is (e.g., early adopter).

https://www.soulmachines.com/ IBM Watson powered. 40% of customer service calls are resolved without human interaction.

Go, go, gone are cashiers

https://en.wikipedia.org/wiki/Amazon_Go As of this writing, there are 30 stores; not the 3000 projected by the book. Frictionless shopping – long lines deter customers, cashiers cost money. https://www.v7labs.com/retail/retail-techology is also in this space. Smart-shelf (RFIDs, weight sensors) tech is already here.

Supply chain management (inventory levels, supplier quality, demand forecasting, production planning, transportation management) will be impacted, because AI can determine patterns in data that humans can't.

The robots are coming, the robots are coming

Domino's Robotic Unit https://www.dominos.com.au/inside-dominos/technology/dru to deliver pizza via a robot.

https://en.wikipedia.org/wiki/Starship_Technologies is another robot delivery platform. https://en.wikipedia.org/wiki/Nuro is another. Amazon is doing drone delivery: https://en.wikipedia.org/wiki/Amazon_Prime_Air (Not much news about this since 2020.)

Softbank has Pepper: https://en.wikipedia.org/wiki/Pepper_(robot) (This has pretty much stalled.) Here's one used in Lowe's https://www.lowesinnovationlabs.com/lowebot (Not really much news about this since 2016.)

Walmart uses shelf-stocking robots for inventory control.

Kiva Systems was acquired by Amazon in 2012 to use robots in warehouses: https://en.wikipedia.org/wiki/Amazon_Robotics Kindred robots are also a thing: https://www.kindred.ai/products

3D printing and retail

https://en.wikipedia.org/wiki/Ministry_of_Supply_(clothing) Uses phase-change materials to control heat and moisture. It makes jackets that respond to voice commands. The "printer" can create pieces with zero waste.

Apparently you can also 3D print things at Staples.

1. End of the supply chain with just-in-time manufacturing
2. End of waste because of lower material cost/waste
3. End of the spare parts market
4. Rise of the user-designed product

Retail's last hope

For birthday cakes, we used to make them ourselves, then we bought cake mixes, then we bought them already made at the store, then we went out for the party (e.g., Chuck-e-Cheese). (Reference: https://hbr.org/1998/07/welcome-to-the-experience-economy)

Experiences > possessions

The book covered this possible future of shopping by Westfield Group: https://www.wundermanthompson.com/insight/enlightening-retail

No more shopping malls

Idea: virtual shopping center via virtual reality, where you get the physical good delivered to it, but can also wear it in VR.

Body scanning is a thing; see also https://en.wikipedia.org/wiki/Body_Labs

Alibaba uses AI applied to fashion: https://www.alibabacloud.com/blog/fashionai-revamping-the-fashion-and-e-commerce-industry-through-artificial-intelligence_595413

Microsoft worked with the London College of Fashion: https://inculture.microsoft.com/fashion/london-college-fashion-2018/

Ch 6: The Future of Advertising

Madder men

The Dot-com era brought an end to the typical landscape of advertising (TV, print, radio). Craigslist killed newspaper classifieds, banner ads went after magazines, Netflix eliminated commercials during movies.

Google and Facebook get more ad revenue than all other print services combined. It took fewer than 15 years for social media advertising to supplant print advertising.

Ads are likely to get more invasive and more personal, but it won't last (according to the authors).

The spatial web

The physical and digital worlds are starting to blend, with layers of information. We once shared a common reality, but in the future each of us can have our own reality.

Web 1.0 - static documents, read-only interactions (banner ads)

Web 2.0 - multimedia, interactive web ads (still 2D though)

Web 3.0 - high bandwidth, AR/VR, sensors everywhere, AI, putting digital info atop physical environments

Visual search is already here. https://en.wikipedia.org/wiki/Content-based_image_retrieval Snapchat and Pinterest can recognize products. "Point, shoot, shop." This is another reason why the shopping mall may be doomed – the world is a mall now.

The eerie power of hyperpersonalization

Imagine walking into a store and a virtual hologram of your mother is trying to tell you to buy something.

30 sentences and a few minutes of example speech can train https://www.descript.com/lyrebird to mimic your voice. Baidu has come up with one that's even faster.

There are upsides to personalized voices – video game development, helping people who have lost the ability to speak (think Stephen Hawking), better speech to speech communication in other languages.

You can also make videos that look like the real thing – https://en.wikipedia.org/wiki/Deepfake. This can fuel distrust (i.e., actual fake news) and other edge cases like people claiming it wasn't them on the video because you can never know.

Goodbye advertising

Ads exist to sell people stuff. “Buy X because you’ll get Y.” What happens when you aren’t doing the buying? “Hey digital assistant, buy me some toothpaste.” Or one step further, you don’t have to ask it to order toothpaste because it already knows how much you have left.

Ch 7: The Future of Entertainment

Going digital

Four key decisions from Netflix: rent DVDs via the postal service, never charge late fees, creating a queue so you could always have something to watch, replace postal service with broadband streaming. Now they’re creating their own content.

At first, the silver screen was dominated by well-capitalized, tightly-controlled studios. Tech, talent, financing, and distribution were hoarded by studios/networks. Now those scarce resources are abundant.

Who makes content

The audio/video equipment is now available to pretty much everyone on our smartphones. This lead to a wealth of user-generated content; blogs and podcasts were mainstream, but there was no home for videos. YouTube beat Google because they were so small and not mired in legal battles. (Note from Geoff: So basically YouTube covered their eyes and did it anyway, got popular, and then decided to figure it out later. Typical approach – make a splash before the lawyers find out.) YouTube democratized content distribution.

Top content producers are making millions of dollars. “Nothing makes money like money,” so venture capitalists are getting in this as well by helping people get famous on these platforms.

Blockchain is being used to ensure the content is legitimate and not a copy.

Anything you could be interested in probably has a channel devoted to it – direct to fan content creation.

In June 2016, AI wrote a sci-fi screenplay: https://en.wikipedia.org/wiki/Sunspring

Video games are affected as well: https://www.cnet.com/news/artificial-intelligence-writes-choose-your-own-adventure/

What the content is

Passive media – one-way flow (e.g., newspaper, books). **Active** media – two-way flow (e.g., game level editors where the levels are shared online).

http://mashupmachine.io/

https://www.theverge.com/2018/8/26/17778792/deepfakes-video-dancing-ai-synthesis

Idea: Using film footage of dead stars to put them in new movies. (We sort of did this in Star Wars.)

https://aifoundation.com/news/p/ai-foundation-acquires-lifekind-to-continue-development-of-ai-native-humans/

Jules Urbach was inspired by Star Trek’s holodeck: https://home.otoy.com/the-company/ https://home.otoy.com/capture/lightstage/

https://www.lightfieldlab.com/ has built a prototype of holographic projections. They’re also using ultrasound to give objects a physical presence.

https://vrscout.com/news/high-fidelity-neosensory-exoskin-haptic-jacket/

https://en.wikipedia.org/wiki/Affective_computing

The book mentioned the company Lightwave that can measure affect of crowds; however, their website has security issues and no news has been published recently about them recently.

Where the content is experienced

Storytelling to the masses began in print. Then came radio so that people could experience the same thing at the same time. Then TV came television to share sound and video together.

The book mentioned AR glasses by Magic Leap (https://en.wikipedia.org/wiki/Magic_Leap); however as of this writing, the valuation from 2019 to 2020 dropped from $6.4B to $450M.

Next is contact lens displays: https://www.cnet.com/tech/mobile/mojo-vision-crams-its-contact-lens-with-ar-display-processor-and-wireless-tech/

Screen tech is getting thinner and can curve around surfaces.

In 2016, Nintendo released the AR game https://en.wikipedia.org/wiki/Pok%C3%A9mon_Go.

https://en.wikipedia.org/wiki/Brain%E2%80%93computer_interface

https://spectrum.ieee.org/video-game-players-electronically-connect-their-brains

http://braincontrolledmovie.co.uk/

Ch 8: The Future of Education

The quest for quantity and quality

Quantity – shortage of teachers

Quality – our education system was created in a different era for the needs of a different world. The system is designed to produce a standardized product: obedient factory workers.

The efficiency of large class sizes makes for a situation where very few students are learning well; many are lost, many are bored. “Quality control” with standardized testing measures skills that often don’t pair with the needs of adult life.

One billion android teachers per year

https://www.technologyreview.com/2012/10/29/84908/given-tablets-but-no-teachers-ethiopian-children-teach-themselves/ (Nicholas Negroponte from MIT Media Lab, 2012)

https://en.wikipedia.org/wiki/One_Laptop_per_Child Technology unlocked self-directed learning and creativity.

https://www.cmu.edu/scs/robotutor/global-learning-xprize/index.html (This software is open-source on Github.)

Idea: Donate old tablets to charity so they can use it to educate others. Plus it reduces e-waste.

The ultimate field trip

It’s infeasible to take a whole class of teenagers to visit Egyptian tombs. Imagine doing this with VR. https://news.elearninginside.com/explore-the-tomb-of-queen-nefertari-in-vr/

Virtual Human Interaction Lab is using VR to expand empathy skills: https://vhil.stanford.edu/topics/empathy-diversity/

VR + AI + 5G makes for a global education network – quality and quantity on demand.

(Question from Geoff: What will we need teachers and educators for anymore?)

School 2030

https://en.wikipedia.org/wiki/The_Diamond_Age Sci-fi novel from 1995 gave an example. (From Geoff: I’m sure there are other examples, but Orson Scott Card had the concept of learning desks in https://en.wikipedia.org/wiki/Ender%27s_Game in 1985.)

https://en.wikipedia.org/wiki/Magic_Leap (This was mentioned in a previous chapter.)

We want to help get students into a flow state during learning.

Ch 9: The Future of Healthcare

Martine and the moonshots

https://en.wikipedia.org/wiki/Martine_Rothblatt -- her daughter had a rare case of pulmonary hypertension, so she was bent on finding a cure. She managed to get a pharmaceutical to market that addresses the symptoms. She's now working on making organ shortages a thing of the past.

Turning sick care into healthcare

Current medicine is reactive (after the fact decisions) and overpriced. Doctors spend $210B in procedures patients don't need so they won't be held liable.

For every new 5K new drugs, 5 makes it to human testing, 1 is approved.

Each person spends on average $10,739/yr on healthcare in the US (more than any other country).

First major shift: sick care to healthcare, being proactive and personalized

Second major shift: management (big pharma + big government + doctors/nurses/professionals). Big tech is now getting into the game; they're already in your home, they have data on you, and they know how to process that data. It's debatable whether these companies should have this power, but it's a first step in getting diagnostics ahead of time.

DIY diagnostics

https://en.wikipedia.org/wiki/Verily Alphabet (Google's parent company) is trying to leverage technology in the healthcare space.

Sensors are everywhere and wearable.

fMRI equivalent device: https://en.wikipedia.org/wiki/Mary_Lou_Jepsen#Openwater

Some companies are trying to invent the tricorder from Star Trek: http://www.basilleaftech.com/dxter

This field is called **mobile health**. Networks, sensors, computing, AI.

Human Longevity Inc. (Diamandis [author] co-founded this company; however, it looks like it's not doing so good). https://en.wikipedia.org/wiki/Human_Longevity Basically they offer a service where you get a complete body scan (blood tests, MRI, CT scans) every year to detect problems early. They aim on moving much of this to technology in your home.

Reading, writing, and editing the code of life

Personalized genomics – how to optimize yourself; the perfect drugs, food, exercise, etc.

https://allofus.nih.gov/

https://en.wikipedia.org/wiki/CRISPR_gene_editing

It's possible to genetically engineer mosquitos that won't reproduce. https://targetmalaria.org/results-from-months-of-monitoring-following-the-first-release-of-non-gene-drive-genetically-modified-mosquitoes-in-africa/

The future of surgery

https://bioe.umd.edu/news/story/smart-tissue-autonomous-robot-raises-the-bar-on-surgery-precision

We already have robot-assisted surgery today. This democratizes surgery by having it be more predictable, available, and accurate.

https://bionautlabs.com/science/ Capsules powered by magnets that deliver medicine exactly where needed (versus orally, intravenously).

https://www.intelligentliving.co/3d-printed-bionic-eye/

Cellular medicine

https://en.wikipedia.org/wiki/Chimeric_antigen_receptor_T_cell In 2017, it was $500K per patient for treatment of cancer. There is a company working on how to do this at scale: https://celularity.com/ Most of the cellular pieces come from placentas (which are in abundant supply).

The future of drugs

Traditional drug formulations involved (1) poring over libraries of chemicals to find possible candidates, (2) going to exotic locations to find natural cures. From there you have to synthesize and analyze the drugs, then test in animals, then small groups of humans, then large groups of humans. 90% of all possible drugs fail.

https://en.wikipedia.org/wiki/Generative_adversarial_network Pit two neural networks against each other to generate novel outcomes. This can be used to generate new molecules.

One example involved synthesizing and computer-testing a new drug molecule in 46 days.

Google's Deep Mind via https://en.wikipedia.org/wiki/AlphaFold is working on finding ways that proteins fold to discover new drug receptors.

Ch 10: The Future of Longevity

Nine horsemen

Aging is not just a running down of the system, it is a programmed event (planned obsolescence) so younger generations have access to resources.

1. **Genomic instability.** DNA copies/corrections eventually fail (like a broken copy machine)
2. **Telomere attrition.** Telomeres act like bumpers on cars, protecting the chromosome; every replication makes the protection wear down
3. **Epigenetic alterations.** Changes in our environment (e.g., exposure to carcinogens) destabilize things.
4. **Loss of proteostasis.** Proteins become less effective over time and are thrown away, but sometimes the "trash doesn't get emptied."
5. **Nutrient sensing goes awry.** Can't process nutrients we need or break down fat properly.
6. **Mitochondrial dysfunction.** Powerhouse wears down, producing free radicals that mangle DNA and proteins.
7. **Cellular senescence.** Can't divide and also resist death; they build up.
8. **Stem cell exhaustion.** We only have so much supply of stem cells.
9. **Altered intercellular communications.** Some cellls are unresponsive or get the wrong messages.

Longevity escape velocity

Roundworms (https://en.wikipedia.org/wiki/Nematode) live about 20 days, but in 2014 scientists increased this number by editing genes (some lived to 100 days).

There are 50+ genes in humans that are related to aging.

Will likely need a combination of on-demand organ creation, robotic surgery, and gene editing.

The most recent extension of life came from antibiotics and sanitation efforts.

Rich people want to keep that money a bit longer, so they're investing heavily. See for example https://en.wikipedia.org/wiki/Calico_(company).

Anti-aging pharmacy

An antifungal chemical (rapamycin – https://en.wikipedia.org/wiki/Sirolimus) was discovered in the soil of Easter Island; it also suppresses the immune system for organ rejection. It also suppresses cancer growth.

https://en.wikipedia.org/wiki/Metformin blocks sugar production and helps regulate insulin; it also slows the burn rate of cells.

https://en.wikipedia.org/wiki/Unity_Biotechnology is working on a way to destroy senolytic cells in mice.

https://en.wikipedia.org/wiki/Biosplice_Therapeutics is working on the intercellular communication mechanism https://en.wikipedia.org/wiki/Wnt_signaling_pathway. They have a treatment for osteoarthritis that can stimulate stem cells to grow new cartilage. They are working on early phase studies for cancer cessation.

The bloody fountain of youth

Blood drinking has been part of human folklore for some time: https://en.wikipedia.org/wiki/Vampire#Ancient_beliefs

In mice, younger blood revived the older mouse. https://en.wikipedia.org/wiki/GDF11 appears to be responsible. https://www.elevian.com is working on this.

Ch 11: The Future of Insurance, Finance, and Real Estate

The origin of insurance

https://en.wikipedia.org/wiki/Lloyd%27s_Coffee_House In the 17th century, London was driven by shipping and finance; the coffee house was located in the center of both. These were the days when coffee houses were places of information exchange and discourse.

The Babylonians developed a strategy for merchants sailing across the Mediterranean. They were given loans to cover the voyage; those loans would be cancelled if the ship was lost. Rates varied on times of year – risk-based pricing.

The finance people that met at Lloyd's developed https://en.wikipedia.org/wiki/Underwriting where the risk for the voyage was spread across several people in exchange for a premium.

1. Entire categories of insurance are being eliminated; shifting risk from consumer to the service provider
2. Crowd insurance is replacing health/life insurance
3. Rise of networks, sensors, and AI changes how insurance is priced and sold

The car that doesn't crash

Insurance is mostly about assessing risk and setting premiums. With the right numbers and enough people paying premiums, this averages out over time to make the underwriter a profit.

Current auto insurance is driven by the non-zero probability of driver error. Also, we insure what we own; what if we didn't own cars anymore?

The risk shifts even when taking the driver out of the equation. For example, if the LIDAR sensor goes out, is it the autonomous car vendor's fault? The sensor manufacturer's fault?

Crowd-surance

Accurate actuarial data requires lots of data, which comes from lots of customers, which come from lots of salespeople. Then you need statisticians. Then you need people to manage all those people. Hence, only the big players play.

Most insurance works by the people that need it the least, paying for those who need it the most. When the lowest risk people (healthiest) opt out, the stats stop working. (Note from Geoff: This is a slippery slope, like the argument "I don't have kids so why am I paying for public schools?" This leans more libertarian, which benefits individuals, not society at large.)

App + DB + AI bots = tech stack. See for example, https://en.wikipedia.org/wiki/Lemonade,_Inc. and https://etherisc.com/ (they offer automatic refunds if your plane is 45 minutes late).

Dynamic risk

Progressive Insurance covered high-risk drivers when the first started. They were also the first insurer to have a website and do business through the site; same with a mobile app. In 2004, they asked for volunteers for a research program TripSense that plugs into ODBC (mileage, speed, travel times) – see also, https://en.wikipedia.org/wiki/Usage-based_insurance. Later versions (Snapshot) captured speed and hard-braking events. This is a balance of getting lower rates for driving less (and for off peak hours), but then you're always being watched.

The same can be applied to home insurance, where claims are filed well after the home is purchased (e.g., water damage). Now sensors can detect potential problems well before they occur.

It's cheaper to fix problem before they occur, but you're always being watched.

Good money

Our money is mostly stored in banks. We also invest it. We also trade it for stuff we want.

Banks make a lot of money in fees. They also invest our money to make a profit, and some of those ventures may not be in line with our values. See: https://en.wikipedia.org/wiki/Good_Money

Unbanked = people in poorer countries that don't have the means to open/use a traditional bank account. Borrowing money is one of their biggest challenges. This led to https://en.wikipedia.org/wiki/Microfinance; see also https://en.wikipedia.org/wiki/M-Pesa.

China has turned its microfinance platform Alipay into social good via https://en.wikipedia.org/wiki/Ant_Forest.

In a typical stock purchase, there are ten entities (buyer, seller, clearinghouses, banks, exchange). Blockchain knocks out most of those.

https://en.wikipedia.org/wiki/Ripple_(payment_protocol) is using blockchain to disrupt typical banking.

The AI invasion

https://en.wikipedia.org/wiki/Financial_technology (fintech) = financial services + technology

https://en.wikipedia.org/wiki/Wise_(company) is taking on the foreign exchange market. Peer to peer lending is risky; the lender rarely gets his money back. With AI, people can come together and share risk – crowd lending (see for example: https://en.wikipedia.org/wiki/LendingTree).

https://www.crunchbase.com/organization/yongqianbao (Smart Bank Financing) in China uses social media information to assess risk and issue loans.

Traditionally investment bankers were only available to the wealthy (because they have access to financial data that is more scalable for wealthier clients). https://en.wikipedia.org/wiki/Wealthfront and https://en.wikipedia.org/wiki/Betterment_(company) are in this space. Nearly 60% of all market trades are made by computers now anyway. The robo-advisors take about 1/10 of what human advisors take in commission.

Cash is starting to go away as well. You don't need coins for toll booths, you can Uber without a wallet. Denmark stopped printing money in 2017.

Real estate

2008 great recession (big banks + big insurance = chaos), which led to a housing crisis. https://exprealty.com/ turned real estate on its head – everything online. They built an online avatar platform: https://www.virbela.com/ (computation + network + VR).

Say goodbye to your broker

Buying a home is typically the largest purchase someone will ever make. Why hire a stranger to sell real estate when all your preferences are online? VR programs can change things like sun orientation, furniture, paint colors in real time.

Reinventing the city

Proximity to things like shopping districts, schools, workplace, restaurants, closeness to friends is important. What happens when we can get to major cities in minutes rather than hours? We can live in more distant areas instead of packed into city centers (which may be unaffordable to most).

With rising sea levels, perhaps we could live on the ocean (for example, https://www.dezeen.com/2019/04/04/oceanix-city-floating-big-mit-united-nations/, https://en.wikipedia.org/wiki/The_Seasteading_Institute).

Ch 12: The Future of Food

The inefficiency of food

All animals eat plants (or eat other animals that eat plants). Solar energy via plants gets turned into fuel. Less than 1% of the sunlight that reaches earth is used for photosynthesis. Once grown, the food is transported elsewhere. 1 out of 8 in the US struggle to put food on the table, while 40% of the food is never eaten (rots in the field, thrown away).

Researchers are working on how to make plants more effective via tobacco. See: https://ripe.illinois.edu/

Food is becoming more durable for transport. See: https://www.apeel.com/ Avocados coated in the same material fruits use to make their peels take 60% longer to soften.

Instead of large swaths of two-dimensional land, we have https://en.wikipedia.org/wiki/Vertical_farming. This brings the farm to the city. This addresses the energy needed for transporting, but also shortens the time between harvesting and consumption (nutritional value drops the longer this time is). Hydroponics and aeroponics make these farms more efficient than traditional farms.

https://www.plenty.ag/ – 40x the amount of plants, 350x yield, less than 1% as much water, 20-35% off cost of traditional grocery stores.

https://www.aerofarms.com/ is producing 2M lb of leafy greens each year with no sun (LEDs) and no soil (aeroponics).

https://ironox.com/ – robot to tote growing containers; helps address the labor of farming.

The inefficiency of growing a cow

50% of all habitable land on Earth is used for agriculture; 80% of that is for livestock. Lots of animal suffering and lots of waste. Farm animals consume 30% of the world's food crops. 70% of global water use goes to meat production. Livestock also contribute to greenhouse gas emissions.

What if you could grow a steak from a single stem cell (via biopsy)? No cow required. This technique uses considerably less land, water, and emits way less greenhouse gas. You also decrease the time – several years to grow a cow, vs. several weeks to grow a cow's worth of meat.

Engineered meat can also have healthier proteins, better fat ratios, can include vitamins, and doesn't require growth hormones and antibiotics. (Another note, 70% of emerging diseases come from livestock.)

See https://en.wikipedia.org/wiki/Upside_Foods (beef)

See https://en.wikipedia.org/wiki/Perfect_Day_(company) (milk)

Ch 13: Threats and Solutions

Water woes

In 2018 the UN released a special report on global warming. Humans have ruined the world. We have about 12 years to fix this. The World Economic Forum seconded this statement.

900M people lack access to clean drinking water; waterborne illness is the number one killer on Earth. Climate change, growing population, and poor resource management are driving this.

https://en.wikipedia.org/wiki/Slingshot_(water_vapor_distillation_system) – can create drinkable water from any source using any combustible fuel.

Others are working on this as well; see https://www.skysource.org/.

On the consumption side, smart-grid technology can mean more efficient water use for crops.

Water tech is about 5 years behind the adoption curve for energy tech.

Climate change for optimists

40B tons of CO2 per year is what fossil fuels produce. This is the principle driver of global warming. We need to focus on energy generation, energy storage, and green transportation.

Wind and solar are more performant and cheaper than coal. Many major countries are shuttering new coal plant development, and many coal companies are going bankrupt.

https://en.wikipedia.org/wiki/Quantum_dot_solar_cell can raise the conversion rate from around 20% efficiency to over 60%.

The earth gets enough solar radiation to meet our yearly needs every 88 minutes. In about 5 days, we'd have enough energy to meet what's known to exist in all fossil fuel reserves.

With renewable energy, it's not about **scarcity**, but **accessibility**.

The story of storage

Batteries help store excess energy that's produced, and act as a buffer for when the wind doesn't blow and the sun doesn't shine.

Lithium ion batteries (storing energy in metal solids) have increased in capacity and are about 90% of their original price. The issues… availability of lithium ore, the amount of water needed to process/mine it. Good for small devices; can handle only about 1000 charge cycles

https://en.wikipedia.org/wiki/Gigafactory is producing batteries at scale.

Flow batteries store energy in molten salt. Big and bulky, but can hold 5-10K charge cycles. They are currently more expensive.

Compressed air storage – https://www.hydrostor.ca/

Electric cars are gaining speed

20% of the US energy budget is fueling cars/trucks. Regulators have been putting pressure on auto manufacturers to ban the sale of gas and diesel engines. Germany will not produce any such vehicles by 2030; Norway has a similar ban but by 2025.

Much of the investment by auto makers to have only electric fleets is spent on batteries.

Range is an issue; most vehicles get about 200 miles per charge; this is going up about 15% a year. Manufactures are looking to get into the 400-500 mile range so that it can match a typical gasoline car.

Charging is also an issue; minutes for gas, hours for electric. Several European companies are working to get from 10% to 80% charged in 15 minutes. https://en.wikipedia.org/wiki/StoreDot is working on technology that will charge a battery in 5 minutes.

Charging station availability is also an issue; we have about 1.2M gas pumps in the US, vs (2018) 68K charging units (not including residential).

Another interesting angle is that the battery in say, a Tesla, could power a typical US home for three days. This could help deal with extreme weather events that disrupt conventional power delivery systems.

Biodiversity, and ecosystem services

According to the UN, on a "bad day" 200 species go extinct. At the current rate, by 2100, 50% of all the large mammals will be gone.

Biodiversity is essential to the health of our ecosystems and all of the things our planet does for us that we can't do for ourselves (oxygen production, wood production, pollination, flood protection, climate stabilization, etc.). 60% of these services are degraded, and it's unsustainable on our current trajectory.

Developments…

- Grown reforestation. (Remember that removing trees removes carbon sinks.) https://dendra.io/ – AI-guided tree planting drones (100K trees a day).
- Reef restoration. See, https://mote.org/.
- Aquaculture reinvention. Tissue engineering techniques lets you grow fish meat in the lab.
- Agricultural reinvention. Things like vertical farming and tissue and cultured meat are helping farmers work elsewhere.
- Closed-loop economies. Shifting from petroleum to renewables helps. Companies need to reduce waste, rather than managing it via landfill (zero to zero).

In other words, we already have the tech to do this.

Economic risks: The threat of technological unemployment

McKinsey, Gartner, and DeLoitte have issued reports saying that this kind of unemployment in is unavoidable. A 2017 report however, showed a labor shortage and low unemployment. (Note from Geoff: Maybe the author will cover the topic, but I wonder how much of this is due to worker exploitation in a capitalist system. Also, this is like looking out to the ocean before a tsunami and saying, "I don't see a big wave out there; what are you all worried about?")

Transitions have occurred over the centuries… agrarian services information.

One counterexample is ATMs, thought to be a predecessor of a bank teller layoff. ATMs made it cheaper to operate banks, leading to more banks being built, leading to more tellers being hired. Another counterexample… AI has led to more output for legal discovery, which requires more paralegals to interpret the results.

Companies want productivity, which seems to be maximized when **augmenting** humans with machines. Those that aim to *replace* humans will only see short-term productivity gains.

Every time a company finds some way to automate, there's usually some "internet-sized opportunity tucked inside."

There will be some industries harder hit – truck driving, taxi driving, warehouse stock people, cashiers. The real question is whether there's enough time to retrain our workforce. **Technological skills** and **agility** will replace deep skills mastery.

Existential risks: vision, prevention, governance

Nick Bostrum published a paper in 2002 about global catastrophic risk: https://www.nickbostrom.com/existential/risks.html. Exponential technology had a bad habit of becoming existential risk.

- **Vision** – time horizons (difficult when humans are very short-term focused – immediate to six months). We do have the ability to delay gratification beyond our lifetimes. Everything is getting faster, which makes the future much harder to think about. See also: https://longnow.org/clock/
- **Prevention** – The Netherlands use their sea-level situation to their advantage. AI + networks + sensors + satellites = global threat detection networks. We can now detect forest fires from space.
- **Governance** – Adaptability and agility will help us navigate; however, this isn't how society is organized, given most of our organizations were built in another era when success was measured in size and stability. Modern democracies were a response to fight tyranny and instability; they are designed to change slowly. Estonia is leading the way in e-governance; 99% of all public services are online (pay taxes in 5 minutes, vote from anywhere in the world, access all health info from a blockchain-protected database). In this space… https://en.wikipedia.org/wiki/OpenGov, https://www.remix.com/, https://appallicious.com/about/, https://discover.glass/

Ch 14: The Five Great Migrations

Migration brings people, ideas, cultures, progress, innovation, etc. There have been studies that show the number of patents in the US increased after the mass exodus of German Jews as Hitler rose to power. Also, migrants account for the rise of many products that displace existing ones (see also: https://www.investopedia.com/terms/c/creativedestruction.asp). Of the Fortune 500 companies, 40% were founded by immigrants or their children.

The challenges discussed in this book require significant innovation. We'll need more empathy of other cultures to solve these global problems.

Climate migrations

Whether the climate shifts, people shift with it. If we do nothing, sea level rise could displace 400-700M people. Several islands disappear. Many major coastal cities will be underwater (about 20M people in the US).

Syria has the highest number of refugees, primarily because of drought. Italy, Spain, and Greece are next (which unfortunately is taking in the most current climate refugees).

Urban relocations

Over the last several centuries, more people have moved to the cities (that's where the jobs were). By 2007, half of the worlds population lived in cities. This migration is expected to include 2.5B people.

Cities are good for business. More people = more productivity. Every time a city population doubles, the number of patents goes up by 15%. Wages, GDP, and quality of life factors grow. Larger, denser cities are more sustainable because of efficiencies of scale (travel distances drop, more shared transportation, less infrastructure needed [water, trash, CO2 output]).

Calamity is a definite possibility. Unplanned urbanization crime, disease, poverty cycle, environmental devastation.

Virtual worlds

So far the biggest forced migrations were the slave trade, India/Pakistan split, and the redrawing of borders after WWII. Economics, religion, and politics are central.

Globally people spend 3B hours a week on video games. In the US, people spend 11 hours a day on digital media. Internet Gaming Disorder is a recognized mental health condition.

- Psychology – internal driver for migration (addictive neurochemistry - dopamine = engagement, desire, excitement, making meaning). Video games are full of these kinds of activities. We get the same rush from checking our phone messages. Researchers estimate that video games are truly addictive to about 10% of the population; VR will increase this (you can get more than just dopamine with this modality). **Flow state** also hits multiple neurotransmitters – addictive, yet meaningful.
- Opportunity. For **jobs**… maybe jobs exist in the virtual space. For **education**… distributed, customized, accelerated learning environments. For **sex**… VR + haptics lets you look at touch.

Space migration

For the US, in the 1960s we competed against the USSR.

Jeff Bezos founded Blue Origin to focus on colonizing space, focusing on a moon base operation. See also: https://en.wikipedia.org/wiki/Gerard_K._O%27Neill

Elon Musk is equally obsessed, but with Mars instead of the moon. He focused on reusable, more inexpensive rockets.

Meta-intelligence

See: https://en.wikipedia.org/wiki/Deep_brain_stimulation This has side effects related to impulse control and depression. This crude approach is being modernized: https://news.harvard.edu/gazette/story/2019/09/a-new-paper-examines-how-neuron-like-implants-could-treat-brain-disorders/

Brain-computer interfaces (https://en.wikipedia.org/wiki/Brain%E2%80%93computer_interface) are the convergence of multiple convergences mentioned in this book. Two companies mentioned in the book are https://en.wikipedia.org/wiki/Neuralink and https://en.wikipedia.org/wiki/Kernel_(neurotechnology_company).

What if we had a cloud-based collective consciousness?

Humans are social, and loneliness is a deadly terror of the modern era. We have a desire for connection.

Group flow (flow state but at the team level) is transcendent.

This human-driven evolution may disruption biologically-based growth of intelligence. Maybe a new species? What could a hive mind planet achieve?