

Примечания

Часть I. Великая сила конвергенции

Глава 1. Конвергенция

- ¹ Inrix. Global Traffic Scorecard // inrix.com/scorecard/.
- ² См.: uber.com/us/en/elevate/summit/2018/.
- ³ Полный текст см.: [youtube.com/watch?v=fmW2Y2nEW1U](https://www.youtube.com/watch?v=fmW2Y2nEW1U).
- ⁴ Perez S. Groupon Product Chief Jess Holden to Depart, Is Heading to a Bay Area Tech Company // TechCrunch, February 11, 2014 // techcrunch.com/2014/02/11/groupon-product-chief-jeff-holden-departs-is-headed-to-a-bay-area-tech-company/.
- ⁵ Green D. A Survey Found That Amazon Prime Membership Is Soaring to New Heights — But One Trend Should Worry the Company // Business Insider, January 18, 2019. P. 1.
- ⁶ Fernholz T. Are There Bubbles in Space // Quartz, July 30, 2018 // qz.com/1343920/investors-have-pumped-nearly-1-billion-into-aerospace-start-ups-this-year/.
- ⁷ Harris M. Larry Page Is Quietly Amassing a ‘Flying Car’ Empire // Verge, July 19, 2018 // theverge.com/2018/7/19/17586878/larry-page-flying-car-opener-kitty-hawk-cora.
- ⁸ AAA. AAA Reveals True Cost of Vehicle Ownership, August 23, 2017 // newsroom.aaa.com/tag/driving-cost-per-mile/.
- ⁹ Сравнительный анализ проведен Uber в рамках внутреннего исследования жизнеспособности идеи // cnet.com/roadshow/news/will-you-be-able-to-afford-uberairs-flying-car-service/.
- ¹⁰ Там же.
- ¹¹ Там же.
- ¹² Подробнее см.: uber.com/us/en/elevate/partners/.
- ¹³ В ранних индуистских текстах мифические, летающие по воздуху колесницы назывались виманами. См.: en.wikipedia.org/wiki/Vimana.
- ¹⁴ Котлер С. Мир завтра. Как технологии изменят жизнь каждого из нас. Мн.: Попурри, 2016.

- ¹⁵ См.: intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html.
- ¹⁶ Kurzweil R. How to Create a Mind. Viking, 2012. Pp. 179–198.
- ¹⁷ Kurzweil R. The Law of Accelerating Returns, March 7, 2001 // kurzweilai.net/the-law-of-accelerating-returns.
- ¹⁸ Кристенсен К. М. Дилемма инноватора. Как из-за новых технологий погибают сильные компании. М.: Альпина Паблишер, 2019.
- ¹⁹ Moore M. Distributed Electric Propulsion Aircraft // Nasa Langley Research Center // aero.larc.nasa.gov/files/2012/11/Distributed-Electric-Propulsion-Aircraft.pdf.
- ²⁰ Строго говоря, КПД этих двигателей находится в диапазоне от 90 до 98%; конкретную разбивку и сопоставления с бензиновым двигателем см.: Nice K., Strickland J. Gasoline and Battery Power Efficiency // How Stuff Works // auto.howstuffworks.com/fuel-efficiency/alternative-fuels/fuel-cell4.htm.
- ²¹ Интервью Холдена, там же.
- ²² Staff at Henry Ford. Willow Run Bomber Plant // thehenryford.org/collections-and-research/digital-collections/expert-sets/101765/.
- ²³ Там же.
- ²⁴ History.com editors. Ford Motor Company Unveils the Model T // History, August 27, 2009 // history.com/this-day-in-history/ford-motor-company-unveils-the-model-t.
- ²⁵ Kolbert E. Hosed // New Yorker, November 8, 2009.
- ²⁶ Kroger F. Automated Driving in Its Social, Historical and Cultural Contexts // Autonomous Driving, May 22, 2016. Pp. 41–68.
- ²⁷ Полную раскладку событий см. на сайте DARPA: darpa.mil/about-us/timeline/-grand-challenge-for-autonomous-vehicles.
- ²⁸ Madrigal A. Waymo's Robots Drove More Miles Than Everyone Else Combined // Atlantic, February 14, 2009 // theatlantic.com/technology/archive/2019/02/the-latest-self-driving-car-statistics-from-california/582763/.
- ²⁹ Hawkins A. Waymo and Jaguar Will Build Up to 20,000 Self-Driving Electric SUVs // Verge, March 27, 2018 // theverge.com/2018/3/27/17165992/waymo-jaguar-i-pace-self-driving-ny-auto-show-2018.
- ³⁰ См. текст пресс-релиза General Motors: media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2018/may/0531-gm-cruise.html.
- ³¹ В беседе с автором.
- ³² Там же.
- ³³ U.S. Census Bureau. Average One — Way Commuting Time by Metropolitan Areas, December 7, 2017 // census.gov/library/visualizations/interactive/travel-time.html.
- ³⁴ На странице «Википедии» en.wikipedia.org/wiki/List_of_car_brands представлен полный перечень этих автомобильных брендов, как действующих, так и ушедших с рынка.
- ³⁵ Шуп Д. Высокая стоимость бесплатной парковки // publications.hse.ru/books/201793177.
- ³⁶ Florida R. Parking Has Eaten American Cities // CityLab, July 24, 2018.

-
- ³⁷ Ben-Joseph E. *ReThinking a Lot*. MIT Press, 2012. Pp. xi–xix.
- ³⁸ Официальный доклад по теме: spacex.com/sites/spacex/files/hyperloop_alpha.pdf.
- ³⁹ Browne M. New Funds Fuel Magnet Power for Trains // *New York Times*, March 3, 1992.
- ⁴⁰ Salter R. The Very High Speed Transit // Rand Corporation, 1972 // rand.org/pubs/papers/P4874.html.
- ⁴¹ Во всех подробностях историю становления Hyperloop One см.: hyperloop-one.com/our-story#partner-program (венчурная компания Питера — ее инвестор).
- ⁴² Из беседы с автором, 2019 г.
- ⁴³ См.: twitter.com/elonmusk.
- ⁴⁴ Hull D. Musk's Boring Co. Raises \$113 Million for Tunnels, Hyperloop // *Bloomberg*, April 16, 2018 // bloomberg.com/news/articles/2018-04-16/musk-s-boring-co-raises-113-million-for-tunnels-and-hyperloop.
- ⁴⁵ Marshall A. Las Vegas Orders Up a Boring Company Loop // *Wired*, May 22, 2019.
- ⁴⁶ Oswald E. Here's Everything You Need to Know About the Boring Company // *Digital Trends*, February 26, 2019.
- ⁴⁷ Подробнее о месте проведения и пр. см.: youtube.com/watch?v=tdUX3ypDVwI.
- ⁴⁸ Etherington D. SpaceX aims to Replace Falcon 9, Falcon Heavy and Dragon with One Spaceship // *Techcrunch*, September 28, 2017 // techcrunch.com/2017/09/28/spacex-aims-to-replace-falcon-9-falcon-heavy-and-dragon-with-one-spaceship/.
- ⁴⁹ См.: twitter.com/mayorofla.
- ⁵⁰ См.: spacenews.com/spacex-begins-starship-hopper-testing/.
- ⁵¹ Все данные (компания, год, рыночная капитализация) взяты отсюда: macro trends.net. По каждой компании мы выбрали максимальное за год значение рыночной капитализации.
- ⁵² Там же.
- ⁵³ Там же.
- ⁵⁴ Там же.
- ⁵⁵ Все показатели компаний, упоминаемых в данном абзаце, взяты из того же источника, что и упомянутые в предыдущем абзаце.
- ⁵⁶ См., например: D'Argembeau A. Modulation of Medial Prefrontal and Inferior Parietal Cortices When Thinking About Past, Present and Future Selves // *Social Neuroscience*, May 2, 2010. Pp. 187–200.
- ⁵⁷ Обзор наибольшего числа подобных исследований см.: Lepore J. Are Robots Competing for Your Job? // *New Yorker*, March 4, 2019. А вот другой обзор: Ward M. AI and Robots Could Threaten Your Career Within 5 Years // *CNBC*, October 5, 2017 // cnbc.com/2017/10/05/report-ai-and-robots-could-change-your-career-within-5-years.html.
- ⁵⁸ Pelissie due Rausas M. Internet Matters: The Net's Sweeping Impact on Growth, Jobs, and Prosperity // *McKinsey Global Institute*, May 2011.
- ⁵⁹ Фостер Р., Каплан С. Созидательное разрушение. Почему компании, «построенные навечно», показывают не лучшие результаты. М.: Альпина Бизнес Букс, 2015. Поскольку исходное исследование проводилось совместно с консалтинговой компанией Innosight, если хотите

быстро получить общее представление, см. их резюме для руководства: innosight.com/insight/creative-destruction/.

⁶⁰ Официальное объявление о конкурсе см.: avatar.xprize.org/prizes/avatar.

Глава 2. Прорыв к скорости света: экспоненциальные технологии

¹ Из беседы автора с Чедом Ригетти.

² Public Information Office, Jet Propulsion Laboratory. Boomerang Nebula Boasts Coolest Spot in the Universe, June 20, 1997. Официальный пресс-релиз отдела внешней информации Лаборатории реактивного движения (NASA/JPL) см.: jpl.nasa.gov/news/releases/97/coldspot.html.

³ Harding L., Barden L. Deep Blue Win a Giant Step for Computerkind // Guardian, May 12, 2011.

⁴ Бриньолфсон Э., Макафи Э. Вторая эра машин. Работа, прогресс и процветание в эпоху новейших технологий. М.: АСТ, 2017.

⁵ Eeckhout L. Is Moore's Law Slowing Down? What Next? IEEE Micro. Vol. 37. No. 4. Pp. 4–5.

⁶ Kurzweil, Law of Accelerating Returns.

⁷ См.: apple.com/iphone-xs/a12-bionic/.

⁸ Тим Феррисс отлично поработал, полно описав и саму идею, и историю ее появления, см.: tim.blog/2018/05/31/steve-jurvetson/.

⁹ Из выступления Саймона Бенджамина в школе Оксфорд-Мартин в феврале 2016 г., подробнее см.: oxfordmartin.ox.ac.uk/videos/the-dawn-of-quantum-technology-with-prof-simon-benjamin/.

¹⁰ Из беседы автора с Ригетти.

¹¹ См.: internetlivestats.com/total-number-of-websites/.

¹² Spencer G. Much More Than a Chat: China's Xiaoice Mixes AI with Emotions and Wins Over Millions of Fans // news.microsoft.com, November 1, 2018. См.: news.microsoft.com/apac/features/much-more-than-a-chatbot-chinas-xiaoice-mixes-ai-with-emotions-and-wins-over-millions-of-fans/. См. также: blogs.microsoft.com/ai/xiaoice-full-duplex/.

¹³ Этот ответ, как и следующий ответ на реплику, что моя девушка на меня сердится, взяты из беседы автора с Zo, американской версией Сяоайс, запущенной в Twitter в 2018 г.

¹⁴ McFarland M. What Happened When a Chinese TV Station Replaced Its Meteorologist with a Chatbot // Washington Post, January 12, 2016.

¹⁵ Ward J. The Services Sector: How Best to Measure It? // International Trade Organization, October 2010.

¹⁶ Проследить прогресс в машинном обучении можно по очень наглядной хронологической таблице в «Википедии»: en.wikipedia.org/wiki/Timeline_of_machine_learning. См. также: Макафи Э., Бриньолфсон Э. Машина, платформа, толпа. Наше цифровое будущее. М.: Манн, Иванов и Фербер, 2019.

¹⁷ Деморолик см.: youtube.com/watch?v=gsfkGlsajHQ.

¹⁸ См.: ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html.

¹⁹ См.: experiments.withgoogle.com/talk-to-books.

-
- ²⁰ Olewitz C. A Japanese AI Program Just Wrote a Short Novel, and It Almost Won a Literary Prize // Digital Trends, March 23, 2016.
- ²¹ Блестящее рассуждение, чем шахматы отличаются от го, см.: Muoio D. Why Go Is So Much Harder for AI to Beat Than Chess // Business Insider, March 10, 2016. Сведения о поражении Ли Седоля см. также: Russell J. Google AI Beat Go World Champion Again to Complete Historic 4-1 Series // Techcrunch, March 15, 2016.
- ²² Sulleyman A. Google AI Creates Its Own Child AI That's More Advanced Than Systems Built by Humans // Independent, December 5, 2017.
- ²³ Dickey M. Facebook Brings Suicide Prevention Tools to Live and Messenger // TechCrunch, March 1, 2017.
- ²⁴ Котлер С., Уил Дж. Похищая огонь. Как поток и другие состояния измененного сознания помогают решать сложные задачи. М.: Манн, Иванов и Фербер, 2019.
- ²⁵ Withers P. Robots Take Over // Express, April 17, 2018. Самое четкое видео: express.co.uk/news/world/947448/robots-japan-tokyo-mayor-artificial-intelligence-ai-news.
- ²⁶ Library of Congress. Invention of the Telegraph // Samuel F. B. Morse Papers at the Library of Congress, 1793-1919 // loc.gov/collections/samuel-morse-papers/articles-and-essays/invention-of-the-telegraph/.
- ²⁷ См.: loc.gov/item/today-in-history/march-10/.
- ²⁸ Общую картину развития средств массовой коммуникации см.: elon.edu/e-web/predictions/150/1870.xhtml.
- ²⁹ См.: verizon.com/personal/info/international-calling/.
- ³⁰ World Bank дает довольно точные цифры: data.worldbank.org/indicator/SP.POP.TOTL.
- ³¹ Там же.
- ³² Smilarubavathy G. The Survey on Evolution of Wireless Network Generations // International Journal of Science, Technology and Engineering. Vol. 3. No. 5. November 2016.
- ³³ См.: loon.com.
- ³⁴ Scoles S. Maybe Nobody Wants Your Space Internet // Wired, March 15, 2018.
- ³⁵ Boyle A. Amazon to Offer Broadband Access from Orbit // GeekWire, April 4, 2019 // geekwire.com/2019/amazon-project-kuiper-broadband-satellite/.
- ³⁶ Оригинал пресс-релиза FCC: fcc.gov/document/fcc-authorizes-spacex-provide-broadband-satellite-services.
- ³⁷ Из беседы автора с CEO компании Oura Харпритом Сингхом (венчурная компания Питера выступает инвестором).
- ³⁸ См.: ouraring.com (венчурная компания Питера выступает инвестором).
- ³⁹ Nagelhout R. Smart Machines and the Internet of Things. Rosen Publishing, 2016.
- ⁴⁰ The Earth Will Don an Electronic Skin // BusinessWeek, August 29, 1999.
- ⁴¹ Evans D. The Internet of Things // Cisco.com, April 2011 // cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf.

- ⁴² Columbus L. Roundup of Internet of Things Forecasts and Market Estimates, 2016 // Forbes.com. 2016. No. 27 // forbes.com/sites/louiscolumbus/2016/11/27/roundup-of-internet-of-things-forecasts-and-market-estimates-2016/#32a1a5ba292d.
- ⁴³ Полный текст доклада Accenture см. здесь: newsroom.accenture.com/subjects/management-consulting/industrial-internet-of-things-will-boost-economic-growth-but-greater-government-and-business-action-needed-to-fulfill-its-potential-finds-accenture.htm.
- ⁴⁴ Kotler S., Diamandis P. BOLD. Simon & Schuster, 2015. Pp. 4–6.
- ⁴⁵ Higgins S. Livox Announces \$600 Lidar for Autonomous Vehicles // Spar3-D.com, January 23, 2019 // spar3-D.com/news/lidar/livox-announces-600-lidar-for-autonomous-vehicles-uav-mapping-and-more-an-its-shipping-now/.
- ⁴⁶ Очень наглядную графику на тему истории развития GPS навигаторов см.: onlinemasters.ohio.edu/blog/the-evolution-of-portable-gps. См. также: web.mit.edu/digitalapollo/Documents/Chapter6/hoagprogreport.pdf.
- ⁴⁷ Koerner B. What Is Smart Dust Anyway // Wired, June 1, 2003. См. также: news.berkeley.edu/2018/04/10/berkeley-engineers-build-smallest-volume-most-efficient-wireless-nerve-stimulator/.
- ⁴⁸ Отличный обзор по теме см.: newsroom.intel.com/news/2018-ces-keynote-intel-brian-krzanich/#gs.yzs68u.
- ⁴⁹ Полный отчет Международной комиссии по атомной энергии о катастрофе на АЭС «Фукусима-1» см. здесь: www-pub.iaea.org/MTCD/Publications/PDF/Pub1710-ReportByTheDG-Web.pdf.
- ⁵⁰ Ackerman E. Honda Halts Asimo Development in Favor of More Useful Humanoid Robots // IEEE Spectrum, June 28, 2018. См. также: blogs.wsj.com/japanrealtime/2011/04/20/the-little-robot-that-couldnt/.
- ⁵¹ Drummond K., Shachtman N. Darpa's Next Grand Challenge // Wired, April 5, 2012.
- ⁵² Отзыв Дж. Пратта о соревнованиях Challenge: spectrum.ieee.org/automaton/robotics/humanoids/darpa-robotics-challenge-amazing-moments-lessons-learned-whats-next.
- ⁵³ См.: bostondynamics.com/atlas.
- ⁵⁴ Ackerman E. Honda Unveils Prototype E2-D2 Disaster Response Robot // IEEE Spectrum, October 2, 2017.
- ⁵⁵ Lunden I. Softbank Is Buying Robotics Firm Boston Dynamics and Schaft from Alphabet // TechCrunch, June 8, 2017.
- ⁵⁶ См.: economist.com/graphic-detail/2019/07/09/japans-pension-problems-are-a-harbinger-of-challenges-elsewhere. См. также статью в Japan Times: japantimes.co.jp/news/2019/06/04/business/financial-markets/japans-pension-system-inadequate-aging-society-council-warns/#.XWayvi2ZOWY.
- ⁵⁷ Посмотрите, как это выглядит, на видео: youtube.com/watch?v=HiOkXKb1DBk.
- ⁵⁸ См.: universal-robots.com/products/ur3-robot/.
- ⁵⁹ См.: amazon.com/Amazon-Prime-Air.
- ⁶⁰ Baig E. Cell Service Can Mean Life or Death After a Disaster. Can Drones Help? // USA Today, March 16, 2018. См. также: nytimes.com/2018/04/06/nyregion/drone-cellphone-disaster-service.html.

⁶¹ Davies A. Boeing's Experimental Cargo Drone Is a Heavy Lifter // Wired, January 14, 2018.

⁶² См.: flyzipline.com.

⁶³ См.: biocarbonengineering.com.

Глава 3. Турбоускорение: экспоненциальные технологии

¹ Из беседы с автором, 2019.

² Patent US2955156A, Stereoscopic-Television Apparatus for Individual Use.

³ Parkin S. Virtual Reality Startups Look Back to the Future // Technology Review, March 7, 2014. См.: technologyreview.com/s/525301/virtual-reality-startups-look-back-to-the-future. См. также: A Whole New Universe // New York, August 6, 1990. P. 32.

⁴ Facebook to Acquire Oculus // Facebook Newsroom. March 25, 2015 // newsroom.fb.com/news/2014/03/facebook-to-acquire-oculus/.

⁵ Takahashi D. The Landscape of VR Is Complicated — with 234 Companies Valued at \$13B // Venture Beat, October 12, 2015.

⁶ Liu S. Worldwide Virtual Reality (VR) Headset Unit Sales by Brand in 2016 and 2017 (In Millions) // Statista, August 9, 2019 // statista.com/statistics/752110/global-vr-headset-sales-by-brand/.

⁷ Horwitz J. Apple Lists AR/VR Jobs, Reportedly Taps Executive Who Finalizes Products // Venture Beat, August 1, 2019.

⁸ См.: vr.google.com/.

⁹ Meggers J. Virtual Reality, Meet Cisco Spark // Cisco.com, September 18, 2017 // blogs.cisco.com/collaboration/cisco-spark-in-virtual-reality.

¹⁰ Robertson A. Microsoft Says It's No Longer Planning VR Support on Xbox // Verge, June 20, 2018 // theverge.com/2018/6/20/17485852/microsoft-xbox-one-no-vr-headset-support-windows-mixed-reality-e3-2018.

¹¹ Google Cardboard // vr.google.com/cardboard/.

¹² Introducing Oculus Quest, Our First 6DOF All-In-One VR System, Launching Spring 2019 // Oculus.com, September 28, 2018 // oculus.com/blog/introducing-oculus-quest-our-first-6dof-all-in-one-vr-system-launching-spring-2019/?locale=en_US. См. также: HTC VIVE Unveils VIVE Focus Plus Pricing, Availability, Improved Connectivity, and Enhanced Lenses // HTC.com, March 25, 2019 // htc.com/us/newsroom/2019-03-25/.

¹³ Vieri C. An 18 Megapixel 4.3, A ≥ 1443 Ppi 120 Hz OLED Display for Wide Field of View High Acuity Head Mounted Displays // Society for Information Display, May 9, 2018. Pp. 314–324. См. также: Etienne S. Google and LG Show Off Their High-Res VR Display for Future Headsets // Circuit Breaker, May 23, 2018 // theverge.com/circuitbreaker/2018/5/23/17383990/google-lg-vr-display-high-res-headsets.

¹⁴ См.: hear360.io/#8ball.

¹⁵ Needleman S. Virtual Reality, Now with the Sense of Touch // Wall Street Journal, April 3, 2018.

¹⁶ См., например, [Feelreal sensory mask: feelreal.com](http://feelreal.com).

¹⁷ См., например, [Neurable: neurable.com](http://neurable.com).

- ¹⁸ Petrook V. Virtual and Augmented Reality Users 2019 // eMarketer, March 27, 2019. См.: emarketer.com/content/virtual-and-augmented-reality-users-2019. См. также: Forecast for the Number of Active Virtual Reality Users Worldwide from 2014 to 2018 (in Millions) // Statista // statista.com/statistics/426469/active-virtual-reality-users-worldwide/.
- ¹⁹ Profiles in Innovation: Virtual and Augmented Reality // GoldmanSachs.com, January 13, 2016 // goldmansachs.com/insights/pages/technology-driving-innovation-folder/virtual-and-augmented-reality/report.pdf.
- ²⁰ Беседа автора с Бейленсоном; см. также: Bailenson J. Experience on Demand: What Virtual Reality Is, How It Works, and What It Can Do. W. W. Norton & Company, 2018.
- ²¹ The Virtues of Virtual Reality: How Immersive Technology Can Reduce Bias. April 26, 2019 (video) // youtube.com/watch?v=vXxfkkINq8M.
- ²² Musni L. Pokemon GO Surpasses the 1 Billion Downloads Milestone // Nintendo Wire, July 31, 2019.
- ²³ Подробности, как в Apple разрабатывали данный комплект инструментов для разработчика, см.: developer.apple.com/augmented-reality/.
- ²⁴ Matney L. Apple Buys Denver Startup Building Waveguide Lenses for AR Glasses // TechCrunch, August 29, 2018.
- ²⁵ Можете сами провести подобный поиск по URL: angel.co/companies?markets=Augmented+Reality.
- ²⁶ Global Augmented Reality (Ar) Market Will Reach USD 133.78 Billion by 2021 // Zion Market Research, November 24, 2016.
- ²⁷ Horwitz J. Leap Motion Shows Crazy-Looking \$100 North Star AR Headset with Hand Tracking // Venture Beat, April 9, 2018.
- ²⁸ Moon M. Microsoft HoloLens 2 Will Go On Sale in September (Update) // Engadget, August 29, 2019. Больше информации о HoloLens можно найти здесь: microsoft.com/en-us/hololens.
- ²⁹ Melina R. International Space Station: By the Numbers // Space.com, August 4, 2017 // space.com/8876-international-space-station-numbers.html.
- ³⁰ Advanced Space Transportation Program: Paving the Highway to Space // National Aeronautics and Space Administration (NASA), April 12, 2018. См. также: nasa.gov/centers/marshall/news/background/facts/astp.html. См. также: Dempsey R. The International Space Station Operating an Outpost in the New Frontier // National Aeronautics and Space Administration (NASA), April 13, 2018 // nasa.gov/sites/default/files/atoms/files/iss-operating_an_outpost-tagged.pdf.
- ³¹ Там же.
- ³² См.: madeinspace.us.
- ³³ Bean Q. 3-D Printing in Zero-G Technology Demonstration // National Aeronautics and Space Administration (NASA) // nasa.gov/mission_pages/station/research/experiments/explorer/Investigation.html?#id=1039.
- ³⁴ Wong J. Y. On-Site 3-D Printing of Functional Custom Mallet Splints for Mars Analogue Crewmembers // Aerospace Medicine and Human Performance, October 2015 // doi: 10.3357/AMHP.4259.2015, pp.

- 911–914. См. также: 3-D Printing the First Medical Supplies on the Space Station, January 12, 2017 // 3-D4md.com/blog/2017/1/12/3-D-printing-the-first-medical-supplies-on-the-space-station.
- ³⁵ History of 3-D Printing: It's Older Than You Are (That Is, If You're Under 30), April 13, 2013 // autodesk.com/redshift/history-of-3-D-printing/.
- ³⁶ Из беседы автора с Ави Райхенталем, CEO компании Exponential Works, 2018.
- ³⁷ Van Dusen M. GE's 3-D-Printed Airplane Engine Will Run This Year. General Electric, June 19, 2017 // ge.com/reports/mad-props-3-D-printed-airplane-engine-will-run-year/.
- ³⁸ Severson B. Shanghai-Based WinSun 3-D Prints 6-Story Apartment Building and an Incredible Home // 3-DPrint.com, January 8, 2015 // 3-Dprint.com/38144/3-D-printed-apartment-building/.
- ³⁹ Nano Dimension Inc.. См.: nano-di.com.
- ⁴⁰ Данные по протезированию конечностей можно найти здесь: 3-D-Printable Prosthetic Devices // National Institutes of Health // 3-Dprint.nih.gov/collections/prosthetics.
- ⁴¹ Gjovik E. Additive Manufacturing and Its Impact on a \$12 Trillion Industry, May 14, 2019 // manufacturing.net/2019/05/additive-manufacturing-and-its-impact-12-trillion-industry.
- ⁴² Griffin B. New Report Shows Manufacturing Output Hit \$35 Trillion in 2017 // Interact Analysis // interactanalysis.com/new-report-shows-manufacturing-output-hit-35-trillion-in-2017-growth-forecast-to-continue/.
- ⁴³ Wittbrodta B.T. Life-Cycle Economic Analysis of Distributed Manufacturing with Open-Source 3-D Printers // *Mechatronics*, September 2013. Pp. 713–726 // sciencedirect.com/science/article/pii/S0957415813001153.
- ⁴⁴ Из беседы автора с Ави Райхенталем.
- ⁴⁵ Mearin L. 3-D Printer Presages the Future of Multi-Layer Circuit Board Design // *ComputerWorld* // computerworld.com/article/3195839/desktop-3-D-printer-presages-the-future-of-multi-layer-circuit-board-design.html.
- ⁴⁶ 3-D-Printed Lithium-Ion Batteries // American Chemical Society, October 17, 2018 // acs.org/content/acs/en/pressroom/presspacs/2018/acs-presspac-october-17-2018/3-D-printed-lithium-ion-batteries.html.
- ⁴⁷ Fingas J. 3-D-Printed Wind Turbine Puts 300W of Power in Your Backpack // *Engadget*, August 17, 2014 // engadget.com/2014/08/17/airenergy-3-D-wind-turbine/. См. также: Transforming Wind Turbine Blade Mold Manufacturing with 3-D Printing // energy.gov/eere/wind/videos/transforming-wind-turbine-blade-mold-manufacturing-3-D-printing.
- ⁴⁸ Bag S. Aerosol-Jet-Assisted Thin-Film Growth of CH₃NH₃PbI₃ Perovskites — A Means to Achieve High Quality, Defect-Free Films for Efficient Solar Cells // *Advanced Energy Materials*, July 14, 2017. См. также: Clark C. Air Force Research Laboratory Creates 3-D Printed Solar Cells // *3-D Printing Industry*, July 19, 2017.
- ⁴⁹ Kellner T. Fired Up: GE Successfully Tested Its Advanced Turboprop Engine with 3-D-Printed Parts // General Electric, January 2, 2018 // ge.com/reports/ge-fired-its-3-D-printed-advanced-turboprop-engine/.
- ⁵⁰ См. историю 3D-печати: 3-Dinsider.com/3-D-printing-history/.

-
- ⁵¹ Watkin H. Doctors Without Borders Hospital in Jordan 3-D Print Prostheses for War Victims // All About 3-D Printing, December 10, 2018 // all3-Dp.com/4/doctors-without-borders-hospital-jordan-3-d-print-prostheses-war-victims/.
- ⁵² unlimitedtomorrow.com/product/.
- ⁵³ По данным openbionics.com.
- ⁵⁴ ten Kate J. 3-D-Printed Upper Limb Prostheses: A Review // Assistive Technology, February 2, 2017. Pp. 300–314.
- ⁵⁵ Atala A. Printing a Human Kidney // TED, 2018 // ted.com/talks/anthony_atala_printing_a_human_kidney?language=en. См. также: Yandell K. Organs on Demand // Scientist, September 1, 2013 // the-scientist.com/features/organs-on-demand-38787. См. также: Patent-US6673339B1, Prosthetic Kidney and Its Use for Treating Kidney Disease.
- ⁵⁶ Listek V. Organovo: Bioprinting Could Be the New Solution to Organ Transplantation // 3-DPrint.com, August 27, 2019. См. также: Hudson K. First Fully Bioprinted Blood Vessels // Business Wire, December 8, 2010 // businesswire.com/news/home/20101208006587/en/Fully-Bioprinted-Blood-Vessels. См. также: Jakab K. Tissue Engineering by Self-Assembly and Bio-Printing of Living Cells // IOP Science, June 2, 2010 // iopscience.iop.org/article/10.1088/1758-5082/2/2/022001.
- ⁵⁷ См.: prellisbio.com. См. также: Claire S. Prellis Biologics Reaches Record Speed and Resolution in Viable 3-D Printed Human Tissue // 3-DPrint.com // 3-Dprint.com/217267/prellis-biologics-record-speed/.
- ⁵⁸ Из беседы автора с CEO Iviva Medical доктором Броксом Ривом. См. также: ivivamedical.com (венчурная компания Питера выступает инвестором).
- ⁵⁹ Там же.
- ⁶⁰ 3-D Printers Print Ten Houses in 24 Hours (video), April 16, 2014 // youtube.com/watch?v=SOBzNdyRTBs. См. также: China: Firm 3-D Prints 10 Full-Sized Houses in a Day // BBC News, April 25, 2014 // bbc.com/news/blogs-news-from-elsewhere-27156775.
- ⁶¹ Gregurić L. How Much Does a 3-D Printed House Cost in 2019? February 12, 2019 // all3-Dp.com/2/3-d-printed-house-cost/.
- ⁶² Chinese Construction Firm Erects 57-Storey Skyscraper in 19 Days // Guardian, April 30, 2015.
- ⁶³ Из беседы с автором в 2019 г. (венчурная компания Питера выступает инвестором).
- ⁶⁴ Из беседы с автором в 2018 г. Подробнее о Хаглере и его жизненном пути см.: Peters A. There Will Soon Be a Whole Community of Ultra-Low-Cost 3-D-Printed Homes // Fast Company, March 11, 2019 // fastcompany.com/90317441/there-will-soon-be-a-whole-community-made-of-these-ultra-low-cost-3-d-printed-homes.
- ⁶⁵ Там же.
- ⁶⁶ Chaum D. Blind Signatures for Untraceable Payments // Advances in Cryptography. Springer 1998. Pp. 199–203 // blog.koehntopp.de/uploads/Chaum.BlindSigForPayment.1982.PDF.
- ⁶⁷ Nakamoto S. Bitcoin: A Peer-to-Peer Electronic Cash System // bitcoin.org/bitcoin.pdf.
- ⁶⁸ Bilton N. Disruptions: Betting on a Coin with no Realm // New York Times, December 22, 2013.
- ⁶⁹ Согласно взятым отсюда данным: coinmarketcap.com/currencies/bitcoin/.

-
- ⁷⁰ Billion Reasons to Bank Inclusively // accenture.com/us-en/_acnmedia/accenture/conversion-assets/dotcom/documents/global/pdf/dualpub_22/accenture-billion-reasons-bank-inclusively.pdf#zoom=50.
- ⁷¹ Mitigation and Remittances // World Bank Group, 2018 // knomad.org/sites/default/files/2018-04/Migration%20and%20Development%20Brief%2029.pdf.
- ⁷² Lobosco K. Walmart Offers Less Costly Money Wire Service // CNN, April 17, 2014 // money.cnn.com/2014/04/17/news/companies/walmart-money-transfers/index.html. Таблицу с расценками Western Union за переводы см.: westernunion.com/content/dam/wu/EU/EN/feeTableRetailEN-ES.PDF.
- ⁷³ Vujayanti D. The Global Identification Challenge: Who Are the 1 Billion People Without Proof of Identity? // World Bank, April 25, 2018 // blogs.worldbank.org/voices/global-identification-challenge-who-are-1-billion-people-without-proof-identity.
- ⁷⁴ Винья П., Кейси М. Машина правды. Блокчейн и будущее человечества. М.: Манн, Иванов и Фербер, 2018.
- ⁷⁵ Paton E. Will Blockchain Be a Boon to the Jewelry Industry? // New York Times, November 30, 2018.
- ⁷⁶ Fenech G. Blockchain in Gambling and Betting: Are There Real Advantages? // Forbes, January 30, 2019.
- ⁷⁷ Goldman: Alastair Marsh. Goldman Sachs Explores Creating a Digital Coin like JPMorgan's // Bloomberg, June 28, 2019. J.P. Morgan: Hugh Son. JP Morgan Is Rolling Out the First US Bank-Backed Cryptocurrency to Transform Payments Business // CNBC, February 14, 2019. Bank of America: Hugh Son. Bank of America Tech Chief Is Skeptical on Blockchain Even Though BofA Has the Most Patents for It // CNBC, March 26, 2019.
- ⁷⁸ Funds Raised in 2018 // icodata.io/stats/2018.
- ⁷⁹ Gartner Predicts 90% of Current Enterprise Blockchain Platform Implementations Will Require Replacement by 2021 // gartner.com/en/newsroom/press-releases/2019-07-03-gartner-predicts-90--of-current-enterprise-blockchain.
- ⁸⁰ См.: crunchbase.com/organization/vatomic.
- ⁸¹ History of the Light Bulb // Department of Energy, November 22, 2013 // energy.gov/articles/history-light-bulb.
- ⁸² Bedi J. Thomas Edison's Inventive Life. Lemelson Center, April 18, 2004 // invention.si.edu/thomas-edisons-inventive-life.
- ⁸³ Edison Files // edisonmuseum.org/content3399.html.
- ⁸⁴ Incandescent Lamp with Ductile Tungsten Filament // americanhistory.si.edu/collections/search/object/nmah_704238.
- ⁸⁵ Obama B. Remarks by the President at Carnegie Mellon University's National Robotics Engineering Center // Office of the Press Secretary: The White House, June 24, 2011. См. также: The First Five Years of the Materials Genome Initiative: Accomplishments and Technical Highlights // mgi.gov/sites/default/files/documents/mgi-accomplishments-at-5-years-august-2016.pdf.
- ⁸⁶ Беседа с автором, 2018 г.

- ⁸⁷ Mouritz A. P. Introduction to Aerospace Materials // Introduction to Aerospace Materials. Woodhead Publishing Limited, 2012. Pp. 1–14.
- ⁸⁸ Katti K. S. Biomaterials in Total Joint Replacement // Colloids and Surfaces B: Biointerfaces, 2004. Pp. 133–142.
- ⁸⁹ Liu Y. Design of Complex Nanomaterials for Energy Storage: Past Success and Future Opportunity // Accounts of Chemical Research, December 5, 2017. Pp. 2895–2905.
- ⁹⁰ Nanotechnology for Quantum Computers, Industry Skills for Physics Students, Technologies That Make Physics Happen // Physics World, August 1, 2019 // physicsworld.com/a/nanotechnology-for-quantum-computers-industry-skills-for-physics-students-technologies-that-make-physics-happen/.
- ⁹¹ Беседа с автором, 2019 г.
- ⁹² Fu R. U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018 // National Renewable Energy Laboratory, 2018 // nrel.gov/docs/fy19osti/72399.pdf.
- ⁹³ Wang B. First Commercial Perovskite Solar Late in 2019 and the Road to Moving the Energy Needle // Next Big Future, February 3, 2019 // nextbigfuture.com/2019/02/first-commercial-perovskite-solar-late-in-2019-and-the-road-to-moving-the-energy-needle.html.
- ⁹⁴ Фейнман Р. П. There's Plenty of Room at the Bottom // Engineering and Science, 1960.
- ⁹⁵ Дрекслер К. Э. Машины создания. Грядущая эра нанотехнологии // https://royallib.com/read/dreksler_erik/mashini_sozdaniya.html#0.
- ⁹⁶ Ferber D. Printing Tiny Batteries, Wyss Institute. June 18, 2013 // seas.harvard.edu/news/2013/06/printing-tiny-batteries.
- ⁹⁷ Разговор автора со Стивом Синклером, SVP, Mojo Vision, 2018 (венчурная компания Питера выступает инвестором).
- ⁹⁸ Li S. A DNA Nanorobot Functions as a Cancer Therapeutic in Response to a Molecular Trigger in Vivo // Nature Biotechnology, 2018. Pp. 258–264.
- ⁹⁹ Molteni M. The Rise of DNA Data Storage // Wire, 2018 // wired.com/story/the-rise-of-dna-data-storage/. Есть и посвежее: Catalog Successfully Stores All 16GB of Wikipedia Text on DNA // Verdict, July 9, 2019 // verdict.co.uk/dna-data-storage-2019/.
- ¹⁰⁰ Беседа автора с Биллом Гроссом, CEO бизнес-инкубатора Idealab, 2018 г.
- ¹⁰¹ John Travolta, IMDb // imdb.com/name/nm0000237/.
- ¹⁰² Welcome Back, Kotter, IMDb // imdb.com/title/tt0072582/.
- ¹⁰³ The Boy in the Plastic Bubble, IMDb // imdb.com/title/tt0074236/.
- ¹⁰⁴ Friedmann T. Gene Therapy for Human Genetic Disease? // Science, March 1972. Pp. 949–955 // science.sciencemag.org/content/175/4025/949.long.
- ¹⁰⁵ Stolberg S. G. The Biotech Death of Jesse Gelsinger // New York Times Magazine, November 28, 1999 // nytimes.com/1999/11/28/magazine/the-biotech-death-of-jesse-gelsinger.html.
- ¹⁰⁶ Why Gene Therapy Caused Leukemia in Some 'Boy in the Bubble Syndrome' Patients // Journal of Clinical Investigation, August 10, 2008 // sciencedaily.com/releases/2008/08/080807175438.htm.
- ¹⁰⁷ Gene Therapy Cures Babies with 'Bubble Boy' Disease // Genetic Engineering & Biotechnology News, August 19, 2019 // genengnews.com/topics/gene-therapy-cures-babies-with-bubble-boy-disease/.

- ¹⁰⁸ Gene Therapy Phase 4 // clinicaltrials.gov/ct2/results?term=gene+therapy&age_v=&gndr=&type=&rslt=&phase=3&Search=Apply.
- ¹⁰⁹ Eveleth R. There Are 37.2 Trillion Cells in Your Body // *Smithsonian Magazine*, October 24, 2013 // smithsonianmag.com/smart-news/there-are-372-trillion-cells-in-your-body-4941473/.
- ¹¹⁰ Humane Genome Results // genome.gov/human-genome-project/results.
- ¹¹¹ DNA Sequencing Costs: Data // [Genome.gov // genome.gov/about-genomics/fact-sheets/DNA-Sequencing-Costs-Data](https://genome.gov/about-genomics/fact-sheets/DNA-Sequencing-Costs-Data).
- ¹¹² Там же.
- ¹¹³ CRISPR 2.0: Genome Engineering Made Easy as A-B-C, November 5, 2017. [Harvard.edu // sitn.hms.harvard.edu/flash/2017/crispr-2-0-genome-engineering-made-easy-b-c/](https://sitn.hms.harvard.edu/flash/2017/crispr-2-0-genome-engineering-made-easy-b-c/).
- ¹¹⁴ Lander E. S. The Heroes of CRISPR // *Cell*, January 14, 2016. Pp. 18–28 // [cell.com/cell/fulltext/S0092-8674\(15\)01705-5?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0092867415017055%3Fshowall%3Dtrue](https://cell.com/cell/fulltext/S0092-8674(15)01705-5?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0092867415017055%3Fshowall%3Dtrue).
- ¹¹⁵ Netburn D. New Gene-Editing Technique May Lead to Treatment for Thousands of Diseases // *LA Times*, October 25, 2017 // latimes.com/science/sciencenow/la-sci-sn-dna-gene-editing-20171025-story.html.
- ¹¹⁶ Regalado A. EXCLUSIVE: Chinese Scientists Are Creating CRISPR Babies // *MIT Review*, November 25, 2018 // technologyreview.com/s/612458/exclusive-chinese-scientists-are-creating-crispr-babies/. См. также: Ledford H. CRISPR Babies: When Will the World Be Ready? // *Nature*, June 19, 2019 // nature.com/articles/d41586-019-01906-z.
- ¹¹⁷ Stem Cell Information // [National Institutes of Health // stemcells.nih.gov/info/basics/1.htm](https://stemcells.nih.gov/info/basics/1.htm).

Глава 4. Ускорение ускорения

- ¹ Hertzfeld A. Saving Lives // *Folklore.com*, August 1983 // folklore.org/StoryView.py?story=Saving_Lives.txt.
- ² Chen Y. A Day Without a Search Engine: An Experimental Study of Online and Offline Searches // *Experimental Economics*. December 2014. Vol. 17. No. 4. Pp. 512–536 // link.springer.com/article/10.1007/s10683-013-9381-9.
- ³ University of Montreal. Fridges and Washing Machines Liberated Women, Study Suggests // *Science Daily*, March 13, 2009 // sciencedaily.com/releases/2009/03/090312150735.htm. Оригинал статьи можно найти здесь: pdfs.semanticscholar.org/423-D/28062802774c5687bd2545c4024a4961085e.pdf.
- ⁴ Maps of the Day: Travel Times from NYC in 1800, 1830, 1857 and 1930 // *AEI.org* // aei.org/publication/maps-of-the-day-travel-times-from-nyc-in-1800-1830-1857-and-1930.
- ⁵ Wallace T. How Sputnik 1 Launched the Space Age // *Cosmos Magazine*, October 4, 2017 // cosmosmagazine.com/space/how-sputnik-1-launched-the-space-age.
- ⁶ Там же.
- ⁷ Dickson P. Sputnik. Walker, 2001. P. 116.
- ⁸ Там же, с. 215.

-
- ⁹ Stine D. D. The Manhattan Project, the Apollo Program, and Federal Energy Technology R&D Programs: A Comparative Analysis // Congressional Research Service, June 30, 2009 // fas.org/sgp/crs/misc/RL34645.pdf.
- ¹⁰ Mettler M. Prog Legends Marillion Have Mastered Crowdfunding, High-Res Rock // Digital Trends, December 2, 2016 // digitaltrends.com/music/interview-mark-kelley-of-marillion/.
- ¹¹ Paynter B. How Will the Rise of Crowdfunding Reshape How We Give to Charity? // Fast Company, March 3, 2017 // fastcompany.com/3068534/how-will-the-rise-of-crowdfunding-reshape-how-we-give-to-charity-2.
- ¹² См.: kickstarter.com/help/stats.
- ¹³ McDermott J. Pebble 'Smartwatch' Funding Soars on Kickstarter // Inc., April 20, 2012 // inc.com/john-mcdermott/pebble-smartwatch-funding-sets-kickstarter-record.html.
- ¹⁴ Massolution/Crowdsourcing.org, 2015 CF Crowdfunding Industry Report // reports.crowdsourcing.org/index.php?route=product/product&product_id=54.
- ¹⁵ The Future of Finance, the Socialization of Finance. Goldman Sachs Report, March 2015 // planet-fintech.com/downloads/The-future-of-Finance-the-Socialization-of-Finance-Golman-Sachs-march-2015_t18796.html.
- ¹⁶ См.: nsf.gov/statistics/issuebrf/sib99303.htm#nsb.
- ¹⁷ PwC | CB Insights MoneyTree™ Report Q4 2018, p. 6 // pwc.com/us/en/moneytree-report/moneytree-report-q4-2018.pdf.
- ¹⁸ Там же, с. 10.
- ¹⁹ Там же, с. 85.
- ²⁰ Там же, с. 82.
- ²¹ Там же, с. 20.
- ²² 3Q 2018 PitchBook-NVCA Venture Monitor Report // files.pitchbook.com/website/files/pdf/3Q_2018_PitchBook_NVCA_Venture_Monitor.pdf.
- ²³ Об ICO этой компании, а также других крупнейших ICO, которые упоминаются ниже, см.: Williams-Grut O. The 11 Biggest ICO Fundraises of 2017 // Business Insider, January 1, 2018 // businessinsider.com/the-10-biggest-ico-fundraises-of-2017-2017-12.
- ²⁴ Получено суммированием данных, приведенных в этой статье «Википедии»: en.wikipedia.org/wiki/Sovereign_wealth_fund, база данных Sovereign Wealth Fund Institute swfinstitute.org.
- ²⁵ Milhench C. Sovereign Investors Hunt for 'Unicorns' in Silicon Valley // Reuters, May 11, 2017.
- ²⁶ Shead S. The Japanese Tech Billionaire Behind Softbank Thinks the 'Singularity' Will Occur Within 30 Years // Business Insider, February 27, 2017 // businessinsider.com/softbank-ceo-masayoshi-son-thinks-singularity-will-occur-within-30-years-2017-2.
- ²⁷ Masayoshi Son Prepares to Unleash His Second \$100bn Tech Fund // Economist, March 23, 2019 // economist.com/business/2019/03/23/masayoshi-son-prepares-to-unleash-his-second-100bn-tech-fund.
- ²⁸ Buhr S. Illumina Wants to Sequence Your Whole Genome for \$100 // TechCrunch, January 10, 2017 // techcrunch.com/2017/01/10/illumina-wants-to-sequence-your-whole-genome-for-100/.

- ²⁹ Полный текст пресс-релиза IRENA: irena.org/newsroom/pressreleases/2019/Apr/Renewable-Energy-Now-Accounts-for-a-Third-of-Global-Power-Capacity.
- ³⁰ Kanigel R. *The Man Who Knew Infinity*. Washington Square Press, 1992.
- ³¹ Это очень хорошо описано у Джонатана Уая из Университета Дьюка, который специализируется на изучении интеллекта, в его статье для журнала *Psychology Today*, см.: psychologytoday.com/us/articles/201207/brainiacs-and-billionaires.
- ³² Chi R., Snyder A. Brain Stimulation Enables the Solution of an Inherently Difficult Problem // *Neuroscience Letters*. May 2, 2012. Vol. 515. No. 2. Pp. 121–124.
- ³³ См.: neuralink.com.
- ³⁴ См.: kernel.co.
- ³⁵ Беседа автора с Брайаном Джонсоном, 2018 г.
- ³⁶ Toh E. USC Researchers Develop Brain Implant to Improve Memory // USC Daily Troj, November 19, 2017 // dailytrojan.com/2017/11/19/usc-researchers-develop-brain-implant-improve-memory/.
- ³⁷ Eugenios J. Ray Kurzweil: Humans Will Be Hybrids by 2030 // CNN, June 4, 2015 // money.cnn.com/2015/06/03/technology/ray-kurzweil-predictions/.
- ³⁸ Basulto D. Why Ray Kurzweil's Predictions Are Right 86% of the Time // Big Think, December 13, 2012 // bigthink.com/endless-innovation/why-ray-kurzweils-predictions-are-right-86-of-the-time.
- ³⁹ Ридли М. *Рациональный оптимист*. М.: Эксмо, 2015.
- ⁴⁰ Уэст написал отличный материал об этих своих исследованиях для платформы Medium. Посмотреть можно здесь: medium.com/sfi-30-foundations-frontiers/scaling-the-surprising-mathematics-of-life-and-civilization-49ee18640a8.
- ⁴¹ Individuals Using the Internet (% of population) // World Bank // data.worldbank.org/indicator/IT.net.USER.ZS. См. также: Population, Total // World Bank // data.worldbank.org/indicator/SP.POP.TOTL.
- ⁴² de Jong M. Disrupting Beliefs: A New Approach to Business-Model Innovation // McKinsey Quarterly, July 2015 // mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/disrupting-beliefs-a-new-approach-to-business-model-innovation.
- ⁴³ Picker R. C. The Razors-and-Blades Myth(s) // University of Chicago Law Review, February 6, 2011 // lawreview.uchicago.edu/publication/razors-and-blades-myths.
- ⁴⁴ Pipes K. History of Franchising: Franchising in the Modern Age // Franchising.com // franchising.com/guides/history_of_franchising_part_two.html.
- ⁴⁵ Келли К. *Неизбежно*. М.: Манн, Иванов и Фербер, 2017.
- ⁴⁶ Jentzsch C. Decentralized Organizations to Automate Government // archive.org/stream/DecentralizedAutonomousOrganizations/WhitePaper_djvu.txt.
- ⁴⁷ Korolov M. Second Life GDP Totals \$500 Million // Hypergrid Business, November 11, 2015 // hypergridbusiness.com/2015/11/second-life-gdp-totals-500-million/.
- ⁴⁸ Pine J., Gilmore J. Welcome to the Experience Economy // Harvard Business Review, July-August 1998.

- ⁴⁹ Johnson M. *Reinvent Your Business Model*. Harvard Business Press, 2018, задняя сторона обложки.
- ⁵⁰ Айзексон У. *Инноваторы. Как несколько гениев, хакеров и гиков совершили цифровую революцию*. М.: АСТ, 2015.
- ⁵¹ Прекрасный очерк о продолжительности жизни в историческом разрезе: ourworldindata.org/life-expectancy.
- ⁵² Беседа автора с доктором медицины Робертом Харири в 2018 г.
- ⁵³ McCracken H. How CEO Larry Page Has Transformed the Search Giant into a Factory for Moonshots. Our Exclusive Look at His Boldest Bet Yet — to Extend Human Life // *TIME*, September 30, 2013.
- ⁵⁴ Simpson C. Google Wants to Cheat Death // *Atlantic*, September 18, 2013.
- ⁵⁵ См.: unitybiotechnology.com.
- ⁵⁶ van Deursen J. M. Senolytic Therapies for Healthy Longevity // *Science*. Vol. 364. No. 6441. Pp. 636–637.
- ⁵⁷ Villeda S. A. Young Blood Reverses Age-Related Impairments in Cognitive Function and Synaptic Plasticity in Mice // *Nature Medicine*. 2014. Vol. 20. Pp. 659–663.
- ⁵⁸ См.: elevation.com (венчурная компания Питера выступает инвестором).
- ⁵⁹ О регенерации сердца: Loffredo F. Growth Differentiation Factor 11 Is a Circulating Factor That Reverses Age-Related Cardiac Hypertrophy // *Cell*. May 9, 2013. Vol. 153. No. 4. Pp. 828–239. Мозга: Katsimpardi L. Vascular and Neurogenic Rejuvenation of the Aging Mouse Brain by Young Systemic Factors // *Science*. May 9, 2014. Vol. 344. No. 6184. Pp. 630–634. Мышц: Sinha M. Restoring Systemic GDF11 Levels Reverses Age-Related Dysfunction in Mouse Skeletal Muscle // *Science*. May 9, 2014. Vol. 344. No. 6184. Pp. 649–652. Легких: Onodera K. Decrease in an Anti-Ageing Factor, Growth Differentiation Factor 11, in Chronic Obstructive Pulmonary Disease // *Thorax*. April 28, 2017. Vol. 72. No. 10. Почек: Zhang Y. GDF11 Improves Tubular Regeneration After Acute Kidney Injury in Elderly Mice // *Nature Scientific Reports*. October 5, 2016. Vol. 6.
- ⁶⁰ Там же.
- ⁶¹ Ramsey L. Samumed, a \$12 Billion Startup That Wants to Cure Baldness and Smooth Out Your Wrinkles, Just Raised Even More Funding as It Plots an IPO // *Business Insider*, August 11, 2018 // businessinsider.com/samumed-raises-438-million-at-12-billion-valuation-2018-8.
- ⁶² См.: celularity.com.
- ⁶³ Беседа автора с доктором Харири.
- ⁶⁴ Рэй Курцвейл, в беседе с автором, 2018. Видеоролик см.: singularityhub.com/2017/11/10/3-dangerous-ideas-from-ray-kurzweil/.

Часть II. Второе рождение всего

Глава 5. Будущее шопинга

- ¹ Howard V. The Rise and Fall of Sears // *Smithsonian Magazine*, July 25, 2017 // smithsonianmag.com/history/rise-and-fall-sears-180964181/. См. также: Richard Warren *Sears: Biography & Sears*,

-
- Roebuck, & Company // schoolworkhelper.net/richard-warren-sears-biography-sears-roebuck-company; Richard W. Sears // britannica.com/biography/Richard-W-Sears.
- ² Why Do We Have Time Zones? // TimeandDate.com // timeanddate.com/time/time-zones-history.html.
- ³ Rural Free Delivery, August 2013 // about.usps.com/who-we-are/postal-history/rural-free-delivery.pdf.
- ⁴ Thompson D. Sears Is Not a Failure // *Atlantic*, October 15, 2018 // theatlantic.com/ideas/archive/2018/10/end-sears/573070/.
- ⁵ Holodny E. A Key Player in China and the EU's 'Third Industrial Revolution' Describes the Economy of Tomorrow // *BusinessInsider*, July 16, 2017 // businessinsider.com/jeremy-rifkin-interview-2017-6.
- ⁶ Thompson, Sears Is Not a Failure.
- ⁷ Gertz M. How One of America's Oldest Retailers Unraveled // *Bloomberg*, October 12, 2018 // bloomberg.com/news/photo-essays/2018-10-12/how-sears-got-left-behind-as-walmart-amazon-took-over-retail. См. также: Day M. The Enormous Numbers Behind Amazon's Market Reach // *Bloomberg*, March 27, 2019 // bloomberg.com/graphics/2019-amazon-reach-across-markets/.
- ⁸ Global Powers of Retailing 2018 // *Deloitte* // www2.deloitte.com/content/dam/Deloitte/tr/Documents/consumer-business/cip-2018-global-powers-retailing.pdf. См. также: Wattles J. 2017 Just Set the All-Time Record for Store Closings // *CNN*, October 25, 2017 // money.cnn.com/2017/10/25/news/economy/store-closings-2017/index.html?sr=twCNN102517economy0528PMStory.
- ⁹ Данные взяты отсюда: macro-trends.net; в таблице указана максимальная стоимость компании в каждом приведенном году.
- ¹⁰ Census.com. Monthly Retail Trade // census.gov/retail/index.html. См. также: Retail E-Commerce Sales in the United States from 1st Quarter 2009 to 2nd Quarter 2019 (In Million U.S. Dollars) // *Statista* // statista.com/statistics/187443/quarterly-e-commerce-sales-in-the-the-us/.
- ¹¹ Quarterly Retail E-Commerce Sales 3rd Quarter 2017 // U.S. Census Bureau // www2.census.gov/retail/releases/historical/ecom/17q3.pdf.
- ¹² Individuals Using the Internet (% of population) // *World Bank* // data.worldbank.org/indicator/IT.net.USER.ZS. См. также: Population, Total // *World Bank* // data.worldbank.org/indicator/SP.POP.TOTL.
- ¹³ Goodkind D. The World Population at 7 Billion // U.S. Census Bureau, October 31, 2011 // census.gov/newsroom/blogs/random-samplings/2011/10/the-world-population-at-7-billion.html.
- ¹⁴ Surowiecki J. Where Nokia Went Wrong // *New Yorker*, September 3, 2013 // newyorker.com/business/currency/where-nokia-went-wrong. См. также: Shaughnessy H. Apple's Rise and Nokia's Fall Highlight Platform Strategy Essentials // *Forbes*, March 8, 2013 // forbes.com/sites/haydnshaughnessy/2013/03/08/apples-rise-and-nokias-fall-highlight-platform-strategy-essentials/#575a41346e9a.
- ¹⁵ Star Trek, IMDb. См.: imdb.com/title/tt0060028/.
- ¹⁶ Digital Voice Assistants in Use to Triple to 8 Billion by 2023, Driven by Smart Home Devices // *Juniper Research*, February 12, 2018 // juniperresearch.com/press/press-releases/digital-voice-assistants-in-use-to-8-million-2023.

-
- ¹⁷ Kim E. Amazon Echo Owners Spend More on Amazon Than Prime Members, Report Says // CNBC, January 3, 2018 // cnbc.com/2018/01/03/amazon-echo-owners-spend-more-on-amazon-than-prime-members.html.
- ¹⁸ Google Duplex: An AI System for Accomplishing Real-World Tasks over the Phone // Google AI Blog, May 8, 2018 // ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html.
- ¹⁹ Li A. Googler in Charge of I/O 2019 Says It Takes 6-9 Months to Plan // 9To5Google, May 6, 2019.
- ²⁰ Keynote (Google I/O '18) // youtube.com/watch?v=ogfYd705cRs.
- ²¹ The Impact of Customer Service on Customer Lifetime Value 2013 // zendesk.com/resources/customer-service-and-lifetime-customer-value/.
- ²² См.: beyondverbal.com/.
- ²³ Woods B. Emotion Analytics Company Beyond Verbal Releases Moodies as Standalone Ios App // TheNextWeb.com // thenextweb.com/apps/2014/01/23/beyond-verbal-releases-moodies-standalone-ios-app/.
- ²⁴ Грег Кросс, в беседе с автором, 2018. См. также: soulmachines.com.
- ²⁵ Soul Machines. IBM.com. См.: ibm.com/case-studies/soul-machines-hybrid-cloud-ai-chatbot.
- ²⁶ Johnson K. How Autodesk's Assistant Ava Attempts to Avoid Uncanny Valley // Venture Beat, May 18, 2018 // venturebeat.com/2018/05/18/how-autodesks-assistant-ava-attempts-to-avoid-uncanny-valley/.
- ²⁷ Hot Off the Press: Emotional Intelligence Daimler Financial Services Invests in Soul Machines // Soul Machines, October 17, 2018 // soulmachines.com/news/2018/10/17/hot-off-the-press-emotional-intelligence-daimler-financial-services-invests-in-soul-machines/.
- ²⁸ См.: mckinsey.com/~media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/the%20internet%20of%20things%20the%20value%20of%20digitizing%20the%20physical%20world/unlocking_the_potential_of_the_internet_of_things_full_report.ashx.
- ²⁹ Beyond Amazon Go: The Technologies and Players Shaping Cashier-Less Retail // CB Insights, October 9, 2018 // cbinsights.com/research/cashierless-retail-technologies-companies-trends/.
- ³⁰ Wingfield N. Inside Amazon Go, a Store of the Future // New York Times, January 21, 2018 // nytimes.com/2018/01/21/technology/inside-amazon-go-a-store-of-the-future.html.
- ³¹ Stone B. Amazon's Most Ambitious Research Project Is a Convenience Store // Bloomberg Businessweek, July 18, 2019 // bloomberg.com/news/features/2019-07-18/amazon-s-most-ambitious-research-project-is-a-convenience-store.
- ³² Wingfield, Inside Amazon Go.
- ³³ The Internet of Things: Mapping the Value Beyond the Hype // McKinsey & Company, June 2015 // mckinsey.com/~media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/The%20Internet%20of%20Things%20The%20value%20of%20digitizing%20the%20physical%20world/The-Internet-of-things-Mapping-the-value-beyond-the-hype.ashx.
- ³⁴ This AI Startup Wants to Automate Every Store Like Amazon Go // Fast Company, November 9, 2017 // fastcompany.com/40493622/this-ai-startup-wants-to-automate-every-store-like-amazon-go. См. также: v7labs.com/retail.

-
- ³⁵ Fannin R. Alibaba Beats Amazon to New All-Digital Retail Trend // Forbes, September 21, 2018 // forbes.com/sites/rebeccafannin/2018/09/21/alibaba-beats-amazon-to-new-all-digital-retail-trend/#6b7660436653.
- ³⁶ The Future of Retail: Shopping and the Smart Shelf // Intel // intel.com/content/www/us/en/retail/digital-retail-futurecasting-report.html.
- ³⁷ Meola A. How IoT Logistics Will Revolutionize Supply Chain Management // Business Insider, December 21, 2016 // businessinsider.com/internet-of-things-logistics-supply-chain-management-2016-10.
- ³⁸ Faggella D. Artificial Intelligence In Retail — 10 Present and Future Use Cases // Emerj.com, March 28, 2019 // emerj.com/ai-sector-overviews/artificial-intelligence-retail/.
- ³⁹ См. видео: youtube.com/watch?v=rb0nxQyv7RU.
- ⁴⁰ Moon M. Domino's Delivery Robots Are Invading Europe // Engadget, March 30, 2017.
- ⁴¹ Mathews K. 5 Ways Retail Robots Are Disrupting the Industry // Robotics Business Review, August 2, 2018 // roboticsbusinessreview.com/retail-hospitality/retail-robots-disrupt-industry/.
- ⁴² Dormehl L. The Rise and Reign of Starship, the World's First Robotic Delivery Provider // Digital Trends, May 22, 2019 // digitaltrends.com/cool-tech/how-starship-technologies-created-delivery-robots/.
- ⁴³ Harris M. Softbank's \$940 Million Smaller Robots Could Leap from Driverless Vehicles to Complete Last-Yard Deliveries // TechCrunch, March 23, 2019 // techcrunch.com/2019/03/23/how-nuro-plans-to-spend-softbanks-money/.
- ⁴⁴ Wiggers K. Nuro Expands Kroger Driverless Deliveries to Houston // Venture Beat, March 14, 2019 // venturebeat.com/2019/03/14/nuro-expands-driverless-delivery-partnership-with-kroger-to-houston/.
- ⁴⁵ Davies A. Nuro's Pizza Robot Will Bring You a Domino's Pie // Wired, June 17, 2019 // wired.com/story/nuro-dominos-pizza-delivery-self-driving-robot-houston/.
- ⁴⁶ First Prime Air Delivery // amazon.com/Amazon-Prime-Air/b?ie=UTF8&node=8037720011.
- ⁴⁷ Lee N. 7-Eleven Has Already Made 77 Deliveries by Drone // Engadget, December 20, 2016 // engadget.com/2016/12/20/7-eleven-has-already-made-77-deliveries-by-drone/?guccounter=1.
- ⁴⁸ Hanbury M. There's a Way Walmart Could Beat Amazon When It Comes to Speedy Delivery, and New Data Shows It's Going All In // Business Insider, June 18, 2019 // businessinsider.com/walmart-invests-in-drones-as-amazon-delivery-war-heats-up-2019-6.
- ⁴⁹ Zaveri M. Wing, Owned by Google's Parent Company, Gets First Approval for Drone Deliveries in U.S. // New York Times, April 23, 2019 // nytimes.com/2019/04/23/technology/drone-deliveries-google-wing.html. См. также: Transforming the Way Goods Are Transported // x.company/projects/wing/.
- ⁵⁰ China Is on the Fast Track to Drone Deliveries // Bloomberg, July 3, 2018 // bloomberg.com/news/features/2018-07-03/china-s-on-the-fast-track-to-making-uav-drone-deliveries.
- ⁵¹ Drone Deliveries Really Are Coming Soon, Officials Say // Drive, March 14, 2018 // thedrive.com/tech/19239/drone-deliveries-really-are-coming-soon-officials-say.
- ⁵² Guizzo E. How Aldebaran Robotics Built Its Friendly Humanoid Robot, Pepper // IEEE Spectrum, December 26, 2014 // spectrum.ieee.org/robotics/home-robots/how-aldebaran-robotics-built-its-friendly-humanoid-robot-pepper.

-
- ⁵³ Streeter B. Seriously Successful Results from HSBC Bank's Branch Robot Rollout // Financial Brand, June 5, 2019 // thefinancialbrand.com/84245/hsbc-banks-branch-robot-pepper-digital-transformation-phygital/. См. также: Olson P. Softbank's Robotics Business Prepares to Scale Up // Forbes, May 30, 2018 // forbes.com/sites/parmyolson/2018/05/30/softbank-robotics-business-pepper-boston-dynamics/#2579283e4b7f.
- ⁵⁴ Nassauer S. Walmart Is Rolling Out the Robots // Wall Street Journal, April 9, 2019 // wsj.com/articles/walmart-is-rolling-out-the-robots-11554782460.
- ⁵⁵ Kumar K. Best Buy Tests Robot at New York Store // Star Tribune, September 26, 2015 // startribune.com/best-buy-tests-robot-at-new-york-store/329583301/.
- ⁵⁶ LoweBot // lowesinnovationlabs.com/lowebot.
- ⁵⁷ Rusli E. M. Amazon.com to Acquire Manufacturer of Robotics // New York Times, March 19, 2012 // dealbook.nytimes.com/2012/03/19/amazon-com-buys-kiva-systems-for-775-million/?mtrref=undefined&gwh=A926616EBBF3A219E03216397142BB8B&gwt=pay&assetType=REGIWALL.
- ⁵⁸ Shead S. Amazon Now Has 45,000 Robots in Its Warehouses // Business Insider, January 3, 2017 // businessinsider.com/amazons-robot-army-has-grown-by-50-2017-1.
- ⁵⁹ Yarow J. Amazon Was Selling 306 Items Every Second at Its Peak This Year // Business Insider, December 27, 2012 // businessinsider.com/amazon-holiday-facts-2012-12.
- ⁶⁰ Trebilcock B. Resilience and Innovation at Gap Inc. // Modern Materials Handling, November 12, 2018 // mmh.com/article/resilience_and_innovation_at_gap_inc.
- ⁶¹ Kindred Robot // kindred.ai/ (венчурная компания Питера выступает инвестором).
- ⁶² Ministry of Supply // ministryofsupply.com. См. также: Kestenbaum R. 3-D Printing In-Store Is Very Close and Retailers Need to Address It // Forbes, April 6, 2017 // forbes.com/sites/richardkestenbaum/2017/04/06/3-d-printing-in-store-is-very-close-and-retailers-need-to-address-it/#4ba78ea333b4.
- ⁶³ Empson R. With Tech from Space, Ministry of Supply Is Building the Next Generation of Dress Shirts // TechCrunch, July 1, 2012 // techcrunch.com/2012/06/30/ministry-of-supply/.
- ⁶⁴ Danit Peleg. См.: danitpeleg.com.
- ⁶⁵ Lord B. Reebok's 3-D Printed Shoe Line Dashes into Production // 3-D Printing Industry. August 3, 2018 // 3-dprintingindustry.com/news/reeboks-3-d-printed-shoe-line-dashes-into-production-137497/.
- ⁶⁶ Koslow T. New Balance Announces 3-D Printed Midsoles in New Running Shoe Line // 3-D Printing Industry, November 19, 2015 // 3-dprintingindustry.com/news/new-balance-announces-3-d-printed-midsoles-in-new-running-shoe-line-62313/.
- ⁶⁷ Grunewald S. J. Staples' New Sculpteo-Powered Online 3-D Printing Service Launches // 3-D Print.com, September 17, 2015 // 3-dprint.com/96380/staples-sculpteo-launched/.
- ⁶⁸ Jackson B. Interview: How ZMorph 3-D Printers Are Helping the Leroy Merlin Bricolab Movement in Brazil // 3-D Printing Industry, January 28, 2019 // 3-dprintingindustry.com/news/interview-how-zmorph-3-d-printers-are-helping-the-leroy-merlin-bricolab-movement-in-brazil-147975/.

-
- ⁶⁹ Pine II B. J. Welcome to the Experience Economy // Harvard Business Review, July-August 1998 // hbr.org/1998/07/welcome-to-the-experience-economy.
- ⁷⁰ Cuvillier C. Destination 2028 // The URW 2018 Report // report.urw.com/2018/.
- ⁷¹ Shopping Center // Encyclopedia.com // encyclopedia.com/reference/encyclopedias-almanacs-transcripts-and-maps/shopping-center.
- ⁷² Mall of America by the Numbers // mallofamerica.com/upload/FactSheets_2016.pdf.
- ⁷³ The Largest Shopping Malls in Asia // World Atlas // worldatlas.com/articles/the-largest-shopping-malls-in-asia.html.
- ⁷⁴ Kokoszka P. Is 3-D Body Scanning the Future Of Fashion? // Verdict // verdict.co.uk/3-D-body-scanning-fashion-future/.
- ⁷⁵ Bain M. Could 3-D Body Scanning Mean Never Entering Another Dressing Room Again // Quartz, September 9, 2015 // qz.com/497259/could-3-d-body-scanning-mean-never-entering-another-dressing-room-again/.
- ⁷⁶ Mageean L. 3-D Technology: A New Dimension for Fashion // whichPLM, November 22, 2018 // whichplm.com/3-D-technology-a-new-dimension-for-fashion/.
- ⁷⁷ Bodi.Me // bodi.me.
- ⁷⁸ Lawler R. 500 Startups-Backed Bombfell Helps Nerds Get Stylish, for Just \$69 a Month // TechCrunch, June 14, 2012 // techcrunch.com/2012/06/14/bombfell/.
- ⁷⁹ Lomas N. Amazon Has Acquired 3-D Body Model Startup, Body Labs, for \$50M-\$70M // TechCrunch, October 3, 2017 // techcrunch.com/2017/10/03/amazon-has-acquired-3-d-body-model-startup-body-labs-for-50m-70m/.
- ⁸⁰ Chou C. New Alibaba Concept Store Teases Future of Fashion Retail // July 4, 2018 // alizila.com/new-alibaba-concept-store-teases-future-of-fashion-retail/.
- ⁸¹ Real-Time Product Recommendations // Amazon // aws.amazon.com/mp/scenarios/bi/recommendation/.
- ⁸² Brown M. How Microsoft Is Shaking Up Fashion with Mixed Reality, AI, and IoT // Windows Central, June 9, 2018 // windowscentral.com/microsoft-fashion-mixed-reality-ai-iot.

Глава 6. Будущее рекламы

- ¹ Avent R. The Wealth of Humans: Work, Power, and Status in the Twenty-First Century. St. Martins, 2016. P. 3.
- ² CM.: statista.com/statistics/266249/advertising-revenue-of-google/.
- ³ CM.: statista.com/statistics/271258/facebooks-advertising-revenue-worldwide/.
- ⁴ CM.: statista.com/statistics/236943/global-advertising-spending/.
- ⁵ Lynley M. Google Joins the Race to \$1 Trillion // TechCrunch, July 23, 2018 // techcrunch.com/2018/07/23/google-joins-the-race-to-1-trillion/.
- ⁶ Egan M. Facebook and Amazon Hit \$500 Billion Milestone // CNN, July 27, 2017 // money.cnn.com/2017/07/27/investing/facebook-amazon-500-billion-bezos-zuckerberg/index.html.

-
- ⁷ Constine J. Snapchat Lets You Take a Photo of an Object to Buy It on Amazon // TechCrunch, September 24, 2018 // techcrunch.com/2018/09/24/snapchat-amazon-visual-search/.
- ⁸ См. оригинал объявления Pinterest: newsroom.pinterest.com/en/post/introducing-the-next-wave-of-visual-search-and-shopping.
- ⁹ См.: lens.google.com.
- ¹⁰ Pardes A. Ikea's New App Flaunts What You'll Love Most About AR // Wired, September 20, 2017 // wired.com/story/ikea-place-ar-kit-augmented-reality/.
- ¹¹ Wurmser Y. Visual Search 2018: New Tools from Pinterest, eBay, Google and Amazon Increase Accuracy, Utility // eMarketer, September 26, 2018 // emarketer.com/content/visual-search-2018.
- ¹² Partner Content. How Lyrebird Uses AI to Find Its (Artificial) Voice // Wired // wired.com/brandlab/2018/10/lyrebird-uses-ai-find-artificial-voice/. См. также: lyrebird.ai.
- ¹³ Allen G. AI Will Make Forging Anything Entirely Too Easy // Wired, July 1, 2017 // wired.com/story/ai-will-make-forging-anything-entirely-too-easy/.
- ¹⁴ Dormehl L. Baidu's New A.I. Can Mimic Your Voice After Listening to It for Just One Minute // Digital Trends, February 28, 2018 // digitaltrends.com/cool-tech/baidu-ai-emulate-your-voice/.
- ¹⁵ Mack D. This PSA About Fake News from Barack Obama Is Not What It Appears // BuzzFeed News, April 17, 2018 // buzzfeednews.com/article/davidmack/obama-fake-news-jordan-peelee-psa-video-buzzfeed.
- ¹⁶ Technology. The Real Danger of DeepFake Videos Is That We May Question Everything // NewScientist, August 29, 2018 // newscientist.com/article/mg23931933-200-the-real-danger-of-deepfake-videos-is-that-we-may-question-everything/. См. также: Swartz O. You Thought Fake News Was Bad? Deep Fakes Are Where Truth Goes to Die // Guardian, November 12, 2018 // theguardian.com/technology/2018/nov/12/deep-fakes-fake-news-truth.
- ¹⁷ См. оригинал статьи специалистов из Университета Карнеги — Меллона: cmu.edu/news/stories/archives/2018/september/deep-fakes-video-content.html.
- ¹⁸ Afshar V. How AI-Powered Commerce Will Change Shopping // ZDNet, December 21, 2018 // zdnet.com/article/how-ai-powered-commerce-will-change-shopping/.

Глава 7. Будущее развлечений

- ¹ Hastings R. How I Did It: Reed Hastings, Netflix // Inc. Magazine, December 1, 2005 // inc.com/magazine/20051201/qa-hastings.html.
- ² Helft M. Netflix to Deliver Movies to the PC // New York Times, January 16, 2007 // nytimes.com/2007/01/16/technology/16netflix.html.
- ³ Iqbal M. Netflix Revenue and Usage Statistics (2018) // Business of Apps, February 27, 2019 // businessofapps.com/data/netflix-statistics/.
- ⁴ Там же.
- ⁵ Ha A. Netflix Added 9.6M Subscribers in Q1, with Revenue of \$4.5B // TechCrunch, April 16, 2019 // techcrunch.com/2019/04/16/netflix-q1-earnings/.

-
- ⁶ Netflix Market Cap 2006-2019 | NFLX // MacroTrends.com // macroTrends.net/stocks/charts/NFLX/netflix/market-cap.
- ⁷ Alsin A. The Future of Media: Disruptions, Revolutions and the Quest for Distribution // Forbes, July 19, 2018 // forbes.com/sites/aalsin/2018/07/19/the-future-of-media-disruptions-revolutions-and-the-quest-for-distribution/#5a2ca52d60b9.
- ⁸ Netflix Is Moving Television Beyond Time-Slots and National Markets // Economist, June 30, 2018 // economist.com/briefing/2018/06/30/netflix-is-moving-television-beyond-time-slots-and-national-markets.
- ⁹ Spangler T. Netflix Eyeing Total of About 700 Original Series in 2018 // Variety, February 27, 2018.
- ¹⁰ Graser M. Epic Fail: How Blockbuster Could Have Owned Netflix // Variety, November 12, 2013 // variety.com/2013/biz/news/epic-fail-how-blockbuster-could-have-owned-netflix-1200823443/.
- ¹¹ Mickle T. Apple Readies \$1 Billion War Chest for Hollywood Programming // Wall Street Journal, August 16, 2017 // wsj.com/articles/apple-readies-1-billion-war-chest-for-hollywood-programming-1502874004.
- ¹² Levy A. Here's Exactly How Much Amazon Is Spending on Video and Music Content // Motley Fool, April 30, 2019 // fool.com/investing/2019/04/30/heres-how-much-amazon-is-spending-on-video-music.aspx.
- ¹³ Общемировые доходы ТВ: Global TV Revenues Grow to \$265 Billion // Broadband TV News, October 22, 2018 // broadbandtvnews.com/2018/10/22/global-tv-revenues-grow-to-265-billion/. Общемировые кассовые сборы: McClintock P. Global Box Office Revenue Hits Record \$41B in 2018, Fueled by Diverse U.S. Audiences // Hollywood Reporter, March 21, 2019 // hollywoodreporter.com/news/global-box-office-revenue-hits-record-41b-2018-fueled-by-diverse-us-audiences-1196010.
- ¹⁴ Me at the Zoo (video), April 23, 2005 // youtube.com/watch?v=jNQXAC9IVRw.
- ¹⁵ Ronaldinho Nike Ad (video), August 2, 2006 // youtube.com/watch?v=i_JS1YG8H2c.
- ¹⁶ Helft M. Venture Firm Shares a YouTube Jackpot // New York Times, October 10, 2006 // nytimes.com/2006/10/10/technology/10payday.html.
- ¹⁷ Там же.
- ¹⁸ Over One Billion Users. См.: youtube.com/about/press/.
- ¹⁹ Binging with Babish (video). См.: youtube.com/user/bgfilms.
- ²⁰ Cooking with Dog (video). См.: youtube.com/user/cookingwithdog.
- ²¹ My Drunk Kitchen (video). См.: youtube.com/user/MyHarto.
- ²² Robehmed N. Highest-Paid YouTube Stars 2018: Markiplier, Jake Paul, Pewdiepie and More // Forbes, December 3, 2018 // forbes.com/sites/natalierobehmed/2018/12/03/highest-paid-youtube-stars-2018-markiplier-jake-paul-pewdiepie-and-more/#22c2828e909a.
- ²³ Bambuser. См.: bambuser.com.
- ²⁴ Sunspring (video). См.: youtube.com/watch?v=LY7x2Ihqjmc.
- ²⁵ BM Creates First Movie Trailer by AI [HD] | 20th Century FOX, August 31, 2016 // youtube.com/watch?v=gJEzuYynaiw.

- ²⁶ Guzdial M. Crowdsourcing Open Interactive Narrative // cc.gatech.edu/~riedl/pubs/guzdial-fdg15.pdf. См. также: Artificial Intelligence System for Crowdsourcing Interactive Fiction (video), September 1, 2016 // youtube.com/watch?time_continue=1&v=znqw17aOrCs.
- ²⁷ Category: Video Games with User-Generated Gameplay Content // Wikipedia // en.wikipedia.org/wiki/Category:Video_games_with_user-generated_gameplay_content.
- ²⁸ См.: mashupmachine.io.
- ²⁹ Chan C. Everybody Dance Now // Arvix.org, August 22, 2018 // arxiv.org/pdf/1808.07371v1.pdf.
- ³⁰ Беседа автора с Тони Роббинсом, 2018.
- ³¹ AI Personas Based on Real People // rivaltheory.com.
- ³² Жюль Урбах, беседа с автором, 2018. См. также: Georgiadis F. The Future Is Now: 'Now We Can Effortlessly Interact with Digital Holographic Objects That Naturally Blend into Everyday Life' with OTOY CEO Jules Urbach & Fotis Georgiadis // Thrive Global, January 16, 2019 // thriveglobal.com/stories/the-future-is-now-now-we-can-effortlessly-interact-with-digital-holographic-objects-that-naturally-blend-into-everyday-life-with-otoy-ceo-jules-urbach-fotis-georgiadis/.
- ³³ Otoy. См.: home.otoy.com.
- ³⁴ Light Field Lab // lightfieldlab.com/. См. также: variety.com/2018/digital/features/light-field-lab-holographic-display-demo-1203026693/.
- ³⁵ High Fidelity Raises \$35m to Bring Virtual Reality to 1 Billion People // High Fidelity, June 28, 2018 // prnewswire.com/news-releases/high-fidelity-raises-35m-to-bring-virtual-reality-to-1-billion-people-300673807.html.
- ³⁶ NeoSensory // neosensory.com/?v=7516fd43adaa. См. также: Eagleman D. Can We Create New Senses for Humans? // TED Talk // ted.com/talks/david_eagleman_can_we_create_new_senses_for_humans.
- ³⁷ Dreamscape. См.: dreamscapeimmersive.com/. См. также: Bishop B. Dreamscape Immersive Wants to Bring Location-Based VR to the Masses, Starting with a Shopping Mall // Verge, January 15, 2019 // theverge.com/2019/1/15/18156854/dreamscape-immersive-virtual-reality-los-angeles-walter-parkes-bruce-vaughn (венчурная компания Питера выступает инвестором).
- ³⁸ Ramirez G. A. Color Analysis of Facial Skin: Detection of Emotional State // University of Texas // cs.utep.edu/ofuentes/papers/emotionSkin_final.pdf.
- ³⁹ Affectiva // affectiva.com/. См. также: Marwan S. Rana El Kaliouby CEO of Affectiva Is Training Robots to Read Feelings // Forbes, November 29, 2018 // forbes.com/sites/samarmarwan/2018/11/29/affectiva-emotion-ai-ceo-rana-el-kaliouby/#7d5f8c5c1572.
- ⁴⁰ Finding the Essence of Fear in Nevermind // July 21, 2016 // blog.affectiva.com/finding-the-essence-of-fear-in-nevermind.
- ⁴¹ Foster T. Ready or Not, Companies Will Soon Be Tracking Your Emotions // Inc. Magazine, July 2016 // inc.com/magazine/201607/tom-foster/lightwave-monitor-customer-emotions.html.
- ⁴² Ubumo. См.: ubimo.com.
- ⁴³ Cluep. См.: cluep.com.

- ⁴⁴ Lopez R. 'Choose Your Own Adventure' Interactive Movie in the Works at Fox // Variety, April 26, 2018 // variety.com/2018/film/news/choose-your-own-adventure-interactive-1202788741/.
- ⁴⁵ Spiegel J. Does a 'Choose Your Own Adventure' Movie Sound Appealing? // Hollywood Reporter // hollywoodreporter.com/heat-vision/choose-your-own-adventure-movie-does-it-sound-appealing-1106999.
- ⁴⁶ Рони Абовиц, беседа с автором, 2018 г. См. также: Magic Leap // magicleap.com/; Yang P. The Untold Story of Magic Leap, the World's Most Secretive Startup // Wired // wired.com/2016/04/magic-leap-vr/.
- ⁴⁷ OLED Lighting Products: Capabilities, Challenges, Potential // U.S. Department of Energy, May 2016 // energy.gov/sites/prod/files/2016/08/f33/ssl_oled-products_2016.pdf.
- ⁴⁸ Bendy Smartphone Made of Graphene Displayed at China Tech Fair (video), April 27, 2016 // youtube.com/watch?v=ZwuQXfHXsa4. См. также: Porter J. Nubia's New Wearable Puts a 4-Inch Flexible Smartphone on Your Wrist // Verge // theverge.com/circuitbreaker/2019/2/25/18240370/nubia-alpha-release-date-price-features-wearable-smartwatch-flexible-display-mwc-2019.
- ⁴⁹ For AR/VR 2.0 to Live, AR/VR 1.0 Must Die // Digi-Capital, January 15, 2019 // digi-capital.com/news/2019/01/for-ar-vr-2-0-to-live-ar-vr-1-0-must-die/.
- ⁵⁰ Phelan D. Apple CEO Tim Cook: As Brexit Hangs over UK, 'Times Are Not Really Awful, There's Some Great Things Happening' // Independent // independent.co.uk/life-style/gadgets-and-tech/features/apple-tim-cook-boss-brexit-uk-theresa-may-number-10-interview-ustwo-a7574086.html.
- ⁵¹ Munsil L. Pokemon GO Surpasses the 1 Billion Downloads Milestone // Nintendo Wire, July 31, 2019 // nintendowire.com/news/2019/07/31/pokemon-go-surpasses-the-1-billion-downloads-milestone/.
- ⁵² Iqbal M. Pokemon GO Revenue and Usage Statistics (2019) // Business of Apps, May 10, 2019 // businessofapps.com/data/pokemon-go-statistics/.
- ⁵³ См.: mojo.vision. См. также: Takahashi D. Mojo Vision Reveals the World's Smallest and Densest Micro Display // Venture Beat // venturebeat.com/2019/05/30/mojo-vision-reveals-the-worlds-smallest-and-densest-micro-display/ (венчурная компания Питера выступает инвестором).
- ⁵⁴ Minkyu A. A Review of Brain-Computer Interface Games and an Opinion Survey from Researchers, Developers and Users // Sensors, August 2014. Pp. 14601–14633, doi: 10.3390/s140814601. См.: ncbi.nlm.nih.gov/pmc/articles/PMC4178978/.
- ⁵⁵ Linxing J. P., BrainNet: A Multi-Person Brain-to-Brain Interface for Direct Collaboration Between Brains // Human-Computer Interaction, May 22, 2019 // arxiv.org/abs/1809.08632.
- ⁵⁶ Ramchurn R. Now Playing: A Movie You Control with Your Mind // MIT Technology Review, May 25, 2018 // technologyreview.com/s/611189/now-playing-a-movie-you-control-with-your-mind/.

Глава 8. Будущее образования

- ¹ Полный отчет Министерства образования США Our Future, Our Teachers: The Obama Administration's Plan for Teacher Education Reform and Improvement можно прочесть здесь: ed.gov/sites/default/files/our-future-our-teachers.pdf.

- ² UNESCO. The World Needs Almost 69 Million New Teachers to Reach the 2030 Education Goals // UNESCO Institute for Statistics. October 2016. No. 39 // uis.unesco.org/sites/default/files/documents/fs39-the-world-needs-almost-69-million-new-teachers-to-reach-the-2030-education-goals-2016-en.pdf.
- ³ Эти вопросы прекрасно освещает в своей работе Кен Робинсон: Robinson K. *Out of Our Minds*. Capstone, 2011.
- ⁴ Полный текст выступления замминистра образования США Тони Миллера в июле 2011 г. можно прочесть здесь: ed.gov/news/speeches/partnering-education-reform.
- ⁵ Полный текст доклада The Silent Epidemic Perspectives of High School Dropouts («Безмолвная эпидемия: что ожидает старшеклассников, бросивших школу»): docs.gatesfoundation.org/documents/thesilentepidemic3-06final.pdf.
- ⁶ Talbot D. Given Tablets but No Teachers, Ethiopian Children Teach Themselves // MIT Technology Review, October 29, 2012 // technologyreview.com/s/506466/given-tablets-but-no-teachers-ethiopian-children-teach-themselves/.
- ⁷ См.: one.laptop.org/.
- ⁸ Там же.
- ⁹ Полный текст TED-лекции Сугаты Митры Kids Can Teach Themselves («Дети могут самообучаться») см.: ted.com/talks/sugata_mitra_shows_how_kids_teach_themselves?language=en.
- ¹⁰ Там же.
- ¹¹ См.: xpriize.org/prizes/global-learning.
- ¹² По данным исследовательской и консалтинговой компании в области ИТ Gartner, в 2017 г. было продано более 1,5 млрд смартфонов. Из них 1,32 млрд работали на ОС Android. Источник: Gartner Newsroom, Press Releases. Gartner Says Worldwide Sales of Smartphones Recorded First Ever Decline During the Fourth Quarter of 2017 // gartner.com/en/newsroom/press-releases/2018-02-22-gartner-says-worldwide-sales-of-smartphones-recorded-first-ever-decline-during-the-fourth-quarter-of-2017.
- ¹³ Беседа автора с Филиппом Росдейлом, 2018. Видеотур можно посмотреть здесь: youtube.com/watch?v=zb2NUs0IDm4ut.
- ¹⁴ Bailey F., Pransky K. Implications and applications of the latest brain research for learners and teachers. Webinar, 2015, July 16 // Association for Supervision and Curriculum Development Webinar Series // ascd.org/professional-development/webinars/implications-and-applications-of-brain-research-webinar.aspx.
- ¹⁵ Биографическую справку см. здесь: vhil.stanford.edu/faculty-and-staff/.
- ¹⁶ Herrera F. Building Long-Term Empathy: A Large-Scale Comparison of Traditional and Virtual Reality Perspective-Taking // PLoS ONE, October 17, 2018. Vol. 13. No. 10 // vhil.stanford.edu/mm/2018/11/herrera-pone-building-long-term-empathy.pdf.
- ¹⁷ Биографическую справку см. здесь: ict.usc.edu/profile/albert-skip-rizzo/.
- ¹⁸ Maples-Keller J. The Use of Virtual Reality Technology in the Treatment of Anxiety and Other Psychiatric Disorders // Harvard Review of Psychiatry, May-June 2017. Vol. 25. No. 3. Pp. 103–113 // ncbi.nlm.nih.gov/pmc/articles/PMC5421394/.

¹⁹ Стивенсон Н. Алмазный век. М.: Fanzon, 2019.

²⁰ Alba D. Sci-Fi Author Neal Stephenson Joins Mystery Startup as ‘Chief Futurist’ // Wired, December 16, 2014 // wired.com/2014/12/neal-stephenson-magic-leap/.

Глава 9. Будущее здравоохранения

¹ Беседа автора с Мартиной Ротблатт, 2018. Подробнее о Мартине см.: Tucker N. Martine Rothblatt: She Founded Siriusxm, a Religion and a Biotech. For Starters // Washington Post, December 12, 2014 // washingtonpost.com/lifestyle/magazine/martine-rothblatt-she-founded-siriusxm-a-religion-and-a-biotech-for-starters/2014/12/11/5a8a4866-71ab-11e4-ad12-3734c461eab6_story.html; Reed T. Martine Rothblatt’s Theory of Evolution // Puget Sound Business Journal, April 3, 2018 // bizjournals.com/seattle/bizwomen/news/latest-news/2018/04/martine-rothblatts-theory-of-evolution.html.

² См.: unither.com/.

³ Sorvino C. How CEO Martine Rothblatt Turns Moonshots into Earthshots // Forbes, June 20, 2018. См. также: Tucker, Martine Rothblatt.

⁴ В 2018 г. в США было пересажено 2530 легких. Более подробные сведения по трансплантации органов см.: unos.org/data/transplant-trends/.

⁵ Ротблатт, там же.

⁶ Там же.

⁷ Описание технологии ex vivo, перфузия легкого см.: Makdisis G. Ex Vivo Lung Perfusion Review of a Revolutionary Technology // Annals of Translational Medicine. 2017. Vol. 5. No. 17 // ncbi.nlm.nih.gov/pmc/articles/PMC5599284/. См. также пресс-релиз, где сообщается, что FDA одобрила одну из разработанных United Therapeutics процедур ex vivo перфузии легкого: biospace.com/article/releases/united-therapeutics-announces-fda-approval-of-xps-and-steen-solution-used-to-perform-centralized-ex-vivo-lung-perfusion-services/.

⁸ Ротблатт, там же.

⁹ New York Times поместила подробный материал о ксенотрансплантации, который можно прочесть здесь: Clynes T. 20 Americans Die Each Day Waiting for Organs. Can Pigs Save Them? // New York Times Magazine, November 11, 2018 // nytimes.com/interactive/2018/11/14/magazine/tech-design-xenotransplantation.html?emc=edit_nn_20181114&nl=morning-briefing&nid=8215381320181114&te=1&mtref=undefined&assetType=PAYWALL. См. также статью в журнале Nature: Reardon S. New Life for Pig Organs // Nature, November 12, 2015 // nature.com/news/polopoly_fs/1.18768!/menu/main/topColumns/topLeftColumn/pdf/527152a.pdf?origin=ppub.

¹⁰ Ротблатт, там же.

¹¹ Regalado A. Inside the Effort to Print Lungs and Breathe Life into Them with Stem Cells // MIT Technology Review, June 28, 2018 // technologyreview.com/s/611236/inside-the-effort-to-print-lungs-and-breathe-life-into-them-with-stem-cells/.

¹² См.: beta.team/. См. также: Adams E. Beta Technologies, a Vermont Air Taxi Start-Up, Might Be About to Change the Aviation World // Drive, January 11, 2019 // thedrive.com/tech/25914/

- beta-technologies-a-vermont-e-vtol-air-taxi-start-up-might-be-about-to-change-the-aviation-world (венчурная компания Питера выступает инвестором).
- ¹³ Allen M. Unnecessary Tests and Treatments // Scientific American, November 29, 2017 // scientificamerican.com/article/unnecessary-tests-and-treatment-explain-why-health-care-costs-so-much/. См. также: nap.edu/read/13444/chapter/1#xvii.
- ¹⁴ Таблица «Разработка новых лекарственных препаратов», подготовленная Калифорнийской ассоциацией биомедицинских исследований: studylib.net/doc/8182066/fact-sheet-new-drug-development-process.
- ¹⁵ Там же.
- ¹⁶ Такие данные по здравоохранению есть на сайте cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/nationalhealthexpenddata/nationalhealthaccountshistorical.html.
- ¹⁷ Подробные доклады вышеупомянутых Centers for Medicare & Medicaid Services см.: cms.gov/newsroom/press-releases/2016-2025-projections-national-health-expenditures-data-released.
- ¹⁸ Gurdus L. Tim Cook: Apple's Greatest Contribution Will Be 'About Health' // CNBC, January 8, 2019 // cnbc.com/2019/01/08/tim-cook-teases-new-apple-services-tied-to-health-care.html.
- ¹⁹ Специалисты по бизнес-аналитике из компании CB Insights проделали отличную работу — дали общий обзор экосистемы hi-tech-здравоохранения в двух докладах: cbinsights.com/research/top-tech-companies-healthcare-investments-acquisitions/; cbinsights.com/research/google-amazon-apple-health-insurance/.
- ²⁰ См.: ouraring.com (венчурная компания Питера выступает инвестором).
- ²¹ Echo Imaging недавно выскочила как черт из табакерки с привлеченным капиталом 35 млн долл. Полный текст их пресс-релиза см.: businesswire.com/news/home/20190805005114/en/Echo-Imaging-Emerges-Stealth-Mode-35M-Series. См. также: echo-imaging.com (венчурная компания Питера выступает инвестором).
- ²² Мэри Лу Джепсен рассказала о компании Openwater в своем TED-выступлении, которое можно посмотреть здесь: youtube.com/watch?v=awADEuv5vWY. См. также: openwater.cc/about-us. (венчурная компания Питера выступает инвестором).
- ²³ Полный текст пресс-релиза Apple см. здесь: apple.com/newsroom/2018/09/redesigned-apple-watch-series-4-revolutionizes-communication-fitness-and-health/.
- ²⁴ См.: XPrize.com, tricorder.xprize.org/prizes/tricorder/articles/family-led-team-takes-top-prize-in-qualcomm-tricor.
- ²⁵ Прогноз приводится агентством Zion Market Research Group в докладе, озаглавленном mHealth Market by Devices, by Stakeholder, by Service, by Therapeutics and by Applications: Global Industry Perspective, Comprehensive Analysis and Forecast, 2014–2022 // zionmarketresearch.com/report/mhealth-market. В этом пресс-релизе есть некоторые сведения из доклада: globenewswire.com/news-release/2017/11/15/1193431/0/en/mHealth-Market-Size-Projected-to-Reach-USD-102-43-Billion-by-2022-Zion-Market-Research.html.
- ²⁶ Molteni M. The Chatbot Therapist Will See You Now // Wired, June 7, 2017 // wired.com/2017/06/facebook-messenger-woebot-chatbot-therapist/. См. также: woebot.io.

- ²⁷ См.: humanlongevity.com.
- ²⁸ Stein R. Routine DNA Sequencing May Be Helpful and Not as Scary as Feared // NPR, June 26, 2017 // npr.org/sections/health-shots/2017/06/26/534338576/routine-dna-sequencing-may-be-helpful-and-not-as-scary-as-feared.
- ²⁹ Vasey J. The Impact of Whole-Genome Sequencing on the Primary Care and Outcomes of Healthy Adult Patients: A Pilot Randomized Trial // *Annals of Internal Medicine*. 2017. Vol. 67. No. 3. Pp. 159–169 // annals.org/aim/fullarticle/2633848/impact-whole-genome-sequencing-primary-care-outcomes-healthy-adult-patients.
- ³⁰ Подробности условий и финансирования проекта All of Us можно найти на сайте Национальных институтов здравоохранения: allofus.nih.gov.
- ³¹ Q&A: George Church and Company on Genomic Sequencing, Blockchain, and Better Drugs // Science, February 8, 2018 // sciencemag.org/news/2018/02/q-george-church-and-company-genomic-sequencing-blockchain-and-better-drugs. Подробнее о компании Nebula Genomics см. на ее сайте: nebula.org.
- ³² Li Y. Genome-Edited Skin Epidermal Stem Cells Protect Mice from Cocaine — Seeking Behaviour and Cocaine Overdose // *Nature Biomedical Engineering*. 2019. Vol. 3. Pp. 105–113 // nature.com/articles/s41551-018-0293-z.
- ³³ Amoasii L. Gene Editing Restores Dystrophin Expression in a Canine Model of Duchenne Muscular Dystrophy // *Science*. Vol. 362. No. 6410. Pp. 86–91 // science.sciencemag.org/content/362/6410/86.
- ³⁴ Mullin E. FDA Approves Groundbreaking Gene Therapy for Cancer // MIT Technology Review, August 30, 2017 // technologyreview.com/s/608771/the-fda-has-approved-the-first-gene-therapy-for-cancer/.
- ³⁵ Molteni M. Here's the Plan to End Malaria with Crispr-Edited Mosquitos // *Wired*, September 24, 2018 // wired.com/story/heres-the-plan-to-end-malaria-with-crispr-edited-mosquitoes/. См. также первую журнальную статью: Windbichler N. Targeting the X Chromosome During Spermatogenesis Induces Y Chromosome Transmission Ratio Distortion and Early Dominant Embryo Lethality in *Anopheles gambiae* // *PLoS Genet*. 2008. Vol. 4. No. 12 // ncbi.nlm.nih.gov/pmc/articles/PMC2585807/.
- ³⁶ Reuell P. A Step Forward in DNA Base Editing // *Harvard Gazette*, October 25, 2017 // news.harvard.edu/gazette/story/2017/10/a-step-forward-in-dna-base-editing/.
- ³⁷ Ben-Senior L. [Infographic] 10 Most Common Genetic Diseases // *LabRoots*, May 22, 2018 // labroots.com/trending/infographics/8833/10-common-genetic-diseases.
- ³⁸ Bridenstine Says NASA Planning for Human Mars Missions in 2030s // *Space News*, July 16, 2019 // spacenews.com/bridenstine-says-nasa-planning-for-human-mars-missions-in-2030s/.
- ³⁹ Summers R. Emergencies in Space // *The Practice of Emergency Medicine/Concepts*, 2005 // pdfs.semanticscholar.org/a102/d4e61620dd77f93639cf47492f7ca6f8c44f.pdf.
- ⁴⁰ Выступление Илона Маска на конференции ISS R&D Conference 19 июля 2017 г. см.: youtube.com/watch?v=BqvBhhTtUm4 (с переводом на русский язык: trshow.info/watch/ITE6mg7uvPI/-lon-mask-na-ss-r-d-conference-2017-19-07-2017-na-russkom.html).

- ⁴¹ Brown A. Smooth Operator: Robot Could Transform Soft-Tissue Surgery // Alliance of Advanced Biomedical Engineering, August 14, 2017 // aabme.asme.org/posts/smooth-operator-robot-could-transform-soft-tissue-surgery.
- ⁴² Hall M. J. Ambulatory Surgery Data from Hospitals and Ambulatory Surgery Centers: United States, 2010 // Centers for Disease Control National Health Statistics Reports. February 28, 2017. No. 102 // cdc.gov/nchs/data/nhsr/nhsr102.pdf.
- ⁴³ Frangou C. An Eye on Surgical Robots // General Surgery News, July 9, 2018.
- ⁴⁴ Текст первоначального пресс-релиза об учреждении партнерства см.: njn.com/media-center/press-releases/johnson-johnson-announces-formation-of-verb-surgical-inc-in-collaboration-with-verily. Более полную информацию по Verb Surgical см. также: verbsurgical.com.
- ⁴⁵ См.: bionautlabs.com (венчурная компания Питера выступает инвестором).
- ⁴⁶ Zhavoronkov A. Artificial Intelligence for Drug Discovery, Biomarker Development, and Generation of Novel Chemistry // Molecular Pharmaceutics. 2018. Vol. 5. Pp. 4311, ai4313.
- ⁴⁷ См.: davincisurgery.com/da-vinci-systems/about-da-vinci-systems.
- ⁴⁸ Американские Национальные институты здравоохранения держат библиотеку CAD-файлов 3D-печатных функциональных протезов, см. здесь: 3Dprint.nih.gov/collections/prosthetics.
- ⁴⁹ Park S. H. 3-D Printed Polymer Photodetectors // Advanced Materials. October 4, 2018. Vol. 30. No. 40 // onlinelibrary.wiley.com/doi/abs/10.1002/adma.201803980.
- ⁵⁰ Основы понятия стволовых клеток см. здесь: stemcells.nih.gov/info/basics/4.htm.
- ⁵¹ Беседа автора с Робертом Харири, 2018.
- ⁵² Там же.
- ⁵³ Национальный институт рака США (US National Cancer Institute) доходчиво описывает суть технологии CAR-T-терапии здесь: cancer.gov/about-cancer/treatment/research/car-t-cells.
- ⁵⁴ Rockoff J. The Million-Dollar Cancer Treatment: Who Will Pay? // Wall Street Journal, April 26, 2018 // wsj.com/articles/the-million-dollar-cancer-treatment-no-one-knows-how-to-pay-for-1524740401.
- ⁵⁵ См.: celularity.com.
- ⁵⁶ См. подготовленное FDA описание процесса разработки новых лекарственных препаратов: fda.gov/patients/drug-development-process/step-1-discovery-and-development.
- ⁵⁷ DiMasi J. Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs // Journal of Health Economics. May 2016. Vol. 47. Pp. 20–33 // doi.org/10.1016/j.jhealeco.2016.01.012.
- ⁵⁸ Беседа автора с Алексом Жаворонковым, 2018. Подробнее о компании Insilico Medicine, см.: insilico.com (венчурная компания Питера выступает инвестором).
- ⁵⁹ Там же. Более подробные сведения можно найти в тематическом выпуске журнала Американского химического общества (American Chemical Society) Molecular Pharmaceutics, по теме применения ИИ для открытия новых лекарств.
- ⁶⁰ Zhavoronkov A. Deep Learning Enables Rapid Identification of Potent DDR1 Kinase Inhibitors // Nature Biotechnology. 2019. Vol. 37. Pp. 1038–1040 // nature.com/articles/s41587-019-0224-x (венчурная компания Питера выступает инвестором).

⁶¹ Renneberg R. *Biotechnology for Beginners*. Academic Press, 2016. P. 281.

⁶² См.: predictioncenter.org.

⁶³ Об AlphaFold можно прочесть в блоге DeepMind здесь: deepmind.com/blog/alphafold/.

Глава 10. Перспективы долгожительства

- ¹ Доктор Фрэнсис Коллинз и Питер в 2018 г. выступали на одном мероприятии, которое принимал Cura Foundation — Фонд, инициировавший движение за всеобщее здоровье в мире. Беседу о долгожительстве и нравственной стороне продления жизни до бесконечности см. здесь: youtube.com/watch?v=z6i0yTA4zRM. Свои впечатления от общения с доктором Коллинзом Питер описал в своей статье: Diamandis P. *The Morality of Immortality*, 2018 // diamandis.com/blog/the-morality-of-immortality.
- ² Lopez-Otin C. *The Hallmarks of Aging* // *PMC*, November 23, 2013. См. также: *The Future of Aging? The New Drugs & Tech Working to Extend Life & Wellness* // *CB Insights*, ncbi.nlm.nih.gov/pmc/articles/PMC3836174/; *CB Insights' report on the future of aging* // cbinsights.com/research/report/future-aging-technology-startups/.
- ³ О роли и значении *C. elegans* в изучении генетики см.: Giurumescu C. A. *Cell Identification and Cell Lineage Analysis* // *Methods in Cell Biology*, 2011 // doi.org/10.1016/B978-0-12-544172-8.00012-8.
- ⁴ *C. elegans* Sequencing Consortium. *Genome Sequence of the Nematode C. Elegans: A Platform for Investigating Biology* // *Science*, December 11, 1998 // ncbi.nlm.nih.gov/pubmed/9851916.
- ⁵ Cook S. J. *Whole-Animal Connectomes of Both Caenorhabditis elegans Sexes* // *Nature*, July 3, 2019 // nature.com/articles/s41586-019-1352-7.
- ⁶ Первую статью об этом см. здесь: Chen D. *Germline Signaling Mediates the Synergistically Prolonged Longevity Produced by Double Mutations in daf-2 and rsk-1 in C. elegans* // *Cell Reports*, December 26, 2013 // [doi: 10.1016/j.celrep.2013.11.018](https://doi.org/10.1016/j.celrep.2013.11.018). См. также: NIH director Dr. Francis Collins's take on the study. *Deciphering Secrets of Longevity, from Worms* // *NIH Director's Blog*, January 7, 2014. См. первую статью об этом исследовании здесь: directorsblog.nih.gov/2014/01/07/deciphering-secrets-of-longevity-from-worms/.
- ⁷ Collins, *Deciphering Secrets*.
- ⁸ Sutphin G. L. *Caenorhabditis elegans Orthologs of Human Genes Differentially Expressed with Age Are Enriched for Determinants of Longevity* // *Aging Cell*, April 2017 // onlinelibrary.wiley.com/doi/full/10.1111/accel.12595.
- ⁹ Riley J., Roser M. *Life Expectancy by World Region* // *Our World in Data*, 2015 // ourworldindata.org/life-expectancy.
- ¹⁰ Рэй Курцвейл в беседе с автором, 2018. См. также беседу Рэя и Питера, в которой они обсуждают концепцию *longevity escape velocity* (скорости убегания от старения): youtube.com/watch?time_continue=2&v=SaOfItoaKqw.
- ¹¹ Peikoff K. *Anti-Aging Pioneer Aubrey de Grey: 'People in Middle Age Now Have a Fair Chance'* // *Leapsmag*, January 30, 2018 // leapsmag.com/anti-aging-pioneer-aubrey-de-grey-people-middle-age-now-fair-chance/.

- ¹² Schwarz J. The Right Chemistry: Easter Island Might Just Hold the Key to Fighting Aging // Montreal Gazette, March 5, 2019.
- ¹³ Halford B. Rapamycin's Secrets Unearthed // C&EN, July 18, 2016. См. также: Gifford B. Does a Real Anti-Aging Pill Already Exist? // Bloomberg, July 12, 2015.
- ¹⁴ Serruys P. W. Rapamycin Eluting Stent: The Onset of a New Era in Interventional Cardiology // Heart, April 2002.
- ¹⁵ Morath C. Sirolimus in Renal Transplantation // Nephrology Dialysis Transplantation, September 2007.
- ¹⁶ Zaytseva Y. Y. mTOR Inhibitors in Cancer Therapy // Cancer Letters, June 2012 // doi.org/10.1016/j.canlet.2012.01.005.
- ¹⁷ Harrison D. E. Rapamycin Fed Late in Life Extends Lifespan in Genetically Heterogeneous Mice // Nature, July 8, 2019.
- ¹⁸ Mannick J. B. mTOR Inhibition Improves Immune Function in the Elderly // Science Translational Medicine, December 2014.
- ¹⁹ Barzilai N. Metformin as a Tool to Target Aging // Cell Metabolism, June 14, 2016. Vol. 23. No. 6. Pp. 1060–1065 // ncbi.nlm.nih.gov/pmc/articles/PMC5943638/.
- ²⁰ См.: unitybiotechnology.com.
- ²¹ van Deursen J. M. Senolytic Therapies for Healthy Longevity // Science, May 2019. Vol. 364. No. 6441. Pp. 636–637.
- ²² Беседа автора с Османом Кибаром, 2018. См. также: samumed.com/default.aspx.
- ²³ Gormley B. Drugmaker Samumed Closes \$438 Million Round at \$12 Billion Pre-Money Valuation // Wall Street Journal Pro, August 6, 2018 // wsj.com/articles/drugmaker-samumed-closes-438-million-round-at-12-billion-pre-money-valuation-1533602014.
- ²⁴ Khan M. Wnt Signaling in Stem Cells and Cancer Stem Cells: A Tale of Two Coactivators // Science Direct, January 2018. Обзор см.: sciencedirect.com/science/article/pii/S1877117317301850.
- ²⁵ Беседа автора с Османом Кибаром.
- ²⁶ См.: samumed.com/pipeline/default.aspx.
- ²⁷ Park J. Various Types of Arthritis in the United States: Prevalence and Age-Related Trends from 1999 to 2014 // American Journal of Public Health, October 5, 2017. Хотя данное исследование затронуло только США, ведущий исследователь доктор Парк позже экстраполировал результаты здесь: fau.edu/newsdesk/articles/arthritis-trends.php.
- ²⁸ Yazici Y. A Novel Wnt Pathway Inhibitor, SM04690, for the Treatment of Moderate to Severe Osteoarthritis of the Knee: Results of a 24-Week, Randomized, Controlled, Phase 1 Study // Osteoarthritis and Cartilage, October 2017 // ncbi.nlm.nih.gov/pubmed/28711582.
- ²⁹ Беседа автора с Османом Кибаром.
- ³⁰ Samumed LLC. A Study Evaluating the Safety, Tolerability, and Pharmacokinetics of Multiple Ascending Doses of SM04755 Following Topical Administration to Healthy Subjects // U.S. National Library of Medicine, July 25, 2017. См. также: Samumed LLC. A Repeat Insult Patch Test (RIPT) Study Evaluating the Sensitization Potential of Topical SM04755 Solution in Healthy Volunteers // U.S.

- National Library of Medicine, April 18, 2018 // clinicaltrials.gov/ct2/show/NCT03229291?term=samumed&recrs=e&phase=0&rank=1. См. также: clinicaltrials.gov/ct2/show/NCT03502434?term=samumed&recrs=e&phase=0&rank=2.
- ³¹ Samumed LLC. A Study Utilizing Patient-Reported and Radiographic Outcomes and Evaluating the Safety and Efficacy of Lorecivivint (SM04690) for the Treatment of Moderately to Severely Symptomatic Knee Osteoarthritis (STRIDES-X-ray) // U.S. National Library of Medicine, April 26, 2019 // clinicaltrials.gov/ct2/show/NCT03928184?term=samumed&phase=2&rank=1.
- ³² Беседа автора с Османом Кибаром.
- ³³ Wright D. E. Physiological Migration of Hematopoietic Stem and Progenitor Cells // *Science*, November 2001 // ncbi.nlm.nih.gov/pubmed/11729320.
- ³⁴ Scudellari M. Ageing Research: Blood to Blood // *Nature*, January 21, 2015 // nature.com/news/ageing-research-blood-to-blood-1.16762. Для цитирования: может быть полезна информация, размещенная по этой ссылке: static1.squarespace.com/static/5b7168984eddec1ee06cba31/t/5b7cfbc3aa4a99594f9ff075/1534917589733/Nature.pdf.
- ³⁵ Katsimpardi L. Vascular and Neurogenic Rejuvenation of the Aging Mouse Brain by Young Systemic Factors // *Science*, May 2014 // ncbi.nlm.nih.gov/pubmed/24797482.
- ³⁶ Loffredo F. S. Growth Differentiation Factor 11 Is Circulating Factor That Reverses Age-Related Cardiac Hypertrophy // *Cell*, May 9, 2013 // [cell.com/abstract/S0092-8674\(13\)00456-X](https://cell.com/abstract/S0092-8674(13)00456-X).
- ³⁷ Там же.
- ³⁸ См.: elevation.com.
- ³⁹ Беседа с автором, 2018.
- ⁴⁰ См.: alkahest.com.
- ⁴¹ Molteni M. Startups Flock to Turn Young Blood into an Elixir of Youth // *Wired*, September 5, 2018 // wired.com/story/startups-flock-to-turn-young-blood-into-an-elixir-of-youth/.
- ⁴² National Institute of Aging, там же.

Глава 11. Будущее страхования, финансов и недвижимости

- ¹ Подробно историю Lloyd's of London см.: lloyds.com/about-lloyds/history/corporate-history.
- ² Полный текст пресс-релиза от 27 марта 2019 г. можно прочесть здесь: lloyds.com/news-and-risk-insight/press-releases/2019/03/lloyds-reports-aggregated-market-results-for-2018.
- ³ Институт страховой информации (Insurance information institute) по пунктам расписывает, из чего складывается страховая премия в автостраховании, здесь: iii.org/article/what-determines-price-my-auto-insurance-policy.
- ⁴ Полный отчет Национальной администрации безопасности движения на шоссе на дорогах (National Highway Traffic Safety Administration) Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey можно прочесть здесь: crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812115.
- ⁵ Доклад ВОЗ Road Traffic Deaths Data by Country: apps.who.int/gho/data/node.main.A997.
- ⁶ Скачайте доклад KPMG Road Traffic Injuries and Deaths — A Global Problem отсюда: insurancejournal.com/research/research/kpmg-automobile-insurance-in-the-era-of-autonomous-vehicles/.

-
- ⁷ Krafcik J. Where the Next 10 Million Miles Will Take Us // Medium, October 10, 2018 // medium.com/waymo/where-the-next-10-million-miles-will-take-us-de51bebb67d3.
- ⁸ См. статистику ФБР по преступности за 2016 г. здесь: ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/tables/table-18.
- ⁹ См.: lemonade.com.
- ¹⁰ См.: etherisc.com.
- ¹¹ Etherisc. First Blockchain-Based App to Insure Your Next Flight Against Delays // Medium, July 23, 2018 // blog.etherisc.com/first-blockchain-based-app-to-insure-your-next-flight-against-delays-10f53b38ad2d.
- ¹² Подробнее с историей компании можно ознакомиться здесь: progressivecommercial.com/about-us/our-history/.
- ¹³ Перечень новшеств компании Progressive Insurance можно посмотреть здесь: progressive.com/about/firsts/.
- ¹⁴ Полный текст пресс-релиза, где объявляется о запуске TripSense, см. здесь: businesswire.com/news/home/20040809005574/en/Innovative-Auto-Insurance-Discount-Program-5000-Minnesotans.
- ¹⁵ По данным Travelers Insurance Company, в секторе жилищного страхования 20% заявлений на возмещение страхового ущерба обусловлены повреждениями от воды, не связанными с погодой, а 11% — с повреждениями от воды погодного происхождения. См.: travelers.com/tools-resources/home/maintenance/top-five-things-can-go-wrong-interactive.
- ¹⁶ McKinsey & Co. Digital Insurance in 2018: December 2018 Driving Real Impact with Digital and Analytics, December 2018 // mckinsey.com/~media/McKinsey/Industries/Financial%20Services/Our%20Insights/Digital%20insurance%20in%202018%20Driving%20real%20impact%20with%20digital%20and%20analytics/Digital-insurance-in-2018.ashx.
- ¹⁷ Там же, с. 38.
- ¹⁸ Беседа автора с Гуннаром Лавлейсом, 2018.
- ¹⁹ См.: thrivemarket.com.
- ²⁰ См.: goodmoney.com.
- ²¹ Беседа автора с Г. Лавлейсом.
- ²² Lamagna M. Overdraft Fees Haven't Been This Bad Since the Great Recession // MarketWatch, April 2, 2018 // marketwatch.com/story/overdraft-fees-havent-been-this-bad-since-the-great-recession-2018-03-27.
- ²³ Сиэтл, Вашингтон (штат) и Дэвис, Калифорния, в общей сложности забрали из Wells Fargo более 3 млрд долл., см.: Chappell B. 2 Cities to Pull More Than \$3 Billion from Wells Fargo Over Dakota Access Pipeline // NPR, February 8, 2017 // npr.org/sections/thetwo-way/2017/02/08/514133514/two-cities-vote-to-pull-more-than-3-billion-from-wells-fargo-over-dakota-pipeline.
- ²⁴ McCarthy N. 1.7 Billion Adults Worldwide Do Not Have Access to a Bank Account // Forbes, June 8, 2018. Исходные данные см.: globalindex.worldbank.org.

- ²⁵ Подробный обзор истории платежной системы М-Pesa см.: Хартфорд Т. 50 изобретений, которые создали современную экономику. От плуга и бумаги до паспорта и штрихкода. М.: Манн, Иванов и Фербер, 2019.
- ²⁶ Там же.
- ²⁷ Western Union берет комиссию за перевод от 2 до 30% в зависимости от того, откуда он делается и какова сумма. См. их прейскурант здесь: westernunion.com/content/dam/wu/EU/EN/feeTableRetailEN-ES.PDF.
- ²⁸ Хартфорд, 50 изобретений.
- ²⁹ Suri T. The Long-Run Poverty and Gender Impacts of Mobile Money // Science. December 9, 2016. Vol. 354. No. 6317. Pp. 1288–1292 // science.sciencemag.org/content/354/6317/1288.
- ³⁰ Читайте об этом What Kenya's Mobile Money Success Could Mean for the Arab World на сайте the World Bank по адресу: worldbank.org/en/news/feature/2018/10/03/what-kenya-s-mobile-money-success-could-mean-for-the-arab-world.
- ³¹ Анализ деятельности bKash как примера инклюзивного бизнеса, сделанный International Finance Corporation, читайте здесь: documents.worldbank.org/curated/en/560181506580665929/pdf/119870-BRI-PUBLIC-bKash-Builtforchangereport.pdf.
- ³² China's Alipay Now Has Over 900m Users Worldwide // China Daily, November 30, 2018 // chinadaily.com.cn/a/201811/30/WS5c00a1d3a310eff30328c073.html.
- ³³ Chou C. How Alipay Users Planted 100M Trees in China // Alizila, April 22, 2019 // alizila.com/how-alipay-users-planted-100m-trees-in-china/.
- ³⁴ См.: r3.com.
- ³⁵ См.: ripple.com.
- ³⁶ В блоге блокчейна Cointelegraph приводится общая оценка взаимоотношений SWIFT и технологии блокчейна, см. здесь: cointelegraph.com/news/swift-announces-poc-gateway-with-r3-but-remains-overall-hesitant-about-blockchain.
- ³⁷ Ожидается, что к 2025 г. численность населения Земли достигнет 8,2 млрд человек — такой прогноз дает Отдел народонаселения ООН. Исходные данные см. здесь: population.un.org/wpp/Graphs/Probabilistic/POP/TOT/900. Для последующего расчета мы использовали данные Всемирного банка, чтобы оценить численность тех, кто сейчас имеет подключение к интернету; World Bank. Individuals using the Internet (% of population) // data.worldbank.org/indicator/IT.net.USER.ZS См. также: Population, total // The World Bank // data.worldbank.org/indicator/SP.POP.TOTL.
- ³⁸ См.: transferwise.com/us.
- ³⁹ См.: prosper.com.
- ⁴⁰ См.: fundingcircle.com/us.
- ⁴¹ См.: lendingtree.com.
- ⁴² Согласно данным в отчете исследовательской компании Transparency Market Research по адресу: globenewswire.com/news-release/2016/08/31/868470/0/en/Increasing-Small-Business-Units-to-Act-as-Building-Blocks-for-Peer-to-Peer-Lending-Market.html.

- ⁴³ Stevenson A. China's New Lenders Collect Invasive Data and Offer Billions. Beijing Is Worried // New York Times, December 25, 2017 // nytimes.com/2017/12/25/business/china-online-lending-debt.html.
- ⁴⁴ См.: wealthfront.com.
- ⁴⁵ См.: betterment.com.
- ⁴⁶ Isidore C. Machines Are Driving Wall Street's Wild Ride, Not Humans // CNN, February 6, 2018 // money.cnn.com/2018/02/06/investing/wall-street-computers-program-trading/index.html.
- ⁴⁷ Там же.
- ⁴⁸ См. комиссионные ставки Wealthfront и Betterment на их сайтах.
- ⁴⁹ Пресс-релиз Комиссии по ценным бумагам и биржевым операциям (SEC), озаглавленный SEC Charges Two Robo-Advisers with False Disclosures, читайте здесь: sec.gov/news/press-release/2018-300.
- ⁵⁰ Keyes G. How Betterment Stayed on Top in 2018 (and How They Plan to Stay There in 2019) // Financial Advisor IQ, January 2, 2019 // betterment.com/press/newsroom/how-betterment-stayed-on-top-in-2018-and-how-they-plan-to-stay-there-in-2019/.
- ⁵¹ Kocianski S. The Evolution of Robo-Advising: How Automated Investment Products Are Disrupting and Enhancing the Wealth Management Industry // Business Insider, July 3, 2017 // businessinsider.com/the-evolution-of-robo-advising-report-2017-7.
- ⁵² Uber Eats — один из немногих стартапов на основе мобильного приложения для доставки еды, действующий по всему миру, см. их сайт: ubereats.com.
- ⁵³ Levring P. Scandinavia's Disappearing Cash Act // Bloomberg, December 15, 2016 // bloomberg.com/news/articles/2016-12-16/scandinavia-s-disappearing-cash-act.
- ⁵⁴ Читайте полный отчет финансового холдинга UBS The Road to Cashless Societies: Shifting Asia здесь: ubs.com/content/dam/WealthManagementAmericas/cio-impact/shifting%20in%20asia.pdf. Этот факт указан на с. 19.
- ⁵⁵ Cashless Payment Posts Double-Digit Growth // Viet Nam News, July 13, 2019 // vietnamnews.vn/economy/522587/cashless-payment-posts-double-digit-growth.html#kpUKGbUeSj1J1IzH.97.
- ⁵⁶ Подробнее см. на официальном сайте Швеции: sweden.se/business/cashless-society/.
- ⁵⁷ Причины финансового кризиса 2008 г. подробно разбирает в своей книге-бестселлере в рейтинге New York Times Майкл Льюис: Льюис М. Большая игра на понижение. Тайны пружины финансовой катастрофы. М.: Альпина Паблишер, 2011.
- ⁵⁸ Беседа автора с Гленном Сэнфордом, 2019.
- ⁵⁹ См.: exprealty.com.
- ⁶⁰ Там же.
- ⁶¹ Там же.
- ⁶² Там же.
- ⁶³ См.: zillow.com/. Подробнее о стратегии применения компанией искусственного интеллекта можно узнать из этого интервью главного аналитика Zillow Стэна Хамфриса: Krigsman M. Zillow:

- Machine Learning and Data Disrupt Real Estate // ZDNet, July 30, 2017 к. сойер групповой гений zdnnet.com/article/zillow-machine-learning-and-data-in-real-estate/.
- ⁶⁴ См.: trulia.com.
- ⁶⁵ См.: move.com.
- ⁶⁶ См.: redfin.com.
- ⁶⁷ Пример инвестиций в ИИ для нужд недвижимости — см. статью в специализированном блоге VentureBeat об одном из последних внедренных Zillow инструментов машинного зрения: Wiggers K. Zillow Now Uses Computer Vision To Improve Property Value Estimates // VentureBeat, June 26, 2019 // venturebeat.com/2019/06/26/zillow-now-uses-computer-vision-to-improve-property-value-estimates/.
- ⁶⁸ Данный доклад на Всемирном экономическом форуме прогнозирует, что 570 прибрежных городов по всему миру окажутся под угрозой, когда к 2050 г. уровень Мирового океана поднимется на 0,5 м, см.: www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf.
- ⁶⁹ По данным ООН, 2,4 млрд человек (около 40% населения планеты) живут в пределах 100 км от побережья. Факт-лист ООН см. здесь: un.org/sustainabledevelopment/wp-content/uploads/2017/05/Ocean-fact-sheet-package.pdf.
- ⁷⁰ См.: oceanix.org. Профиль компании см. также здесь: Schwab K. Floating Cities Once Seemed Like Sci-Fi. Now the UN Is Getting On Board // Fast Company // fastcompany.com/90329294/floating-cities-once-seemed-like-sci-fi-now-the-un-is-getting-on-board.
- ⁷¹ См.: seasteading.org.
- ⁷² Gelles D. Floating Cities, No Longer Science Fiction, Begin to Take Shape // New York Times, November 13, 2017 // nytimes.com/2017/11/13/business/dealbook/seasteading-floating-cities.html.

Глава 12. Пища и ее будущее

- ¹ Chadwick J. Here's How 3-D Printers Are Changing What We Eat // TechRepublic, November 7, 2017 // techrepublic.com/article/heres-how-3-d-food-printers-are-changing-the-way-we-cook/.
- ² Farrmiond S. The Future of Food: What We'll Eat in 2028 // Science Focus, May 17, 2019 // sciencefocus.com/future-technology/the-future-of-food-what-well-eat-in-2028/.
- ³ Simon M. Lab Grown Meat Is Coming, Whether You Like It or Not // Wired, February 16, 2018 // wired.com/story/lab-grown-meat/.
- ⁴ Manning R. The Oil We Eat: Following the Food Chain Back to Iraq // Harpers, February 2004 // harpers.org/archive/2004/02/the-oil-we-eat/.
- ⁵ Pirog R. The Evolution of Food Miles and Its Limitations as an Indicator of Energy Use and Climate Impact // aceee.org/files/pdf/conferences/ag/2008/RPirog.pdf.
- ⁶ Move for Hunger. About Food Waste // moveforhunger.org/about-food-waste/.
- ⁷ Khan A. Scientists Aim to Feed the World by Boosting Photosynthesis // Los Angeles Times, November 18, 2016 // latimes.com/science/sciencenow/la-sci-sn-boosting-photosynthesis-20161117-story.html.

-
- ⁸ Benjamin C. Scientists Boost Crop Production by 47 Percent Speeding Up Photorespiration // Ripe Project, May 31, 2018 // ripe.illinois.edu/press/press-releases/scientists-boost-crop-production-47-percent-speeding-photorespiration.
- ⁹ Food Production Must Double by 2050 to Meet Demand from World's Growing Population, Innovative Strategies Needed to Combat Hunger, Experts Tell Second Committee // United Nations, October 9, 2009 // un.org/press/en/2009/gaef3242.doc.htmfood.
- ¹⁰ См.: apeelsciences.com.
- ¹¹ Apeel Avocados Expected at Every U.S. Grocery Store Within a Year // Freshfruitportal.com, October 24, 2018 // freshfruitportal.com/news/2018/10/24/apeel-avocados-expected-at-every-u-s-grocery-store-within-a-year/.
- ¹² Despommier D. The Vertical Farm. Picador, 2011.
- ¹³ Rabin C. R. Do Prepackaged Salad Greens Lose Their Nutrients? // New York Times, November 3, 2017 // nytimes.com/2017/11/03/well/eat/do-prepackaged-salad-greens-lose-their-nutrients.html.
- ¹⁴ Despommier, Vertical Farm. См. также: Scott L. G. Vertical Garden Towers Can Grow Plants Three Times Faster Than Normal: How a Business in the Bronx Is Trying to Take Urban Gardening Mainstream // Inverse, June 1, 2018 // inverse.com/article/45464-rooftop-garden-technology-vertical-garden.
- ¹⁵ См.: plenty.ag.
- ¹⁶ Ballarte C. Jeff Bezos and Other Investors Raise \$200 Million for Vertical Farming Startup Plenty // GeekWire, July 20, 2017 // geekwire.com/2017/jeff-bezos-investors-raise-200-million-vertical-farming-startup-plenty/.
- ¹⁷ См.: aerofarms.com.
- ¹⁸ Solon O. Inside the World's Largest Vertical Farm // Wired, February 29, 2016 // wired.co.uk/article/aerofarms-largest-vertical-farm.
- ¹⁹ Agtech Startup Plenty Plans To Grow Hydroponic Peaches // Matteroftrust.org // matteroftrust.org/agtech-start-up-plenty-plans-to-grow-hydroponic-peaches/.
- ²⁰ Tarantola A. The Future of Indoor Agriculture Is Indoor Farms Run by Robots // engadget, October 3, 2018 // engadget.com/2018/10/03/future-indoor-agriculture-vertical-farms-robots/.
- ²¹ См.: ironox.com.
- ²² Там же.
- ²³ Food and Agriculture Organization of the United Nations. 2050: A Third More Mouths to Feed // FAO News, September 3, 2009 // fao.org/news/story/en/item/35571/icode/.
- ²⁴ United Nations. What's in Your Burger? More Than You Think // UN Environment, November 8, 2018 // unenvironment.org/news-and-stories/story/whats-your-burger-more-you-think.
- ²⁵ Brooks N. Chart Shows What the World's Land Is Used for... and It Explains Exactly Why So Many People Are Going Hungry // One Green Planet, 2018 // onegreenplanet.org/news/chart-shows-worlds-land-used/.
- ²⁶ Robinson T. P. Mapping the Global Distribution of Livestock // PLoS ONE, May 29, 2014 // journals.plos.org/plosone/article?id=10.1371/journal.pone.0096084#pone-0096084-g002. См. также:

- Counting Chickens // Economist, July 27, 2011 // economist.com/graphic-detail/2011/07/27/counting-chickens.
- ²⁷ Water for Sustainable Food and Agriculture: A Report Produced for the G20 Presidency of Germany // Food and Agriculture Organization of the United Nations, 2017 // fao.org/3/a-i7959e.pdf.
- ²⁸ Ebikeme C. Water World // Scitable, July 25, 2013 // nature.com/scitable/blog/eyes-on-environment/water_world/.
- ²⁹ Friedman L., Pierre-Louis K., Sengupta S. The Meat Question, by the Numbers // New York Times, January 25, 2018 // nytimes.com-2018/01/25-climate-cows-global-warming.
- ³⁰ Carrington D. Avoiding Meat and Dairy Is 'Single Biggest Way' to Reduce Your Impact on Earth // Guardian, May 31, 2018 // theguardian.com/environment/2018/may/31/avoiding-meat-and-dairy-is-single-biggest-way-to-reduce-your-impact-on-earth.
- ³¹ Baker S. Will 2019 Be the Year of Lab Grown Meat? // DW.com, March 1, 2019 // dw.com/en/will-2019-be-the-year-of-lab-grown-meat/a-46943665.
- ³² Tuomisto H. L., Teixeira de Mattos J. M. Environmental Impacts of Cultured Meat Production // Environmental Science and Technology, June 17, 2011 // doi.org/10.1021/es200130u; pubs.acs.org/doi/10.1021/es200130u.
- ³³ Zaraska M. Is Lab Grown Meat Good for Us? // Atlantic, August 19, 2013 // theatlantic.com/health/archive/2013/08/is-lab-grown-meat-good-for-us/278778/.
- ³⁴ Food and Agriculture Organization of the United Nations. Surge in Diseases of Animal Origin Necessitates New Approach to Health // FAO, December 16, 2013 // fao.org/news/story/en/item/210621/icode/.
- ³⁵ Ghosh P. World's First Lab-Grown Burger Is Eaten in London // BBC News, August 5, 2013 // bbc.com/news/science-environment-23576143.
- ³⁶ Sorvino C. Tyson Invests in Lab-Grown Protein Startup Memphis Meats, Joining Bill Gates and Richard Branson // Forbes, January 29, 2018 // forbes.com/sites/chloesorvino/2018/01/29/exclusive-interview-tyson-invests-in-lab-grown-protein-startup-memphis-meats-joining-bill-gates-and-richard-branson/#5f4025763351.
- ³⁷ Back L., Cohen T. On the Menu Soon: Lab-Grown Steak for Eco-Conscious Diners // Reuters, July 15, 2019 // reuters.com/article/us-food-tech-labmeat-aleph-farms/on-the-menu-soon-lab-grown-steak-for-eco-conscious-diners-idUSKCN1UA1ES.
- ³⁸ Nahmias Y. Lab-Grown Meat Is Getting Cheap Enough for Anyone to Buy // Fast Company, May 2, 2018 // fastcompany.com/40565582/lab-grown-meat-is-getting-cheap-enough-for-anyone-to-buy.
- ³⁹ Peters A. The Meat Growing in This San Francisco Lab Will Soon Be Available at Restaurants // Fast Company, December 11, 2018 // fastcompany.com/90278853/the-meat-growing-in-this-san-francisco-lab-will-soon-be-available-at-restaurants.
- ⁴⁰ См.: perfectdayfoods.com/. См. также: Wilson A. Got Milk? This \$40M Startup Is Creating Cow — Free Dairy Products That Taste like the Real Thing // Forbes, January 9, 2019.

Часть III. Будущее все ближе

Глава 13. Угрозы и решения

- ¹ Межправительственная панель по изменениям климата: ipcc.ch/sr15/.
- ² World Economic Forum. Global Risks Report 2018: 13th Edition // January 17, 2018 // weforum.org/reports/the-global-risks-report-2018.
- ³ Беседа автора с Дином Кейменом, 2018. Подробнее см. его биографию на сайте FIRST Robotics: firstinspires.org/about/leadership/dean-kamen.
- ⁴ Диамандис П., Котлер С. Изобилие. Будущее будет лучше, чем вы думаете. М.: AST Publishers, 2018.
- ⁵ World Health Organization (WHO), United Nations Children's Fund (UNICEF). Progress on Drinking Water, Sanitation and Hygiene, 2017 // apps.who.int/iris/bitstream/handle/10665/258617/9789241512893-eng.pdf;jsessionid=1FDA500FD803F836724FE17B699EE7AA?sequence=1.
- ⁶ United Nations Educational, Scientific, and Cultural Organization. Managing Water Report Under Uncertainty And Risk — the United Nations World Water Development Report 4 Volume 1, 2012, p. 96 // unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/WWDR4%20Volume%201-Managing%20Water%20under%20Uncertainty%20and%20Risk.pdf.
- ⁷ World Health Organization. Drinking Water, June 14, 2019 // who.int/news-room/fact-sheets/detail/drinking-water.
- ⁸ Coca Cola Corporate. Coca-Cola Announces Long-Term Partnership with DEKA R&D to Help Bring Clean Water to Communities in Need, September 25, 2012. Пресс-релиз Coca-Cola об этой договоренности см. здесь: coca-colacompany.com/press-center/press-releases/deka-partnership-announcement. См. также: EKOCENTER & Slingshot Clean Water Partnerships // coca-colaafrica.com/stories/sustainability-water-ekocenter#.
- ⁹ Ryan T. From Big Idea to Big Bet: How the Coca-Cola Freestyle Fountain Dispenser Came to Be, December 6, 2017 // coca-colacompany.com/stories/freestyle-q-a.
- ¹⁰ Там же: coca-colaafrica.com/stories/sustainability-water-ekocenter#.
- ¹¹ The Coca Cola Company. Scaling Sustainability: Have Programs, Will Travel, August 24, 2018 // coca-colacompany.com/stories/sustainability-lift-and-shift-have-programs-will-travel.
- ¹² Там же.
- ¹³ См.: skysource.org/.
- ¹⁴ См.: xprize.org/prizes/water-abundance. См. также: Coldewey D. Water Abundance Xprize's \$1.5M Winner Shows How to Source Fresh Water from the Air // TechCrunch, October 22, 2018 // techcrunch.com/2018/10/22/water-abundance-xprizes-1-5m-winner-shows-how-to-source-fresh-water-from-the-air/.
- ¹⁵ Peters A. A Device That Can Pull Drinking Water from the Air Just Won the Latest XPrize // Fast Company, October 20, 2018 // fastcompany.com/90253718/a-device-that-can-pull-drinking-water-from-the-air-just-won-the-latest-x-prize.
- ¹⁶ Hill T. The Smart Grid for Water: How Data Will Save Our Water and Your Utility. Advantage, 2013.

-
- ¹⁷ В одних только США в год теряется примерно 6,4 трлн л воды из-за аварий на водопроводных магистралях.
- ¹⁸ По данным издания Максвелла Рознера Our World in Data, в 2017 г. эмиссия CO₂ составила 35,46 млрд т. См.: ourworldindata.org/co2-and-other-greenhouse-gas-emissions.
- ¹⁹ Scharf C. The Crazy Scale of Human Carbon Emission // Scientific American, April 26, 2017 // blogs.scientificamerican.com/life-unbounded/the-crazy-scale-of-human-carbon-emission/.
- ²⁰ Griffin P. CDP Carbon Majors Report, 2017 // Carbon Majors Database, July 2017 // b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/002/327/original/Carbon-Majors-Report-2017.pdf?1499691240.
- ²¹ Приводимые здесь цены на электроэнергию взяты из беседы автора с Рамезом Наамом, главой направления «Энергетика, климат и инновации» Университета сингулярности, 2019. В основном обработка данных о стоимости энергии, приведенные в этом разделе, производилась с использованием LCOE, нормированной стоимости энергии, полученной из базы данных Национальной лаборатории по изучению возобновляемой энергии (U.S. National Renewable Energy Laboratory): openei.org/Transparent-Cost-Database. См.: openei.org/apps/TCDB/.
- ²² Там же.
- ²³ Там же.
- ²⁴ Там же.
- ²⁵ Там же.
- ²⁶ Там же.
- ²⁷ Там же.
- ²⁸ Сюда входят: James River Coal Company (2014), Patriot Coal (2015), Walter Energy (2015), Alpha Natural Resources (2015), Peabody Energy (2016), Blackhawk Mining (2019), Blackjewel (2019), Cloud Peak Energy (2019).
- ²⁹ Там же. См. также: Forsythe M. China Cancels 103 Coal Plants, Mindful of Smog and Wasted Capacity // New York Times, January 18, 2017 // nytimes.com/2017/01/18/world/asia/china-coal-power-plants-pollution.html.
- ³⁰ Там же.
- ³¹ На сайте Ontario Power Generation подробнее описан их проект Nanticoke Generating Station solar farm: opg.com/strengthening-the-economy/our-projects/nanticoke-solar-facility/.
- ³² Ambrose J. Fossil Fuels Produce Less Than Half of UK Electricity for First Time // Guardian, June 20, 2019 // theguardian.com/business/2019/jun/21/zero-carbon-energy-overtakes-fossil-fuels-as-the-uks-largest-electricity-source.
- ³³ Полный список более 100 крупнейших городов мира, у которых в общем потреблении электроэнергии 70% составляет энергия из возобновляемых источников, см. в базе данных Carbon Disclosure Project: cdp.net/en/cities/world-renewable-energy-cities.
- ³⁴ См. рис. 8 в главе 1 публикации: REN21. Renewables 2019 Global Status Report: ren21.net/gsr-2019/.

- ³⁵ LCOE, нормированная стоимость энергии, позволяет сопоставлять разные способы выработки электроэнергии. Загляните в Transparent Cost Database (openei.org/apps/TCDB/) на сайте Национальной лаборатории по изучению возобновляемой энергии (U.S. National Renewable Energy Laboratory) — и сами увидите, что производить электроэнергию из энергии ветра и солнца бывает дешевле, чем из угля.
- ³⁶ Беседа автора с Наамом.
- ³⁷ Там же. А по проекту 2017 г. Bhadla solar park мощностью 250 мегаватт (солнечный парк Бхадла на северо-западе Индии, штат Раджастан) стоимость электроэнергии достигает 0,038 долл. См. также: Aggarwal M. Solar Power Tariffs Fall to New Low of Rs2.62 Per Unit // *livemint*, 2017 // livemint.com/Industry/MKI7QvOhpRoBAw3-D4PM5K/South-African-firm-bid-takes-solar-power-tariffs-to-new-low.html.
- ³⁸ Беседа автора с Р. Наамом. См. также: Bellini E. Dubai: Tariff for Large-Scale PV Hits New Low at \$0.024/kWh // *PV Magazine*, 2018 // pv-magazine.com/2018/11/05/dubai-tariff-for-large-scale-pv-hits-new-low-at-0-024-kwh/.
- ³⁹ Беседа автора с Р. Наамом.
- ⁴⁰ Беседа автора с Р. Наамом.
- ⁴¹ Историю вопроса см.: Kamat P. Quantum Dot Solar Cells. The Next Big Thing in Photovoltaics // *Journal of Physical Chemistry*, February 28, 2013. Pp. 908–918 // doi.org/10.1021/jz400052e.
- ⁴² Беседа автора с Р. Наамом.
- ⁴³ Беседа автора с Р. Наамом.
- ⁴⁴ Согласно исследованию, проведенному National Renewable Energy Lab в 2013 г., на переменные затраты приходится «64% розничной цены электроэнергии для населения, 57% для малых коммерческих потребителей (менее 250 кВт) и 52% для крупных коммерческих потребителей (250 кВт или больше)». См.: Friedman B. Benchmarking Non-Hardware Balance-of-System (Soft) Costs for U.S. Photovoltaic Systems, Using a Bottom-Up Approach and Installer Survey — Second Edition // National Renewable Energy Laboratory, 2013.
- ⁴⁵ Беседа автора с Р. Наамом.
- ⁴⁶ Pontin J. We Gotta Get a Better Battery. But How? // *Wired*, September 17, 2018 // wired.com/story/better-battery-renewable-energy-jason-pontin/.
- ⁴⁷ Беседа автора с Р. Наамом.
- ⁴⁸ Беседа автора с Р. Наамом.
- ⁴⁹ Зайдите на сайт Gigafactory 1: tesla.com/gigafactory. См. также: Wald M. Nevada a Winner in Tesla's Battery Contest // *New York Times*, September 4, 2014 // nytimes.com/2014/09/05/business/energy-environment/nevada-a-winner-in-teslas-battery-contest.html.
- ⁵⁰ См. сайт Gigafactory 2 здесь: tesla.com/gigafactory2.
- ⁵¹ Alvarez S. China Formally Adds Tesla Gigafactory 3 Area to Shanghai's Free-Trade Zone // *Teslarati*, August 6, 2019 // teslarati.com/china-adds-tesla-gigafactory-3-shanghai-free-trade-zone/.
- ⁵² На момент публикации книги Gigafactory 4 все еще находилась в Tesla на стадии планирования. Подробнее о ситуации см. статью: Alvarez S. Tesla Closing In on Lower Saxony, Germany as

- Final Europe Gigafactory Location: Report // Teslarati, August 22, 2019 // teslarati.com/tesla-europe-gigafactory-4-location-lower-saxony-germany/.
- ⁵³ Leonardo DiCaprio, Before the Flood (documentary) [Спассти планету], National Geographic, October 21, 2016. Клип можно посмотреть на YouTube-канале National Geographic здесь: youtu.be/iZm_NohNm6I.
- ⁵⁴ Ong T. Elon Musk Has Finished Building the World's Biggest Battery in Less Than 100 Days // Verge, November 23, 2017 // theverge.com/2017/11/23/16693848/elon-musk-worlds-biggest-battery-100-days.
- ⁵⁵ См.: renault.co.uk/vehicles/new-vehicles/zoe/motor.html.
- ⁵⁶ Fingas J. BMW i3 Batteries Provide Energy Storage for UK Wind Farm // Engadget, May 21, 2018 // engadget.com/2018/05/21/bmw-i3-battery-packs-join-uk-power-grid/.
- ⁵⁷ Service R. New Generation of 'Flow Batteries' Could Eventually Sustain a Grid Powered by the Sun and Wind // ScienceMag, October 31, 2018 // sciencemag.org/news/2018/10/new-generation-flow-batteries-could-eventually-sustain-grid-powered-sun-and-wind.
- ⁵⁸ Посмотрите вот эту статью по аккумуляторам на образовательном сайте Battery University: batteryuniversity.com/learn/article/how_to_prolong_lithium_based_batteries.
- ⁵⁹ Naam R. How Cheap Can Energy Storage Get? Pretty Darn Cheap, October 14, 2015 // rameznaam.com/2015/10/14/how-cheap-can-energy-storage-get/.
- ⁶⁰ Nikolewski R. New Battery Storage Technology Connected to California Power Grid // San Diego Union Tribune, May 6, 2019 // sandiegouniontribune.com/business/energy-green/story/2019-05-03/new-battery-storage-technology-connected-to-california-power-grid.
- ⁶¹ Беседа автора с Р. Наамом.
- ⁶² Rathi A. To Hit Climate Goals, Bill Gates and His Billionaire Friends Are Betting on Energy Storage, qz, June 12, 2018.
- ⁶³ spectrum.ieee.org/transportation/advanced-cars/the-charge-of-the-ultra-capacitors.
- ⁶⁴ U.S. Energy Information Administration, Monthly Energy Review, Table 2.1, April 2019, preliminary data. С данными можно ознакомиться здесь: eia.gov/energyexplained/use-of-energy/transportation.php.
- ⁶⁵ US Energy Information Administration, Annual Energy Outlook 2019, Table 36, April 2019, preliminary data. С данными можно ознакомиться здесь: eia.gov/energyexplained/use-of-energy/transportation-in-depth.php.
- ⁶⁶ US Energy Information Administration, International Energy Outlook 2016, Chapter 8, p. 131. US Energy Information Administration, International Energy Outlook 2016, Chapter 8, p. 131. С отчетом можно ознакомиться здесь: eia.gov/outlooks/ieo/pdf/transportation.pdf.
- ⁶⁷ (Опубликовано в Германии) Böll S. Bundesländer wollen Benzin- und Dieselaautos verbieten // Spiegel Online, October 8, 2016 // spiegel.de/auto/aktuell/bundeslaender-wollen-benzin-und-dieselaautos-ab-2030-verbieten-a-1115671.html.
- ⁶⁸ Gjerstad T. Frp vil fjerne bensinbilene, June 2, 2016. См.: dn.no/motor/fremskrittspartiet/bensin/drivstoff/frp-vil-fjerne-bensinbilene/1-1-5657552.

- ⁶⁹ Бюро транспортной статистики США (US Bureau of Transportation Statistics) сообщает о 272 млн автомобилей на ходу в 2017 г. А издание Scientific American утверждает, что к 2018 г. по дорогам страны ездил 1 млн электромобилей. Если принять, что с 2017 г. и на протяжении 2018 г. число автомобилей в стране оставалось более или менее неизменным, то как раз и получим менее 0,36% автомобилей. Joselow M. The U.S. Has 1 Million Electric Vehicles, but Does It Matter? // Scientific American, October 12, 2018 // bts.gov/content/number-us-aircraft-vehicles-vessels-and-other-conveyances.
- ⁷⁰ Ghoshal A. Watch: India Unveils Ambitious Plan to Have Only Electric Cars by 2030 // International Business Times, April 30, 2017 // ibtimes.co.in/watch-india-unveils-ambitious-plan-have-only-electric-cars-by-2030-724887. См. также презентацию министра железнодорожного транспорта, торговли и промышленности Индии Пиюша Гойяла: youtube.com/watch?v=zCefO9qqZ_I.
- ⁷¹ См. соответствующий пресс-релиз Volvo: Volvo Cars Aims for 50 Per Cent of Sales to Be Electric by 2025, April 25, 2018 // media.volvocars.com/global/en-gb/media/pressreleases/227602/volvocars-aims-for-50-per-cent-of-sales-to-be-electric-by-2025.
- ⁷² Petroff A. These Countries Want to Ditch Gas and Diesel Cars // CNN Business, July 26, 2017 // money.cnn.com/2017/07/26/autos/countries-that-are-banning-gas-cars-for-electric/index.html.
- ⁷³ Lienert P. Global Carmakers to Invest at Least \$90 Billion in Electric Vehicles // Reuters, January 15, 2018 // reuters.com/article/us-autoshow-detroit-electric/global-carmakers-to-invest-at-least-90-billion-in-electric-vehicles-idUSKBN1F42NW.
- ⁷⁴ Boston W. VW Accelerates Electric Car Effort with \$40 Billion Investment // Wall Street Journal, November 17, 2017.
- ⁷⁵ Lienert P. Exclusive: VW, China Spearhead \$300 Billion Global Drive to Electrify Cars // Reuters, January 10, 2019 // reuters.com/article/us-autoshow-detroit-electric-exclusive/exclusive-vw-china-spearhead-300-billion-global-drive-to-electrify-cars-idUSKCN1P40G6.
- ⁷⁶ Toyota, Panasonic Announce Battery Venture to Expand EV Push // Reuters, January 22, 2019 // reuters.com/article/us-toyota-panasonic/toyota-panasonic-announce-battery-venture-to-expand-ev-push-idUSKCN1PG0MP.
- ⁷⁷ См. пресс-релиз по поводу их сотрудничества: Ultra-high-power Charging Technology for the Electric Vehicle of the Future // newsroom.porsche.com/en/company/porsche-fastcharge-prototype-charging-station-ultra-high-power-charging-technology-electric-vehicle-16606.html.
- ⁷⁸ Подробнее о QuantumScape см.: quantumscape.com/. Подробности 100-миллионной операции Volkswagen см.: volkswagenag.com/en/news/2018/09/QuantumScape.html. См. также: Edelstein S. Volkswagen Invests \$100 Million in Solid-State Battery Firm QuantumScape // Drive, September 16, 2018 // thedrive.com/tech/23586/volkswagen-invests-100-million-in-solid-state-battery-firm-quantumscape.
- ⁷⁹ Дальность пробега видов электротранспорта на одной зарядке можно найти в интернете. Данные хорошо обобщены здесь: McDonald L. US Electric Car Range Will Average 275 Miles by 2022, 400 Miles by 2028 — New Research (Part 1) // CleanTechnica, October 27, 2018 //

cleantechnica.com/2018/10/27/us-electric-car-range-will-average-275-miles-by-2022-400-miles-by-2028-new-research-part-1/.

⁸⁰ Там же.

⁸¹ Там же.

⁸² Согласно Edelman, Volkswagen Invests.

⁸³ См.: store-dot.com.

⁸⁴ Их еще называют ультраконденсаторами, и в них применяется другой тип хранения энергии, позволяющий накапливать огромный запас энергии, а также невероятно быстро заряжаться и разряжаться. За более подробными сведениями можно обратиться к статье на сайте Battery University: batteryuniversity.com/learn/article/whats_the_role_of_the_supercapacitor.

⁸⁵ Brandt E. Israeli Company Demonstrates 300-Mile Electric Car Battery That Charges in 5 Minutes // Drive, May 12, 2017 // thedrive.com/news/10227/israeli-company-demonstrates-300-mile-electric-car-battery-that-charges-in-5-minutes.

⁸⁶ Как производилась одна из оценок числа автозаправочных станций на территории США, можно посмотреть на странице основных отраслевых показателей на сайте Национальной ассоциации круглосуточных магазинов США (National Association of Convenience Stores): convenience.org/Research/FactSheets/FuelSales.

⁸⁷ См. материал Alternative Fuel Data Center (Информационного центра по альтернативным видам топлива) при Министерстве энергетики США: Electric Vehicle Charging Station Locations, September 9, 2019 // afdc.energy.gov/fuels/electricity_locations.html#.

⁸⁸ По данным Министерства энергетики США, американские водители производят более 80% зарядок электромобилей дома. См.: energy.gov/eere/electricvehicles/charging-home.

⁸⁹ См.: chargepoint.com/. См. также заявление о намерении построить 2,5 млн зарядных портов к 2025 г.: chargepoint.com/about/news/chargepoint-makes-landmark-commitment-future-mobility-pledge-25-million-places-charge/.

⁹⁰ По данным независимого агентства в составе Федеральной статистической системы США US Energy Information Administration, среднестатистическое американское домохозяйство потребляет 867 кВт·ч электроэнергии в месяц, или около 29 кВт·ч в день. См.: eia.gov/tools/faqs/faq.php?id=97&t=3.

⁹¹ См.: tesla.com/models.

⁹² Parker L. Coral Reefs Could Be Gone in 30 Years // National Geographic, June 23, 2017 // nationalgeographic.com/news/2017/06/coral-reef-bleaching-global-warming-unesco-sites/.

⁹³ Согласно данным Всемирного фонда дикой природы: wwf.panda.org/our_work/oceans/coasts/coral_reefs/.

⁹⁴ Gaskill M. The Current State of Coral Reefs // PBS, July 15, 2019 // pbs.org/wnet/nature/blog/the-current-state-of-coral-reefs/.

⁹⁵ Heron S., United Nations Educational, Scientific and Cultural Organization. Impacts of Climate Change on World Heritage Coral Reefs: A First Global Scientific Assessment // World Heritage Convention, 2017.

- ⁹⁶ Согласно данным Всемирного фонда дикой природы. См.: worldwildlife.org/threats/deforestation-and-forest-degradation.
- ⁹⁷ biocarbonengineering.com.
- ⁹⁸ Price-Waldman S. A Breakthrough for Coral Reef Restoration [Video] // Atlantic, February 22, 2016. Всю историю полностью посмотреть можно здесь: youtube.com/watch?v=qHKpcnn5Tws.
- ⁹⁹ Leschin-Hoar C. Seafood Without the Sea: Will Lab-Grown Fish Hook Consumers? // The Salt: NPR, May 5, 2019 // npr.org/sections/thesalt/2019/05/05/720041152/seafood-without-the-sea-will-lab-grown-fish-hook-consumers.
- ¹⁰⁰ Уилсон Э. Будущее Земли. Наша планета в борьбе за жизнь. М.: Альпина нон-фикшн, 2017.
- ¹⁰¹ Мы опирались на два набора данных Всемирного банка: 1. Annual Freshwater Withdrawals, Agriculture (% of total freshwater withdrawal) // data.worldbank.org/indicator/ER.H2O.FWAG.ZS; 2) Agricultural Land (% of landarea) // data.worldbank.org/indicator/AG.LND.AGRI.ZS.
- ¹⁰² Landriganm P. The Lancet Commission on Pollution and Health // The Lancet Commissions. Vol. 391. October 19, 2017. Pp. 462–512 // [doi.org/10.1016/S0140-6736\(17\)32345-0](https://doi.org/10.1016/S0140-6736(17)32345-0).
- ¹⁰³ Flooding and Damage from 2008 Myanmar Cyclone Assessed // Science Daily, August 10, 2009 // sciencedaily.com/releases/2009/07/090717104618.htm.
- ¹⁰⁴ Peters A. These Tree-Planting Drones Are About to Start an Entire Forest from the Sky // Fast Company, August 10, 2017 // fastcompany.com/40450262/these-tree-planting-drones-are-about-to-fire-a-million-seeds-to-re-grow-a-forest.
- ¹⁰⁵ Nedelkoska L. Automation, Skills Use and Training // OECD Social, Employment and Migration Working Papers. No. 202. OECD Publishing, Paris, 2018 // doi.org/10.1787/2e2f4eea-en.
- ¹⁰⁶ Surowiecki J. Robots Will Not Take Your Job // Wired. August, 2017 // wired.com/2017/08/robots-will-not-take-your-job/.
- ¹⁰⁷ Подробнее см.: classroom.synonym.com/during-early-1800s-americans-earned-living-what-12580.html.
- ¹⁰⁸ Больше сведений о занятости по отраслям можно получить в Бюро трудовой статистики США, Employment by Major Industry Sector // bls.gov/emp/tables/employment-by-major-industry-sector.htm.
- ¹⁰⁹ Andrews T. L. Robots Won't Take Your Job — They'll Help Make Room for Meaningful Work Instead // Quartz, March 15, 2017.
- ¹¹⁰ Там же.
- ¹¹¹ Harvard Business Review: Wilson J. Collaborative Intelligence: Humans and AI Are Joining Forces // Harvard Business Review, July-August 2018 // hbr.org/2018/07/collaborative-intelligence-humans-and-ai-are-joining-forces.
- ¹¹² Hollinger P. Meet the Cobots: Humans and Robots Together on the Factory Floor // National Geographic, May 6, 2016 // nationalgeographic.com/news/2016/05/financial-times-meet-the-cobots-humans-robots-factories/.

- ¹¹³ Manyika J. The Internet Created 2.6 New Jobs for Every 1 It Destroyed // McKinsey, May 2011 // mckinsey.com/~ /media/McKinsey/Industries/High%20Tech/Our%20Insights/Internet%20matters/MGI_internet_matters_exec_summary.ashx.
- ¹¹⁴ LeSage J. GOLDMAN SACHS: Self-Driving Trucks Will Kill 300,000 Jobs per Year // Business Insider, November 15, 2017 // businessinsider.com/goldman-sachs-says-self-driving-trucks-will-kill-300000-jobs-per-year-2017-11.
- ¹¹⁵ Cox J. The U.S. Labor Shortage Is Reaching a Critical Point // CNBC Markets, July 5, 2018 // cnbc.com/2018/07/05/the-us-labor-shortage-is-reaching-a-critical-point.html.
- ¹¹⁶ Existential Risks: Analyzing Human Extinction Scenarios and Related Hazards // Journal of Evolution and Technology. Vol. 9. March 9, 2002.
- ¹¹⁷ Brand S. Clock of the Long Now: Time and Responsibility, The Ideas Behind the World's Slowest Computer. Basic Books, 1999. P. 1.
- ¹¹⁸ Kimmelman M. The Dutch Have Solutions to Rising Seas. The World Is Watching // New York Times, June 15, 2017.
- ¹¹⁹ Подробнее о Sentry см. здесь: sneos.jpl.nasa.gov/sentry/vi.html.
- ¹²⁰ Подробности о DART Mission, называемой также Double Asteroid Redirection Test, взяты с сайта NASA: nasa.gov/planetarydefense/dart.
- ¹²¹ Snow J. Future Wildfires Will Be Fought with Algorithms // Fast Company, November 26, 2018 // fastcompany.com/90269483/how-ai-software-could-help-fight-future-wildfires.
- ¹²² Heller N. Estonia, the Digital Republic // New Yorker, December 11, 2017 // newyorker.com/magazine/2017/12/18/estonia-the-digital-republic.
- ¹²³ См.: opengov.com.
- ¹²⁴ См.: social.glass.
- ¹²⁵ Walker A. Here Is Sidewalk Labs's Big Plan for Toronto // Curbed, June 24, 2019 // curbed.com/2019/6/24/18715669/sidewalk-labs-toronto-alphabet-google-quayside.

Глава 14. Пять великих миграций

- ¹ Goldin I., Cameron G. Exceptional People. Princeton University Press, 2012. P. 12.
- ² Parker C. Jewish Emigres Who Fled Nazi Germany Revolutionized U.S. Science and Technology, Stanford Economist Says // Stanford, August 11, 2014. Обзор исследования см.: news.stanford.edu/news/2014/august/german-jewish-inventors-081114.html.
- ³ Там же.
- ⁴ Moser P. German Jewish Emigres and US Invention // American Economic Review, October 2014.
- ⁵ Grant A. The Scientific Exodus from Nazi Germany // Physics Today, September 26, 2018 // physicstoday.scitation.org/doi/10.1063/PT.6.4.20180926a/full/.
- ⁶ Partnership for a New American Economy. Patent Pending: How Immigrants Are Reinventing the American Economy, June 2012 // newamericaneconomy.org/sites/all/themes/pnae/patent-pending.pdf.

-
- ⁷ Khanna G., Lee M. Hiring Highly Educated Immigrants Leads to More Innovation and Better Product // Conversation, September 26, 2018 // theconversation.com/hiring-highly-educated-immigrants-leads-to-more-innovation-and-better-products-100087.
- ⁸ Там же.
- ⁹ Там же.
- ¹⁰ Nasri G. The Shocking Stats About Who's Really Starting Companies in America // Fast Company, August 14, 2013 // fastcompany.com/3015616/the-shocking-stats-about-whos-really-starting-companies-in-america.
- ¹¹ Boslet M. NVCA Study Finds 1/3 Of Recently Public Venture Companies Have Immigrant Founders // PE Hub Network, June 20, 2013 // nvcaccess.nvca.org/index.php/topics/public-policy/372-nvca-releases-results-from-american-made-20.html.
- ¹² Anderson S. Immigrants and Billion Dollar Startups // National Foundation for American Policy, March 2016 // nfap.com/wp-content/uploads/2016/03/Immigrants-and-Billion-Dollar-Startups.NFAP-Policy-Brief.March-2016.pdf.
- ¹³ Climate Change: The IPCC 1990 and 1992 Assessments // Intergovernmental Panel on Climate Change, 2010 // ipcc.ch/report/climate-change-the-ipcc-1990-and-1992-assessments/.
- ¹⁴ Myers N. Environmental Refugees: A Growing Phenomenon of the 21st Century // Philosophical Transactions of the Royal Society B Biological Sciences, May 2002. DOI: 10.1098/rstb.2001.0953.
- ¹⁵ Levine M. A Storm at the Bone: A Personal Exploration into Deep Weather // Outside, November 1, 1998 // outsideonline.com/1907231/storm-bone-personal-exploration-deep-weather.
- ¹⁶ New Report and Maps: Rising Seas Threaten Land Home to Half a Billion // Climate Central, November 8, 2015 // sealevel.climatecentral.org/news/global-mapping-choices.
- ¹⁷ Там же.
- ¹⁸ Strauss B. American Icons Threatened by Sea Level Rise: In Pictures // Climate Central, October 16, 2015 // climatecentral.org/news/american-icons-threatened-by-sea-level-rise-in-pictures-19547#mapping-choices-us-cities-we-could-lose-to-sea-level-rise-19542.
- ¹⁹ O'Hagan E. M. Mass Migration Is No 'Crisis': It's the New Normal as the Climate Changes // Guardian, August 18, 2015 // theguardian.com/commentisfree/2015/aug/18/mass-migration-crisis-refugees-climate-change.
- ²⁰ History's Greatest Migration // Guardian, September 25, 1947 // theguardian.com/century/1940-1949/Story/0,,105131,00.html. См. также: unhcr.org/3ebf9bab0.pdf.
- ²¹ Tanzi A., Lu W. Tokyo's Reign as World's Largest City Fades // Bloomberg, July 13, 2018 // bloomberg.com/news/articles/2018-07-13/tokyo-s-reign-as-world-s-largest-city-fades-demographic-trends. См. также: en.wikipedia.org/wiki/Megacity.
- ²² UN Population Division, World Urbanization Prospects, the 2001 Revision. New York, 2002.
- ²³ Kennedy D., Cohen L. The American Pageant: A History of the American People, 15th (AP) edition. Cengage Learning, 2013. Pp. 539–540.
- ²⁴ Davis M. Planet of Slums. Verso, 2006.

-
- ²⁵ Там же, с. 5.
- ²⁶ UN Population Division, World Urbanization.
- ²⁷ Флорида Р. Новый кризис городов. М.: Издательская группа Точка, 2018. См. также: Florida R. The Roots of the New Urban Crisis // Citylab, April 9, 2017 // citylab.com/equity/2017/04/the-roots-of-the-new-urban-crisis/521028/.
- ²⁸ Leal Trijullo J., Parilla J. Redefining Global Cities: The Seven Types of Global Metro Economies // Global Cities Initiative, 2016 // brookings.edu/wp-content/uploads/2016/09/metro_20160928_gcitytypes.pdf.
- ²⁹ Glaeser E. L., Xiong W. Urban Productivity in the Developing World // National Bureau of Economic Research, March 2017 // nber.org/papers/w23279.pdf.
- ³⁰ Там же.
- ³¹ Lehrer J. A Physicist Solves the City // New York Times, December 17, 2010 // nytimes.com/2010/12/19/magazine/19Urban_West-t.html.
- ³² Johnson K. Environmental Benefits of Smart City Solutions // Foresight, July 19, 2018 // climateforesight.eu/cities-coasts/environmental-benefits-of-smart-city-solutions/.
- ³³ McGonigal J. We Spend 3 Billion Hours a Week as a Planet Playing Videogames. Is It Worth It? How Could It Be MORE Worth It? // Ted, 2011 // ted.com/conversations/44/we_spend_3_billion_hours_a_wee.html.
- ³⁴ S. Korean Dies After Games Session // BBC News, August 10, 2005 // news.bbc.co.uk/2/hi/technology/4137782.stm.
- ³⁵ McCurry J. Internet Addiction Driving South Koreans into Realms of Fantasy // Guardian, July 13, 2010 // theguardian.com/world/2010/jul/13/internet-addiction-south-korea.
- ³⁶ Butet-Roch L. Pictures Reveal the Isolated Lives of Japan's Social Recluses // National Geographic, February 14, 2018 // nationalgeographic.com/photography/proof/2018/february/japan-hikikomori-isolation-society/.
- ³⁷ Berns G. Satisfaction. Henry Holt and Co., 2005.
- ³⁸ How Does Cocaine Produce Its Effects? // National Institute on Drug Abuse, May 2015 // drugabuse.gov/publications/research-reports/cocaine/how-does-cocaine-produce-its-effects.
- ³⁹ Keilman J. Are Video Games Addictive like Drugs, Gambling? Some Who've Struggled Say Yes // Chicago Tribune, May 30, 2017. См. также: Kotler S. The Rise of Superman. New Harvest, 2013. P. 98.
- ⁴⁰ Haynes T. Dopamine, Smartphones & You: A Battle for Your Time // Harvard University: the Graduate School for Arts & Sciences, May 1, 2018 // sitn.hms.harvard.edu/flash/2018/dopamine-smartphones-battle-time/.
- ⁴¹ Kotler S. Legal Heroin: Is Virtual Reality Our Next Hard Drug // Forbes, January 15, 2014 // forbes.com/sites/stevenkotler/2014/01/15/legal-heroin-is-virtual-reality-our-next-hard-drug/#1cb0e6511a01.
- ⁴² Facebook Twists Reality Again and Risks Ruining Your Children // Fox News, May 3, 2014 // foxnews.com/opinion/facebook-twists-reality-again-and-risks-ruining-your-children.
- ⁴³ Kotler, Legal Heroin.

- ⁴⁴ Kotler, Rise of Superman.
- ⁴⁵ My Virtual Life // Bloomberg Businessweek, April 30, 2006 // bloomberg.com/news/articles/2006-04-30/my-virtual-life.
- ⁴⁶ Клайн Э. Первому игроку приготовиться. М.: Neoclassic, АСТ, 2013.
- ⁴⁷ The Nielsen Total Audience Report: Q1 2018 // The Nielsen Company, 2018 // nielsen.com/us/en/insights/reports/2018/q1-2018-total-audience-report.html.
- ⁴⁸ Overbye D. Is It Time to Play with Space Again? // New York Times, July 15, 2019 // nytimes.com/2019/07/15/science/apollo-moon-space.html.
- ⁴⁹ Konstantin E. Tsiolkovsky // NASA, September 22, 2010 // nasa.gov/audience/foreducators/rocketry/home/konstantin-tsiolkovsky.html.
- ⁵⁰ Gilbey J. Backing Up the Biosphere // Nature, April 7, 2012 // nature.com/news/backing-up-the-biosphere-1.10395.
- ⁵¹ twitter.com/JeffBezos.
- ⁵² twitter.com/ElonMusk.
- ⁵³ Беседа автора с Джеффом Безосом, 2015. См. также: Clifford C. Jeff Bezos: You Can't Pick Your Passions // CNBC Make It, February 7, 2019 // cnbc.com/2019/02/07/amazon-and-blue-origins-jeff-bezos-on-identifying-your-passion.html.
- ⁵⁴ Reichhardt T. Jeff Bezos' Simple Two-Step Plan // Air & Space, September 16, 2016 // airspacemag.com/daily-planet/jeff-bezos-simple-two-step-plan-180960498/.
- ⁵⁵ Haynes K. O'Neill Colonies: A Decades-Long Dream for Settling Space // Astronomy, May 17, 2019 // astronomy.com/news/2019/05/oneill-colonies-a-decades-long-dream-for-settling-space.
- ⁵⁶ Patel N. V. Jeff Bezos Wants to Solve All Our Problems by Shipping Us to the Moon // Popular Science, May 9, 2019 // popsci.com/blue-origin-moon-lander/.
- ⁵⁷ Там же. См. также: Allen I. Jeff Bezos Wants Us All to Leave Earth — for Good // Wired, October 15, 2018 // wired.com/story/jeff-bezos-blue-origin/.
- ⁵⁸ Grush L. Jeff Bezos: 'I Don't Want a Plan B for Earth,' // Verge, June 1, 2016. См.: theverge.com/2016/6/1/11830206/jeff-bezos-blue-origin-save-earth-code-conference-interview.
- ⁵⁹ Mosher D. Here's Elon Musk's Complete, Sweeping Vision on Colonizing Mars to Save Humanity // Business Insider, September 29, 2016 // businessinsider.com/elon-musk-mars-speech-transcript-2016-9.
- ⁶⁰ Anderson C. Elon Musk's Mission to Mars // Wired, September 21, 2012 // wired.com/2012/10/ff-elon-musk-qa/.
- ⁶¹ Sheetz M. The Rise of SpaceX and the Future Of Elon Musk's Mars Dream // CNBC, March 20, 2019 // cnbc.com/2019/03/20/spacex-rise-elon-musk-mars-dream.html. См. также: Fernholz T. The Complete Visual History of SpaceX's Single-Minded Pursuit of Rocket Reusability // Quartz, July 1, 2017 // qz.com/1016072/a-multimedia-history-of-every-single-one-of-spacexs-attempts-to-land-its-booster-rocket-back-on-earth/.
- ⁶² Wall M. Big Leap by SpaceX's Starship Prototype Pushed to Next Week // Space, August 16, 2019 // space.com/spacex-starhopper-big-test-flight-target-date.html.

-
- ⁶³ Williams M. Musk Gives an Update on When a Mars Colony Could Be Built // Universe Today, September 25, 2018 // universetoday.com/140071/musk-gives-an-update-on-when-a-mars-colony-could-be-built/.
- ⁶⁴ Kooser A. Elon Musk Expects SpaceX Ticket to Mars Will Cost \$500,000 // CNET, February 11, 2019 // cnet.com/news/elon-musk-expects-spacex-ticket-to-mars-will-cost-500000/.
- ⁶⁵ Jung Min Lee. Nanoenabled Direct Contact Interfacing of Syringe-Injectable Mesh Electronics // Nano Letters, 2019 // cml.harvard.edu/assets/Nanoenabled-Direct-Contact-Interfacing-of-Syringe-Injectable-Mesh-Electronics.pdf.
- ⁶⁶ См.: youtube.com/watch?v=MZ3Q638aMA.
- ⁶⁷ Hong G. A Method for Single Neuron Chronic Recording from the Retina in Awake Mice // Science, June 29, 2018 // ncbi.nlm.nih.gov/pmc/articles/PMC6047945/.
- ⁶⁸ Lutz E. Elon Musk Has Created “Threads” to Weave a Computer into Your Brain // Vanity Fair, July 17, 2019 // vanityfair.com/news/2019/07/elon-musk-neuralink-created-threads-to-weave-computer-into-your-brain.
- ⁶⁹ Kauhanen L. EEG-Based Brain-Computer Interface for Tetraplegics // Computational Intelligence and Neuroscience, September 19, 2007 // ncbi.nlm.nih.gov/pmc/articles/PMC2233767/.
- ⁷⁰ Brain-Computer Interface Enables Paralyzed Man to Walk Without Robotic Support // Kurzweil, September 25, 2015 // kurzweilai.net/brain-computer-interface-enables-paralyzed-man-to-walk-without-robotic-support.
- ⁷¹ Alkawadri R. Brain-Computer Interface (BCI) Applications in Mapping of Epileptic Brain Networks Based On Intracranial-EEG: An Update // Frontiers in Neuroscience, March 27, 2019 // frontiersin.org/articles/10.3389/fnins.2019.00191/full.
- ⁷² Xu L. Humans, Computers and Everything In Between: Towards Synthetic Telepathy // Harvard Science Review, May 1, 2014 // harvardsciencereview.com/2014/05/01/synthetic-telepathy/.
- ⁷³ Kerous B. EEG-Based BCI and Video Games: A Progress Report // Virtual Reality, June 2018. Pp. 119–135.
- ⁷⁴ Gil N. Loneliness: A Silent Plague That Is Hurting Young People Most // Guardian, July 20, 2014 // theguardian.com/lifeandstyle/2014/jul/20/loneliness-britains-silent-plague-hurts-young-people-most.
- ⁷⁵ Sawyer K. Group Genius. Basic Books, 2017.
- ⁷⁶ См., например: Yaeger L. S. How Evolution Guides Complexity // HFSP Journal, October 2009 // ncbi.nlm.nih.gov/pmc/articles/PMC2801533/. См. также: Keim B. The Complexity of Evolution // Wired, April 15, 2008 // wired.com/2008/04/the-complexity/.
- ⁷⁷ Lopatto E. Elon Musk Unveils Neuralink’s Plans for Brain-Reading ‘Threads’ and a Robot to Insert Them // Verge, July 16, 2019 // theverge.com/2019/7/16/20697123/elon-musk-neuralink-brain-reading-thread-robot.